Illustrative Cases for Teaching IWRM (Volume I)

A Compendium of Ten Illustrative Cases from South Asia

SaciWATERs

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Crossing Boundaries commissioned Illustrative Cases for Teaching IWRM (Volume I), prepared by Tata Institute of Social Sciences, Mumbai

Designed by:
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Preface

Crossing Boundaries (CB) Project of the organization saciWATERs is a multi-activity project around the substantive theme of Integrated Water Resources Management (or IWRM) and Gender in South Asia. The project is focused on capacity building through education, research, and training in the IWRM area, especially in engineering institutions in South Asia. The CB Project involves collaborative efforts of four premier engineering institutions from South Asian countries (Sri Lanka, Nepal, India, and Bangladesh) and other supporting institutions. One of the main thrust areas of the CB project is to develop 'pedagogic material' for teaching IWRM in the engineering institutions, especially at the master's level. The project had a component which focused on developing 'case studies' around the themes of IWRM for teaching the IWRM courses at the master's level. Tata Institute of Social Sciences worked on this project component with faculty members from the three partner engineering institutions, viz., (a) Nepal Engineering College, Kathmandu, Nepal, (b) Postgraduate Institute of Agriculture, University of Peradeniya, Sri Lanka, and (c) Centre for Water Resources (CWR), Anna University, Chennai, Tamil Nadu, India. This compendium of ten case narrations is output of the efforts under the component.

This set of case narrations is the result of the team effort by a host of individuals, mainly faculty and staff from the three engineering institutions, saciWATERs, and TISS. The ten faculty members from the three institutions who wrote the case narrations are the primary architects of this product. The support provided by Dr. N. C. Narayanan and Dr. Dibya Ratna Kansakar, the Project Directors of CB Project needs to be appreciated. Dr. Narayanan continued to be supportive of work under this component, even after he joined IIT Bombay. Prof. Biswas from Institute of Rural Management, Anand (IRMA) conducted a few sessions in the teaching workshop as the Primary Resource Person. Equally important was the critical support provided by the team of faculty members and Research Officers from TISS, which needs to be duly acknowledged. Dr. Sai Thakur and Dr. Laxmi Thummurru provided critical analytical support, while Ms. Sharmila Joshi, among other things, provided editorial support. Mr. Yacoub Kuruvilla and Mr. Mohankumar Bera also provided support during the workshops. Cooperation from Prof. Lakshmi Lingam, who has been coordinating the project from TISS side, is also appreciated. Finally, the work on this component would not have reached its conclusion without consistent support and guidance from Prof. Parasuraman, Director of TISS.

Preparation of these pedagogic cases has been a rich learning experience to all of us. It was a shared feeling in the concluding session of the last workshop that this effort to prepare case narrations need to be continued, even beyond the framework of the CB project.

Prof. Subodh Wagle, Tata Institute of Social Sciences

About SaciWATERs

The South Asia Consortium for Interdisciplinary Water Resources Studies, SaciWATERs, is committed to bringing about structural change in the dominant water resources management paradigm in South Asia. Within that, SaciWATERs focuses on transforming water resources knowledge systems. Key ideas are an interdisciplinary approach to understanding water resources issues, from a pro-poor, human development perspective, with an emphasis on exchange, interaction and collaboration at South Asia level. The longer term aim is to establish a South Asian "virtual water university".

SaciWATERs feels the need for a paradigm shift in the overall framework for water management in South Asia. It aims at contributing to this paradigm shift by means of various partnership-based programmes for capacity building of water professionals through higher education, innovation and social learning focused research, 'research with an impact', knowledge based development and networking. SaciWATERs is active in three domains: education, research and advocacy, by implementing Projects.

About Crossing Boundaries Project

The Crossing Boundaries (CB) project aims to contribute to the paradigm shift in water resources management in South Asia, summarized in the concept of IWRM (Integrated Water Resources Management), by means of a partnership-based programme for capacity building of water professionals on IWRM and gender & water through higher education, innovation and social learning focused research (‘research with an impact’), knowledge base development and networking.

The project has received financial support from DGIS (Department of International Cooperation), Government of The Netherlands. SaciWATERs, Hyderabad, India and the Irrigation and Water Engineering group at Wageningen University, are implementing the project with six South Asian Partner Institutions (PIs) namely;

1) Bangladesh Centre for Advanced Studies (BCAS), Dhaka, Bangladesh, in collaboration with
2) Institute of Water and Flood Management (IWFM), Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh
3) Centre for Water Resources (CWR), Anna University, Chennai, Tamil Nadu, India
4) Postgraduate Institute of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka
5) Nepal Engineering College (NEC), Kathmandu, Nepal
6) Tata Institute of Social Sciences (TISS), Mumbai, India

The activities of the project take place at two levels, the national and the South Asian. The university partner institutions implement the national level activities. The regional South Asia level activities are coordinated and implemented by SaciWATERs.

Content

Introduction

In the very beginning, the title of the compendium—Illustrative Cases for Teaching IWRM—needs some explanation. During the initial work, it was realized that what was envisaged under the project was fundamentally different from the pedagogic case-studies used in the management institutions.

First of all, the pedagogic cases used in management schools are primarily aimed at training future managers in learning the art and science of decision-making; as a result, these case-studies are generally short and essentially describe the problem about which the decision is to be made. These case-studies are expected to generate vigorous and intense debates among students in the class, bringing out multiple view-points and options for solution in order to arrive at appropriate and optimal decisions for resolving the problems posed in the case-studies. Such discussion tends to be adversarial and competitive; one participant posing a better option than the previous ones.

As against this, the main objective of developing the pedagogic cases under the CB project was to expose students to relevant real-life experiences, in order to facilitate better understanding of the issues, concepts, and theories taught in the IWRM classes. This objective required that the narrations in the pedagogic cases proposed in the project have to be fundamentally different from those of the management case-studies, which are often short and posing the problem begging a decision. In contrast, the envisaged IWRM cases need to contain the narration of real-life situations or conditions—in a vivid and elaborate manner—in order to facilitate experiential learning. Hence, more appropriate term for these cases, it was felt, would be the 'illustrative case narrations'. Further, The discussion in the class, based on these case narrations, would be aimed not at adversarial competition to bring out diverging view-points or better options, but on helping each other in unraveling the case narration to bring out different nuances and details of the ground situation that do or do not complement the concepts and theories of IWRM taught in the class.

In this sense, the learning gained through these case narrations is supplementary or supportive to teaching of theory. As against this, many management institutions prefer to substitute theoretical teaching (through lecture / presentation) by case study method. The last and most practical difference that was brought out during the workshop was that there is significant difference in the make-up of students from management programs and engineering programs, at least in the South Asian situation. While management students tend to be more outspoken and ready and willing for group discussions right from their admission stage, the engineering students—trained more through the medium of lectures—are less prepared to readily engage in nuanced discussions with the teacher in the class. This makes the task of the teacher—using these case narrations—both critical and challenging. This also indicates that more work is needed for preparing engineering teachers to use such innovative tools. To this end, the participating faculty also prepared support material for teachers.

This compendium contains ten illustrative case narrations from the three South Asian countries, viz., Nepal, Sri Lanka, and India. They cover different themes under the rubric of IWRM such as gender dimension of water sector, pollution of water, and traditional institutional and governance arrangements, and contestation and claims on water. They could be used by engineering or other institutions teaching the IWRM-related courses in South Asia or even from other parts of the world.

At the end, it needs to be mentioned that these case narrations are developed by the faculty from engineering colleges—and not by specially hired consultants—as teaching material for their own use. The CB project was very clear in laying emphasis on this aspect of building capacity of teachers.

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Case 1:

Water and women on a tea estate in Sri Lanka

Saliya De Silva

1. Malathi's day at the tea estate

On a tea plantation near Pussallawa town, Malathi carries two heavy cans of water from a public tap to her barrack-type room. She makes this trip twice every day, each time carrying a 20 kilo load of 20 litres of water, her back bent with the effort.

Her day begins at 4 a.m. Water is supplied only from 6.30 to 9 in the morning, and Malathi must collect enough for the family's morning needs during this time. The early morning hours are spent in preparing breakfast and lunch, feeding and sending the children to school, and cleaning. If her husband, Moorthi, who is an estate labourer, has to work that day, he has to report to work at 6.00 a.m. Malathi prepares his breakfast and sends it to the field. She has to go to the tea-plucking field at 7.30 a.m., after leaving her two-year-old daughter on the way at the Child Development Centre, the tea estate's crèche. At 9.30 a.m. she gets a half hour break to eat breakfast. At noon, Malathi weighs her collection, picks up her daughter from the crèche, has lunch and returns to work at 1.30 p.m.

Moorthi usually completes his work by 12.30 p.m. While resting, he keeps their two daughters, aged eight and two, at home. If he cannot do that, Malathi takes her younger daughter back to the crèche and works till 4.30 p. m or till 5.30 p.m. at peak harvesting time. When she reaches home after weighing the tea leaves, it is almost 6 in the evening. She collects firewood on the way back. She has to hurry before it gets dark, to have a bath and bathe the children, wash clothes and collect drinking water. She spends the next few hours preparing dinner, washing and cleaning the house. She goes to sleep by 10.00 or 11.00 p.m. Her husband has adequate time for leisure and alcohol, whereas Malathi gets barely six hours of sleep.

Like other women on the tea estates, Malathi has to work 365 days a year. Weekends and public holidays are not granted to women workers on the estates. Every day of the year, about 10 hours are spent on the estate and about six hours doing housework. The facilities provided to the workers are minimal. Numerous women on the estates relentlessly work to produce tea that is globally renowned and the principal plantation crop of Sri Lanka. For over a century, tea has significantly contributed to the Sri Lankan economy, particularly in foreign exchange earnings. In 2007, it was the second largest export commodity, contributing Rs. 114 billion from 312 million kilos of tea exports.[1] Thus, the women working on the estates are the lifeline of the economy.

2. Low education, low incomes and poor living conditions

The majority of the workers living on the upcountry estates today are second or third generation immigrants; their parents or grandparents were brought to Sri Lanka by the British after 1827. The early migrants were mainly “lower” caste Hindus from South India. Some of them still do not have Sri Lankan citizenship.

Various socio-economic parameters indicate acute deprivation among the upcountry workers. A survey done on two plantations near Pussallawa town showed that a fair proportion of both men and women had never been to school. The majority (57 percent) of those who did go to school, studied only up to Grade 5. Amongst these, 31 percent found it difficult to write and read. These percentages are significantly lower than those of other rural areas in Sri Lanka. Compulsory education was introduced on the plantations in 1907, but was never enforced. Plantation owners and managers have always discouraged formal education, which they perceive as a potential threat to a stable supply of labour.

The survey also showed that in a majority of families (76 percent), both husband and wife are engaged in income-earning activities. In Sri Lanka, women are expected and encouraged to do extra-domestic remunerative work. The average monthly income of a working couple was calculated at Rs. 12800,[2] but their take-

[1] Central Bank of Sri Lanka (2008), Annual Report 2007
[2] Sri Lanka’s per capita GNP at current market prices in 2007 was US $1,599 (about Rs. 15,000 per month)

home salary[3] was reported as only Rs. 4000 (1 US$ = SL Rs. 114). The average monthly savings for emergencies such as health problems was Rs. 350.

There are two types of houses on the tea estates: (a) line rooms or a barrack-like structure with a row of attached small houses, and (b) separate houses or cottages. The construction of separate houses was started in 1985 under a housing programme, but a majority of families (78 percent) still live in line rooms. The shabby living conditions of these rooms are similar to the conditions in urban slums. The lack of sanitary latrines is a major problem. Pour-flush latrines or pit latrines are sometimes shared by three-four families, and a secure water source is rarely nearby. The toilets are located about 20-30 metres away from the houses, and they are often dirty and choked. Open drains full of stagnant water, heaps of garbage and smoke-filled rooms are common sights.

In terms of assets, 42 percent of the families own the house and the land on which they live. A majority have radios (79 percent) and television sets (63 percent). Many do not possess any kind of vehicle; only four percent men own a bicycle or a motorcycle. Private transportation is very important in this area, where public transportation is inadequate and unpredictable.

The average monthly expenditure of a family is Rs. 11,800.[4] Of this, nearly 55 percent is spent on food. The monthly income is used to ensure the family's survival and maintenance (for example, for food, clothes and healthcare) but not for upward mobility (that is, for purposes such as education and vocational training). Only five percent of the income is spent on education. According to the Estate Medical Assistant (EMA), alcohol is consumed in 90 percent of the families, and by 70 percent of the women on the estates drink.[5] On an average, Rs. 1600 per month are spent on alcohol.

3. Adding discrimination to deprivation

The social status of women on the estates is inferior. This gives them little access to and control over resources and services. Women get less education than men; the survey showed that as many as 70 percent women (but only 44

[3] A portion of household staple foods including rice, flour, tea, and *dal* is supplied as "advance" by the management and the cost is deducted from the workers' salaries.

[4] The expenditure includes the advance taken away by the management and their personal expenses. Note of caution is that usually in surveys of this nature income is underreported while expenditure is exaggerated.

[5] Although women consume alcohol, they are not addicted and consume large quantities on regular basis like the men do.

percent men) had studied till less than the primary level. Women form the majority who cannot, or find it difficult to, write and read.

The wages of women workers on the estate are Rs. 269 per day,[6] Rs. 117 less than the wages of men. Although the gender gap in wages was removed with the enactment of the equal wages for equal work rule by the Wage Boards Ordinance in 1984, differential wages persist due to a perceived difference between "women's work" and "men's work". Women are not permitted to work if they arrive late; they are paid significantly less if they fail to reach the daily norm of 19 kilos of plucked tea leaves, and so on. Although women earn only 61 percent of the income earned by men, they save more (Rs. 408) than men (Rs. 316) for family emergencies and healthcare. Illnesses are frequent. Either mothers or elder daughters have the responsibility of looking after the sick.

The excessive use of alcohol is a major problem on the estates. According to the EMA, domestic violence, including verbal and physical harassment[7] of wives and children, is common. The plantation management perceives women as part of a family labour unit and not as independent wage earners. Men are permitted to collect women's wages and even their maternity benefits, which they often spend as they wish. The women complain bitterly that their wages have been spent on alcohol by their husbands.[8] The loss of an already inadequate income affects their children's education, nutrition and health (particularly of daughters), which are regarded as the mother's responsibilities. A considerable number of families are indebted, and the women's only asset, jewellery, is often pawned to meet family needs.

3.1. Bare homes, barely any water

A majority of the families live in line rooms, where the women in particular face various difficulties. The average size of a line room is smaller than a room in a separate house. In a majority of the line rooms (65 percent), the kitchen is outside. When the women are at home, they spend most of their time in the kitchen, and spend a lot of time and energy moving to and from the kitchen and the main room.

[6] It is one of the lowest wage rates among similar occupations in Sri Lanka, even after 38% increase of minimum daily wage to Rs. 269 from Rs. 189 in June 2007 by HE the President of Sri Lanka (Central Bank, 2008).
[7] In an incident reported by an EMA, an alcoholic father sexually harassed his young daughter.
[8] Jayaweera, S (1991), Women in the Estate Sector, Working Paper No. 1, Centre for Women's Research (CENWOR), Sri Lanka.

The line rooms are not solid constructions; most of them (72 percent) are plastered with clay or have wattle and daub walls, dung or earth floors (42 percent), and galvanized sheet roofs, which often leak. The women maintain the dung floors, re-plastering them occasionally. The line rooms have walls on both sides and only one small window each in the front and the back; as a result the ventilation inside is poor. The layout offers no privacy.

Most of the families use kerosene for lighting and firewood for cooking. The hearth is either three stones (49 percent) or mud (30 percent), and it consumes energy inefficiently. The use of firewood and its inefficient utilization adds to the work of women, who also have to collect the firewood along with the men.

Most of the families (48 percent) get water for drinking and cooking from a pipe located outside their line room.[9] In most cases, the water comes from unprotected springs or a small tank constructed a few hundred meters away by the estate management. People who do not have a separate pipeline collect water from a public tap (27 percent). The public taps usually serve two rows of line rooms or about 20 families. Water is available on these taps only for one-two hours a day. The women have to bathe using the only tap available outside their houses. In interviews with them, the women said that the lack of privacy inside and outside the rooms is very stressful.

Some of the pipes, usually diversions from small tanks constructed around a spring, do not function properly due to poor maintenance; sometimes the pipes are stolen. During most of the year, the pipe-borne water is just enough for drinking and cooking. Various other sources of water—streams, ponds, and protected and unprotected common wells—have to be used for laundry and bathing.

The supply of water in Sri Lanka is handled by the local municipal council or the National Water Supply and Drainage Board. A majority of households are supplied with piped water. The two government agencies however provide a water connection only up to the point where private property begins. Within the property, water supply is the responsibility of the owner of the property. Most of the land on which estate workers live is owned by the workers themselves; the estate management therefore believes that securing water is the workers'

[9] Appendix 2 shows the water sources used for different purposes.

responsibility. On the other hand, the workers believe that water supply is the responsibility of the government or the estate management. Many efforts made by the estate management to provide and maintain a supply of water with a nominal contribution (Rs. 10 per month) from the estate workers have failed in the past.

The women face various difficulties in accessing water and 45 percent of them said that the quality of water they have access to was unacceptable. They said that the water that they collect is discoloured (26 percent), contaminated with solid matter (13 percent) and chemicals (4 percent), or smelly (2 percent). One group of people said the water was contaminated with human faeces. The unprotected spring from which they get water is located near the toilets of a community living closer to that spring. To make the water safe for drinking for the family, the women have to boil it, often on firewood that could be used to prepare meals. If anyone in the family gets sick due to the contaminated water, it is the women's responsibility to take care of them.

Women living in separate houses use improved stoves, which are more energy efficient. Most families in these houses have tap water inside the house. More space and facilities such as hygienic toilets, and a kitchen inside or attached to the house, provide some degree of relief to the women living in separate houses.

3.2. Juggling multiple tasks

Women like Malathi have multiple roles. They constitute about 65 percent of the labour force on tea plantations, and play a major role as income earners by contributing 40 percent to the family income.[1] However, notions of the "male breadwinner" and "dependent housewife" persist on the estates. Most of the women work as tea-pluckers. Their working conditions are amongst the hardest on the plantations; they work on hilly terrain travelling across dangerous routes with 20-30 kilos on their backs. The estates are located in the upcountry wet zone, and most of the time the women work in the rain and cold, without adequate protection.

A majority (92 percent) of the women on the estates are married and they play multiple roles as mothers, wives and household managers (S*ee Appendix 1*). They contribute to all the reproductive work in the family. Their involvement in fetching water, preparing meals, bathing children, feeding children, washing utensils and doing laundry is more than 85 percent. The women spend, on an average, 106 minutes a day in the kitchen preparing meals for the family. If they cook twice a day, the time spent on cooking can extend to three hours per day. The only activity that men share equally is collecting firewood.

Women also spend a lot of time in collecting water (72 minutes on an average per day); this task is done at least twice a day. On an average, women on the estates walk 77 metres to collect drinking water; the distance varies from two metres to 500 metres. If there is piped water inside or just outside the house, the time spent in filling water is only a few minutes. Sometimes during the dry season, women have to travel a few kilo-meters for spend a few hours to collect drinking water. They travel longer distances for laundry and bathing, averaging 153 metres and 235 metres respectively. Some families walk two kilometres to bathe, particularly during the dry seasons. All water-related tasks—bathing and feeding children, laundry, washing utensils—consume the limited time available to women on the tea estates.

Most of the women believe that they have to do these reproductive tasks because their husbands are involved in income-generating work (34 percent); they seem to forget that they themselves also earn wages. Only two percent of the women believe they have special skills that men don't possess, which qualify them to engage in reproductive tasks. For 24 percent of the women, this division of labour is the family custom. When the children are not at school (which is frequent), the girls help with various household tasks, while the boys play with their friends. Girls (sometimes as young as five years) go to collect water from the public taps. When their mothers and elder sisters are working on the estates, the girls look after the domestic work. Men undertake domestic tasks only in emergency situations, when no woman is available for such work.

3.3. *Water, sanitation and the status of women*

Good water supply and sanitary conditions influence the health, productivity and overall socio-economic conditions of the estate workers. Sanitation is an indicator of social development, it is important for maintaining personal and family hygiene. The cleaning of toilets is not a common practice on the estates. Using water that has been collected after a lot of effort to clean toilets may be regarded as wasteful; this may also be due to low awareness about hygiene. Open defecation and the use of pit latrines near the streams are serious problems in controlling waterborne diseases not only on the estates, but also in the nearby downstream Pussallawa town.

When toilets do get cleaned, in most of the families, this task is done by either the mother or daughters. However, a minimum amount of water is used for cleaning toilets, drains and kitchen utensils. Personal hygiene is also neglected. Washing hands after using the toilet and before eating are unusual practices. If water were not so difficult for the women to access, it is likely that they would implement more hygienic practices for the household.

According to the EMAs, outbreaks of communicable diseases like hepatitis, cholera, and typhus occur from time to time on the estates and in Pussallawa town. Cold-fever, diarrhoea and skin diseases are common. The connection between these diseases and contaminated water is well-established. The survey indicated that about 39 percent of family members who had a disease during the last one year were mothers, 26 percent were fathers, and 23 percent were daughters; sons, at 12 percent, showed the highest resistance to diseases.

A greater degree of physical and mental stress makes women more susceptible to illnesses. Cultural practices require women to eat last and, in low income families, the least. The physical strain and exhaustion caused by long hours of tea plucking, carrying heavy baskets of tea and cans of water two times a day over hilly terrain and uneven ground, and other household chores, make women more prone to diseases. Abortions, still birth, pains in the joints and back, abrasions, callosities of the soles and abnormalities and degenerative changes in the spine are common. Malathi occasionally gets severe back pain after she had a Caesarean section for her second child. When the bouts of pain begin, she has to stay at home, at times for a month or two, and cannot go to work. However, her arduous work—walking 200 metres twice a day with heavy cans continues.

The consequences of such health problems are serious for the family as well as for the estate management: 71 percent of the respondents indicated that their illnesses prevented them working on the estates, 18 percent said they were not able to carry out their routine household work during periods of sickness. Medical care usually draws a fair proportion of their limited income. Although medical facilities are provided free on the estates (as in other parts of Sri Lanka), some prefer to visit private doctors. The average expenditure on healthcare is Rs. 2133 per year, but, at times, this increases to exorbitant amounts depending on the condition. The health of the family most closely affects women, who have to attend to the health problems of other family members.

A major factor that contributes to the deprived living conditions of women on the estates is the lack of secure access to water and safe sanitation. Women travel long distances to fetch water, thereby sacrificing their time and using energy. The extra time needed to collect water and to maintain family hygiene prevents estate women from accessing education and more remunerative work, which are means to achieve higher social status.   Low family incomes, poor sanitary practices, and the practice of women eating last and least means insufficient nutrition, which make women more prone to illnesses. Better access to good quality water and proper housing facilities would only be a first step in improving the socio-economic conditions of women on the tea estates of Sri Lanka.

4. Summary

Women on the tea plantations near Pussallawa town in Sri Lanka are the lifeline of the national tea economy. However, they are located at multiple disadvantages along the class and gender axes. Most of the workers on the plantations live in shabby rooms, work hours are long, healthcare facilities are limited, alcoholism is common. Within this context of deprivation, women have the additional burden of doing remunerative work on the plantations for wages that are lower than those paid to men, as well as being responsible for multiple time-consuming and tiring household tasks, including cooking, cleaning and looking after the children.

Their already heavy workload is aggravated by poor access to water. Most of them have to collect water, over several trips every day, from pubic taps located some distance away from their homes, where water is available only for a few hours. Bathing at the public taps means little privacy; washing clothes and utensils often requires further trips. The water often comes from unprotected springs, and is sometimes contaminated. Sanitation and hygiene are inadequate due to inadequate water. All of this contributes to frequent illnesses in the family. Long-term solutions to the water problem on the tea estates remain elusive.

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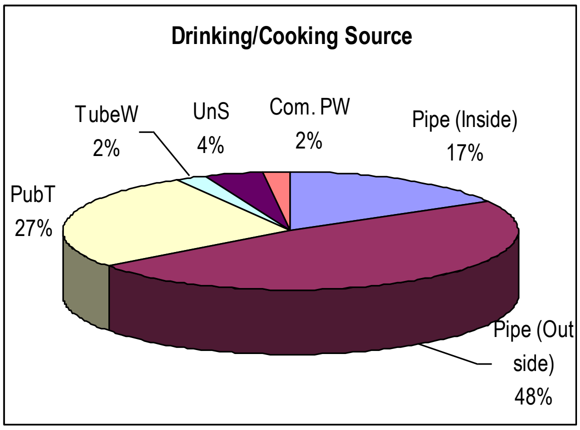
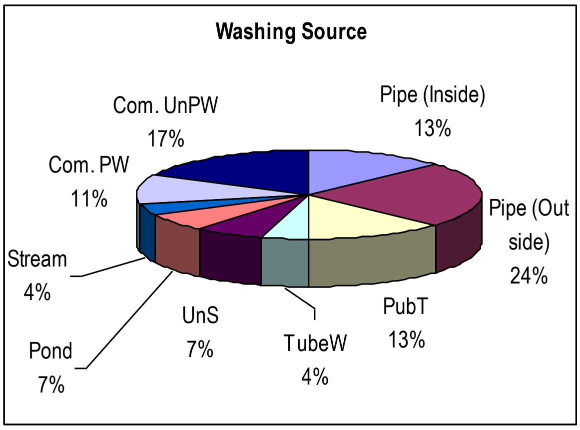
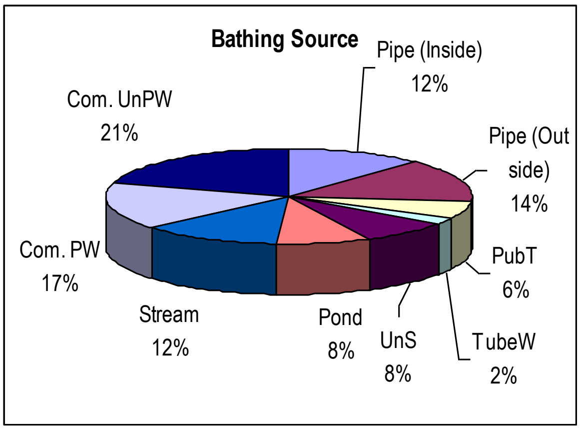
Appendix 1: Reproductive tasks in a family

Activity	Family member involved (%)		Average time taken to complete the task (min)		Number of times involved per week	
	Male	Female	Average	Maximum	Average	Maximum
Collecting water	10	90	72	420	15	60
Cooking	10	90	106	180	11	21
Bathing children	4	96	67	180	7	7
Feeding children	4	96	52	90	21	21
Washing utensils	3	97	52	180	6	7
Laundry	13	88	54	180	8	21
House cleaning	16	84	41	120	7	14
Washing toilets	19	81	23	30	4	7
Attending to children's health	16	84	29	60	4	7
Collecting fuel wood	48	52	196	300	1	4
Participation in Hindu Temple Committee	46	5	31	60	6	12
Participation in Death Benevolence Society	36	3	90	90	5	12

Appendix 2: Sources of water for different purposes







**PubT: public tap; TubeW: Tube well; UnS: Unprotected Spring; Com PW: Common*

Case2:

Why is Meda Ela so murky?

M.I.M. Mowjood

1. Pollution of the Meda Ela

Kandy, the largest city in the hilly region of Sri Lanka, is abundant in scenic beauty. The city is a world heritage site of religious and cultural importance. It offers many tourist attractions, including Kandy Lake and the world famous Buddhist pilgrimage site, the temple of the 'tooth relic', popularly known as the Dalada Maligawa.

The Meda Ela originates as an outflow of Kandy Lake and flows about eight kilometres along the southern boundary of Kandy city before it merges with the Mahawelli River at Gatambe (*See Figure 1*). The canal is essentially a natural stream whose headwater is confined to the south-eastern foothills of the Kandy Lake watershed.

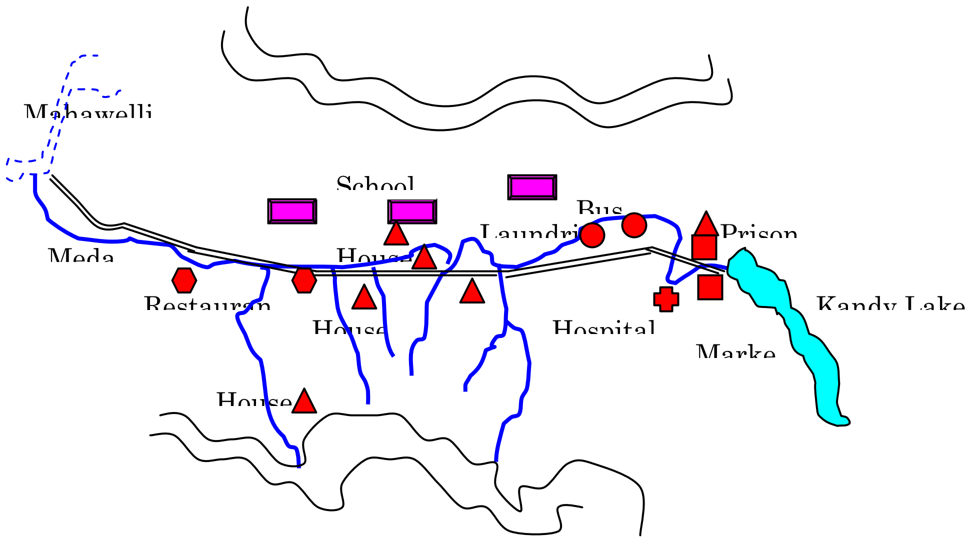


Figure 1: Geographical illustration of the Meda Ela and sources of pollution

The Meda Ela is being indiscriminately polluted. Solid waste floats everywhere in the murky water, and wastewater from various sources is discharged into the river. The water smells bad and its colour ranges from brown to black depending on the wet and dry season. The nitrate loading and high concentration of coliform in the canal are attributed to biogenic waste such as human and animal excreta. The nitrate concentration in the Meda Ela increased from 0.2 to 12.39 mg/l between 1982 and 2008. The total coliform, the bacteria that cause hepatitis, was around 10 200 cfu/100ml in 2008. This indicates that the canal receives human excreta.

As a result, the people around the Meda Ela are living through a nightmarish experience. The strong foul smells and the brown murky water are unattractive to tourists and unbearable for people who live close by. As a natural stream running in the middle of a historically important and sacred city, the role of the Meda Ela in terms of aesthetics, the ecosystem, and health and sanitation is vital.

2. Polluters and victims

The pollution of the Meda Ela causes several problems for the people and the ecosystem. The environment along the Meda Ela has become unsuitable for human habitat. People in the area are affected by vector borne diseases. The Meda Ela is a breeding place for mosquitoes. Children are frequently affected by dengue and malaria fever. The windows and doors of the houses have to be kept closed for 24 hours due to the bad smells and mosquitoes. The costs of medical treatment are a burden for the people living in this area.

People living downstream are more affected because of activities in the upstream areas. The discharge of wastewater and dumping of garbage has created tensions amongst the communities, between people living upstream and downstream, and with government officials. People have lost confidence in official agencies and the officials have lost their drive to implement the regulations.

The biodiversity of the Meda Ela has been badly affected, as the canal has changed from a natural stream to wastewater. Aquatic life is endangered, and the number and abundance of aquatic species in the Meda Ela have been affected. Fish and water spiders can be found at the beginning of the Meda Ela, but only worms that can survive in low levels of dissolved oxygen are found downstream.

The Meda Ela adds a substantial amount of EColi bacteria to the Mahawelli river, where the intake of water is located downstream of the meeting point. The Meda Ela is polluted by several sources of organic and biological waste. Point sources and non-point sources contribute significantly to the deterioration in the quality of the water

3. Multiple sources of pollution

The quality of the water of Kandy Lake has been maintained to a certain standard due to its close proximity to the Dalada Maligawa site. There are many hotels for tourists, restaurants and private hospitals around the lake. The discharge of wastewater into the lake from these establishments is monitored in order to protect the lake. The water that spills from Kandy Lake into the Meda Ela is therefore comparatively less polluted.

The contamination of the Meda Ela begins from the market in Kandy, which is maintained by the Kandy Municipal Council (KMC). More than 20 meat and fish stalls are located in the complex. Wastewater from the meat, fish and vegetable stalls and restaurants is added to the water that flows from Kandy Lake. This wastewater carries a high organic load. The Kandy Bogambera prison, located adjacent to the market, also releases its wastewater into the Meda Ela.

Kandy is one of the focal points of public transport in Sri Lanka. According to the traffic police, more than 30,000 vehicles enter the city every day. Numerous centres for healthcare, education, business, cultural and ritual interests are located in Kandy. All of these attract a large commuting population of about 125,000-175,000 people every day. The runoff from the bus stands, which carries oils, grease and suspended particles attached with heavy metals, flows into the Meda Ela that runs underneath the bus stands.

The main hospital in Kandy is a large teaching hospital maintained by the Ministry of Health with modern facilities for medical treatment. Its wastewater goes through a treatment facility within the hospital and is then discharged into the Meda Ela. However, occasionally, the treatment plant does not function, and untreated wastewater is discharged into the Meda Ela. Hospital wastewater carries contaminants that can cause infectious diseases.

Commercial laundries (*dobby* communities) along the canal also discharge untreated water used for washing, into the Meda Ela. The *dobby* community has been living at this location for more than a hundred years. Clothes that have been used even in the operation theatres and wards of the hospital are washed in these laundries. This enhances the possibility of the water being polluted with pathogens and other microbes. The high concentration of phosphate in the Meda Ela may be due to the detergent used in the laundries.

Solid waste in the Meda Ela has become a routine sight. Solid waste management is a serious problem for the municipal corporation. The central collection system covers a limited number of areas due to the financial constraints; the land available for dumping is also limited. The KMC does not have a sanitary landfill site and open dumping along the streams is common. The dumping of solid waste into the Meda Ela becomes an easy way of solving the problem of solid waste, but not of the pollution of Meda Ela.

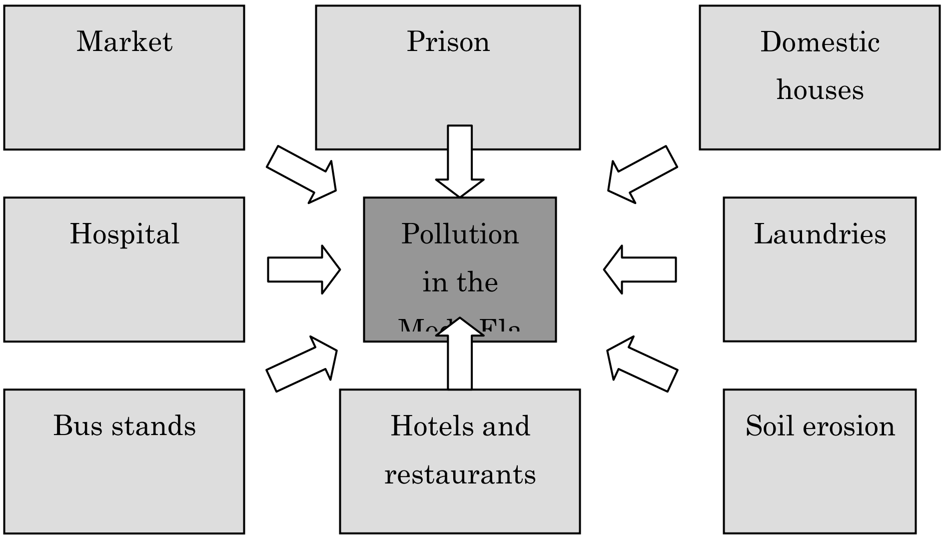


Figure 2: Multiple sources of pollution of the Meda Ela

3.1. Development and water pollution

The population of the Kandy city is growing fast; it was 110, 049 in 2001. The number of hotels and restaurants is increasing to cater to the increasing numbers of foreign and domestic tourists. Private hospitals and clinics have also increased to provide more medical facilities. New supermarkets, vehicle service stations, commercial venues and houses also indicate the rapid development of Kandy. These developments increase the physical and aesthetic impact on the Meda Ela.

A highway was constructed in 1988 alongside the Meda Ela, running parallel to the existing old road in order to reduce traffic congestion. The allocation of land for the development of the highway and the relocation of people also influenced the pollution of the Meda Ela. The rehabilitation package of the government failed to effectively relocate the people. Land was acquired for road expansion in 1988 and some of the people relocated to small plots near the banks of the Meda Ela. As a result houses were constructed in the riparian zone of the Meda Ela with or without prior approval from the KMC.

The high cost of construction perhaps acted as a deterrent for constructing proper sewage-disposal facilities. The limited land and shallow groundwater also created problems for construction of septic tanks and soaking pits; as a result, wastewater from the toilets and bathrooms flows directly into the Meda Ela. The count of coliform in the Meda Ela clearly indicates discharge of human excreta in its water.

Other recent developments along the Meda Ela, such as the Kandy court complex, supermarkets, channelling centres, several restaurants, fire brigade depots and new houses make the canal even more vulnerable to further pollution.

4. Multiple laws, acts and institutions

The pertinent questions in this context are: whether there are any restrictions or regulations related to pollution of streams? Whether there is any mechanism to monitor implementation of these regulations? The situation gets very convoluted due to multiplicity of sources of pollution, diversity and complexity of the problems and impacts created by pollution on environment and public health, and multiplicity of the possible victims. This complexity and multiplicity in diverse factors pulls a score of government agencies into the task of protecting the natural streams like Meda Ela. The complexity and multiplicity also attracts provisions of various laws. Further, diverse nature of these laws and criss-crossing jurisdictions of these institutions further complicates the situation. More than fifty legal enactments and government agencies deal with the water sector in Sri Lanka. Some of these laws and institutions pertain to the control of pollution and related issues.

4.1. The KMC and the UDA

The Kandy Municipal Council (KMC) is governed by the Mayor, members elected by the people, and the Commissioner appointed by the government. The KMC consists of different departments responsible for maintaining different aspects of Kandy city. The departments of Health, Environment and Buildings play a major role in enforcing the policies and regulations related to the problems affecting Meda Ela. Local government acts, municipal and urban councils' ordinances, the Pradesha Shaba act, Land Development Ordinances (No. 19 of 1935, No. 3 of 1946), the Land Acquisition Act and the Crown Land Ordinance (No.8 of 1947, 9 of 1947 and 13 of 1949) are prescribed in the government policy for land development and rehabilitation, and to maintain the reservation area of the Meda Ela.

The KMC and the Urban Development Authority (UDA), a body entrusted with the function of planning of major cities in Sri Lanka, are responsible for the resettlement of people displaced by the construction of the highway that runs parallel to the Meda Ela. There are differences in the levels of interests and influence of the political leadership and administrative leadership in different cases. Most of the institutions are regional bodies, which come under national ministries. The KMC, however, is a local body and it can make decisions independently under its political leadership. Opinions and views on policies at the local and national levels are likely to differ or clash.

The KMC is responsible for the collection and disposal of solid waste. The provisions related to solid waste management in the municipal council ordinance says that all street refuse, house refuse, night soil, and other similar matter collected shall be the property of the council and the council shall have full power to sell or dispose of all such matter. The ordinance also prescribes that the municipal council shall, from time to time, provide places convenient for the proper disposal of all street refuse, house refuse, night-soil or other similar matter.

The Urban Development Authority (UDA) deals with the major development plan of Kandy city. The Urban Development Authority Act (No. 4 of 1982) states that “any development activity should obtain a development permit from the relevant local authorities.” The Buildings Department has the task of approving plans for building houses and look into giving approval according to the specific reservation limits on building houses near waterways. The Act also specifies that waste generated within any premises shall be collected and disposed of in a manner which the authority considers essential, so as to safeguard the health of the inhabitants.

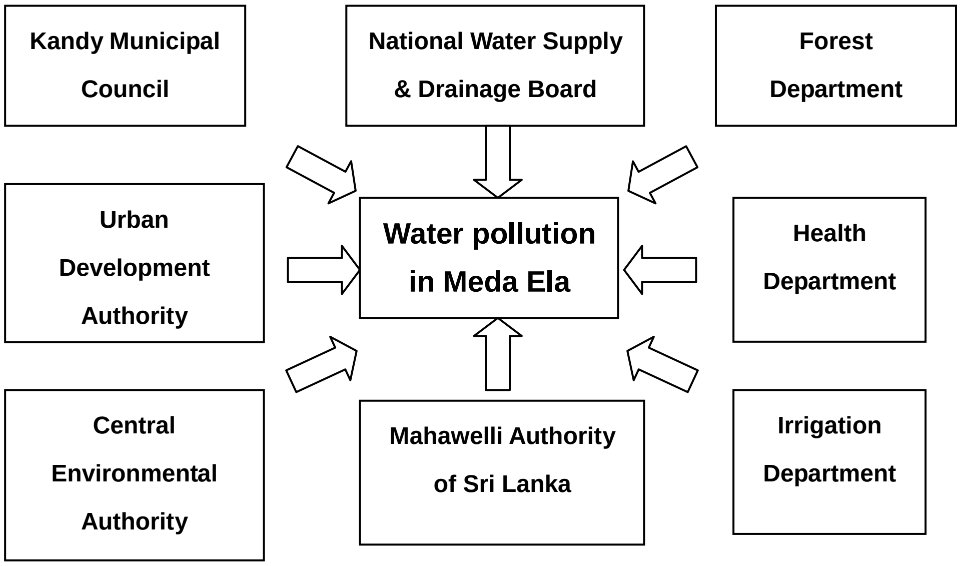


Figure 2: Institutions and departments linked to the Meda Ela

The building department of the KMC grants a certificate of conformity after the construction work is completed. This certifies that the work has been completed as per the approved plans and permit. This certificate is required for obtaining water supply from the National Water Supply and Drainage Board (NWSDB), and electricity supply from the Ceylon Electricity Board. Water and electricity may be provided, if necessary, during construction, but at higher rates. The rates are reduced after the certificate of conformity is produced. Illegal buildings or premises are not supposed to get water and electricity from the respective institutions.

The UDA Act, in Schedule IV (Form E-Regulation 18) also provides for the reservation of ‘no-construction areas’ along waterways. This reservation of area is meant to protect the waterways and facilitate the flow of water, particularly during floods. The reservation line is drawn at a certain distance away from the edge of the high water level of the Meda Ela. This distance is three meters for the portion of Meda Ela between the Kandy Lake and to Heerassagala junction, and six meters for the portion between Heerassagala Junction and Mahawelli River. In spite of these restrictions, houses have been constructed entirely or partially in the reserved areas along Meda Ela. The reservation limit is also meant for restraining discharge of wastewater and dumping of solid waste in the waterways. However, several pipes open directly into the Meda Ela, despite existence of reservation lines.

The UDA act also provides detailed norms for disposal of sewerage to be followed to obtain a development permit. It says: “All sewerage and wastewater outlets shall be connected to an existing sewerage system and the authority may in any particular case require the sewerage and wastewater to be pre-treated to bring them to acceptable standards before being connected on to a public sewerage system.” In the case of the Meda Ela, where a public sewerage system does not exist, the Act prescribes that the outlets cannot be connected to the natural stream, which sewerage must be disposed through a septic tank, and that wastewater should be suitably disposed through a soaking pit. The bacterial contamination of Meda Ela confirms that the contents of septic tanks are discharged into the canal, despite the regulations.

The UDA and other departments have to work in coordination for successful implementation of legal provisions related to the development permit. According to Section 4 (vii) of the UDA Act, in case low lying areas are to be filled up, the UDA must seek approval from the Commissioner of the Department of Agrarian Development, the Chairman of the Sri Lanka Land Reclamation and Development Cooperation and the Head of the Department of Irrigation. The reservation and other linked areas along Meda Ela (valley) are low lying and were used for paddy cultivation in the past. The filling of paddy fields for constructing houses was recently banned, in view of the importance of the reserved areas along waterways, which enable water storage, groundwater recharge, and protection from floods.

4.2. Sectoral agencies dealing with the issues involved

The National Environment Act (No. 47 of 1980) prescribes that “No person shall discharge, deposit or emit waste into the environment or carry on any prescribed activity determined by an order made of the Act in circumstances which cause or are likely to cause pollution or noise pollution, otherwise than license issued by

CEA and in accordance with the standards and criteria specified." The Central Environmental Authority (CEA) is empowered to give an Environment Protection Licence (EPL) for medium and large industries and processing plants, to monitor the effluent discharge and to take necessary legal action to safeguard the environment. The CEA has set a standard for wastewater discharge. Both the CEA and the Public Health Department have to monitor wastewater discharge. The CEA and the Health Department of the KMC are responsible for monitoring wastewater discharge into the Meda Ela from the hospital and prison in Kandy.

The National Water Supply and Drainage Board is responsible for the supply of safe drinking water and proper drainage facilities. A law of the Water Supply and Drainage Board (No.2 of 1974) provides for pumping water from the intake at Mahawelli River, operating and maintaining a water treatment facility, distributing water and collecting payments from customers. The Board must also ensure proper drainage in order to protect the water resources. The Board does not allow water supply for houses and other premises built illegally, without prior approval or a certificate of conformity.

According to a public health ordinance, the Health Department is responsible for the cleanliness of all roads, drains, markets and the environment in general. Responsibilities of the Health Department includes: implementation of the health policy, monitoring effluent discharge of small scale operations (markets, hospitals and restaurants), creating public awareness regarding health issues and taking legal action if necessary when it comes to public health and sanitation. The Public Health Inspectors (PHIs) are ground-level implementing officers of the Health Department. Legal actions for non-compliance can be taken by the PHI, but actions against polluters, particularly government establishments like the prison and hospital, are a challenge for the PHIs.

The Mahawelli Authority Act (No 23 of 1979) of the Mahawelli Authority of Sri Lanka (MASL) prescribes the development of the Mahawelli river basin for agriculture and hydro-power generation. The Irrigation Department is responsible for water bodies other than the Mahawelli River. Kandy Lake comes under the Irrigation Department according to an Irrigation Ordinance (No 32 of 1946). The forest department is responsible for implementing the Forest Ordinance (No. 13 of 1966) and the Fauna and Flora Protection Ordinance.

4.3. Overlaps and gaps

The ownership and responsibility for the drainage area of the Meda Ela falls in multiple jurisdictions, since it comes under the Mahawelli river basin, and originates from a lake and forest reservation. The overlap in terms of responsibilities requires effective coordination among the institutions to protect the Meda Ela from pollution.

All the departments linked with the Meda Ela are, in one way or another, responsible for its present situation. These institutions come under different ministries of the government. Regional centres of the institutions implement the national policies in the region. The Acts and Ordinance related to the Meda Ela are institution-specific. Most of the laws and Acts were formulated in pre-independence era, and a few amendments were later added. The challenges and issues in the present context are not the same as they were in past decades. The gaps and weaknesses in policy related to approving, monitoring and evaluating human activities that indiscriminately pollute the Meda Ela have to be identified and rectified.

5. Summary

The Meda Ela is polluted at multiple locations by multiple sources. The complexity of this problem is only added to by the multiple laws, regulations and government institutions responsible for maintaining the Meda Ela and its surrounding areas. Official agencies and the people have attempted several times to clean the canal, but the situation has not improved. Instead, the pollution now poses a threat to the environment, to livelihoods and to public health.

Serious concerns have been raised by policy makers, water and environment regulators, and the people about the Meda Ela and its deteriorating condition. A government initiative to solve the problem through a Centralised Sewage Treatment Plant has been opposed by some sections of the community for various reasons, such as the location of the plant, investment and recovery of costs, and doubts about the proposed technology and management of the plant. People have suggested that they themselves can take measures at the household level to solve the problem.

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Case 3:

'Unlike people, Meda Ela does not complain' [10]

Shamala Kumar and
Tehani Gunawardena

1. The Meda Ela and Kandy

Meda Ela, a natural water-stream, begins from Kandy Lake in the centre of Kandy city. Kandy is one of the larger cities in Sri Lanka, with a population of a little over 100,000 people. It is historically significant and designated as a world heritage site. It is a charming city, situated amid lush natural beauty.

Along its eight kilometre journey through Kandy, the Meda Ela is a sore point in this scenario. It flows underground for about a kilometre from the Kandy Lake watershed, after which it surfaces and moves parallel to the William Gopallawa Road, one of the main roads that enter Kandy city. On either side of the Ela is residential housing that stretches quite high up onto the surrounding hills. The water from these hills flows down to the Ela in small streams. A network of drains, some of which are managed by the municipal council, connects the city's drainage system to the Ela. A highly polluted Ela finally enters the Mahawelli, a river that has social, cultural and environmental significance to Sri Lankans.

Such is that state of the canal that research indicates it has no aquatic life. The Ela emanates a strong stench, which, at times, is unbearable. The water looks murky; and plastic bags, empty coconut shells, and other solid waste float on the surface or stick to the banks. On certain days, the water turns a dull red and on other occasions it becomes deep blackish grey. The changes in colour are probably due to pollution from various sources along the Ela,

[10] A statement made by an official during an interview with the author

such as a slaughter house and the major food market of Kandy. Garbage and sewage from many houses along the canal are also dumped into the Ela. The canal receives waste directly from tourist hotels, schools, hospitals, markets, slaughter houses, garages and laundries. The drains connected to the Ela, which are managed by the municipal council, look dirty and smell bad.

1.1. Peoples' perceptions of the Ela

Residents living around the canal seem to be wary of the Meda Ela. In interviews we conducted in 2008 with the community, only one of the 13 respondents living along the Meda Ela did not report some issue associated with the canal as a negative characteristic of the location of their home. Specifically, seven reported flooding, six reported unbearable odours emanating from Ela, and four reported mosquitoes as the negative attributes of their location.

The other consistent characteristic was congestion, which was reported by three respondents. These characteristics were listed without our introducing the Meda Ela as the focus of the survey. When asked if their perception of the Ela was positive, negative or neutral, all respondents said that it was negative.

Similar responses emerged amongst people living about 100 meters away from the Ela. One woman, whose house adjoins the Ela, told a story of a man who, she said, had died while trying to collect worms as bait from the canal. She said that the man died because the water was so polluted. Her home, a temporary shack, in which she and her daughter live, floods during heavy rains. She attributed an illness that her daughter got after a flooding incident to the polluted water; in another instance, she got a skin rash due to, she said, contact with the water when she rescued a kitten from the Ela. People living close to the Ela view it a pervasive negative influence on their living environment.

Despite these perceptions, some people indirectly use water from the canal or from tributaries of the Meda Ela. They use water from wells close to the canal. The water from a tributary, the Nagasthanna stream, is used by laundry workers; worms are collected from the Meda Ela to be sold in Colombo as bait for recreational fishing.

2. The story of Malini

Adjoining the Meda Ela stands a somewhat new building. Signboards advertise two eateries and other products for sale. As you approach the building from the side of the William Gopallawa Road, a bad smell emanates from the vicinity. For the ignorant, the smell may signal unhygienic food and a need to find food elsewhere. To others, it is simply a troubling reminder of the Meda Ela flowing by silently.

This building belongs to Malini. Like others we interviewed, Malini was unhappy about living so close to the Meda Ela because of the smell and the flooding. According to her, the main reason for the flooding is the violation of the river reservation limit of six metres set by the municipal council. A major supermarket and restaurant in the area and a paint shop altered the natural course of the Ela during the construction of their building. "The Meda Ela didn't flood like this before," Malini reminisces. She got the land some time ago, but built her complex after her husband's death only three years before, with the help of a loan and income she earned working abroad. Her complex seems to be successful, going by the constant stream of customers.

Malini lives on a plot adjoining the retail outlet, in a small half-built structure, with her 17-year-old daughter and 64-year-old mother. She acquired the plot from her previous neighbour, who was also relocated, just as she was, when the William Gopallawa road was built about 20 years ago. The neighbour sold her the property because of financial difficulties. According to Malini, he was a quiet and "scared" sort of person who let others push him around, which might explain why another member of the Meda Bowala village set up a 'Cushion Works' service on the premises. The municipality confirmed that the 'Cushion Works' was illegally built.

Malini feels she is viewed as an intruder or even as someone who usurped property belonging to the Meda Bowala village. The village is a cohesive community with historical roots in the area. As a result, they have a feeling of ownership of the local land. Malini said that when she and others were relocated to this area, the community looked upon them as outsiders. 'Cushion Works' is owned by long time residents of Meda Bowala. Although, the owners illegally acquired the land, they have the support of the community; Malini says she gets little support from the Meda Bowala community.

Malini's brother, who works with the Mayor of the city, helped her get the approval to build the business complex. However, on at least one occasion, these connections have been a liability. When she went to complain about the activities of her neighbours to the Buildings Department, she said that she was "scolded" and asked if she felt that she could just push them around because of her brother's connections. Malini was critical of the municipality and its inability to help her. She seemed to think that if only they did their jobs, her problems would be over.

3. The official view: A system in need of repair

The municipality, however, seems to have its own problems, which the officers involved are quick to point out. It has a multiplicity of institutions; three major institutions are directly responsible for curbing pollution. Each of these institutions has field level officers who are responsible for implementing the policies and laws designed to control pollution and manage water drainage: the Public Health Inspector (PHI), the Central Environment Authority (or CEA) Officer, and the officers from the Buildings Department.

The CEA officer, Chandanie,11 is responsible for giving an Environmental Protection License (EPL) for medium and large industries and processing plants, monitoring effluent discharge and conducting awareness programmes about environmental pollution and possible solutions to these problems. The Buildings Department is in charge of approving plans for building houses. According to this department, construction around the Meda Ela must be six meters away from the canal where Malini lives. All buildings must have soakage pits for disposing wastewater and sewage, and the drainage system must only be used to deposit rain water and not waste. The Health Department has to monitor the residents of the community and prevent unlawful disposal of waste into the Ela, using the same code applied by the Buildings Department. The PHIs are expected to first warn violators but can also take legal action against them. Bandara, the PHI in charge of the Meda Ela, admitted that it was of the low priority for him. Unlike people, he said, "The Meda Ela does not complain."

[11] Names have been changed.

Poor coordination hinders effective functioning of the system. Ananda, another PHI, said, “We don’t even get documentation about this approval process, but then it is up to us to make sure that these same buildings do not pollute after the building is constructed. How can we do that?” Technically, a copy of the approved plan should be sent to the office of the Medical Officer of Health, where the PHI works. However, according to Ananda, these copies are often not sent.

The field officers say they are burdened with work. Bandara, who has been at this position for eight months, has a diverse set of responsibilities such as providing health education, inspecting schools, conducting legal proceedings, eradicating illegal substances, disposing of waste and building material, and dealing with environment problems. The officer of the Central Environment Authority, who is in charge of three districts, agreed that there is an overload.

Perhaps as a result of the workload, the officers seem to work in a somewhat ad-hoc manner. Bandara said that he receives around four-five complaints about illegal activities every day from citizens; sometimes these complaints are related to the Meda Ela. He attends to other complaints much of the time instead of those directly related to the Meda Ela because of time constraints, he said. Records of complaints are also kept in an ad-hoc manner and are not revisited, except when another complaint is lodged. Nor has he followed up on his predecessor’s cases or even had a briefing of ongoing activities with his predecessor.

To some extent, however, the PHIs do have some consensus about priority in terms of pursuing industrial rather than domestic non-compliance. Ananda said that he was primarily interested in big institutions that do not comply with the regulations. “It’s not the small people who are the problem but the rich people who come to argue with us when we try to do our job.” According to him, the bigger institutions are the biggest polluters and they are the cases that the judges have said should preferably be brought to them. Because licensing from the Central Environmental Authority must be renewed regularly, enforcement is done in a more regular manner.

3.1. The problems in dealing with pollution

For the field officers, the incentives to effectively implement policy seem to be few. Field visits, according to Bandara, are difficult, because he only get US$ 8.41 per month as petrol allowance. The current price of petrol per litre is US$ 1.47. The red tape involved in getting the $ 8.41 is so cumbersome, that Bandara says he uses his own funds for travel most of the time.

The PHIs don't feel compelled to legally pursue cases because they do not get batta (a daily allowance) for the time they spend in court, unlike police officers, who get an allowance even when they work within city limits. "So why should we waste our time in the courts, spending our own money to get them convicted?" Bandara asks. He also complained about the time lag involved in pursuing offenders through the legal system, which can take several months. "It would be nice," he said, "if like the police we could just issue tickets to wrong-doers."

Both Bandara and Chandanie, the officer from the Central Environmental Authority, talked about the lack of funds. Chandanie said that although they would like to conduct programmes such as awareness campaigns, there is no money and at times they even use their own funds.

The system sucks initiative out of its workforce. Bandara said that he attempted to institute a recycling campaign along the Meda Ela for 250 houses. Non-degradable waste would be taken to recycling centres and other waste would be left to decompose naturally. However, he gave up this programme because it was difficult for him to implement it. After writing the proposal, he had to pursue people to get the proposal and funding approved. It took so long that he stopped pursuing the project.

Perhaps because of the lack of incentives, officers need added pressure to pursue a particular case. "The only time I take the trouble to file a case is when the (erring) resident has attitude problems," Ananda said. He is particularly reluctant to get involved with problems initiated with an intention to settle personal scores between neighbours. He categorically said, "I do not pursue them when I feel that we are being used to further their personal agendas."

Bandara was also dismissive. He said that Malini and the owners of the 'Cushion Works' had a personal disagreement, which they were trying to deal with by involving officials. "Why should we get involved with their personal problems?" he asked; he is not intervening in this case. His attitude indicates that the PHIs have substantial discretion in doing their work. Their perceptions and bias may determine when they intervene. A statement Bandara made further indicates biases. When asked who he thought were the main polluters he said "rich Muslims".

Practical issues associated with their work make matters worse; the near-impossibility of detecting illegal sewage outlets, for example, which are only opened during heavy rains. This is corroborated by an extremely pungent smell that pervades the area whenever it begins to rain. Residents are expected to build soakage pits on their land to dispose of this water. Bandara said that because the soil is quite saturated in this area, soakage pits have a tendency to overflow. "Many residents don't have the money or space to build them anyway," he said.

The PHIs indicated that the Department of Health does not have a licensing system, unlike the Central Environmental Authority, that would help them to systematically monitor unlawful activity. Although Chandanie of the Central Environmental Authority denied this, Ananda said that licensing made service stations more compliant. Chandanie said that the hoteliers normally listened to their advice but not the service station owners and workers.

It would be incorrect however to say that the officers are completely ineffective. Bandara said that he is not completely neglecting the Meda Ela. He said, "The major contributor to the high pollution level of the Meda Ela is solid waste," and labourers are regularly employed to collect the solid waste dumped and piled up along the Ela. "The people only see how much the Ela is polluted. Yet they do not see how much work is already done to keep the Ela in its present condition. If we stopped doing what we are doing now people will not be able to even walk through Kandy because of the accumulated garbage."

3.2. How corruption affects the Ela

Corruption is also a feature of the system. Our efforts to talk to the officials of the Buildings Department were unsuccessful; they were reluctant to cooperate. When discussing this issue with others who have been involved with the same department, questions about corruption arose. A member of the staff, when approached after office hours, said that the department was sensitive about public scrutiny because it was engaged in an ongoing national-level investigation into allegations of the mishandling of funds by staff members. The Minister of Public Affairs was reportedly overseeing the investigation.

About a year ago, Malini had to deal with corrupt garbage collectors. With no alternative method of solving the problem of waste disposal for her business, she said she constructed a compartment for collecting garbage using her own money. The former PHI in charge of the Ela advised her on how to carry out this task. She said, “I even invited him to the opening ceremony.” For some time, her tenants complied with this system and put their garbage into the compartment. However, the municipality workers who came to collect the garbage asked from her renters a monthly “unofficial fee,” which she rejected. She launched many complaints when the garbage started piling up. The PHI advised them not to use the bins because they would not be collected again. Now the garbage is dumped into the Ela, and people seem to be uninterested in finding solutions to the problem.

Malini said that she also rejected the contractor’s offer to build her a mechanism to directly dump her sewage into the Meda Ela. She feels that residents bribe the officers; she has observed officers receiving free services and food from boutiques and houses. She has seen the ‘Cushion Works’ owners and officers “laughing and talking with each other.” She is unhappy with the slowness with which the matter of the ‘Cushion Works’ shop is being dealt with by the municipality, and complains that the owners must be bribing the municipal officers (PHIs).

Based on a court case, a judge had apparently ordered the municipality to remove this building. Malini said that each time the officials came to give notice, the owners disappeared. She suggested that the owners were informed prior to the visit of the officials. This case has dragged on for a long time. Malini is hopeful that in the near future the judge would intervene; but it has been several months since the judicial order, and the shop is still functioning.

3.3. Political pressure and pollution

Amidst these difficulties lies the pervasive influence of politicians. Much of the Meda Ela is within Kandy city limits and is therefore under the purview of the Kandy Municipality. The Kandy Municipality is steered by a legislative body headed by the Mayor. It is responsible for creating the laws and policies relevant to the Municipality—including those related to the Meda Ela. The Mayor and other members of the council are elected through local elections. The members of the council represent the governing party and the opposition. The council comprises 14 members of the governing party, the United National Party (UNP) and 10 members in the opposition. Although the UNP governs the Kandy Municipality, it is part of the opposition in the national government.

The national government can influence local pollution. The policies developed by the municipal council are administered through the Sri Lanka Administrative Service. At the municipal level, the Commissioner heads this administrative structure. Through the Commissioner the minister can also influence how policies are implemented. Under the Commissioner are many heads of department, such as the Medical Officer of Health, who heads the Department of Health and Sanitary Services. The Commissioner of Kandy is attached to the Ministry of Public Administration and Home Affairs, currently under Sarath Amunugama (Ministry of Public Administration and Home Affairs, 2008), representing the United National Freedom Alliance (UNFA), the party in power at the national level, and often at loggerheads with the UNP.

Chandanie said that their work is made difficult by political interference. Political influence seems to help at times and at times it hinders citizens in getting their voices heard. Political considerations probably explain why the municipality would allow structures to be built without space for sewage pits. Malini and her friend Menike both got legal approval to build that went against the policy directive. In both cases, political intervention seems to have been used to get special permission for their buildings. Menike’s building and the adjoining house were approved after they were built on illegally acquired land. As a result, the building did not even go through the approval process.

Yet, when Malini applied for permission to construct a retaining wall along the Ela to deal with the flooding, she said an approval was granted but later withdrawn. She said that this was because the 'Cushion Works' owners, who supported the UNFA, sent a petition to the President stating that the Mayor was unfairly favouring her because she supported the UNP. She said, "I know the Mayor well, but now the Mayor is too scared to help me."

When Malini went along with her neighbours to complain to the Mayor and the President's special squad about a house on the Ela, which according to her is illegally built on reservation land, no action was taken. Malini also described a large house close to her home that she said a minister had built, also on reservation land, which was corroborated by another member of the community. A relatively larger structure does exist further upstream.

Although Malini is critical of individuals who build on the reservation land along the Ela, her building is also partly built on this land. She had met the planning committee, which approves all structures built in Kandy municipality, and got a special concession on grounds of sympathy. She said that she had to give 26 perches (units) of land to the government when the new road was built, and in exchange received this piece of land that was only five feet wide. The 26 perches of land the government acquired was her on a "temporary basis"—a euphemism that means her family illegally settled on that site. She could not do much with the land and was therefore allowed to build on the reservation land. Thus, she too has contributed to the flooding.

4. Summary

This case has examined how policies related to the Meda Ela are implemented from the perspective of those responsible for the implementation, as well as from the point of view of the community. Systemic problems pervade this process. Unfair political and financial manipulation is viewed as the norm. Everybody involved in the Meda Ela seems to be frustrated. Multiple interconnected issues have to be addressed through interventions to curb pollution. The story of the Meda Ela and the solutions it generates could be relevant in other contexts.

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Case 4:

The tale of a tank

C. Sivayoganathan

1. Minor irrigation tanks in Sri Lanka

The Divullewa Mahawewa tank is a recently renovated minor tank in the district of Kurunagela. It has a command area of 15 hectares and is part of a cascade system managed largely by the villagers. Of the 11257 minor irrigation tanks in Sri Lanka, 4192 or 37 percent are in Kurunagela district; 22 percent of the command area of the recently rehabilitated minor tanks is in this district.

Sri Lanka is divided into two major dry and wet agro-climatic zones, based on the amount of annual rainfall received during the two rainy seasons, Maha and Yala. The northern and eastern parts of the country are predominantly in the dry zone. The wet zone covers the south western region, including the central hill country. The dry zone receives an average annual rainfall of less than 1750 mm. The Maha season (October to April) brings heavy rains to this dry zone, which covers nearly two-thirds of the country. This makes irrigated agriculture an important aspect of Sri Lankan agriculture in the dry zone.

The irrigation tanks are classified as major, medium and minor on the basis of the command area they serve. Minor irrigation tanks have a command area of 80 hectares or less. However, in terms of the total extent and the number of farmers served in the country, minor village-level irrigation tanks play an important role. The Divullewa Mahawewa is one such minor irrigation tank. It is believed to have been originally constructed in King Mahasena’s era. The Divullewa Mahawewa is one of the 16 tanks of the cascade system that receives water from a main tank called Magallewewa.

The minor tanks in the dry zone of Sri Lanka are mainly water storage facilities created by people as elements of cascade systems of interconnected tanks. The minor tanks provide water for irrigation and are also the centre of village life. The tanks are the meeting point for bathing, washing clothes, fishing and work on water-based industries. The tanks are thus regarded as crucial support for sustainable livelihoods for households and the village, through increased agricultural production, employment and income. The tanks recharge and regulate the local groundwater table, and are therefore also vital for ensuring the supply of drinking water. The local community generally claims to “own” the tanks, though the major responsibility of rehabilitating the tank lies with the government.

1.1. Maintaining the minor irrigation tanks

In the past, the tanks were maintained by the people from surrounding villages under the supervision of the Mahagamurala (village leader) and the Wel Vidane (irrigation leader). This system, called Rajakari, effectively managed the minor tanks. The villagers cleaned the tank and the surrounding areas during the dry season every year in August, under the leadership of the village leader.

The British administration abolished the Rajakari system without introducing an alternative system for the maintenance of the tanks; consequently, the tanks were abandoned. In 1958 the Sri Lankan government introduced cultivation committees to manage the tanks. The small tanks subsequently became the responsibility of the Department of Agrarian Services, which was later renamed the Department of Agrarian Development. Even after the Department of Agrarian Services took over, the minor tanks were not properly managed, mainly because the local people had by then been displaced due to economic, political, environmental and security reasons.

In the recent past, many of these deteriorated and abandoned tanks have been renovated by the government, international development agencies and non-governmental organisations. The tanks were renovated to increase the availability of water for irrigation and for other purposes. However, the villagers have not received the expected benefits from the renovated tanks, and the operation and maintenance of the tanks is not satisfactory.

2. The village and its people: beneficiaries of the tank

The beneficiaries of the tank mainly consist of two groups: 45 title-owners of paddy fields and 30 other villagers who are engaged in part-time farming and off-farm activities, though they do not own the land. The owners of the paddy fields are the main beneficiaries of the tank, and use its water mainly for cultivating paddy. Highland crop-growers or people engaged in brick-making, who form the other group of 30, are not eligible to use the tank water for their purposes. However, they use the water draining out from the spills and turn-outs. The farmers here cultivate paddy and other field crops by directly using tank water; vegetables and betel are grown as highland crops. The tank also provides water to another small tank. A farmer appointed as a jalapalaka (water flow controller) oversees the distribution of water in the village.

In the village where the beneficiaries of the Divullewa Mahawewa tank live, only a few houses near the main road have electricity. Transportation in most parts of the village is poor. A majority (83. 9 percent) of the beneficiary households who have legal titles are traditional settlers and the others (16.1 percent) are new settlers. Most of the people are Sinhalese Buddhists and there are no distinct caste differences among the villagers.

Our survey conducted in 2008 showed that the male heads of households had higher levels of education (average grade 7.9) than their wives (average grade 5.8). Although a somewhat comparable percentage of men (32.3 percent) and women (35.5 percent) amongst the respondents had studied beyond the ninth grade, 29 percent of the wives reported not attending school at all as compared to only 3.2 percent of the husbands (See Table 1 in the Appendix section).

The men (average age 49 years) were significantly older than their spouses (average age 33 years); 41.9 percent of the male respondents were between 41 to 60 years old, whereas exactly a same 41.9 percent of the women were between 23-40 years old. And 22.6 percent men and 6.5 percent of their spouses were over 60 years old (See Table 2 in the Appendix section). The family size of the respondents ranged from 1-7 members, and nearly one-third (32.3 percent) families had four members (See Table 3 in the Appendix section). Most of the respondents (90 percent) were engaged in farming as their main enterprise. Some were also engaged in brick making, fishing and off-farm employment.

2.1. Uses of tank water

The tank water is used by the households for various activities (See Table 4 in the Appendix section). It is however apparent that the tank water is mainly used for paddy cultivation (90.3 percent), followed by bathing and washing (48.4 percent). The other activities for which the water is used are brick making, for livestock and their grazing, and cultivation of perennial and other field crops. No respondents reported using tank water for drinking, because they use well water for this purpose. According to a previous study, only one percent of the villagers were engaged in inland fisheries in this tank. The farmers' organisation leased out the tank for fishing to the villagers and charged a tax of five percent from the fish harvest.

2.2 Land ownership and use

The farmers generally have three types of lands: highland, lowland and chena land, which is used for shifting cultivation. On an average, farmers owned 1.30 acres of lowland, 1.60 acres of highland areas, and 0.30 acres of chena land. Most of the land was owned by the households, with only a small portion of the lowland (0.13 percent) rented out for cultivation (See Table 5 in the Appendix section).

Paddy is the main crop. During Maha, most of the lowland is used for paddy cultivation, whereas during the Yala season only half of the lowland is planted with the same crop. Small amounts of other crops are cultivated on the highland during both Yala (average 0.35 acres) and the Maha (average 0.55 acres) seasons. No other field crops are cultivated in the lowland either in the Maha or the Yala seasons. Some perennial crops such as mangoes, jak, coconuts and citrus are grown in the highland (See Table 6 in the Appendix section).

2.3. Reported inequity in use of the tank

In terms of the use of tank water for various purposes, almost all the respondents indicated that water was used mainly for irrigation during paddy cultivation rather than for any other activities. A majority of respondents who are farmers (51.6 percent) said the use of the tank was inequitable, but a close minority (45.2 percent) perceived no inequities. Of those who reported inequities in irrigation (25.8 percent), everyone indicated that the head-enders along a channel, who had fields closer to the tank, benefited more than the tail-enders.

Over three-fourths did not report any inequity in water use with respect to the sex of the farmer, duration of settlement in the village (that is, whether they were traditional settlers or new settlers) and scale of farming (See Table 7 in the Appendix section). It should be noted that more land can be brought under cultivation by enhancing the capacity of the tank. The survey did not collect any information from non-beneficiaries, either general or specific to inequities in the use of water.

2.4. Who really owns the tank?

The ownership of Mahawewa tank is not clearly defined. It is likely that many parties share the ownership. The resources within the tank such as fish and plants are owned by the Divisional Secretariat, while administration and maintenance activities such as conducting kanna (seasonal) meetings and water distribution are undertaken by the Agrarian Services Centre. However, the villagers had different opinions: “We all own it”; “The government owns it”; “The government and villagers both own it”. A majority of 54.8 percent said that they themselves owned the tank, whereas 29 percent said the farmers' organisation was the owner. Only 9.7 percent said that the government owned the tank. These different perceptions of who owns the tank may be impacting the levels of participation.

3. Taking care of the tank

The management of the irrigation tanks includes three major tasks: rehabilitation, operation and maintenance. All these tasks involve planning, implementation and evaluation. Many stakeholders are involved in the management of the tank, and their participation in the whole process is vital for the success of the programme. The Department of Agrarian Development plays a major role, because funds from the government or from other agencies are generally channelled through this department. It is also responsible for coordinating the activities of the various agencies engaged in the management of the minor tanks.

3.1. Rehabilitation activities

Over the past decade, the Mahawewa tank was rehabilitated three times. During 1996-98, the bund and the sluice were reconstructed and the lower tank area was developed with Rs. 12 lakhs given by the Asian Development Bank. In 2004, under a project to develop 10,000 tanks, the tank bed was deepened at a cost of Rs. 4 lakhs. In 2006 the third tank rehabilitation project, which included improving infrastructure in the village, was implemented with funds from the Asian Development Bank.

Farmers were brought in to work on the rehabilitation by using a combination of food-for-work and cash-for-work approaches. Farmers were engaged as unskilled labour mainly for earthwork related to deepening the tank bed, improving the tank bund and constructing or repairing channels. Over 90 percent of the farmers participated in these activities. This seems natural because the farmers draw direct, tangible and significant benefits from the tank. It is expected that farmers who volunteer for and assume responsibilities as office-bearers of farmers' organisation are more aware and committed.

Participation in rehabilitation work is expected to promote ownership, leading to proper maintenance of the tank after the rehabilitation. According to the data (see Table 8 in the Appendix section), the men participated more than women in all the rehabilitation activities. This could be due to prevailing perceptions about the differential abilities of men and women, which may determine what kind of work is allocated to whom. Both men and women contributed to activities such as deepening the tank bed, constructing/repairing spills, channels and turnouts. Skilled labour was largely employed for constructing /repairing spills and turnouts. Unskilled labour received food for their work, whereas the skilled workers got both food and cash. A few men said they contributed cash instead of labour for the rehabilitation work; no woman reported any cash contribution. The overall low level of contribution in cash could be due to the low economic status of the villagers. In conventional South Asian societies, women in rural areas additionally have little access to and control over money; their work is often regarded as non-productive and therefore non-remunerative, and payments in kind (food) are often deemed more suitable.

3.2. Operation and maintenance activities

The president of the farmers' organisation said that a 20 percent contribution was expected from the villagers, either in the form of labour or cash, for the maintenance of the tank. The cash collected was deposited into the organisation's fund, from which money was drawn for expenses related to the maintenance of the tank.

The data clearly show that both the office bearers and the beneficiaries (ordinary members) of the farmers' organisation took responsibility for activities related to the operation and maintenance of the rehabilitated tank (See Table 9 in the Appendix section). Men seemed to play a more active role than women in all these activities, such as earthwork, cutting shrubs, removing anthills and weeding channels. The power to make decisions, as the table indicates, is also more with men than with women: deciding cultivation dates and preparing the schedule for delivering water for cultivation, for example.

Although government officers are involved to a small extent in maintenance activities such as earthwork and weeding, their primary role appears to be deciding cultivation dates and preparing the schedule for delivering water for cultivation. According to the respondents, government officers as well as the office bearers of the farmers' organisation (president, secretary and treasurer), were involved in these decisions.

The maintenance work on tank bunds and irrigation channels was done by the villagers usually as shramadana (collective voluntary labour). Most of the respondent villagers (93.5 percent) saw themselves as being knowledgeable about the activities related to the maintenance of the tank. According to the Agrarian Development Officer, political interference in the management of the tank was low.

3.3. Levels of participation

According to the Agrarian Research and Production Assistant, there was harmony in the village, the villagers were enthusiastic and their participation in the tank management activities was high. The president of the farmers' organisation reportedly facilitated this; he is highly respected by the villagers as a responsible and unbiased middle-aged bachelor who had few family responsibilities.

The level of the stakeholders' participation was also assessed by finding out if they attended meetings and gave ideas, whether these ideas were favourably considered in making decisions, and whether the decisions made based on the ideas given were implemented. Although the Agrarian Research and Production Assistant reported that participation was uniformly high, the data show that men participated a lot more than the women in all phases (planning, implementation and evaluation) of the tank management process (rehabilitation, operation and maintenance) (See Table 10 in the Appendix section).

Over two-thirds of the respondents reported that male beneficiaries, office bearers of the farmer organisation and government officers attended the meetings and expressed their ideas. However, office bearers of the farmers' organisation and government officers together had a greater role and influence than ordinary male beneficiaries. Less than 50 percent of the respondents reported that women beneficiaries attended meetings and expressed their ideas. Most of the men indicated that their ideas were used for decisions and that the decisions based on their ideas were implemented.

Overall, the participation of the beneficiaries in the evaluation process was reported to be low. However, the office bearers of the farmers' organisation seemed to participate in evaluation in addition to planning and implementation. The government officers were reported to have participated the most in the planning phase of the rehabilitation process.

4. Summary

Minor irrigation tanks like the Divullewa Mahawewa play a vital role in Sri Lanka. They provide water for irrigation, recharge groundwater tables, and serve as a centre of village life. When effective and traditional systems of managing the tanks were discontinued, the tanks decayed. In recent years, several attempts have been made to resurrect the tanks, with varying degrees of success in terms of availability of water and its equitable distribution.

As primary beneficiaries of the Divullewa Mahawewa, owners of paddy fields command greater access to the tank's water; disparities also exist in the water available to head-enders and tail-enders. The ownership, formal and informal, of the tank, is perceived differently by different people. This, along with the socio-economic dynamics, impacts access to the tank's water and the levels of participation in the management of the tank.

Management activities such as rehabilitation and operation and maintenance are underlined by gender differentials, in terms of the wages received and types of work done by men and women, and the power to decide cultivation dates and distribution schedules. Men participate more than women in all phases of the management process. Other hierarchies exist in the form of government officers and office bearers of the farmers' organisation having a greater say in making decisions and getting their opinions through in meetings.

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Appendix

Table 1: Education levels of heads of households and spouses

Grade	*Head*		*Spouse*	
	No.	*%*	*No.*	*%*
0	1	3.2	9	29.0
1-5	5	16.1	4	12.9
6-8	10	32.3	1	3.2
9-13	10	32.3	11	35.5
Non-response	5	16.1	6	19.4
Total	31	100	31	100
Mean	7.9		5.8	
Range	0-13		1-11	

Table 2: Ages of heads of households and spouses

Age (yrs)	Head		Spouse	
	No.	%	No.	%
23-40	11	35.5	13	41.9
41-60	13	41.9	8	25.8
61-78	7	22.6	2	6.5
Non response	0	0	8	25.8
Total	31	100	31	100
Mean	49		33	
Range	28-78		23-67	

Table 3: Family size of the respondents

Number of members	No.	%
1	4	12.9
2	6	19.4
3	3	9.7
4	10	32.3
5	5	16.1
6	2	6.5
7	1	3.1
Total	31	100

Mean. 3.52 *Range. 1-7*

Table 4: Main uses of the tank

Number or respondents citing the categories of work						
Uses of tank	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Total No.*
	No.	No.	No.	No.	No.	
Paddy cultivation	28	-	-			28 (90.3)
Bathing/ washing	-	14	-		1	15 (48.4)
For livestock	-	-	3	2		5 (16.1)
Brick-making	3	1	-			4 (12.9)
Cultivation of perennial crop	-	-	2			2 (6.5)
Cultivation of other field crops	-	1	1			2 (6.5)
Grazing	-	-	1		1	2 (6.5)

**Values in parentheses are percentages*

Table 5: Ownership of land

Type	*Total area accessed (in acres)*		*Area of land owned (in acres)*		*Area of rented land (in acres)*	
	Mean	***Range***	***Mean***	***Range***	***Mean***	***Range***
Lowland	1.44	0-5.00	1.30	0-5.00	0.13	0-1.50
Highland	1.60	0-12.00	1.60	0-12.00	0	0
Chena	0.30	0-4.00	0.30	0-4.00	0	0

Table 6: Area of land mainly under crops

Crops cultivated	*Highland*				*Lowland*			
	Yala (acres)		*Maha (acres)*		*Yala (acres)*		*Maha (acres)*	
	Mean	***Range***	***Mean***	***Range***	***Mean***	***Range***	***Mean***	***Range***
Paddy	0.01	0-0.25	0.05	0-1.50	0.82	0-4.00	1.25	0- 4.50
Other field crops	0.35	0-4.00	0.55	0-40	0	0	0	0
Perennials	Mean 0.93, Range 0-9.00				0			

Table 7: Inequities reported in use of tank

Type	*Reporting inequity*		*Not reporting inequity*	
	No.	***%***	***No.***	***%***
Farmers	16	51.6	14	45.2
Persons involved in other occupations	1	3.2		
Head enders	8	25.8	23	74.2
Tail enders	0			
Small scale	4	12.9	23	74.2
Large scale	4	12.9		
Traditional settlers	4	12.9	26	83.9
New settlers	1	3.2		
Males	3	9.7	28	90.3
Females	0			

Table 8: Involvement of beneficiaries in rehabilitation activities

Activity	*Food for work*			*Cash for work*			*Contribution in cash*		
	M*	***F*****	***Both***	***M***	***F***	***Both***	***M***	***F***	***Both***
Deepening tank bed	10	1	8	9	-	-	-	-	2
Improvement to tank bund	8	8	-	12	-	1	1	-	2
Construct/ repair spill	3	-	6	11	-	1	-	-	2
Construct/ repair channel	4	-	7	3	-	9	-	-	1
Construct/ repair turnouts	3	1	6	6	-	2	2	-	-
Other	-	-	-	-	-	-	-	-	-

** male ** female*

Table 9: Participation of stakeholders in operation and maintenance activities

Number of respondents reporting participation in these activities					
Activity	***Male beneficiaries***	***Female beneficiaries***	***Office bearers of farmers' organisation***	***Govt. officers***	***Others***
Earth work on bund	20	10	16	4	3
Cutting shrubs on bunds	19	7	11	-	3
Removing anthills on bunds	20	4	8	-	2
Maintaining the sluice	13	2	11	2	5
Earth work on channels	18	7	6	-	2
Weeding channels	20	12	8	1	3
Deciding cultivation dates	16	3	22	12	4
Preparing water delivery schedule for cultivation	11	5	24	12	4
Operating sluice	7	-	18	2	6
Distributing water along the channels	12	4	18	2	3

Table 10: Levels of participation of stakeholders in different phases

Number of respondents reporting												
Level of Participation	***Planning***				***Implementation***				***Evaluation***			
	Men	***Women***	***FO office bearers***	***Govt. officers***	***Men***	***Women***	***FO office bearers***	***Govt. officers***	***Men***	***Women***	***FO office bearers***	***Govt. officers***
Attending meetings	26	10	25	23	24	14	20	18	15	6	20	16
Giving ideas	23	7	15	16	20	16	16	13	13	5	17	14
Ideas used for decisions	20	5	15	14	16	9	14	12	12	4	11	10
Implementation of decisions based on given ideas	18	4	14	14	14	8	12	11	10	3	10	10

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Case 5:

Rural-Urban water transfer in two cities in Tamil Nadu

Prakash Nelliyat

1. Chennai's thirst for water

Chennai is the fourth-largest metropolitan city in India; it is also one of the rapidly urbanising centres of South Asia. From 1951 to 2001, Chennai's population grew from 1.5 million to more than 7 million. The Chennai metropolitan area comprises a total area of 1189 $km.^2$ It consists of Chennai city (176 km^2), 16 municipalities (240 km^2), 20 town *panchayat*s (156 km^2), and 216 village *panchayat*s (617 km^2).

The Chennai metropolitan area encompasses Chennai district and parts of Tiruvallur and Kanchepuram districts. The peri-urban municipalities and town *panchayat*s have, in recent times, have seen a higher growth in population than the city corporation (*See Appendix 1*). Besides the permanent residents, the number of migrants and itinerant population in Chennai are also high. In 2001, there were an estimated 0.93 million migrants to the city, and 1.60 million to the urban agglomeration.

Chennai gets an average annual rainfall of 1290 mm, which is much more than the state and national average. In the urban areas, only about five percent of the rainfall seeps into the ground. Today 80 percent of Chennai's groundwater has been depleted, and any further extraction could lead to further degradation in quality, including the intrusion of salt water.

The Chennai river basin consists of a group of small rivers such as the Araniyar, Kusathalayar, Cooum and Adyar, which supplied fresh water to the city. Chennai currently does not have access to a perennial river and has to depend primarily on three major reservoirs (former irrigation tanks) and one small reservoir across a river that flood only for a few days during the monsoon.[12] The northeast

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[12]Janakarajan S, John Butterworth, Patrick Moriarty and Charles Batchelor. 2007. 'Strengthened City, Marginalized Peri-urban Villagers: Stakeholder Dialogues for Inclusive Urbanization in Chennai, India'. In

monsoon and surface run-off from the Araniyar and the Kortalaiyar rivers replenish the Poondi, Cholavaram and Red Hills reservoirs (the three major drinking water sources for the city). These reservoirs are shallow and are spread over a total catchment area of 3.513 km.[2.] On an average, the total freshwater yield from these three sources is 200 million litres a day (mld). To reduce this shortage, the Water Board draws about 100 mld of groundwater from the well fields of the Araniyar-Kortalaiyar basin (A-K Basin).

All these sources, together, supply about 300 mld in a year with average rainfall, which is nowhere near the city's requirement. The gap between supply and demand, for the last two decades or so, has been met from groundwater pumped from agricultural wells in peri-urban villages. Wells supply about 125 mld of water, which is roughly equal to the shortage in normal years for the city's water supply. Together with the 300 mld from the A-K basin, the total supply is about 425 mld.

The scarcity of water in Chennai is not a new phenomenon. The city has been historically water deficit due to a lack of perennial rivers. Rapid urbanisation and the expansion of residential areas and industrial and business establishments have put pressure on the water resources of the city and its periphery. The surface and groundwater available in most parts of the city is not of good quality and unsuitable for drinking and other domestic purposes.

Successive governments in the state of Tamil Nadu have spent over Rs. 40 billion on various measures to augment the supply of drinking water in Chennai. In recent times, two large scale water supply schemes have been implemented: the Telugu-Ganga project and the New Veeranam project, to take water from the Veeranam tank at a distance of over 250 kilometres.

However, the Water Board has not been able to supply an adequate quantity of water. In times of scarcity, the peri-urban villages around Chennai are important sources of groundwater to cater to the demand for water in the urban area. A large amount of groundwater is supplied by tankers, pipelines and sealed water cans and bottles to supplement the supply of water to the city.

Despite these measures, water scarcity persists in Chennai. The per capita water supply in the city is hardly 76 litres a day, which is lower than in any other city in

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John Butterworth (Ed), '*Peri-urban Water Conflicts*', IRC Technical Working Paper- 50, The Netherlands.

India. Even this supply is irregular and, if conveyance losses are taken into account, the point-of supply figure is nearer to 50 lpcd (litre per capita per day). Only in exceptionally good monsoon years is there an uninterrupted supply of 76 lpcd.[13]

2. Drawing water from surrounding villages

The Metro Water Board started pumping groundwater from peri-urban villages to supplement the city's water requirements as early as 1965 when it identified rich aquifers in the A-K and Palar basins. The first well field identified was in Minjur (A-K basin) about 40 kilometres north of Chennai. The Board identified about 180 private agricultural wells from which raw water was purchased. From each well at least 10 to 18 loads of water were pumped (0.1 to 0.2 mld). Another 40 mld was pumped from the Palar basin.

The Water Board has established a network of wells from which water is drawn. Giant bore wells in these well fields were installed for round-the-clock pumping. During peak seasons, the Metro Water Board transports at least 6,000 tankers of water each day to the city from these well fields. The price of water paid to the well owners varies with the season and quality of groundwater. The total estimated cost of hiring these agricultural wells is Rs. 85 million per year.

The quality of water available in the village, the distance to the villages and their connectivity by road were the main criteria for including these wells into the network of the Water Board. Private tanker operators constitute a key set of non-state actors who supply water, and who draw water from various peri-urban villages to supply water to commercial establishments, hotels, construction sites and hospitals.

In July 2000, for example, the piped water supply was only able to provide 59 lpcd to the city. In response, the Metro Water Authority installed 4,525 water tanks in various part of the city and hired many tankers to deliver water to under-served areas. It was estimated that the quantity of water mined from the surrounding farmlands, would be equal to the capacity of about 13,000 tankers; and, every day, at least 3,000 tanker loads of water went into the city to meet the needs of multi-storied apartments, hotels, hospitals, other commercial

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[13] Ruet J, Saravanan V S and Zerah M. 2002. 'Water and Sanitation Scenario in Indian Metropolitan Cities'. CSH, French Institute of India. Occasional Paper Serious No 6. Delhi.

establishments, and construction activities. During peak summer months, this number shoots up steeply. Acute water scarcity, coupled with the ineffectiveness of government action, has made the water supply business through tankers a lucrative industry over a short span of time.

Other than the tanker owners, packaged water companies are also extracting a huge volume of groundwater from rural areas and transferring it to urban areas. According to a proprietor of a packaged water company in Chennai, around 350 packaged water companies operate in the Chennai metropolitan area and many of them also do business from the peri-urban areas.

3. The consequences of water transfer

Water has been transported from peri-urban villages to Chennai city for more than four decades; the practice started in the early 1960s. In proportion to the booming demands of the city, the water transferred from the peri-urban villages has also increased, which has affected agriculture. When groundwater starts to decline/deplete in the coastal areas, sea water enters the aquifer and occupies the places where fresh water was present. As a consequence, the groundwater turned saline and affected agriculture in this region.

During the initial period of water extraction from the peri-urban villages, no significant impact either in the form of groundwater depletion or degradation was noticed. Perhaps the extraction rate was below the recharge rate or within the limits of a sustainable yield. Over a period of time, as the extraction rate has increased considerably in proportion to the water requirements of the city, the groundwater table and the village economy have been affected in various ways.

For example, the estimated sustainable yield from the A-K basin was 100 million cubic meters (mcm) per year, but the current total extraction is 300 mcm per year, three times the sustainable yield.[1] This over-extraction from the A-K basin leads to intrusion of sea water into the aquifer, especially in areas like Minjur. Some peri-urban villages have faced continuous droughts. In certain places, conflicts and law and order problems have been reported.

Due to the transfer of water, the peri-urban villages of Chennai face serious livelihood problems. Many farmers have become heavily indebted due to their large investments in developing wells for irrigation, which did not bring them adequate returns. This has seriously affected agricultural activity in the peri-urban villages, resulting in decimated agricultural incomes and considerably reduced employment opportunities. Many people had purchased tractors on loan but, in some cases, these remain unused because of a lack of agricultural activity. Unemployment is now emerging as a major problem in the villages. Many landless agricultural labourers and marginal farmers have started migrating to other villages, towns and cities looking for employment; this moving population adds to the pressure on an already stressed urban infrastructure.

Many studies[14],[15] have highlighted the socio-economic impacts of water extraction in the peri-urban areas of North Chennai. The majority of the villages in the peri-urban areas have suffered from a lack of assured and gainful employment, whether on-farm or non-farm. Even water sellers who benefited greatly by supplying to the city began to feel the pinch after their bore wells started drying up. Quite a number of water sellers started constructing houses when business was good; many of these houses remain incomplete. The drying up of aquifers has led to the cancellation of contracts between the water sellers and the Metro Water Board.

4. Impact on Somangalam village

Somangalam is a peri–urban village of Chennai. Located about 30 kilometres from the city, it was formerly a primarily agrarian village. The Somangalam tank and its sophisticated irrigation network provided adequate water for agricultural activities. The groundwater potential in the village was also good. Over some time, however, agriculture in the village has considerably reduced, and most of the fields are no longer being cultivated. Since Somangalam is near the City, most of its inhabitants are able to get some work in Chennai. For them, employment in the city is more remunerative than agriculture. This makes agricultural labour scarce in the villages. Farmers feel agriculture is not profitable any more.

In 2002, a water scarce period, almost the entire village was involved in the business of selling water. Most of the farmers sold an average of 20 tankers

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[14] Janakarajan S. 2005. 'Dying Agriculture, Weakening Environment and Fading Institutions: Draft'. Chennai.

[15] Nisha Khanam. 2008. 'Building an Enable Environment of Drainage Course to Meet the Rural and Peri-urban Needs'. ME (IWRM) Thesis, Centre for Water Resources, Anna University, Chennai.

(12,000-13,000 litres) per day. Brokers facilitated the process by getting orders for water and making the necessary arrangements for extracting water from different locations in the village. Virtually, the entire village supplied water from irrigation wells with pumping facilities, which were facilitated by free electricity. According to a villager, “the government itself ordered us to provide water to the city with the help of irrigation pumping systems.”

The selling price of water was Rs. 50 per tanker; this means that every farmer who was involved in the water supply business earned Rs. 1,000 per day or Rs. 30,000 per month. According to a farmer, “It was a golden opportunity for us. We never earned Rs. 30,000 per month with agriculture. We are still eagerly waiting for such opportunities”. The villagers said that the water sold during 2002 did not affect either the groundwater table or the village eco-system. This might be because the overall extraction of groundwater in the village was less than its regeneration.

However, after the boom year of 2002, when the demand for water was high due to scarcity in Chennai and other areas, the Somangalam water business slumped. Continuously transporting water in tankers over long distances from the village to Chennai became economically unsustainable.

5. Impact on Valliyur village

The situation is different in villages where water extraction is continuous, especially in the A-K basin. In these villages, a significant impact is evident due to the depletion or degradation of water resources. In villages like Valliyur, frequent conflicts over water also occur.

Valliyur is located 30 kilometres from the city, in the A-K basin of North Chennai. Groundwater was historically the primary source of irrigation here, and the main crops cultivated were paddy and groundnut. During the 1980s about 280 agriculture wells existed in the village at depths of 50-80 feet. When pumping of groundwater for sale began on a large scale, the water table in the village gradually declined. Farmers deepened their wells up to 130-160 feet; and 60 dug wells were abandoned due to the falling water table in 1990. Nine of the 11 bore wells of the Metro Water Board, used for supplying 16 mld water to the city both for the domestic and industrial purposes, also failed.

The Board then started to purchase water from farmers in the village. In the initial period, about 40 mld water was purchased from 75 farmers; this came down to 16.84 mld in 2004 due to depletion of the groundwater. The Tamil Nadu Water Supply and Drainage Board also started to pump water from Valliyur for supplying Thiruvallur town. Over-extraction of the water gradually reduced the groundwater table, and the people in the village now face various problems of water scarcity including a fall in agricultural activity and inadequate water for domestic use.

Till 1995, the people of Valliyur did not resist the pumping and transfer of water from the common lands of the village. But when the water table in the village started to decrease, agriculture was affected and the livelihood of marginal farmers and agricultural labourers was hit. The farmers had to spend a considerable amount of money to deepen their wells.

Local self-help groups (SHGs) started opposing the transfer of water out of the village during 1995. By then, the water scarcity in Chennai had escalated due to low rainfall and the drying up of other major sources of water. The extraction of water from villages such as Valliyur therefore became even more vigorous. The SHGs insisted that the village *panchayat*s pass a resolution banning the sale of water from the village. But the *panchayat* refused, saying that groundwater was being pumped only from land owned by the government.

When the purchase of water from the farmers started in 2000, the people protested again. This time also the *panchayat* refused to pass a similar resolution on the ground that the farmers were selling water from their own land. Because the ownership of groundwater remains contested, nothing much could be done. Some people from the village subsequently filed court cases to ban the sale of water from the village. However, the Metro Water Board succeeded in getting stay orders.

A violent conflict broke out on August 15, 2004 when more than 400 people gathered near the Metro Water pumping station. Officials of Metro Water and of the revenue department arrived on the spot. To stem the crisis, a “peace committee” was formed. The committee consisted of water sellers, non-sellers, officials and members of SHGs. The sale of water by farmers to the Metro Water Board was to be stopped according to a decision taken by the committee. It did stop on September 15, 2004.

But the “treaty” did not hold, and the selling of water continued in the village. Metro Water argued that the purchase of water should not be stopped. Water sellers in the village were also keen to continue selling sell water. On September 16, 2004, villagers gathered near the Metro Water Board’s huge tank, from which water is pumped to the city, blocked the road and broke the pipelines. The police arrested 44 persons for damaging public property and remanded them in judicial custody for 15 days. The sale of water resumed in Valliyur village.

6. The case of Tiruppur

Tiruppur is known as the “knitwear capital” of India. It is located on the banks of the Noyyal river in Coimbatore district of Tamil Nadu. Tiruppur is a special grade municipality, consisting of an area of 27.20 km^2 divided into 52 wards. According to the census the total population of Tiruppur was 2,35,666 in 1991 and it had increased to 2,98,853 in 2001. However, the migrant/ itinerant population in Tiruppur is high; it is estimated to be two lakh.

6.1. *The textile industry’s demand for water*

The export-oriented industries related to cotton knitwear in Tiruppur have grown tremendously over the last two decades. At present more than 9000 small scale units are functioning in this city. The city produces 56 percent of the total cotton knitwear exported from India. It provides employment to more than 3,00,000 people. Different varieties of hosiery products, which are in demand in domestic and international markets, are manufactured in Tiruppur. The hosiery industries in Tiruppur entered the export market in the early 1980s. During the 1980s, the exports grew at a moderate rate, but after 1990, with economic liberalisation, exports recorded faster growth and reached about Rs. 11,000 crore by 2007.

Textile processing, that is, bleaching and dyeing, is an intermediate segment of the hosiery industry, for which water is an important input. The availability of good quality water in adequate quantities was one of the reasons that the bleaching and dyeing industry grew in the Tiruppur area. In the initial stages of industrial development, units pumped the water they required from the Noyyal river. When the water scarcity and pollution of the Noyyal subsequently grew, the industries used well water; most of the units have open wells in their premises.

After the export boom started in the 1980s, the number of processing units as well as their water requirements rapidly increased. In 1980, there were only 26 textile processing units in Tiruppur; by 1997, this number had reached 866. Due to pressure from the Tamil Nadu Pollution Control Board (TNPCB) to stop the discharge of untreated effluents, 164 units were closed, and at present 702 textile processing units are functioning. As a result of the growth of textile processing units, the volume of water used in the industrial sector also increased (*See Appendix 2*). The current water requirement is 86.4 million litres per day (mld).

The continuous discharge of untreated effluents on land led to the contamination of local aquifers. From the early 1990s onwards, most of the water in the industrial wells became unsuitable for use. This compelled the units to transport water from the peripheral villages of Tiruppur. The water market started during the early 1990s and has continued ever since.

6.2. *Local sources of water*

Tiruppur city historically relied largely on groundwater for domestic water requirements. With the growth of the textile industry, a growing migrant population, and industrial pollution, the pressure on water resources had led to deterioration in the quality and quantity of water.

The first water supply scheme (the Kovilvazhi head work scheme) which was implemented for Tiruppur in 1932, supplied only 0.17 mld of water. In 1968, Mettupalayam Scheme I was completed at a cost of Rs. 1.08 crore. It supplied 6 mld of water from the River Bhavani. In 1993 Mettupalayam Scheme II was completed at a project cost of Rs. 20.34 crore. It supplied 26 mld of water. After this, the total public supply of water was around 33 mld. In addition, around 6 mld of water was supplied by private lorries.

The total water supply, however, was not sufficient for the growing domestic and industrial water requirements. The Tiruppur municipality made the following observation about the need for a third scheme in a report dated January 12, 2000: “The groundwater within Tiruppur town is highly polluted and unfit for drinking purposes. The supply through the existing two schemes is inadequate to meet the requirement. As such another scheme to cater to the need of the public is inevitable."[16]

6.3. *The industrial water market*

A detailed study was carried out in the late 1990s and again in 2004-05 about the functioning and nature of the water market for Tiruppur's textile industries. It highlighted that private water supply catered to about 85 percent of the industrial water demand. It is difficult to estimate the actual number of tankers involved in the business of supplying water. Researchers have quoted figures ranging from 250 to 1000 tankers. But only 205 water tankers are registered at the Tiruppur Regional Transport Office (RTO). Most of the industries in Tiruppur have their own tankers. Based on available figures, we estimated that about 250 tankers (lorries) with an average capacity of 12,000 litres were engaged in the water business, making an average of seven trips per day.

The bore wells which supply water to industries are located at a radius of 5 to 30 kilometres from Tiruppur. From November to March, the industries get water from the wells that are located 5-10 kilometres away from the town, but from April to October water is pumped from wells as far away as 10-30 kilometres.

Tankers usually collect water from the wells located proximate to the seven major corridors (Palladam road, Dharapuram road, Mangalam road, Uthukuli road, Perumanallur road, Avinashi road and Kangayam road) leading to Tiruppur. Bore wells located adjacent to Palladam road do better business than the wells located along any other corridor, primarily due to the accessibility of wells through road networks and better quality of water.

Bore wells selling water for industrial purposes are included in the 'Tariff 4' category of the Tamil Nadu Electricity Board (TNEB). But in suburban Tiruppur a sizeable number of agriculture wells, which are outside the purview of TNEB's industrial tariffs, are also involved in the sale of water. A study carried out in Pollikallipalayam South (a TNEB sub-division which provides water to Tiruppur) showed that of the 84 wells supplying water, only 27 had secured service connections. That means the majority were supplying water to the industry without the knowledge of the TNEB, or with the help of irrigation pumping facilities where electricity is free.

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[16] Tiruppur Municipality 2000. 'Water Supply and Street Light Report'. Tiruppur Municipal Office, Tiruppur.

Based on 1994-95 prices, the buying price of water from wells ranged between Rs. 25 to Rs. 65 per tanker depending upon the season and availability. The selling price for a 12,000 litre capacity tanker varies from Rs. 225 to Rs. 475 with an average of Rs. 293 (Rs. 24.42/kl), and at the rate of Rs. 450 (Rs. 37.50/kl) from June to September. The selling price includes the cost of transport and the profit margin of the tankers. In 2004 industries paid Rs. 400 to Rs. 600 for a 12,000 litre capacity tanker with an average of Rs. 41.70 /kl.

In 2004-05, industries transported 85 percent of their required water, that is, 73.4 mld, from neighbouring villages. The average price of water was estimated to be Rs. 41.7 per kilolitre. The daily expenditure incurred by the industrial units would therefore be approximately Rs. 30.6 lakh per day. If the processing units in Tiruppur function for 27 days per month or 324 days a year, the annual expenditure for purchasing water would be approximately Rs. 100 crore.

In the peripheral villages of Tiruppur only rich farmers were able to sell water, since the water business required substantial capital investment. The owners of bore wells have land holdings which vary from two to eight acres, with an average land holding of about four acres. The majority of the owners used water for agriculture and selling. Most of the bore wells were dug after 1990. The water drawn from these wells is first let out into huge tanks constructed at ground level, which have a capacity of 0.5 to 1 lakh litres. Another motor is used (either electric or diesel) to pump water from these tanks to the tankers. This practice is more effective than directly pumping the water to the tankers, because less time is required for filling the water.

6.4. *Impact of trading water on the nearby villages*

The continuous pumping of water from villages to Tiruppur has depleted the groundwater in many villages. The depletion of the water table has affected agriculture and allied activities in all the villages involved in water trading. The impact has been more severe for marginal and poor farmers and agricultural labourers. When the aquifer starts to deplete most of the rich farmers, who are also actively involved in the water business, sell the water from their wells. Poor farmers are not financially secure enough to invest in deepening the wells. The sharp decline in water levels in villages, and of water available for domestic and irrigation purposes, ultimately affects the livelihood of the rural poor, including agricultural labourers. Many young and middle-aged men have migrated to work in textile units at Tiruppur. The estimated annual loss in agriculture to marginal farmers is Rs. 11.7 lakh.[17]

The supply of drinking water has also been severely affected in these villages. Since groundwater is the major source of drinking water, the drying up of wells is a major concern. Collecting the required water from available sources is a great challenge, particularly for women. Continuous water supply to industries has led to conflicts in the villages. Adversely affected communities have often stopped tankers; many violent incidents have been reported.

6.5. *Solutions that fell short*

From mid-2000 onwards, realising the problems in getting fresh water from the sub-urban villages of Tiruppur, the industries entered into a Public Private Partnership (PPP) with the Tamil Nadu government to implement a water supply scheme for Tiruppur. Under this scheme, water was to be pumped from the Kaveri river, 55 kilometres away. An investment of Rs.1028 crore made costs high and difficult to recover.

The Tiruppur Area Development Project (TADP) was implemented through the New Tiruppur Area Development Corporation Limited (NTADCL), a group of public and private entities. NTADCL acts as a Special Purpose Vehicle operating on a Build-Own-Operate-Transfer basis with a 30-year time stipulation. It is the first PPP in the water sector in South Asia, inaugurated in February, 2006. It was supposed to bring 185 mld of water from the Cauvery river with the price of water set at Rs. 45/kl for the industry.

It was assumed that after the project commenced the tankers would disappear and industry would prefer TADP water. The Tiruppur municipality had also announced that no private or informal water supply would be allowed to operate in Tiruppur. However, some of the industries are not happy with TADP water because of its high price as compared to tanker water. The private tanker owners responded by reducing the price from Rs. 40 to Rs. 35 per kilolitres. In short, even with water supply from the TADP, the private water market is active in the Tiruppur due to the tankers.

[17] Palanisamy, K. 1995. '"Rural and Urban Interaction: Water Market in Tiruppur, Coimbatore District, Tamil Nadu'. In *Proceedings of the Second Water Congress,* Centre for Water Resources and Centre for Environmental Studies, Anna University, Chennai.

7. Emerging issues in rural to urban water transfer

The State has attempted to legally address the issues in the Chennai and Tiruppur cases, which involve the transfer of groundwater from rural areas to cities. The Chennai Metropolitan Area Groundwater (Regulation) Act, 1987, "envisages control, regulation, abstractions and transportation of groundwater in the notified area through (i) regulation of existing wells, (ii) regulation of sinking of new wells, (iii) issues of licenses to extract water for non domestic use and (iv) issues for licenses for transportation through goods vehicles."

The Tamil Nadu Groundwater (Development and Management) Act, aims "to protect groundwater resources to provide safeguards against hazards of it's over exploitation and to ensure its planned development and proper management in the state of Tamil Nadu and matters connected therewith or incidental thereto." This Act extends to the entire state except the area covered by the Chennai Metropolitan Area Groundwater (Regulation) Act, 1987.

Notwithstanding these Acts, over-exploitation of resources continues. Water trading in Chennai and Tiruppur violates the conditions prescribed in these Acts. Government agencies are also not strictly enforcing the laws or taking any serious action whenever norms are violated.

These case studies also highlight issues of power and rights to water. The economically powerful in the villages are generally involved in the water business. They are able to manage pressure from local people against the extraction of water by using money and political influence. When a water "market" starts to operate, water becomes a commodity and prices start to play a significant role. For farmers who sell water, the price of water is better than using the water for agriculture.

Costs related to the depletion of water become external costs to marginal farmers and agricultural labourers. The environmental sustainability in the region also suffers. The economically strong in urban areas are demanding a major share of the traded water. They are willing to pay. In this process, a substantial share of water goes to higher income groups while the poor in the cities also lose out.

8. Summary

This case study examines the socio-economic aspects of transferring groundwater from rural to urban areas in two cities, Chennai and Tiruppur, in Tamil Nadu state. The case of Chennai case primarily focuses on domestic water supply while the case study of Tiruppur focuses on industrial supply. The Chennai case covers the demographic expansion of the city, current status of water supply, significance of rural and peri-urban groundwater to the city's water supply, problems faced by the villagers and peri-urban communities, and conflicts. The Tiruppur case includes a description of the textiles-led industrial growth and demand for water, features of the industrial water market, impact of the water market in the villages and the Tiruppur Area Development Project. This study concludes with a brief discussion of emerging issues concerning rural to urban water transfer.

The case studies of Chennai and Tiruppur clearly demonstrate the significance groundwater can acquire for economic activities (in urban areas), as well as the consequences (to rural areas) if the resource is over extracted. Can urban need be met without affecting village economic activities? How can the extraction and transfer of groundwater from the villages be done within the limit of its regeneration? These remain persistent challenges.

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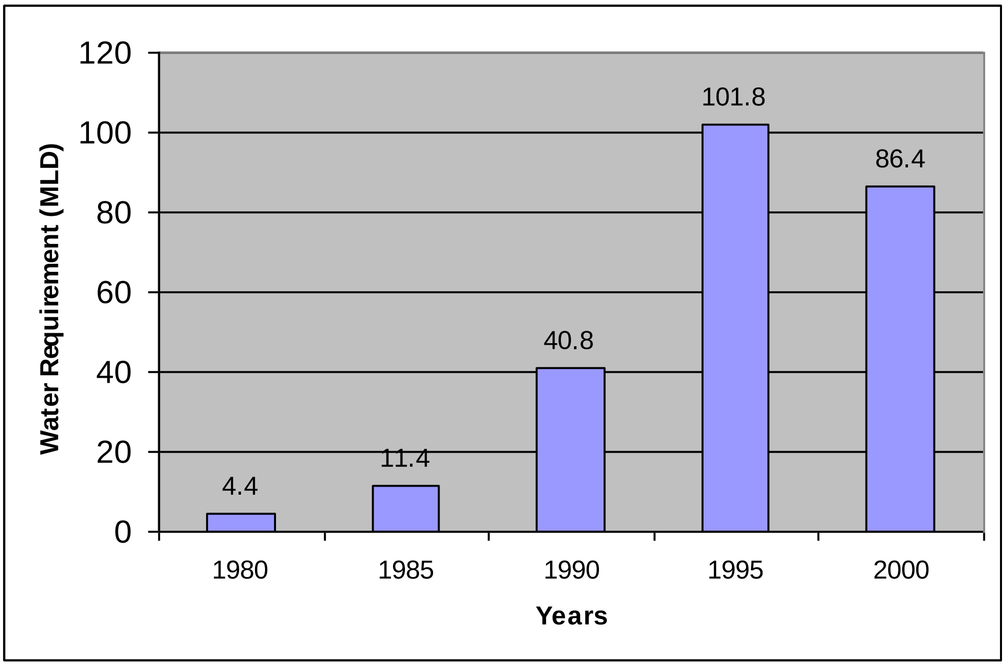
Appendix 1: Growth of population in the Chennai Metropolitan Area (in millions)

No.	Area	1971	1981	1991	2001
1	Chennai city	2.64	3.28	3.84	4.34
2	Municipalities	0.48	0.81	1.18	1.58
3	Town *panchayats*	0.12	0.16	0.27	0.39
4	Village *panchayats*	0.26	0.34	0.52	0.73
	Total	**3.50**	**4.59**	**5.81**	**7.04**

Source: Chennai Metropolitan Development Authority (2007)[18]

Appendix 2: Industrial water requirements in Tiruppur



Source: Nelliyat, 2005[19]

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[18] Chennai Metropolitan Development Authority. 2007. ‘Draft Master Plan II for Chennai Metropolitan Area’. Chennai.

[19] Nelliyat Prakash. 2005. ‘Industrial Growth and Environmental Degradation: A Case Study of Industrial Pollution in Tiruppur’. Ph D Thesis, University of Madras, Chennai (unpublished).

Case 6:

Pollution seeped into lives of people of Orthapalayam

R. Saravanan and Prakash Nelliyat

1. Tiruppur: The industrial city

Tiruppur is the centre of India's cotton knitwear industry. This town in Tamil Nadu is known by various names, such as ‘The Manchester of South India’, ‘Dollar City’, ‘Knit City’ and ‘Cotton City’. It is located near Coimbatore city, on the banks of the Noyyal river in Coimbatore district.

About 2000 units in Tiruppur manufacture a variety of garments such as vests, briefs, panties, tracksuits, sweatshirts, pullovers, blouses, shirts, leggings, pyjamas, sportswear, beachwear, and shorts. The Tiruppur industrial cluster has made a significant contribution to the growth in the production and export of textiles. A whole range of ancillary industrial units manufacturing cartons, polythene bags, zips, buttons, tapes and packing material have also flourished in this area.

Yet, at the first glance, nothing about Tiruppur can make an observer believe that this town earns US$720 million in foreign exchange every year. The large-scale industrial activity involves significant levels of chemical processing, and it produces 85 million litres a day (or mld) of effluents after exports started in 1980s. This waste is discharged into the Noyyal river, untreated or partially treated. Most of the effluents accumulate at Orthapalayam reservoir, about 30 kilometres downstream. In the shadow of the hectic industrialization that made Tiruppur an important industrial town lies its decaying environment and ecological balance.

2. The Orthapalayam reservoir

The Noyyal is a sacred river in Tamil history; its original name was Kanchinadi. The Noyyal starts from the Vellingiri hills in the Western Ghats and flows east. It creates a total area of 3,600 km². Noyyal is a seasonal river, fed by the monsoon. The Noyyal basin has 23 anicuts, 30 system tanks, 20 channels and two reservoirs (viz., Orthapalayam and Authupalayam). The average rainfall in the basin is about 700 mm. Rainfall in the basin is highly variable due to the orographic effects of the Western Ghats. The mountains form a rain shadow area over the plain, which consequently has a dry climate. As a result, the basin receives relatively low rainfall, which is generally insufficient for agriculture and allied activities. Due to the low rainfall, the groundwater recharge is low and the groundwater level only varies from 3.08m to 31.9m during winter and summer respectively.

In 1992, a reservoir was constructed across the Noyyal, downstream of Tiruppur at Orthapalayam village in Erode district of Tamil Nadu. It was meant to store occasional floodwater to meet the demand during periods of scarcity. The reservoir was originally used to store floodwater for irrigating about 4050 ha of dry land in Perundurai, Kangeyam and Karur *taluka*s of Erode.

Thus, the 180 households in Orthapalayam village, located downstream, benefited economically from the dam. The left and right main canals from the dam helped to irrigate dry lands and increased the productivity of crops. This helped to increase the farmers' incomes.

The sources of surface water (fresh water) in the basin had been fully exploited, primarily for irrigation. The groundwater availability in some parts of the basin was also good and the groundwater was used extensively for domestic, industrial and irrigation purposes. In other words, before they became polluted, the water resources in the Noyyal basin were important for enhancing the livelihood of the people. This was also true for socially vulnerable groups like scheduled castes and scheduled tribes, which used to get wage labour in the irrigated agriculture and also water required for other livelihoods activities.

The reservoir continuously received textile industrial effluents from the Tiruppur area. In course of time, it became highly polluted and the stored water was rendered unfit for irrigation and fisheries due to the high total dissolved salts

(TDS) and other pollutants. As a result, the quality of the groundwater in the areas surrounding the reservoir has deteriorated. This critically affects economic activities in the villages. Continuous exposure to poor quality groundwater also leads to harmful diseases.

3. Causes of pollution in the reservoir

An analysis of the data on water quality shows very high levels of pollution around the reservoir and accumulation of pollutants in the groundwater and soil of Orthapalayam village. Based on the intensity of pollution, a village can be classified into different zones; Orthapalayam is located in a highly polluted zone.

The water resources downstream of the dam and its surrounding villages are severely affected by the effluent discharge from the textile industries of Tiruppur. Among the downstream villages the magnitude of pollution is especially acute at Orthapalayam because highly contaminated effluents have been continuously accumulating in the reservoir for nearly a decade.

Textile industries use huge quantities of salt and different dyes. The pollution shows up in the form of dissolved solids, which is often called as TDS (or Total Dissolved Solids). This makes the water taste odd and causes serious health problems. The maximum average concentration of TDS in the Orthapalayam reservoir water is 10938.50 mg/l (or milligram per liter). This data is based on a recent testing of 54 samples. This is considered as very high level of pollution. The normal range is about 500 mg/l for drinking water and about 1500 mg/l for irrigation water. Since most of the effluents drain into the river, the groundwater in the areas adjacent to the river, in a radius of five kilometres on each side, is affected by means of infiltration and percolation. Though the water release from the reservoir is closed most of the time, the pollution in the area has not reduced. This is because water seeping from the reservoir continues to spread into the groundwater.

4. Impact of Pollution

As mentioned before, the concentration of TDS in the groundwater around Orthapalayam village is extremely high. It has affected local livelihood activities like agriculture, livestock rearing and fisheries. Since agriculture and allied activities are the major source of income for the people here, the loss of productivity in terms of crops, fish and livestock, and its effect on household income, are significant. In some cases, farmers and agricultural laborers have abandoned their farms and migrated to urban areas. Apart from this impact on livelihoods, pollution has also affected satisfaction of different livelihood needs for which water is required.

4.1 Water for domestic needs

In the past, the groundwater in the village was good and villagers depended on it for domestic uses and used it as drinking water. But after the pollution increased in the Orthapalayam dam, the quality of well water has deteriorated. It cannot now be used for any domestic purpose. No one in the villages drinks the local groundwater because of its high concentration of salt.

The people complained that it is very difficult to bathe or wash clothes with the groundwater since the soap does not produce detergent effects. The villagers also face huge problems in obtaining drinking water. The *panchayat* is providing drinking water through the rural water supply program. The water is brought from Kumarapuram, a neighboring village, where the quality of water is relatively good. But the people in Orthapalayam are not happy with the quantity and frequency of supply. Accessing water from the limited number of stand-posts (i.e., common water taps) is also a major problem.

The quantity of water supplied is sometimes insufficient during festivals or emergencies. At such times, the people bring water from distant sources such as the common bore wells of Pandiannagar, Thippanpm, or Ramalingapuram, which are pollution-free areas. These are two-three kilometres away from the village. Water is usually transported by trucks or cycles.

The economic and social costs of obtaining water have become very high. Time that could be spent in working on agriculture or livestock is lost in collecting freshwater from distance sources. A few young people in the village have stopped going to school (after class 10 or 12) to focus on their water collection duties. Collecting and storing water for domestic use is the responsibility primarily of women in rural areas; women therefore bear the greatest brunt of this impact of pollution. Fetching water from long distances is arduous and comes with security risks at night. The time and labour invested in this activity drains time and energy away from other household tasks and agricultural activities.

Households are compelled to incur extra costs to purchase fresh water or to purify the available water. This can be called “defensive expenditure”. Some people in the village have had to buy fresh water, spending considerable amounts; for example, 6000 litres of fresh water costs about Rs. 300.

According to Kandasamy Rengasamy Goundar, a resident of the village, people from other villages are now unwilling to send young women in marriage to Orthapalayam village because of the scarcity of water. Many of the men of Orthapalayam are now getting married only after the age of 30, well beyond the average age of marriage in these parts.

4.2. Health issues

Economically and socially deprived people from scheduled castes and scheduled tribes continue to use the local, contaminated surface water and groundwater for their non-drinking domestic purposes such as washing and bathing. Some people in the village, who cannot access fresh water or local groundwater, depend on the highly polluted river and reservoir for bathing and washing. The frequent use of this polluted water causes gastritis, hypertension, joint pains, respiratory problems, heart disease and complications during pregnancy. A majority of the people in Orthapalayam said that their skin itched after bathing in the well water. Some people get frequent allergies.

Initially, the local people were not aware about the risks of using the polluted water; diarrhea was frequent in the village. Most of them are now aware of the risks of using the contaminated local water. They are cognizant of the long-term health problems of living near the Orthapalayam reservoir. Most of them are trying to safeguard themselves by avoiding the local water, but this is done at a high cost, and not everyone can totally avoid this water.

4.3 Agriculture and livestock

Orthapalayam was primarily an agrarian village. Different varieties of crops were cultivated, like paddy, sugarcane, banana, turmeric, coconut, grapes, cotton, vegetables, cereals and pulses. The major source of irrigation was groundwater. The drainage effects of the Noyyal helped to improve the groundwater potential in the village. Even the proposal to construct the Orthapalayam reservoir was considered a landmark by the villagers, because it made irrigated agriculture possible with its left and right main canals.

After the construction of the dam, the farmers used the reservoir for irrigation for about three years. The pollution gradually increased and spread to neighboring areas. The farmers used groundwater till the pollution reached even higher levels. The quality of the soil in the village deteriorated; eventually, the productivity of rain-fed crops also decreased.

Now the farmers cannot use the reservoir water or groundwater for irrigation because of high levels of salinity. They have developed coping mechanisms by changing the cropping pattern and using more inputs like fertilizers. Most of the salt-sensitive crops like paddy, sugarcane and banana have completely disappeared from the village, and been replaced by salt-tolerant crops such as corn, cotton and coconut. The yield of the existing crops has considerably reduced. The farmers said that even the taste of tender coconut water has changed due to the pollution.

The animals of the village have also been seriously affected by pollution. The number of cattle and goats has reduced after the pollution escalated. According to the villagers, this has happened mainly because it is not possible to grow enough feed for the animals when water is so scarce. Milk production has reduced by 30 percent and the quality of milk has deteriorated.

4.4 Impact on fisheries

Like agriculture and domestic water, fisheries have also been seriously affected. Before the reservoir was constructed, the people of Orthapalayam used the Noyyal river for fishing. The construction of the reservoir was a turning point in the fishing history of the village. Immediately after the reservoir was completed, in 1993, the fisheries department started fisheries activities. The stock of fingerlings in Orthapalayam was 385,000 in 1993; it was increased to 700,000 in 1993-94 and to 801,000 in 1996-97. In subsequent years however, no stocking took place in the polluted reservoir.

Towards the end of 1997, fish died in huge numbers in the Orthapalayam reservoir. In early December, due to the discharge of untreated effluent, dead fish—a potentially serious health hazard—were floating near the dam site. The district Collector made arrangements to bury the several tons of dead fish. The government also ordered the fisheries department to immediately remove all the fish in the reservoir to avoid further fish mortality and health hazards. The public works department requested the fisheries department to stop fisheries activities in Orthapalayam. The Director of fisheries stopped fisheries at Orthapalayam in March 1998.

This event was a great loss for a number of fishing families in the village. Still, some informal fishing continues in the reservoir. Only one type of fish (*talapia*) is caught. The fishermen used to catch about 30-40 kilos of fish every day in the past when the pollution was low; now they get only 3-4 kilos of fish.

4.5 Unemployment and migration

When the dam was constructed, landowners got compensation from the government of Tamil Nadu (though they were not satisfied with the Rs. 36, 000 per ha). Marginal farmers and agriculture laborers—who depended on agriculture wage for their livelihoods—were the most severely affected. Because they had little or no land, they could get small or no compensation; though they lost their livelihoods completely.

With limited opportunities for employment in Orthapalayam village, many people have migrated to neighboring areas, looking for better livelihood options. About a hundred people from the village go to Tiruppur's industries every day as daily wage laborers.

5.0 How the government responded?

In 2001, some people filed a writ petition against the industries, asking them to stop discharging the effluents. The court ruled that industries had to set up either individual or common treatment plants and follow effluent discharge norms and water quality standards. As a result of this ruling, the government and the industries have set up effluent treatment plants. There are now about 300 individual and eight common effluent treatment plants in Tiruppur. But the treatment plants have not reduced the environmental problems, because they are not functioning properly.

The pollution of the water of the Noyyal River, which is stored at Orthapalayam, continues. The water has been rendered unfit for irrigation and fisheries due to high TDS and other pollutants in the industrial effluent. This has been highlighted in various reports of the Central Ground Water Board and the Tamil Nadu Pollution Control Board.

5. Summary

The dependence on groundwater, particularly in developing counties like India, has increased due to the increase in population, industrialization and new agricultural practices. However, domestic and industrial wastes, disposed off both in liquid and solid forms in land and water bodies, percolate into the groundwater. Different pollutants in the groundwater system threaten water quality, which ultimately affects the socio-economic life of the people who directly depend on groundwater for various purposes.

The people living in Orthapalayam village, downstream of Tiruppur along the Noyyal River, extensively used the groundwater available at different locations in the basin for domestic and irrigation purposes. With the construction of the reservoir at Orthapalayam, fisheries also became an important source of livelihood. Over the years, the pollution has drastically altered this scenario. Fishing has dwindled, agriculture has been affected, drinking and domestic water has become extremely difficult to access, people face health problems due to the pollutants in the water, and unemployment and migration have escalated.

This case highlights conflicts—between industrialization and ecological sustainability, between industrial development and people's livelihoods—and the need to achieve a balance.

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Case 7:

Where have fish from the Krishnagiri reservoir gone?

S. Ravichandran

1. The Krishnagiri reservoir

The Krishnagiri reservoir, constructed in 1954, is one of the oldest dams across the Ponnaiyar River, near Krishnagiri town in the north-western part of Tamil Nadu. It is a medium-scale reservoir, with a storage capacity of 66 million cubic metres of water at its full level. Water is supplied for direct irrigation through two canals on the right and left sides of the reservoir. The reservoir also supplies water to 26 small tanks, which, in turn, distribute the water for irrigation.

The reservoir is located in Perumuthupalayam village. The other hamlets in the vicinity include, Bolwarpatti, Turinjipatti and Pazhiya Paeanapalli. This area was regarded as the abode for a deity and it remains the venue of cultural ceremonies. The reservoir serves the irrigation needs of 3462 hectares of land. Indirect benefits of the reservoir include supply of drinking water to many towns, fisheries, and a recreation facility consisting of parks, swimming pools, and pathways, which attracts people living nearby as well as from the entire district.

The Krishnagiri reservoir was highly productive; it gave a good yield of fish and had a wide range of varieties of native and exotic fish, introduced by the fisheries department of the government of Tamil Nadu. In the past, more than 600 families from the surrounding villages made their livelihood from fishing in the reservoir.

The fisheries department, which controls the fishing activity in the reservoir, awards licenses to catch fish. The department has a hatchery unit below the dam and stocks the reservoir with fingerlings every year. It releases fingerlings of different varieties of fish reared in the hatchery. People licensed by the department are eligible to harvest; and have to share 50 percent of the catch with the department. However, the quantity as well as the variety of fish caught has significantly reduced.

2. Mahendran's story

Mahendran, aged 35, is a fish farmer living near the reservoir. He comes from one of the 27 families in Perumuthupalayam which still depend on fishing for a livelihood. Every day, at 5 a.m., he sets off in a small boat called a *parisal* to collect the net laid in the reservoir. By 9 a.m. he goes to the fisheries office with the catch. Back home after lunch, he has to mend the net, repair floats and dry other items. At 5 p.m, he again sets out in the *parisal* to put up his net, and returns home by 7-8 p.m

He catches an average of four to six kilos of fish every day. The catch is mostly *jilei*, a local variety. This gets him a maximum market price of Rs. 20 per kg. The more expensive carp delicacies like *rohu*, *catla*, and *mirgal* have become rare and are available for only a few months in the year. These varieties now constitute less than 10 percent of the catch. During summer, when the water level is low, Mahendran gets a better catch of other native fish like *keluthi*, *aaralmeen*, *panchalai*, and *arinchaan*. Mahendran remembers that for his father, also a fisherman, every trip to the reservoir was rewarding and would fetch 10 to 12 kilos of a wide variety of fish. The carp varieties also sold at a better rate in those days.

Despite the hard work and low returns, Mahendran continues to do this work because he does not have any other livelihood option. His wife helps him in his work. After a session of fishing, she cleans the net, puts it to dry in the sun and repairs any damage. In some families, women also help to sell the fish. The fishing is often done by two people using a *parisal*, the boat made of bamboo and local material. One person paddles and sails the *parisal* while the other person operates the fishing net. In most cases, but not always, this is a fisherwoman, the wife of the fisherman. The catch is taken to the fisheries office at the site of the dam, from where it is bought by traders. The fish produce registered at this office have decreased over the years.

Many of Mahendran's neighbours have stopped fishing because it is no longer economically viable. According to him, about 100 fishing families used to get adequate catch 30 years ago; now even 27 families have to struggle to survive.

3. Why did the catch decrease?

Like many others, Mahendran believes pollution and the resultant decline in the quality of the water are the main problems, and are the main reason underlying decreased fish catch. Many a times, he gets skin rashes and itches after work. He remembers seeing dead fish in a large number in the reservoir, which is called as ‘fish-kill,’ some years ago during the summer.

The quality of the water in a reservoir depends on the nature of the inflow, the condition of the catchment from where the inflow comes and the discharge of effluents, if any, by industries into the river.

3.1 *Industrial pollution*

Mahendran recalls that, in the 1980s, an alcoholic beverages factory started about 10 kilometres upstream of the reservoir. The factory used molasses as raw material to produce beverages, and released effluents into the Ponnaiyar River upstream for about 15 years. This contributed to the deteriorating quality of the water. The effluents from the factory had high levels of biological oxygen demand and total suspended solids, indicating a very high level of water pollution. This caused biological oxidation of the water in the reservoir, leading to reduction in the oxygen available in the lake water. As a result, the habitat conditions for fish culture and sensitive fauna have been severely affected, and would account for the changes in the types and variety of fish in the reservoir over the years.

Even after the factory closed in 2002, this problem continues to persist. The quality of water in the reservoir at present is rated as medium to average for drinking purposes, with total dissolved solids in the higher range. The closing of the factory is a step forward in improving the quality of the water of the reservoir. It has helped stop the “fish kills”.

‘Fish-kills’ are caused by several factors related to the condition of water in the reservoir. One important cause is the sudden release of a large quantity of effluents by an industry, which has a drastic impact on the availability of oxygen in the surface layers. The effluents demand a large amount of oxygen for biological oxidation. Under normal circumstances this process may take place gradually, so that the availability of oxygen for other organisms is not affected. A sudden decrease in oxygen levels will make all organisms biologically (fish are more susceptible) inactive and it will kill them. The high concentration of pollutants may also become lethal to higher forms of organisms like fishes in the water. The ‘fish-kills’ noticed in the reservoir by Mahendran during the 1990s may have been due to the impact of a sudden release of effluents in the summer. Such ‘fish-kills’ have not been seen in the last few years, which may be because the factory has closed.

However, the quality of water in the reservoir may not have immediately improved, because the accumulated pollutants in the sediments require more time for natural attenuation. Besides, other sources of pollution need to be arrested. The pollution load accumulated in the sediments of the reservoir may slowly release the pollutants back to the water even after the inflow of polluted water has stopped. Therefore, there may be incremental improvement in water quality, but the major benefit of closing the factory may only be limited to prevention of ‘fish-kills’.

3.2 *Sewage and poaching*

There are other reasons for the pollution. Sewage flows into the Ponnaiyar River near Hosur town, which is located at about 85 kilometres upstream. The spill-over of polluted water from the lakes situated near Bangalore also comes into the Ponnaiyar upstream. Many people illegally “poach” fish in the reservoir. They fish either as a hobby or for a small income at different locations in the reservoir—in the canals, downstream below the dam and in the upper part of the water spread area. This may also be affecting the amount of fish available to the legally licensed fishermen.

3.3 *Accelerated soil erosion*

The decreasing fish catch from the reservoir may also be related to developments on the upstream side of the lake. Many areas on the upstream side have come under irrigated agriculture in the last few decades, which has accelerated soil erosion. Soil erosion occurs due to the action of wind and/or water; it is a natural, general process, but can become a serious problem if it exceeds certain levels. With soil erosion, topsoil is removed, which reduces fertility, eventually making the soil unfit for agriculture. Ecological productivity is also affected when the soil that is eroded flows into rivers and reservoirs. The water absorbs the nutrients and pollutants present in the soil, as well as any agrochemicals used in agriculture, which affect the quality of the water.

The soil to the north and north-western parts of the Krishnagiri reservoir catchment area was naturally more prone to erosion compared to other areas. This problem has been aggravated further due to development and spread of agriculture over the last three decades. The severe soil erosion in the north-western part delivers about 30,000-40,000 tons of eroded soil every year. The reservoir, therefore, slowly lost its capacity by more than 30 percent in the last three decades.

3.4 Fewer *fingerlings*

Despite closing of the factory, the yield of fish has not improved. Mahendran's friends, Srinivasan and Thangavelu, were of the opinion that the stocking of the reservoir—a process of releasing the fingerlings—itself has reduced; only 2.5 lakh fingerlings are released per year at present, whereas it used to be about 10 lakh per year in the past. The hatchery in the Krishnagiri reservoir has not been functional for some years. The fingerlings are brought from the hatcheries in the Mettur dam for release in the Krishnagiri reservoir. The fisheries department says that the stocking rate is sufficient; but it admits that the quality of the water has declined and this may be impacting the growth of fish.

4. Coping with the changes

The socio-economic profile of Perumuthupalayam village suggests that fishing is no longer the main occupation of the people. The village has 900 households, and there are 300 houses in Pazhayapayenapalli hamlet. Only about 27 families, mostly from this hamlet, now depend on fishing.

With the steady fall in the fish catch, many people have moved on to other jobs to earn a living. The most affected are the people who live in the smaller (caste-specific) hamlets away from the main village. Most of them have become daily wage agricultural labourers, or they work in dairies or as casual labourers in Hosur and Bangalore. The women in these hamlets are the most affected, because the men drink and waste their meagre earnings. Many women work as maids or construction workers in Hosur or Bangalore to support the family.

Agriculture-related activities have become the main avenue of work in the village, employing about 60 percent of the people. Of this, about 20 percent are landless labourers, while about 40 percent are landowners. The people who own land are mostly downstream of the reservoir and have managed to sustain agriculture. About 20 percent of the people are involved in the dairy business. Floriculture has emerged as a new employment option in the last decade; about 20 percent of the people in the village grow *malli*, *kakra*, and *saamanthi* flowers, mainly for export.

Seasonal activities like a mango juice factory and pulp factories offer employment to some people for three-four months in a year. Flower-cutting and spinning mills are also a source of seasonal income for a small number of daily wage earners.

In one way or the other, the people seem to have coped with the impact of the decline of fishing. Alternative livelihoods opportunities have been generated in the village and some people have found work by migrating. However, a few families in the village still depend on fishing. The fish catch from the Krishnagiri reservoir has reduced drastically, seriously affecting the way of life for fisher-folk of this village.

5. Summary

Changes taking place upstream have severely impacted fishing in the Krishnagiri reservoir. The quality of the water in the reservoir is dependant on upstream activities. Upstream inflows and changes in quantity or quality of inflowing water, over a time, affect the quality of water in the reservoir and determine the rate of sedimentation. The growth and culture of fishes is mainly dependant on these two factors, which control the quantum of fish catch and the variety of fish that can survive. The livelihood of the people who fish in the reservoir depends on all these factors. The links between pollution, the impact on livelihoods and the response of the people, which this case study highlights, can point to ways in which the economic and ecological viability of the Krishnagiri reservoir might be preserved.

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Case 8:

Embedding social equity in governance of the Chattis Mauja irrigation system

Ashutosh Shukla

1. The locale and historical context

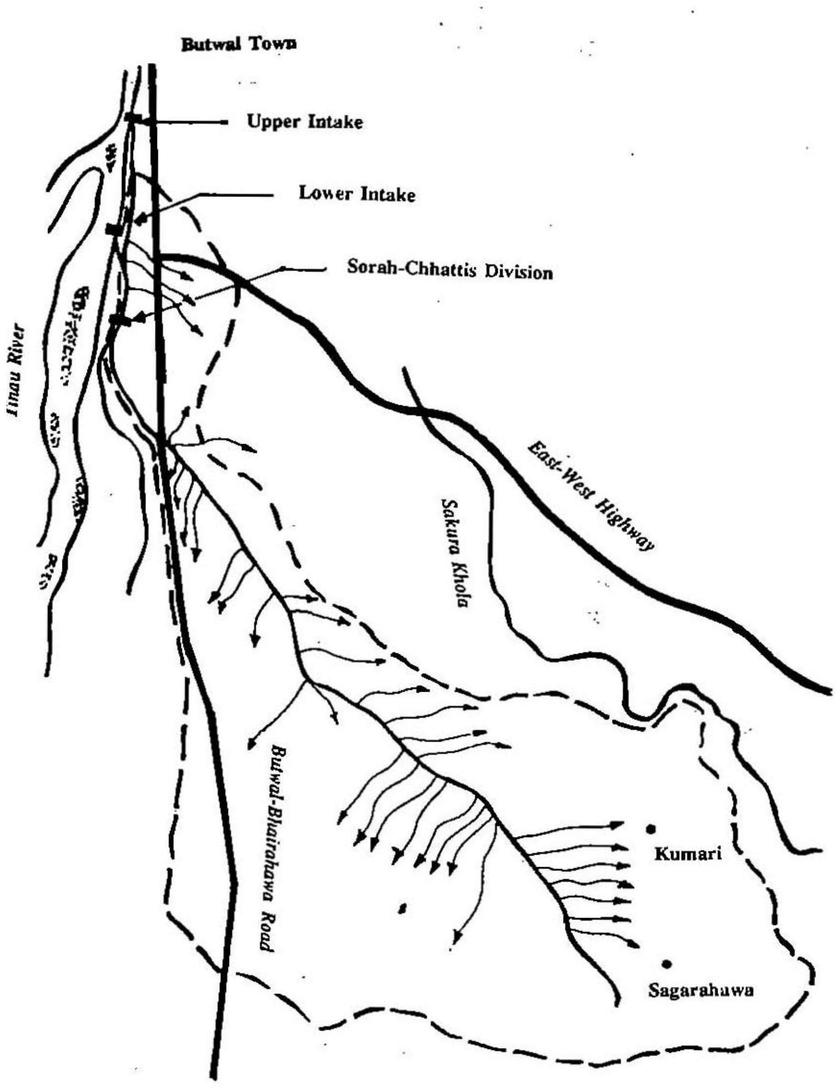
The Chattis Mauja irrigation system is a large 'farmer managed irrigation system' (FMIS) located in the western Terai region of Nepal (*See Figure 1*). The system was developed by the Tharus, the original inhabitants of the area, some 170 years ago. The system was named Chattis Mauja because it was originally meant to provide irrigation to a total of 36 *maujas* (villages/settlements). The number of villages served by the system has increased to 56 since the original construction, due to the increase in population that started after 1950. Most settlers who moved to the area were from the adjoining hills. They acquired land by clearing forest and also by purchasing cultivated lands from the Tharu landlords. The Tharus, who constructed the system, gradually lost control on the system after 1960, and by 1970s the migrants completely took over its management.

The source of water in Chattis Mauja is Tinau River, which is a perennial stream originating from the mid-hills and fed by surface runoff and groundwater, though water flow in the dry season is very small. The river leaves the hills and enters the plains of Terai at Butwal, the place where the intake of the system is located. Five canals off-take from the location of the current intake of the system and compete for water at the source. Three of them take water to the right bank of the main river channel. On the left bank, there used to be two separate intakes for Sorah Mauja and Chattis Mauja irrigation systems until 1959.

The government took the initiative of constructing the Tinau irrigation scheme in 1959 with a major diversion weir, located just above the intake of Sorah Mauja.

This construction resulted in the permanent closure of the intake of Sorah Mauja. The users of Sorah Mauja filed a petition with the then zonal commissioner of Lumbini Zone. With the mediation of the zonal commissioner, another intake in Tanau river was provided to Sorah Mauja, located upstream of the existing intake of Chattis Mauja. A link canal from the new intake was also developed to bring water to the main canal of Chattis Mauja. Since then, the two intakes and the main canal, up to the point of division of water between the two systems, became common infrastructure for both the systems. A proportional structure was constructed to divide the water in the proportion of 40:60 in Sorah and Chattis Mauja.

Figure 1: Layout of the Chattis Mauja irrigation system



The diversion structures at the two intakes are of the temporary brushwood type. The feeder canal bringing water to the point of water division between the two systems passes through a river course that gets almost filled by sand and gravel after every monsoon. The main canal of Chattis Mauja, after the point of division, is 11 km long. It serves 3,500 ha of land and 2,500 households in 56 villages in the irrigation command. Water is distributed through 44 branch canals, with one branch canal serving a single village in most cases. Inlets to the branch canals, in most cases, are temporary structures with only wooden posts driven into the canal bed to define the opening width.

As stated earlier, the social composition of the users in the command area dramatically changed after the 1960s with migrants coming to settle in the area. The data on irrigator households reveal that a majority (89.7 per cent) are migrants from the hills. These include Brahmins (65.5 per cent) followed by *Chhettris (*14.8 per cent), people of Mongoloid origin (12 per cent), and Tharus, Madhesis and other minorities (7.7 per cent).

The migration that started in 1950, and continued until the late 1990s, had a significant impact on the governance of Chattis Mauja. The most significant change has been that the social composition of the area dramatically changed. The leadership of the irrigation organisation was completely taken over by the migrants. The original *maujas* (villages) of the head location became the tail-end *maujas* with the reclamation of land from forest in the head end. Another change included codification of the traditional rules, with modifications brought to address the changed context.

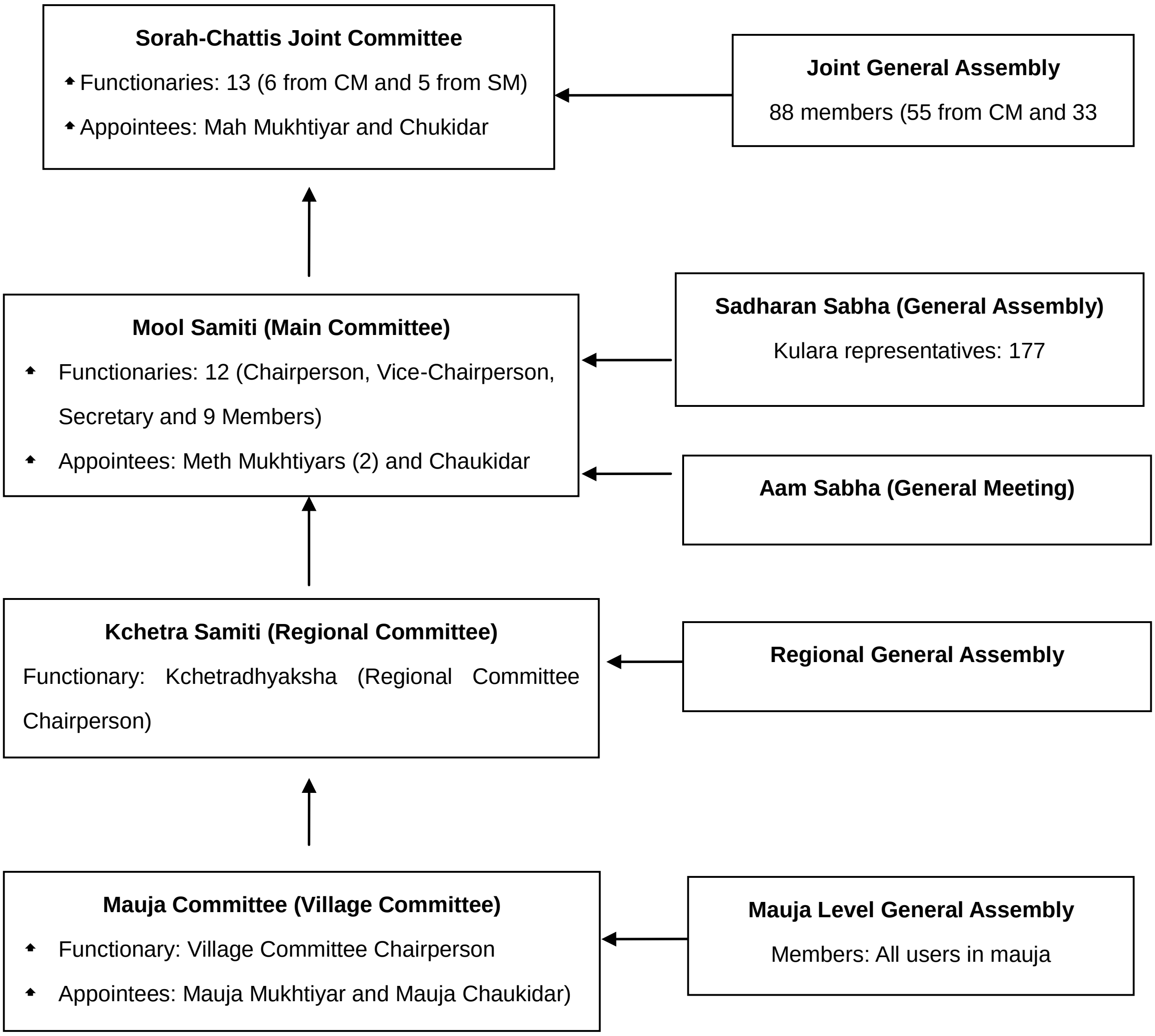
The migrants were familiar with cropping systems other than those for rice and saw the need for winter and spring irrigation as well. Cultivation of winter crops, such as wheat, was introduced to the area only after 1965. With increased access to border towns along the Indo-Nepal border in the south, and with the connection of this area to other parts of Nepal, market opportunities for exporting surplus agricultural products gradually opened up. This resulted in increasing urbanisation of the economy. The head and middle portions of the command area have greatly urbanised in the last two decades.

2. Governance structure

A four tiered governance structure has evolved in the Chattis Mauja irrigation system, comprising: (a) the Sorah-Chattis Joint Committee, (b) the System Level

Committee, (c) Regional Committees and (d) *Mauja* (Village) Level Committees (*See Figure 2*).

Figure: 2. Governance structure of the Chattis Mauja irrigation system



The final authority for decision making is vested in the *Sadharan Sabha* (General Assembly), which comprises the commensurate number of representatives with voting rights from each *mauja*, depending upon the *kulara* entitlement of the respective *mauja*. *Kulara,* in local parlance in Chattis Mauja, indicates the unit for sharing of water in proportion to land under irrigation. The same unit (i.e., *kulara*) is used to ascertain water entitlement, obligations to mobilise resources, and voting right of users.

At present, the total area under irrigation in the system is considered equivalent to 177 *kulara*. Therefore, 1 *kulara* is equivalent to about 25 *bigha* of land under irrigation (1 *bigha* = 0.67 hectare). Thus, a *mauja* with area of irrigation equivalent to 5 *kulara* has an entitlement of 5/177 portion of total water available in the main canal. It is also responsible for contributing 5/177 portion of total unit of resources needed for repair and maintenance of the main system and has five out of total 177 votes in the important decision making process in the general assembly.

The general assembly is the forum where every representative has the opportunity to articulate the system level and *mauja* level problems and actively contribute to making decisions. The *Aam Sabha* (General Meeting) is another forum for making decisions about important recurrent events. The representatives in the General Meeting are functionaries of all the branch-level committees and executives of the main committee.

The *mauja* committee is the lowest tier in the governance structure, responsible for all the operation and management functions at the branch canal level. These include: acquisition of entitled water from the main canal, allocation of water to the farmers, planning and execution of repair and maintenance works within the branch canal, mobilisation of resources for repair and maintenance of the main system, assessing fines and conflict resolution within the branch canal.

The number of functionaries in the *mauja* committee is not uniform across the system. However, in all cases, the irrigators nominate a leader (other than the elected/nominated functionaries), called *Mauja Mukhtiyar*, who functions as the village-level official in the *mauja c*ommittee. This official is responsible for distribution of water among the irrigators, conflict resolution, mobilisation of resources for repair and maintenance and dissemination of the main committee‘s decisions. Though not uniform to all *maujas*, the irrigators also appoint a *Mauja Chaukidar* (village-level watchman) who assists the *Mauja Mukhtiyar* in disseminating information.

The second tier in the irrigation organisation is the Regional Committee *(Kchetra Samiti)*, which functions as a link between the *mauja* committee and the main committee. The entire command area of Chattis Mauja has been divided into nine regions, with one Regional Committee constituted in each region. The Regional Committee is composed of chairpersons of the Mauja Committees who then nominate a *Kchetradhyaksha* (Chairperson of the Regional Committee). The Regional Committee is instrumental in coordinating operation and management at the regional level.

The *Mool Samiti* (Main Committee) is the upper tier in the irrigation organisation, consisting of 12 functionaries. Of them, the chairperson, vice-chairperson and secretary are elected by ballot for a two-year term by members with voting rights (*kulara* representatives from each *mauja*) in the general assembly. In addition, there are nine general members who are ex-officio chairpersons of the Regional Committee. The Main Committee is responsible for allocation of water into the branch canals, repair and maintenance of main canal infrastructures, coordination with Sorah Mauja for water sharing, coordination with government and external agencies and upgrading of irrigation infrastructures.

The Main Committee has power to appoint two *Meth Mukhtiyars* (Chief Official of the System) to coordinate and supervise day-to-day operation and management of the main canal and related infrastructures. They are responsible for assigning works to each *mauja* at the time of annual repair and maintenance of the system, monitoring of repair and maintenance works to ensure the quality of work and their completion within the stipulated time, recording absentees at repair and maintenance, allocation of water to different *maujas* as per their entitlement and dissemination of decisions of the main committee to *mauja* level committees. The *Meth Mukhtiyars* are assisted by two messengers *(chaukidars)*.

Given the fact that Sorah and Chattis Mauja started sharing water from a common intake, under a water sharing arrangements beginning in 1959, a joint committee was constituted to look after the operation and management of infrastructure and services in the portion under the joint control of the two systems. The Sorah and Chattis Mauja irrigation systems have made constitutional provisions for election/nomination of functionaries in the joint committee. At present, Chattis Mauja nominates six members and Sorah Mauja nominates five members from their system-level executive committee. The chairman, vice-chairman, secretary and treasurer in the joint committee are elected/ nominated from among the 11 nominated representatives of the two systems in a combined general meeting where all *Mukhtiyars* (54 from Chattis Mauja and 33 from Sorah Mauja) represent the irrigators. The chairmen of Sorah and Chattis Mauja work as ex-officio members in the joint committee. The committee appoints a *Mah Mukhtiyar* (Chief Official of Joint System) and a

Chaukidar (watchman-cum-messenger) for delivering operation and management functions.

3. Operation and management activities

3.1. Water allocation and distribution

Irrigation to each branch canal *(mauja)* is allocated based on the *kulara* entitlement of the respective *mauja*. As discussed in the previous section, *kulara* defines the proportion of total perennial discharge flowing in the main canal to which each *mauja* is on a fraction. The need for the number of *kulara* of water in each *mauja* is decided by the *Mauja* Committee depending upon the number of users and land area to be irrigated. Other considerations in decisions are type of land and soil, availability of labour to meet the repair and maintenance obligations, proximity to main canal and access to drainage water. The type of soil at the head reach of the system is porous, with high seepage and percolation losses, while at the soil at the tail reach is predominantly clayey in nature, which holds water for longer duration. Many of branches at the tail reach also have access to drainage water; therefore the *kulara* entitlement to the branch canals in the tail reaches is generally lower than those at the head reaches.

The size of the inlet to a branch canal is decided by the Main Committee depending upon the *kulara* entitlement of the respective branch. Accordingly the *Meth Mukhtiyars* make adjustments in the length, width and height of the inlet opening. Though the fixing of the size of the inlet to the branch canal is based on observed judgment and does not follow strict hydraulic principles, this is generally perceived as reliable by the farmers. The temporary nature of the inlet to the branch canals makes the canals vulnerable to tampering; as a result, strict monitoring is needed. The *Meth Mikhtiyars* monitor the size of the inlet to each branch, and if found tampered with, they adjust the inlet in the presence of branch level *Mukhtiyars*.

The water flows continuously to all the branches during the monsoon, when there is abundance of water at the source and the main canal. During the dry season and during periods of prolonged dry spells in the monsoon, a rotational schedule in water distribution is practiced. The chairman and *Meth Mikhtiyars* of the main system together with several village level *Mukhtiyars* evaluate the water available at the source and the main canal to decide upon the rotational schedule. Usually, the rotation begins with a group of branch canals getting water for a fixed duration and then shifting the turn to another group of branches. When the available supply diminishes further, the schedule of rotation may be a single branch getting water at a time for a fixed duration. The *kulara* entitlement of the branch canal is used as the basis to work out the duration that water is available to a branch canal.

Once the water flows within the boundary of the *mauja*, the *Mauja Mukhaiyar*, with the advice of the *mauja* level committee, works out the schedule to distribute water to the farmers at different locations of the branch. The distribution of water to the farmers within the branch canal is always by time, regardless of abundance or scarcity of water. During periods of serious water scarcity, each farmer may get water for only a few hours in each turn. The *Mauja Mukhtiyra* and *Mauja Chaukidar* communicate to the farmers at different locations their irrigation turn as well as the duration of irrigation available to them. They are also responsible for monitoring the water distribution within the *mauja*.

3.2. Repair and maintenance

The repair and maintenance tasks in the system include emergency repair of the diversion structure after each flood damage, annual de-silting of the main and branch canals, de-silting of the canal above the point of water division between Sorah and Chattis Mauja, and regular preventive maintenance when the system is in operation.

The responsibility of repair and maintenance of the two diversion structures and the portion of the main canal above the point of water division is with the Sorah-Chattis Joint Committee. The Joint Committee's *Mah Mukhtiyar* and messenger have the responsibility of monitoring the diversion structure and issuing a call for labour and materials when maintenance is required. In case of emergency repair and maintenance, a message is sent to the *Meth Mukhtiyars* or the Chairperson of Sorah and Chattis Mauja to mobilise the required amount of labour and materials. For emergency repair and maintenance, users from head end branches of both the systems are usually called more frequently due to their proximity to the intake. They are compensated by exempting them during the annual de-silting of the main canal to balance the labour they contribute for the emergency maintenance.

The basis of labour mobilisation for *Sheer Kulahi*, which is the repair and maintenance of the two intakes and joint-operated section of canal, is based on *kulara,* which, as stated earlier, means one person day of labour per 25 *bigha* of land. Both Sorah and Chattis Mauja follow a system of labour mobilisation for *Sheer Kulahi* matching with the intensity of repair and maintenance needs. These are *Sabik* (one person day for 25 *bigha* of land) when the need for labour mobilisation is not large. However, in the situation of larger quantum of work, *Duna* (two labour per 25 *bigha* of land), *Tirble* (three labour per 25 *bigha* of land) or *Chauble* (four labour per 25 *bigha* of land) labour may be mobilised proportional to the quantum of repair and maintenance work needed to be done.

In the event of extraordinary work at the intake and the joint canal, there may be exhortation from the executive committees of both the systems to compulsorily send one labour per household, which is called *Jharuwa* in local parlance. *Jharuwa* used to be the usual practice of labour mobilisation for repair and maintenance of the system until the point of time that the Tharus were in a majority and controlled the operation and management of the system. The system included *Sidhabandi* (labour contribution with foodstuff packed for the night halt until the works would be completed) and *Bhujabandi* (labour contribution with tiffin packed to work for the full day until the work would be completed). These systems of compulsory labour mobilisation are no longer in practice after the migrants took over the operation and management of the system. They found the *Jharuwa* system of labour mobilisation exploitative because the small holders were required to mobilise as much labour as those with larger land holdings.

The annual repair and maintenance of the main canal in Chattis Mauja involves removal of silt deposited in the canal bed, removal of weeds and vegetation growing in the bed and banks and strengthening the canal bank. Earlier, annual repair and maintenance used to be carried out during April-June, just before the onset of the monsoon. In 1988, a decision was made to undertake the annual repair and maintenance during February, when the temperature is low and more favourable for physical work.

On the day the annual repair and maintenance starts, all *Mauja Mukhtiyars*, main committee functionaries and *Meth Mukhtiyars* meet at *Satkule*, which is considered the termination point of the main canal. The *Meth Mukhtiyars* then assign the *Maujan Nath* to each *mauja*, which is the measured length of the main canal assigned to each *mauja* for de-silting. It is then the responsibility of each *mauja* to clean the canal in the assigned portion by mobilising labour proportionate to landholding size.

The *Meth Mukhtiyars* usually give three assignments to each *mauja* based on their *kulara* entitlement to ensure equity in the allocated work. The main canal near the head reach is wider, the canal banks are high, and the depth of silt and gravel deposited in the canal is usually larger than the tail reach. In the first assignment a section of the tail and middle reach of the canal is assigned to all the *maujas*. In the second and third assignment, sections in the head reaches are assigned where the works are more difficult. Once the work is assigned, it is the responsibility of the *Mauja Mukhtiyar* to ensure that the all irrigators from the respective *maujas* mobilise labour proportionate to their landholding size in accomplishing the assigned work.

The usual pattern of labour mobilisation by the irrigators in most *maujas* is on the basis of landholding size. However, in some *maujas*, where the Tahrus are in a majority, labour mobilisation is still on the basis of *Jharuwa*, where all able-bodied men in the household come to work on the canal. The *Mauja Mukhtiyar* records the absentees, who are fined for their absence from work. The *Meth Mukhtiyars* need not worry about each day's attendance of people at work. His responsibility is only to monitor that each *mauja* completes the assigned work properly and on time. If a *mauja* fails to mobilise labour to complete the assigned work on time and of an expected quality, the *Meth Mukhtiyar* fines the concerned *mauja*; this is called *khara*. The fine is determined based on the response of the concerned *mauja*. In the event of a *mauja* ignoring the assigned *khara*, the non-compliance may result in denial of water allocation for the given year.

Each *mauja* is independent in deciding the timing and approach for the annual repair and maintenance of the branch and tertiary canals in their portion. A village level meeting is called by the *Mauja Mukhtiyar* to decide the timing of annual de-silting. The labour mobilisation for annul repair and maintenance is either on the basis of landholding or on a household basis. In the tail end *maujas*, a majority of the households are Tharus who still practice *Jharuwa* system, whereby each household mobilises one labour irrespective of their landholding size. Most households in the middle and head reach are migrants from the hills who mobilise labour proportional to landholding.

The irrigators in all *maujas* have the option to pay *khara* in cash instead of providing labour. The payment in cash exempts irrigators from all labour mobilisation obligations in main canal de-silting, emergency repair and maintenance or repair and maintenance works within the *mauja*. The cash raised through *khara* every year is the major source of revenue to pay for the appointed staff and to meet the operation and management costs. Many farmers in Chattis Mauja are subsistence farmers and prefer doing the maintenance works on their own rather than paying *khara*. The farmers paying *khara* in cash are those who have other jobs that conflict with demands of the repair work.

3.3. Resource mobilisation

Resource mobilisation in Chattis Mauja includes: (i) labour mobilisation for emergency repair and maintenance, (ii) labour mobilisation for annual repair and maintenance, (iii) cash mobilised from among the users, from time to time, for system improvement and upgrading, (iv) cash mobilised as *khara* for exemption from labour obligations, (v) occasional grants received from the government and non-governmental organisations in cash, and (vi) fines in cash collected for defaults from the irrigators.

The *mauja*-level organisations raise most of their cash resources through labour exemptions. Fines imposed on individuals for absence from work or for other defaults are another source of income. The regular source of cash income to the Main Committee or Sorah-Chattis Joint Committee are fines for absence from emergency and annual repair and maintenance, fines collected for stealing water, and periodic cash contribution raised from among the users.

The periodic cash contribution, called *Bighatti*, raised from among the farmers on the basis of their landholding size, is used for rehabilitating and upgrading the system, when construction materials are to be purchased from outside. In addition, the *mauja* level organisations are required to pay an annual fee of Rs. 55 per *kulara*, which is used towards paying the appointed staff. In case of a need to increase *kulara* allocation to a specific *mauja*, the *mauja* level organisation is required to pay the Main Committee a fee of Rs. 500.00 per *kulara* for each additional *kulara* of water. Increasing *kulara* entitlement to a *mauja* requires the prior approval of the Main Committee.

3.4. Decision making and communication of decisions

The decision making in Chattis Mauja involves different entities at different stages of decision making. The Joint General Assembly, composed of 54 *Mauja Mukhtiyars* from Chattis Mauja and 22 *Mauja Mukhtiyars* from Sorah Mauja, is the highest level decision making body of the joint system.

Within Chattis Mauja, there are two levels of decision making bodies: the General Assembly *(Sadharan Sabha)* and General Meeting *(Aam Sabha)*. All users are welcome to participate in the General Assembly, called two times in a year, though only designated representatives can vote on important decisions and for the election of the functionaries. Two-thirds of the representatives must be present for required quorum. The General Meeting is called whenever important operation and management issues have to be decided. However, the General Meeting does not have the authority to make policy decisions affecting the users, such as rates of fines and sanctions, annual fees and cash mobilised for improving and upgrading the system.

The Main Committee is authorised to make decisions about the day to day operation and management of the system. In case a decision is likely to influence many irrigators, the chairman calls the meeting of the executive committee to make the decision. Any decisions, beyond recurrent operation and management and likely to influencing a large number of irrigators, made by the Main Committee, need to be approved in the General Assembly.

At the *mauja* level, the *mauja* committees can independently decide on operation and management activities within the *mauja*. For major decisions about operation and management within the *mauja*, a meeting of all irrigators is called. However, for day to day operation of the system, the *Mauja Mukhtiyars* are authorised to make and execute decisions.

Communicating the decisions, which are made at different levels and in top-down or bottom-up manner, constitutes an important element of the operation and management activities in Chattis Mauja. For prompt communication of decisions at different levels, messengers *(chaukidars)* are appointed. The main task of the joint system messenger is to guard the two intake points at the river, at the joint canal and at the proportional weir for water division between Sorah and Chattis Mauja. Any damage caused to the intake during a flood is promptly reported to the Joint System Chairperson.

In case of the need for repairs, the *Mah Mukhtiyar* calls the *Meth Mukhtiyars* of Sorah and Chattis Mauja to assess the resources required to accomplish the repair and maintenance. The system level messengers are then responsible for informing the *Mauja Mukhtiyars* about the intensity of the damage and the labour to be mobilised from each *mauja* for the repair and maintenance of the damaged portion. In Chattis Mauja, the two main system messengers are provided bicycles, a bag to carry letters, an attendance register, a raincoat and a flashlight to be able to carry out their duties even in the night.

Decisions made at the general assembly and general meeting are communicated to the irrigators by the voting representatives in the general assembly from each *mauja*. The decisions made at the Main Committee meeting are communicated to the *Mauja Mukhtiyars* by the system messengers. The *Mauja Mukhtiyars* are then responsible for communicating the decisions to the concerned irrigators within the *mauja.*

The system for bottom-up communication is equally strong as that for the top-down communication. For example, the decisions made by *mauja*-level committees are communicated to the *Meth Mukhtiyar* or Main Committee Chairperson by the *Mauja Mukhtiyars.* The nine *Kchetradyaksha*s (Regional Representatives) also work as the link of communication between the *mauja* and the Main Committee. When the farmers are confronted with serious problems within the *mauja*, unsolved or unaddressed by the *Mauja Committee*, the issue is referred to the Main Committee by *Mauja Mukhtiyar* for resolution. The Chairperson of the Main Committee then calls either the *Meth Mukhtiyar* or the main system messenger to verify the information and takes corrective action.

The decisions made by the Main Committee, likely to influence the operation and management of the Sorah-Chattis Joint System, are promptly communicated to the *Mah Mukhtiyar* or Chairperson of the Joint Committee. Depending upon the seriousness of the problems/issues, formal (through written letters) or informal (verbal) means of communication are used. The decisions of the Joint Committee are also communicated to the Main Committees of the respective systems in formal or informal ways.

3.5. Conflict management

The farmers in Chattis Mauja have developed mechanisms to deal with different situations of defaults and conflicts emerging as a result of the defaults. Both formal and informal mechanisms are employed to deal with infractions of rules. Considering the spatial extent and structural complexity of the system, the conflicts may arise at the portion of the system jointly managed by Sorah and Chattis Mauja (inter-system conflict), among *maujas* acquiring irrigation from the main canal (inter-*mauja* conflict) or among the farmers irrigating from a branch canal (intra-*mauja* conflict). The rules developed to deal with the possible defaults at each of these levels and the mechanisms for conflict resolution are unique.

The joint committee is responsible for resolving any outstanding issue or conflicts resulting from the sharing of water between Sorah and Chattis Mauja. In over 50 years of experience of joint management, both the systems have realised the need of mobilising enormous resources for the maintenance and upkeep of the intake and joint canal. This has built trust and solidarity among the two systems, which brings about consensus decisions in the event of conflict.

The inter-*mauja* conflicts generally occur in periods of water scarcity. This is more frequent during paddy nursery preparation, which is generally done by most farmers in May when the available supply at the source is limited. During this period, the usual tendency is to steal water and tamper with the size of the inlet to the branch canals in an attempt to increase the quantity of inflow. Stealing water by increasing the *mohada* (inlet to the branch canal from the main canal) is considered a serious offence because only *Meth Mukhtiyars* have the authority to set the *mohada*. In Chattis Mauja, a graded compensatory fine, depending on the seriousness of the offence, is imposed on the *mauja* found tampering with the *mohada*. For the first time the fine is usually Rs. 1,000, for the second time Rs. 1,500 and Rs. 3,000 for the third time. If a particular *mauja* continues to not comply, it may result in closing the *mohada* for a season or for the entire year. The same levels of fines are also imposed on the *mauja* involved in *maujani palo* (stealing water during the irrigation turn of other *maujas*).

If a *mauja* cannot finish the assigned *nath* at the time of annual repair and maintenance of the main canal, the concerned *mauja* is fined Rs. 250 per *kulara* for each day. This fine is to be paid to the Main Committee for the number of days required for completing the assigned *nath*. The concerned *mauja* has to clear all the *khara* of the previous year prior to accepting the *nath* in the succeeding year. The rate of *khara* for the absence at work to be paid by an individual irrigator is decided by the General Assembly.

Within a m*auja*, the kinds of usually occurring conflicts comprise violation of irrigation turn among the farmers located at the head, middle and tail reaches, and water theft during others' turn. Water theft within a *mauja* is more frequent during the period of paddy nursery preparation and during the flowering stage of maize (March-April). A one time fine for water theft within the *mauja* is generally Rs. 500.00, provided the default is established. Once an event of water theft occurs, the case is reported to the *Mauja Mukhtiyar*, who makes an on the spot observation to verify the complaint. During the period of observation by the *Mauja Mukhtiyar* the conflicting parties are allowed to present their arguments. Witnesses are also called to present their opinions. Once the complaints of the conflicting parties and the opinions of the witnesses are heard, the *Mauja Mukhtiyar* persuades the conflicting parties to resolve the conflict. Failing this the case is brought to a *mauja* level mass meeting where an elaborate discussion on the issue takes place. The persons involved in the infractions have to accept the decision of the mass arbitration, including the level of compensatory fine decided upon.

Water theft seems to be the most frequent for maize irrigation during March-April. The crop during this period is at the flowering stage and one round of irrigation at this stage is valuable to produce a good crop. The farmers in the area grow maize to produce green cobs, which are high in demand in the market. The farmers deliberately attempt to steal water from others, knowing that they will be fined if caught. One farmer in the area said, "The farmers are ready to pay the fine of Rs. 500 if caught stealing water because one round of irrigation at the flowering stage of maize can produce green cobs worth of Rs. 7000 to Rs. 8,000 per *bigha*." In order to check this trend, the *Mauja Mukhtiyar* intensifies monitoring during periods of water scarcity.

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Case 9:

Establishing claims on water in Chitwan, Nepal

Rupak Bastola and Ashutosh Shukla

1. The locale and historical context

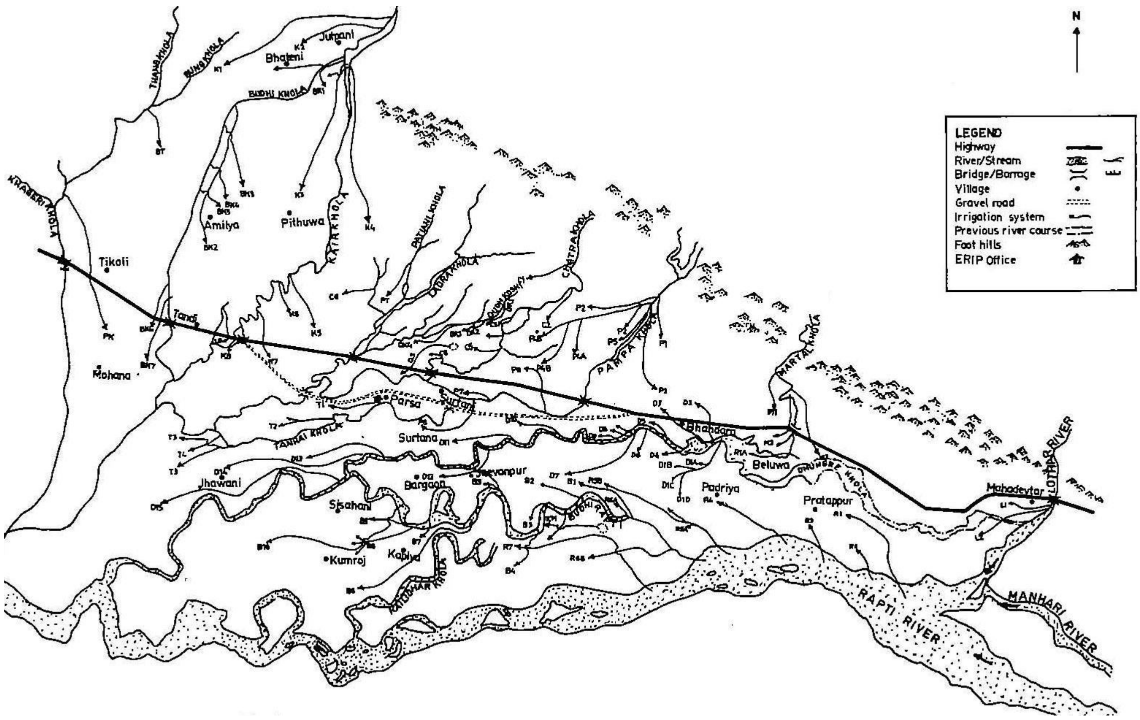
The three irrigation systems, viz., Pampa, Chipleti and Kyampa, which are discussed in this study, are located in the eastern part of Chitwan district. The district is located in the south-western part of Nepal, in Chitwan valley, between the Mahabharat range of mountains to the north and the Shiwalik hills to the south.

The eastern part of Chitwan district has a dense network of irrigation systems managed by farmers (or 'farmer-managed irrigation systems or FMISs), and developed by them during different periods of time (*See Figure 1*). The Rapti River is the major source of water in eastern Chitwan; it flows from the north-east to the south-west before joining the Narayani River. Lothar and Manhari are perennial rivers flowing through the eastern boundary, while the Khageri River flows through the western boundary. Several other seasonal and perennial streams originating in the Mahabharat range of hills flow through the valley; these include Kair Khola, Pampa Khola, Tanhi Khola, Chatra Khola and Martal Khola. Dhongre Khola and Budhi Rapti are perennial spring-fed streams, flowing east to west, almost parallel to the Rapti River.

All these seasonal and perennial streams have been tapped by the farmers in the area for their irrigation needs. An irrigation resource inventory carried out in the area in 1993 identified the existence of 88 FMISs in the area, of different sizes and origin, which brought 10,704 ha under irrigation. The area south of the Narayanghat-Hetauda section of the east-west highway had a higher concentration of FMISs. The FMISs located to the north of the highway are generally seasonal, with irrigation only possible in the monsoon. The possibility of irrigation with the network of FMISs in the area makes East Chitwan agriculturally prosperous.

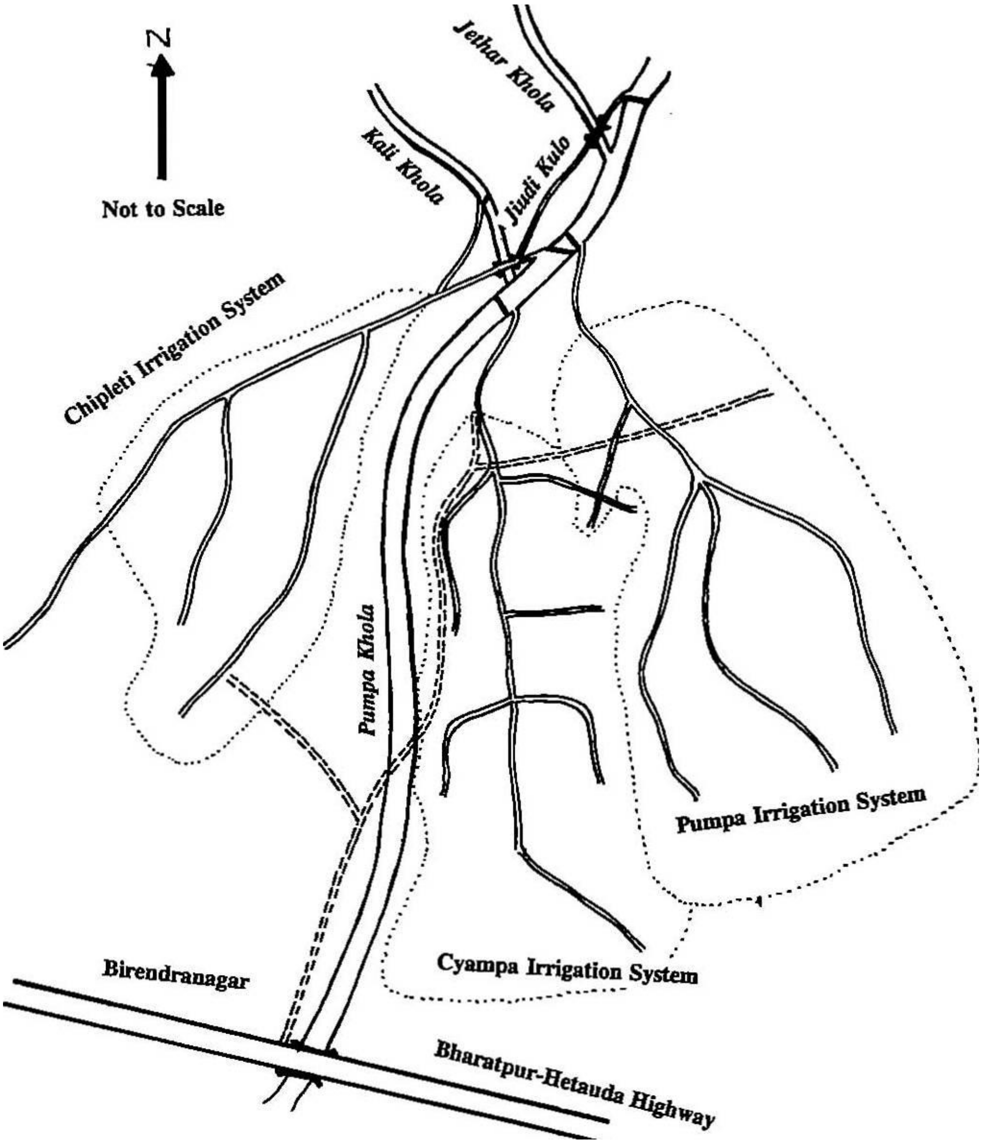
The Chitwan valley is a recently-settled area of Nepal. Until 1953, a major part of the valley was under forest. There were only scattered settlements of Tharus and Darais, the original inhabitants of the area. The valley was known for its Malaria epidemics. In 1953, the government initiated Malaria eradication programmes and planned resettlement programmes in the valley under Rapti-Doon Development Project. In the same year, floods and landslides washed away hundreds of villages on the adjoining hills. The government decided to encourage the victims of the flood and landslides to settle in the valley, and to clear and cultivate the land. They were given land titles. From 1953 to 1970, people from all parts of the country came to settle in the area, but the major influx was from the adjoining hill districts. The migration of people that started in 1953 accelerated throughout 1960-1980. The rate of migration slowed thereafter, but it continues due to the high agricultural potential of the area, its central location and accessibility from different parts of Nepal.

Figure 1: Farmer managed irrigation systems in East Chitwan



2. The quest for a stable source of water

Figure 2: Schematic diagram of the Pampa, Chipleti and Kyampa irrigation systems



2.1. The origin of the irrigation systems

The Pampa, Chipleti and Kyampa irrigation systems are located in Birendranagar in East Chitwan, to the north of the Narayanghat-Hetauda section of the east-west highway (*See Figure 2*). The source of water in the three systems is Pampa Khola, which is a seasonal stream with a large monsoon flow and a small dry season flow. During monsoon the stream brings massive amounts of coarse sediments; this has accelerated the process of sedimentation in the river bed in recent years, probably due to increased erosion resulting from deforestation and cultivation expanding to the steep hill slopes.

The area of the three irrigation systems is among the recently settled areas in Chitwan valley. In 1961, ex-army personnel, from the Nepalese and Indian forces were brought to settle in this area. They were earlier settled across the Rapti River, but the settlement was acquired by the Chitwan National Park. At the time, the forests in the area were being cleared by the Timber Corporation of Nepal (TCN). Tree stumps and roots were left in the area. The ex-army personnel brought to settle in the area requested the late King Birendra, during his visit to Bharatpur (the headquarters of Chitwan district), to permit them to use the leftover stumps and roots. They were given permission, and they sold the leftover forest products as firewood. This raised Rs. 1.5 million, which they used to form a cooperative fund. This fund was utilised in later years for the development of roads, schools and drinking water and irrigation schemes in the area. This cooperative fund, generated from the sale of the leftover forest products, was the initial source of funding for the development of the three irrigation schemes.

2.2. The quest for water by Pampa beneficiaries

The Pampa irrigation system, developed in 1967, is the oldest of the three irrigation systems. Before it was constructed, the entire area under the command of the three irrigation systems was essentially rain-fed and under maize and millet farming. To initiate work of this system, the ex-army men's cooperative provided Rs. 40,000. All the potential users provided free labour to dig the canal. This money was used to contract out the work of cutting the rocks to pass the canal through a rocky terrain near the water intake point on Pampa Khola.

The initial construction of this system was completed in 1969, and water was obtained to irrigate 20 ha of land in the head reach, through a brushwood weir built for diverting water at the intake point. The intake was found to be unsuitable because the brushwood weir built for diversion would get damaged after every flood in the river. In 1970, the users decided to move the intake further upstream Pampa Khola, in search of a more suitable intake. Even this new intake was found to be unsuitable; the diversion structure used to get damaged after every flood. Although the farmers continued using this intake, it involved frequent repair of the brushwood diversion structure, adversely affecting reliability of irrigation until 1976.

In 1976, the users decided to move the intake further upstream in search for a more stable site, and decided to dig a 20 m long tunnel through the rocky terrain near the intake. It was decided to dig the tunnel because the cross-section of the canal dug earlier through the rock was limiting the volume of water acquired. The users obtained the support of the Community Surface Irrigation Program (CSIP) of the Agricultural Development Bank of Nepal (ADB/N) in 1991. This was used to dig the tunnel, construct a permanent intake at the source and strengthen the canal. The total cost of this development was Rs. 246,000, of which 60 percent was a government grant, 30 percent was provided by ADB/N as group credit and 10 percent equivalent of labour was mobilised by the users. This improvement increased the irrigated area to 70 ha. In subsequent years, the command area of the scheme expanded to 105 ha.

2.3. The quest for water by Chipleti beneficiaries

The Chipleti irrigation system was initiated in 1971 with an intake in Pampa Khola, upstream of the earlier intake (as in 1970) of the Pampa irrigation system. However, water could not be acquired with the alignment of the canal developed. In 1973, the farmers decided to build another intake in Kali Khola, a seasonal tributary of Pampa Khola, to acquire water for irrigation during the monsoon. The farmers provided free labour to dig the canal along the new alignment and the ex-army men’s cooperative provided Rs. 90,000, which was used to build the intake, canal crossing and to dig the canal through rocky terrain.

Both these early attempts could not succeed and the system remained defunct from 1973 to 1981. During this period, the farmers in Chipleti continued growing maize and millet, while the farmers in the Pampa irrigation system, just across the river, were growing rice, thanks to availability of irrigation. This was humiliating to the farmers in Chipleti, because prosperity in the Nepalese household is valued in terms of the number of months for which rice is eaten in the household.

In 1981, a farmer from Chipleti, who had worked in the engineering corps of the Indian Army, re-initiated the construction of the canal. It took 44 days of continuous work by 86 men who dug the canal along the new alignment to obtain water from Kali Khola and the earlier intake in Pampa Khola. The farmers succeeded in acquiring water from the two intakes in the same year to irrigate 48 ha of land. Three years later, in 1984, the District Development Committee (DDC) of Chitwan provided a grant of Rs. 12,000 and 11 gabion panels (for building the diversion structure), which were used to improve the intake in Kali Khola. This investment increased the reliability of irrigation from Kali Khola in the monsoon.

After the construction of a permanent intake in the Pampa irrigation system in 1991 with CSIP assistance, which was located upstream of the intake of Chipleti, the available supply at the intake of Chipleti got significantly reduced. The intake in Kali Khola was good only for irrigation during monsoon. For irrigation in the dry season, the farmers depended on the intake in Pampa Khola. They were in dire need of a dependable source for dry season irrigation.

A few Chepang households were irrigating five ha of land through a small canal, named Jiudi Kulo, with an intake in Jethar Khola. This area is upstream of the command area of Chipleti. The farmers in Chipleti were obtaining the drainage from Jiudi Kulo for dry season irrigation and also to augment the available supply during the monsoon. In 1975, the Chepang households obtained a group credit of Rs. 9,000 from the Small Farmers' Development Project (SFDP) of ADB/N. This was used to improve the canal and the intake of Jiudi Kulo in Jethar Khola.

In the same year, a Community Water Supply Scheme was developed in the area that tapped water from Jethar Khola, upstream of the intake of Jiudi Kulo. Since the development of the scheme reduced the available supply at Jiudi Kulo, the Chepang households decided to build an intake in Pampa Khola in 1978, upstream of the intake of Pampa Kulo. As a result of this change in intake, the available supply in Jiudi Kulo increased significantly in the monsoon as well as in the dry season.

Due to limited supply from the two intakes in Pampa Khola and Jethar Khola, from 1985, the farmers in the Chipleti irrigation system began obtaining water for dry season irrigation by requesting the Chepang households in Jiudi Kulo. The users of Chipleti had realised the value of this water for dry season irrigation. On the other hand, the Chepang households were not in a position to pay back the loan that they had obtained from SFDP in 1975. By this time, the amount of outstanding loan, including interest, had reached Rs. 20,000. Failure to clear the loan would mean auction of the land mortgaged against the loan.

In 1990, the Chepang households entered into an agreement with Chipleti that resulted in the merger of Jiudi Kulo with Chipleti. In turn, the farmers of Chipleti raised Rs. 20,000 to pay the Chepang households to clear the outstanding loan. After this merger, in 1991, the Chepang households became regular users of the combined Jiudi-Chipleti irrigation system.

2.4. The quest for water by Kyampa beneficiaries

The Kyampa irrigation system was initiated in 1969. At the time of construction of the Pampa irrigation system, the users of Kyampa had also contributed cash and labour with the hope of getting irrigation. However, after the initial construction of the Pampa system was completed in 1969, they were denied access to irrigation.

A prominent farmer from the area decided to invest his own money for the construction of the Kyampa irrigation system. He invested Rs. 12,000 and the users of Kyampa mobilised labour for the construction of the canal. It took nearly one month for 45 men to dig the canal and construct an intake in Pampa Khola, downstream of the intake of the Chipleti irrigation system. They succeeded in obtaining water to irrigate 53 ha of land. In 1970, the ex-army men's cooperative provided Rs. 6,000, which was used to further improve the intake and the canal. With the availability of irrigation, the command area increased in subsequent years to 90 ha.

3. Emergence of conflict and conflict management

3.1. Pampa versus Chipleti irrigation systems

In 1971, when the initial construction of the Chipleti irrigation system took place, its intake was downstream of the earlier intake of the Pampa irrigation system. The Pampa system continually moved its intake upstream in Pampa Khola, in search for a more stable intake. This continued from 1970 to 1976. In 1991, significant amount of financial support was received for rehabilitation and improvement of the system from CMISP-ADB/N, which was spent to construct a permanent intake facility and to improve the canal. The objective was to divert the maximum possible water from Pampa Khola.

Until 1990, the available supply of water in Chipleti, despite its two intakes in Pampa Khola and Kali Khola, was very limited. The major constraint on irrigation used to arise in the dry season. The only supply available for dry season irrigation was the drainage of Jiudi Kulo, and whatever limited supply the people could obtain from the intake in Pampa Khola. Their negotiations resulted in a merger of Chipleti in Jiudi Kulo in 1990; it gave them access to a more dependable source in Pampa Khola for dry season irrigation.

On July 7, 1992, when the new intake of the Pampa irrigation system, constructed with CMISP-ADB/N assistance, was being inaugurated, the users of Pampa organised a feast at the intake. During the feast, the users of Pampa decided to break the upstream intake of Jiudi-Chipleti combined. The position taken by the users of Pampa system was that the intake by the Chipleti system from Jiudi Kulo would reduce the available supply of water in Pampa Kulo. They also claimed that they had prior appropriation right at the source, and, therefore, Chipleti's negotiation with Jiudi, to get access to water through an intake upstream, was unauthorised.

When the intake was damaged, the farmers in Chipleti were busy transplanting monsoon rice. As the water in the canal ceased, the users went to the intake to inquire into the matter and found the intake broken. The users' committee of Jiudi-Chipleti combined system sent a written message to the users' committee of Pampa to inquire into the matter. When they got no response from the users' committee of Pampa Kulo, they filed a written complaint at the Birendranagar VDC's office, claiming compensation of Rs. 52,820 for four days of delays in transplanting rice, due to the damage done to the intake by the users of Pampa Kulo.

The functionaries of Birendranagar VDC failed to arbitrate and the issue was referred to the District Administration Office (DAO) of Chitwan district. The DAO organised several hearings from both the disputing parties. While the case was still pending at the DAO, the users of Pampa filed a legal case against Chipleti at the District Court of Chitwan. Their position was that Pampa Kulo had prior appropriation rights in Pampa Khola. Therefore, the negotiation of Chipleti with Jiudi Kulo to access river water was a violation of their prior appropriation right.

The District Court gave its verdict on June 17, 1994, in favour of Pampa Kulo. The verdict stated: "Until 1978, the intake of Jiudi Kulo was from Jethar Khola and that it was moved to Pampa Khola only after 1978. Since this change in intake was made after construction of Pampa Kulo and likely to reduce available supply in Pampa Kulo, this would be violation of prior appropriation right."

The users of Jiudi-Chipleti combined challenged this verdict of the District Court in the Appellate Court, where the verdict went in favour of Jiudi-Chipleti combined. The new verdict stated: “The existing intake of Jiudi-Chipleti in Pampa Khola is 1.5 km upstream of the existing intake in Pampa Kulo, therefore the claim made by the users of Pampa irrigation system that this would reduce the available supply cannot be justified.”

This verdict of the Appellate Court was challenged by the users of the Pampa irrigation system in the Supreme Court of Nepal. The Supreme Court reinstated the judgement made by the District Court that debarred Chipleti Kulo from using water from the upstream intake as negotiated with Jiudi Kulo. However, considering the limitation of water sources for dry season irrigation in Chipleti, the court issued a ruling to allow Chipleti to use this intake for one week for winter irrigation of wheat.

3.2. Pampa versus Kyampa irrigation systems

At the time of the initial construction of the Pampa irrigation system, the users of Kyampa had also contributed cash and labour. However, they were denied access to irrigation when the construction was completed. The users of Kyampa decided to dig a new canal only after being denied access to irrigation in Pampa Kulo.

The conflict between Pampa and Kyampa arose when the construction of a permanent intake structure was initiated in the Pampa irrigation system with CSIP-ADB/N’s assistance in 1991. Until this time, the Pampa irrigation system had a brushwood diversion structure at the intake that was allowing significant flow downstream. When the construction of the new intake was in progress, the users of Kyampa filed a written complaint to the Birendranagar VDC and District Administration Office of Chitwan. When we asked why the users of Kyampa filed the complaint, they said, “We saw a cement-concrete diversion structure being built with almost six feet deep foundation. A structure of this nature was sure to reduce the downstream flow of water in Pampa Khola, sure to reduce our share of water at the source”.

The functionaries of Birendranagar VDC involved the officials of ADB/N in the process of arbitration of the dispute between the Pampa and Kyampa irrigation systems. On March 10, 1992, the dispute was settled with the mediation of the Birendranagar VDC and ADB/N. Both the parties reached an agreement that instead of using cement-concrete for a diversion structure in Pampa Khola, the structure would be built of gabion boxes. The Pampa irrigation system would provide access to dry season irrigation in Kyampa.

Since then, if there is a need for dry season irrigation, the users' committee in Kyampa gives a written application to the users' committee in Pampa, stating the area to be irrigated and actual irrigation time required. The users' committee of Pampa, upon validating the request made, provides dry season irrigation in Kyampa. This arrangement is respected by both the parties, though the users of Kyampa complain that the amount of water made available by Pampa has never been adequate.

4. Summary

The three irrigation systems, Pampa, Chipleti and Kyampa, which are discussed in this case study, are located in the eastern part of Chitwan district. The source of water in the three systems is Pampa Khola, which is a seasonal stream with a large monsoon flow and a small dry season flow. When the initial construction of the Chipleti irrigation system took place, its intake was downstream of the earlier intake of the Pampa irrigation system. The Pampa system continually moved its intake upstream in Pampa Khola, in search for a more stable intake. Until 1990, the available supply in Chipleti, despite its two intakes, was seriously limited. The major constraint arose in dry season irrigation. The only supply available for dry season irrigation was the drainage of Jiudi Kulo, and whatever limited supply the people could obtain from the intake in Pampa Khola. Their negotiations resulted in a merger of Chipleti in Jiudi Kulo in 1990; it gave them access to a more dependable source in Pampa Khola for dry season irrigation.

In 1992, the users of Pampa decided to break the upstream intake of Jiudi-Chipleti combined. The position taken by the users in Pampa was that with the access of Chipleti in Jiudi Kulo, this would reduce the available supply of Pampa Kulo. They also claimed that they had prior appropriation right at the source and therefore Chipleti's negotiation with Jiudi, to get access to water through an intake upstream, was unauthorised. At the time of the initial construction of the Pampa irrigation system, the users of Kyampa had also contributed cash and labour. However, they were denied access to irrigation when the construction was completed. The users of Kyampa decided to dig a new canal only after being denied access to irrigation in Pampa Kulo. The conflict between Pampa and Kyampa arose when the construction of a permanent intake structure was initiated in the Pampa irrigation A structure of this nature was sure to reduce the downstream flow of water and reduce Kyampa's share of water at the source.

While the first conflict went up to the Supreme Court of Nepal, the second conflict was successfully arbitrated at the Birendranagar VDC's office. Different conflicts over irrigation systems built and managed by farmers can be resolved in different ways, which require a context-specific approach that considers local history as well as changes over time.

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Case 10:

Contesting claims and sharing water of Begnas Lake

Mohan Bikram Prajapati and Ashutosh Shukla

1. The locale and geographical context

Begnas Tal is a highland freshwater lake located in Pokhara valley, in the western mid-hills of Nepal. The lake falls in the administrative jurisdiction of the Lekhnath municipality, which is a growing township close to the Pokhara sub-metropolis. Pokhara is an important tourist destination and commercial centre.

The total area of Begnas Tal is 373 ha; this includes shallow areas associated with the marshes and rice fields located on the eastern, western, and northern shorelines of the lake. The elevation of the lake is 650 m amsl (i.e., above mean sea level). The major inlet stream into the lake is Syankhudi Khola, a seasonal stream flowing only during the monsoon. The outlet stream is Khudi Khola. The average depth of water in the lake is estimated to be 6.6 m, with the level of water surface at 655.7 m amsl. The total area of the Begnas watershed is 2000 ha (*see Figure 1*). It feeds water and sediment to Begnas Lake. This watershed contains ecologically and culturally diverse landscapes, natural resources, and settlements of people. This region is very rich in different species of flora and fauna.

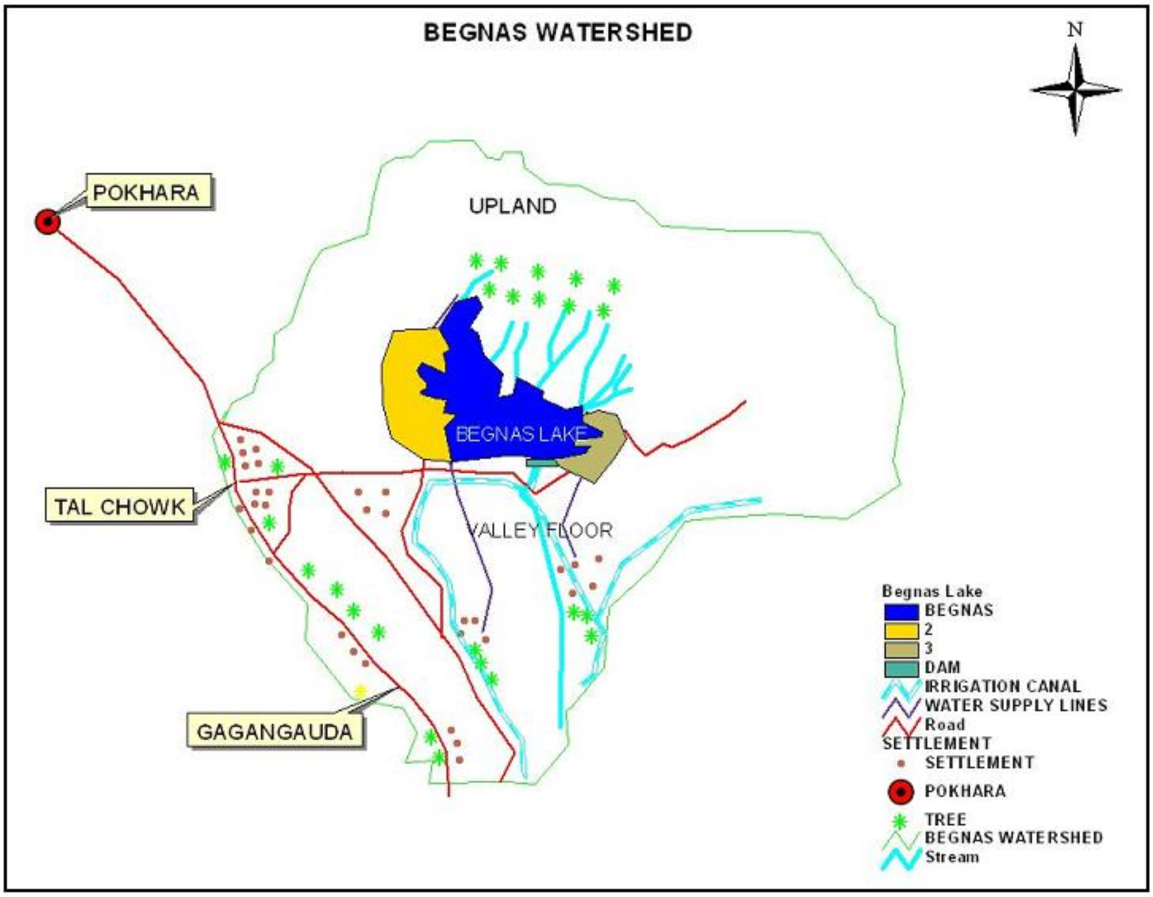
The population in the settlements around the lake significantly increased after 1970s. Many of these settlements came into existence after construction of the Kathmandu-Pokhara highway in 1973 and the Talchowk-Tal Bensi link road in 1982, which passes by the Begnas Lake. There are also settlements to the north of the lake, but the population in these settlements is not dense. A trend of migration of people from the hills in the north to the valley floor has been continuing since the 1960s.

2. The quest for natural resources at Begnas Lake

2.1 Development of irrigation infrastructure

In 1988, Khudi Khola, the outlet stream of Begnas Tal, was blocked by constructing an earthen dam, 160 m in length and 10 m in height. An irrigation canal off-taking from the dam through a gated orifice-intake was also constructed, which led to development of the Begnas irrigation scheme. The scheme was designed to serve a total of 600 ha of land in the valley floor, with a 9.36 km long main canal and four branch canals. The financial support for the dam and the irrigation system was provided by the Asian Development Bank.

Figure 1: The Begnas watershed area



The dam and the irrigation infrastructure on the downstream side of the lake were under the control of the Department of Irrigation. A water users' association (WUA) was constituted for operating and managing the irrigation scheme under the participatory irrigation management policy of the government.

The construction of dam and the irrigation scheme led to changes in Begnas Tal, which have important implications for arrangements for sharing water in the lake. While the dam raises the water level in the lake, it also maintains environmental sustainability of the lake.

The lake level of environmental degradation was serious prior to construction of the dam, mainly due to silt deposition and encroachment on the areas along the lake-shore for cultivation of rice. There were large areas with shallow water and dense growth of water plants near the inlet and outlet of the lake. In 1992, during assessment of the lake's biodiversity and productivity, the World Conservation Monitoring Centre (WCMC) found the lake degraded to the extent that it warranted efforts for conservation and restoration. The increase in storage and in the depth of water in the lake, which was made possible due to construction of the dam, created opportunities for fishery and use of the lake for boating, recreation, and tourism. On the other hand, use of water from the lake for irrigation on the downstream side led to creation of a new set of claims on water stored in the lake, which were in conflict with fishery and recreational uses of the lake.

2.2 Migration from the hills to the valley

With opening of the Kathmandu-Pokhara highway during the 1960s, people began migrating from the hills to the valley floor. Construction of this highway accelerated urbanisation in and around Pokhara. Urbanisation in Pokhara and development of settlements around the lake during this period led to denudation of primeval forests around Begnas Lake. The area was deforested to meet the growing demands of rapidly urbanising Pokhara. The loss of forest cover affected the local economy, by limiting the availability of fuel wood and supply of organic manures and biomass for farming and animal husbandry.

It is important to understand here that farming in the hills of Nepal is characterised by a symbiotic relationship between forest and agriculture. When the forest-cover declines, this traditional symbiosis begins to break. Agricultural enterprise throughout the watershed, and especially in the hills to the north of the lake, is traditional and predominantly rain-fed. Only a few scattered 'farmer-managed irrigation canals' supply water to limited areas; therefore, intensive crop cultivation is limited only to these areas. As such, the households' economy depends heavily on raising livestock for sustenance as well as supplemental income. The loss of forest cover that started during the 1960s, and continued, at accelerated pace, throughout 1970-1980 led to serious environmental degradation and impact on livestock rearing.

After the mid 1980s, the concept of community forestry was reintroduced in the Begnas Lake area. Reforestation and watershed management activities were pursued by government agencies. The organised community forest users' groups (FUGs) started protecting and managing the forest resources. This helped to restore the forest-cover and fodder-blocks in the area, and also regenerated the ecosystem in the area.

In contrast to the situation on the ridges and hill-slopes to the north of the lake, the valley floor is agriculturally prosperous due to its fertile soil and possibilities for irrigation. This area was traditionally under irrigation using drainage-water from the Begnas Lake and the adjoining Rupa Lake. Development of the Begnas irrigation scheme in 1988 created an opportunity for year-round cultivation in most pockets in this area. The flat terrain and fertile soil of the valley floor created an opportunity for increasing irrigated agriculture. This further prompted migration of people from the uplands to the valley.

2.3 Transfer of drinking water from upland to lowland

The floor of the valley does not have economically-exploitable groundwater reserves. The only sources of drinking water for the settlements in the valley are springs and streams in the watershed are upstream of the lake from where water is transported to the valley floor. As stated earlier, the number of settlements in the valley and population in these settlements has been increasing continuously since the 1960s. Most of these settlements depend on the drinking water schemes that tap water from the numerous streams and springs on the upstream side. These schemes to access water from springs and streams have been developed by the users of water themselves. Investments for development of these schemes have come from different sources, including contributions from the community. For many of the schemes, the pipelines have been laid across the lake. Many such community drinking water schemes now exist in the valley, transporting water from the watershed on upstream side of the lake.

No information is available about the quantum of water transported by these schemes from the upstream watershed to the valley floor, or about how this transfer is affecting water supply to the lake. The water thus diverted is definitely cutting down the water supply reaching the lake through surface and sub-surface flow. The effect of this diversion is likely to be more critical for recharge of the lake during the dry season.

2.4. Promotion of fishery in Begnas Lake

The Nepal Agricultural Research Council (NARC) established a fishery research centre in 1980 adjacent to the dam on the Begnas Tal. The council intended to promote open and enclosure fishery in the lakes in the Pokhara valley to enhance livelihood opportunities of the people who depended on fishing. The project introduced exotic fish species in the lakes, brought in the plank boats, and provided technical support to promote cage and enclosure fishery, especially of hybrid species.

The promotion of fishery in the lake had a significant effect on the livelihoods of the people depending on the lake. The fishing communities in Begnas lake region, locally called Jalharis, live along the lakeshore; their livelihoods depend entirely on fishing. They catch fish in the lake and also rare fishes in cages and enclosures in the lake. In addition, there are many other local inhabitants engaged in cage and enclosure fishery in the lake. The cages and enclosures created in the lake cover approximately two ha of the lake. These cages and enclosures are private properties within the lake, while the lake fishery continues to function as common pool resource.

The households whose livelihood depends on fishery in the lake have organised a cooperative to regulate fish production and management in the lake and to organise marketing. The catch from the lake, and from the cages and enclosures, is brought to the cooperative, which fixes the rate and also makes arrangement for marketing with some taxes. In addition, the middlemen/contractors purchasing fish from the cooperative are required to pay some money on the total amount of sale. This fund is used by the cooperative for purchasing fingerlings to renew the fish stock in the lake and to manage the cooperative. The cooperative also issues licenses to the Jalharis to develop cages and enclosures in the lake.

2.5. Tourism and recreational use of the lake

The current tourism and recreational use of the lake is limited to boating and people coming for day-long picnics on the lakeshore. A majority of the visitors are from adjoining cities and towns. The flow of tourists from foreign countries has been almost negligible unlike at the Phewa Lake. Many plank boats operate in the lake, which are used for fishing and also for boating by the visitors. Visitors come to the lake throughout the year, though the frequency is higher during September to November.

Table 1: The actors, activities and impacts

Upland			
Actor	**Activity**	**Impact on**	
		Ecology	**Users**
Upland Farmers	• Chemical flow • Sediment flow	Contamination of the lake	Dying fish affect fishing communities and the lake
Forest Users' Groups	Reforestation	Increased recharge of the lake	Livelihoods improvement for lake water users
Lake			
Actor	**Activity**	**Impact on**	
		Ecology	**Users**
• Fishing communities • Boat operators	• Fishery • Boating	Not remarkable	• Sustains daily life • Recreation
• Authority • WUA	• Taxation • Dam construction	Lake maintenance	Feeling responsible
Valley floor			
Actor	**Activity**	**Impact on**	
		Ecology	**Users**
Inhabitants, residents	Water tapping for drinking, domestic, irrigation	Reduced water level	Suffering of fishing communities and boat operators

The current level of tourism activity is very low and hence the pressure on the lake due to tourism is almost negligible. This is mainly due to the lack of infrastructure and facilities for tourism and promotional activities. The proximity of this lake to Pokhara and the tranquil environment has enormous potential for tourism. Begnas Lake can be a good place for tourists who want to be away from the crowds while being near the city's amenities. In order to profit from this opportunity, a local entrepreneur has proposed to build a resort with luxury houseboats in Begnas. However, this proposal has not been sanctioned by the government due to the possible adverse impact on the lake environment and the socio-economics of the area.

2.5. The issue of rights to the lake's resources

The dam and irrigation infrastructure that has been developed in Begnas are controlled by the Ministry of Water Resources and Department of Irrigation. A water users' association (WUA) was constituted to operate and manage the Begnas irrigation scheme. Though a registered organisation under the Water Resources Act, it is yet to establish the rights for resource use of water from the lake.

The Local Self-Governance Act (1998) empowers local authorities with ownership rights over natural resources within their territory. This applies to lakes, ponds and other water bodies that are within the administrative boundaries of the municipalities and village development committees (VDCs). Under this provision of the Act, ownership of the lake would go to Lekhnath municipality. The Aquatic Life Act (1961) delegates the harvest and management of lakes to the Ministry of Agriculture, with some autonomy to the VDCs. So, all these acts and legislative instruments create contestation with regards to rights to the lake resources.

3. Emergence of contestation due to multiple uses of the lake's resources

The claims on lake water in Begnas and the contestations that emerge can be seen at two levels: (i) at the level of Begnas watershed wherein the hill slopes to the north, the water body of Begnas Tal, and the valley floor are integral components, and (ii) at the level of the lake itself wherein the current users/ appropriators of water involve irrigators downstream, the Fish Research Centre, the fishing community, and the boat operators. The dimensions and magnitude of conflicts at these two levels are narrated in this section.

3.1 Contestation at the watershed level

The hydrologic characteristics of the watershed controlling the total quantum of water reaching the reservoir would be crucially linked to the land use and types of land cover in the watershed. A good forest cover would help in reducing the surface runoff, enhancing the process of groundwater recharge that would recharge the lake through sub-surface flow links. So, in the rainy season, the lake is fed by water from sub-surface infiltration and springs and streams flowing towards the lake. In the dry season, from November to March, seasonal streams dry off and the sub-surface flow of water is not significant. On top of that, the communities in the valley withdraw water from the lake for irrigation and water from springs and streams upland for drinking and domestic purposes. So, the water level in the lake reduces and conflicts arise among the users of the lake water.

The activities involving use of land and/ or water in the upstream watershed, which compete and/or complement the water production in the lake are presented in Table 2. Community forestry in the watershed has definitely contributed to water storage in the lake. The forest cover in the community forestry area is expected to reduce the intensity of surface runoff and sediment transport from the watershed, while enhancing the groundwater recharge to maintain dry season recharge of the lake. The use of water in irrigated farming and diversion of water to community drinking water schemes in the settlements, in the upstream watershed and on the valley floor, are expected to significantly reduce the flow of water in the lake in the dry season.

Table 2: Land / Water use in the upstream watershed that compete and/or complement water storage in Begnas Tal

Land / Water use in upstream watershed	Effect on water availability in lake		Remarks
	Wet season	Dry season	
Community forestry	Negative	Positive	Good forest cover reduces wet season flow but enhances recharge to maintain dry season flow
Crop land: i. Irrigated ii. Rain fed	 Negative Negative	 Negative None	 Irrigation would mean water withdrawal, reducing the amount of water reaching the lake
Drinking water	Negative	Negative	Withdrawal of water in community drinking water schemes can reduce the dry season supply to the lake
Livestock	Negative	Negative	Water consumption for livestock raising is not very high

The growing use of agricultural chemicals and pesticides in irrigated farming in the upstream watershed is another significant land-use related activity. It is a major concern because it is likely to have a serious effect on quality of reservoir water and environmental sustainability of the lake. These are the areas which are subjected to year-round crop cultivation with a high intensity of use of chemical fertilisers and pesticides. The growth of population and of commercial activities in the valley have created a demand for vegetables. In the irrigated areas in the upstream watershed, due to the suitability for year-round vegetable cultivation, the farmers have switched from cereal-based farming to vegetable-based farming.

The intensity of the use of chemical fertilisers and pesticides has also significantly increased. The required data is not available to analyse the relation between the use of chemicals in agriculture in the upstream watershed and the quality of lake water; though the fishermen have started noticing instances of fish mortality. There was large scale fish mortality during 1993 and 1994 due to a fish disease called “ulcerative epizootic syndrome,” which especially affected the local fish species. The disease persisted for two months, probably due to water pollution from the increased organic and chemical activities in agriculture upstream.

3.2. Shaping of contestation over water utilisation

The construction of the dam and irrigation infrastructure of the Begnas irrigation scheme was started in 1985, though irrigation was started from the monsoon season of 1988. As discussed earlier, construction of the dam led to the restoration and rejuvenation of the lake that was seriously degraded due to continued siltation, shrunk storage area and water volume, heavy growth of aquatic weeds near the inlet and outlet, and encroachment by the people. After the construction of the lake, the storage area of the lake increased significantly.

The irrigation scheme was meant to provide year-round irrigation on 600 ha to the farmers in the valley, to the south and south-west of the lake. Prior to construction of the dam, the farmers in this area were diverting water from Khudi Khola—the outlet stream drawing water from the overflow and drainage from the lake—into a ‘farmer-managed irrigation system’. At the time of the construction of the dam and the irrigation infrastructure, this traditional use of water was not taken into account. Since the construction of the dam reduced the water supply in Khudi Khola, these prior users of lake water for irrigation raised objections, which were accommodated by providing them the access to irrigation through a new branch canal.

The Begnas irrigation scheme was under the administrative and management control of the District Irrigation Office, which is handed over to the WUA after 2002. The control of WUA over the scheme is as per the participatory irrigation management policy of the Department of Irrigation.

In order to release water for downstream irrigation use, the reservoir level is monitored on a daily basis and the overseer and *dhalpas* (supervisor) responsible for the operation of the intake maintain daily records of the reservoir level. A minimum acceptable reservoir level is always ensured, while deciding the quantum of water to be released from the dam for downstream irrigation. The release of water for irrigation during the monsoon is not a problem because the area receives a high amount of rainfall and the lake is almost full throughout this period. However, the utilizable volume of water for downstream irrigation is seriously constrained during the dry season, which starts from November. Irrigation during the dry season also creates difficulties for the Jalharis (fishermen) and boat operators.

The Jalharis and the boat operators are generally not consulted while deciding the quantum of water to be released for irrigation; however the minimum water level in the lake is always ensured during the release. The Jalharis and boat operators are not possibly consulted for two reasons: the need to maintain the minimum water level in the lake is always respected, and the Jalharis and boat operators are not organised to collectively influence reservoir operation. There is no record of any conflicts over the existing arrangement of operating the reservoir or the release of water for downstream irrigation. However, the Jalharis and boat operators occasionally do make verbal complaints to the irrigation officials and WUA functionaries about the decreasing water level due to irrigation releases.

4. Summary

Begnas Tal exists as a natural resource, creating distinct economic opportunities to a range of lake users: (i) forest users' groups in the upstream watershed (ii) irrigation water users in the valley floor (iii) community drinking water users in the settlements both in the upstream watershed and the valley floor (iv) Jalharis engaged in lake fishery (v) boat operators (vi) tourism entrepreneurs operating hotels and restaurants in the around the lakeshore (vii) local government and (viii) development agencies. The lake continues to exist as a common pool resource, though claims on the lake ownership are fuzzy in the absence of distinct legislations.

This case study looks into the different dimensions of conflicts resulting from resource use by multiple stakeholders in Begnas Lake. Though the lake exists as a common pool resource contributing significantly to economic gains made by multiple stakeholders, there is no clearly defined institutional arrangement for lake governance. This is a situation of "free riding" and, if allowed to continue, it would result into serious degradation of the lake and its resources.

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