CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

As we know, about 67 percent of the populations are engaged in agriculture so our country Nepal is known as an agricultural country. Most of them are self-employed and depending on agriculture as their primary source of employment (CBS, 2003). However, 69 percent of the agricultural holdings are less than one hector. Disparities in landholding and income result in the bottom 20 percent of the population getting just 3.7 percent of the national income while the top ten percent claims 50 percent (CBS, 2003). With inequality intrinsic to social organization, endemic poverty is the result. As a rule, based on topography, the Terai of Nepal are, even today, better off than the hills, and geographically the eastern parts of Nepal are better off than the western parts economically and in human development indices.

Nepal is a landlocked and developing country, which depends on the poor agricultural economy. Nepal's gross domestic product (GDP) for 2008 was estimated at over us $12 billion (adjusted to Nominal GDP), making it the 115th –largest economy in the world. Agriculture accounts for about 40 % of Nepal's GDP, services comprise 41% and industry 22 %. Agriculture employs 76 % of the workforce, services 18 % and manufacturing/craft-based industry 6 %. Agricultural produce mostly grown in the Terai region bordering in India-includes tea, rice, corn, wheat, sugarcane, root crops, milk and water buffalo meat.

Industry mainly involves the processing of agricultural produce, including jute, sugarcane, tobacco and grain (CIA, 2005).

Nepal is very rich in bio-diversity, language and linguistic, tradition and norms and values of societies. There are varieties of Indigenous knowledge system to manage natural resources in Nepal viz-a-viz forestry management, bio-diversity management, soil management and so on and so forth. Among them managing water resource by farmer in indigenous way is great identical knowledge system to manage water resource renown over the world.

Farmers in Nepal have been developing and managing irrigation since long time immortally that appears to have been contemporaneous with agriculture. Although Nepal has a long history of irrigated agriculture, the importance of irrigation has been realized only in the recent years with the advancement in the irrigated agriculture technology. A substantial portion of country's irrigated area is under numerous farmer managed irrigation systems (FMIS), scattered throughout the country. There is large discrepancy in the total area reported under FMIS, probably due to lack of information on number and size of FMIS. A recent statistics indicate 17,700 units of FMIS existing in the country that accounts roughly 75 percent of the total irrigation development (Poudel, 1993).

1.2 STATEMENT OF THE PROBLEM

Farmers in Nepal have been developing and managing irrigation System since long time. One of them the Sorah Chhattis Mauja Community Irrigation System is very famous in the contemporary irrigation systems. Sorah and Chhattis Mauja, indigenous irrigation system locates in the plain of Rupandehi district of Western Terai. Sorah

and Chhattis Mauja community irrigation system has the command areas of about 1,500 and 3,500 hector of land, respectively. These were originally constructed by the Terai autochthonous Tharu people. Initially, Sorah Mauja irrigation system served a total of 16 Maujas and Chhattis Mauja irrigation system served a total 36 Maujas. But the command areas of both the irrigation systems later expanded which has been a function of the population growth triggered by the Hill to Terai migration particularly after 1960 (Uprety, 2008).

Agriculture remains Nepal's major economic activity, only about 20% of the total area is cultivatable; another 33% is forested; most of the rest is mountainous. Rice and wheat are the main crops. The lowland Terai region produces an agricultural surplus, part of which supplies the food deficient hill areas.

Irrigation is major aspect of Agriculture. Agricultural productions became poor if irrigation system is weak. Nepal's agricultural productivity is very low because in Nepal no sufficient irrigation system has been established, mostly depending on the monsoon.

The source of water of SCMCIS is Tinau River. A total of the water the proportionate distribution of the water is 40:60 for Sorah and Chhattis Mauja respectively. Most of the researcher and scholar such as; Upreti Laya Pd., Pradhan Prachand, Zaverteen and Neupane Anita and others have found that it is well managed irrigation system in the Nepal. But the River Tinau, Source of water for this Irrigation system, is losing natural form day by day due to the poor urban settlement, industrial pollution and development activities. Many River-based industries were established within last few years in Tinau River. One side River based industries exporting Stones and Sands from the River

as raw materials and products of them and another side most of the population were throwing their wastages in the river and Irrigation Canal. Therefore Tinau River is becoming deeper than of previous years and Irrigation canal is uplifting every year. Industrial chemicals are mixing in the river without clarification. With these broad perspectives this study will be conducted to find out the Impact of Urbanization on Irrigation System in the context of Sorah Chhattis Mauja Community Irrigation System of Rupandehi District. Considering above issues this study has focused on the following research questions.

General research question is:

1. What is the condition of the Irrigation System?

Specific research questions:

1. How the urbanization affecting the irrigation system?
2. Are they achieving any help from the industries and municipality for the irrigation system?
3. What is the pattern of garbage mixing in the canal?
4. What are the steps taken by any concerned agencies for the conservation of Tinau River?

1.3 OBJECTIVES OF THE RESEARCH

The main objective of this research is to find out the present condition of SCMCIS and to determine the industrial and urbanization impact up on SCMCIS. Moreover, the specific objectives of this study are:

I. To examine the influence of urbanization on SCMCIS.
II. To access the pattern of garbage mixing in the irrigation canal.

III. To find out those institutional effort on conservation of the Tinau River.

1.4 RATIONALE OF THE STUDY

The study would be helpful to the policy maker agencies of Agriculture and irrigation, Industrial, environmental and development sector to the analysis of empirical findings from the fields. Therefore this study would contribute academically for others interested in Farmer Managed Irrigation System issues especially related to the Rupandehi District of Western Nepal. The study can also help to provide benchmark information to the future researchers. In addition, this study would provide useful information, suggestions and recommendation to various I/NGOs, CBOs, Government and other institutions working in this field.

1.5 ORGANIZATION OF THE STUDY

This thesis has been organized on the basis of Tribhuvan University's Format. Firstly the Cover of this thesis have been used, after that the recommendation letter, approval letter, acknowledgment, abbreviation/ acronyms, glossary, abstract, list of table and contents is concluded on the initial Part.

In the main part of this thesis has been started with Chapter One. In this chapter background of the study, statement of the study, objective of the research, rationale of the study and organization of the study has been included. This chapter is the introduction part of this thesis.

The Second Chapter begins with review of the previous literature. In this chapter literatures related with irrigation management have been described and discussed.

The Chapter Three begins with research methodology. This chapter focuses on the methodology of this research including selection of the study area, research design, nature and sources of data, universe and sampling, data collection technique, method of data analysis and limitations of the study.

The Chapter Four begins with presentation and analysis of data. This chapter related to the presentation and analysis of data. In this chapter background of the study area, study areas land holding pattern, irrigation facility, alternative means of irrigation, impact on agriculture and other data have been presented respectively.

The Chapter Five started with summary of major findings, conclusions, and recommendation. This chapter focuses on the major findings, conclusions and recommendation of the study. In this Chapter researcher presents study's summary and recommendation to the stakeholders of this system.

References, questionnaire and related photos of this study have been included in the final part of this thesis.

CHAPTER TWO

REVIEW OF THE PREVIOUS LITERATURE

Historically, while centralized states have invested in irrigation development, there has usually been parallel activity by individual cultivators or groups of farmers, sponsored perhaps by local rulers or landowners, who have also constructed irrigation systems. Some of these systems date back to hundreds of years and have well-established institutions for managing operation and maintenance. Though these systems are generally small in size, their vast number collectively makes them a significant factor in agricultural production in many countries.

In irrigation, two types of technology can be discerned: Farmer Managed Irrigation Systems (FMIS) technology and Agency Managed Irrigation Systems (AMIS) technology. Each of them has its own principles of water allocation and water distribution. In the following section, two technologies will be discussed with special reference to those structures in the system dividing the water to farmers or groups of farmers. These water division structures play the crucial role of regulating and dividing the flows of water to the various parts of the system. FMIS TECHNOLOGY, FMIS are the results of communal efforts to exploit water resources. Fixed shares allocate the water. The shares are determined by consensus and are often proportional to the areas to be irrigated. Adjustments can be made, however, in terms of: Seepage

losses larger shares for farmers who contributed more, either in labor or in money, to the construction · Larger shares for influential or powerful persons basically; the water can be divided in two ways:

***Proportional division*:** Each user or group of users receives a fixed continuous flow. In most cases weirs in line are placed perpendicular to the canal flow. Each weir has the same crest elevation, while the widths are based on the predetermined ratios of flows (shares). Consequently a consensus should be reached in terms of the widths of the weir openings. Although corrections can be made, this system has little flexibility. This method is widely 3 Professor Emeritus, Wageningen Agriculture University, The Netherlands. 7 used in the world: not only in Nepal, but also in Yemen, Tunisia, Spain, Indonesia, India, etc. ***Rotation*:** Each user or group of users receives a fixed flow over a certain period of time. In this case consensus should be reached on the time periods. Rotation is often only used in times of water shortages. In both cases the technology is transparent: everybody can understand the Principle and can clearly observe whether the water is divided according to the agreed shares. The technology renders social control possible.

AMIS TECHNOLOGY, Where fixed water shares are the cores of FMIS technology, the AMIS technology is based on water requirements derived from calculations and assumptions in the fields of soils, water, plant and climate. These water requirements are not uniform but differ in time and place. For this reason the flows in the system should be regulated and measured. Consequently the system should be equipped with movable gates. Because of the possibility to regulate the water, these systems are very flexible (contrary to the FMIS technology). Due to this flexibility varying water demands by (groups of) farmers can be

accommodated. In theory therefore, AMIS technology might be considered superior to the FMIS technology. In practice however the following problems emerge: In smallholder schemes, there are numerous small plots with different soils (percolation losses) and different crops (evapotranspiration). To accurately determine the water requirements means collection of huge amounts of data. Many irrigation agencies do not have enough staff for such an undertaking. As a result, water distribution is not according to water requirements. Moveable water division structures are often complicated and difficult to handle. Trained staff is not always available. Again, if these structures are not operated according to hydraulic standards, there will be unequal water distribution. Moreover these structures are often not transparent. The hydraulic principles are beyond farmer's comprehension. In many cases these three problems result in unequal water distribution, farmers interfering with the operation, or even worse: farmers breaking the gates. In short, very few AMIS are performing as designed. Prior to the sociological knowledge in the field of irrigation, irrigation was simply seen as a technical enterprise and understood primarily in terms of engineering models. Irrigation was simply understood to be a technological input to increase agricultural production. After the entry of sociological knowledge, irrigation has begun to be viewed more as a social process, which involves institutions and organizations, and fussed together through the concept of roles (Coward, 1986).

Irrigation technologies in farmer managed irrigation systems (FMISs) do not entirely follow the standard engineering and agronomic design. Besides these considerations, they are also strongly influenced by a number of other factors, which are often social and cannot be planned.

The differences in design principles of irrigation technology between farmer and agency managed irrigation systems (AMISs) in Nepal. As the current approach to irrigation development and management considers farmers as the major actors in both turn-over of agency managed irrigation systems and rehabilitation of farmer managed irrigation systems, this paper argues that design principles like operational objectives, management functions and irrigation duty should be given new thoughts in designing irrigation technology in both farmer and agency managed irrigation systems. It further suggests that recognition of these design principles can guide policies for greater use of water resources and to improve local livelihoods in Nepal. Being a social enterprise, irrigation has specific characteristics and also carries certain implication of different members of the society. As a social enterprise, its major social processes consist of water acquisition, water allocation, system maintenance, and resource mobilization and conflict management (Ostrom, 1992) mentions that irrigation systems are backbones of Nepalese agriculture within the context of national development. Community irrigation systems are very important because they make use of the many small rivers, and streams that could not be tapped by national systems. Irrigation is viewed as a sociological process, which involves institutions and organizations, which are fussed together through the concepts of roles. In Nepal, because over 67% of the population is directly or indirectly depends on agriculture. As irrigation is one of the main factor of agricultural development and management has become an important issue in the country's development. It has been acknowledged by the government and international development agencies that, to look deeper into the irrigation management activities (Pradhan and Pradhan, 1996).

Some of the world's oldest irrigation system are built and operated by farmers themselves exist in Nepal and have made a substantial contribution in the irrigation development of Nepal.

FMIS are dependent for their operation and maintenance on the contribution of resources from many people. These organizations allocate and distribute water to many farmers in the fields though the organization may not be formal all the time (Martin, 1987).

Pradhan (1996), discuss some important mechanisms of conflict presentation in situation of water scarcity in systems in which both farmer themselves and government make improvements on the irrigation systems. Farmers in general, are aware of the existing rules and regulations, but that does not prevent some from violating them or exclusively interpreting them to their own advantages. The authors provide a history of water management and control of distribution and allocations and the presence of a special officer as *Pani Thekedar* physical infrastructures themselves are a way to actualize and protect right, because they determine the reach of command area, and are more management and rights to water from gender perspective. Thus, irrigation system activities can be divided into three categories: organizational management activities, physical system activities and water use activities. Furthermore, irrigation management includes management of water acquisition, water allocation, system maintenance, resource mobilization and conflict management. Now these days most of the researchers are including such issues in their research of irrigation management.

Some systems divert water from natural, unregulated streams. In South India and Sri Lanka, numerous systems, perhaps as many as several

hundred thousand, distribute water from tanks replenished by water harvested from a catchment rather than from a river diversion. Karez irrigation systems (called *qanat* in Iran and *foggara* in North Africa) are found in many countries around the world, with a major concentration in Iran, Afghanistan and Pakistan. These systems tap the water bearing alluvial fans at the base of mountains and lead it through gently sloping tunnels to the surface, sometimes many miles out in the plains (Rahman, 1981).

Lift irrigation from wells and surface sources is expanding rapidly, often with little or no direct assistance from central government agencies. Martin and Yoder (1986) used the term "fanner-managed" for systems where cultivators controlled the irrigation enterprise including control of access to water from a natural source. In fanner-managed systems, the authority for allocating the irrigation resource rests with the community of irrigators. Some systems have many, but not all, of the characteristics of farmer-managed systems. Irrigation district seen the western United States, for example, include all land that could potentially be irrigated in their tax base, in some cases even land occupied by municipalities. This gives non-irrigating property owners the right to participate in the management of the irrigation districts. Lansing (1987) determined that the priests in the temple system play an important role in managing irrigation in *subaks* (local-level fanners' organizations for irrigation) of several watersheds in Bali, Indonesia. The local government is technically in control of small irrigation systems in Java.

Though many local officials are fanners, some operate other businesses. The term "locally managed irrigation system" is used in this paper to encompass all fanner-managed and other systems where the charter of

authority is with the local community. In a locally managed system, the leaders come from the local area, do much of their business there, and intend to stay there. The leadership is committed, in one way or another, to the local scene and the outcome of the irrigation enterprise. Organization in these systems comes about in the broadest sense to coordinate the flow of resources necessary to accomplish irrigation delivery in a way that could not be done individually. Coordination is necessary because of the complexity and interrelatedness of the many tasksthat must be performed (Uprety, 2008).

Most of the Historical literature contains numerous references to irrigation systems managed by local communities. The British Colonial Government, for example, operated a research institution called the "Board of Economic Inquiry, Punjab" and its studies surveying agricultural conditions in Northern India have described the operation of canals by local communities (Board of Economic Inquiry 1933). Dutch civil servants have recorded irrigation practices in Bali and Java and British civil servants have written about tanks used for irrigation in South India. Anthropological field studies and irrigation ethnographies give details of highly organized irrigation communities in numerous countries. Since the 1970s there have been an increasing number of field studies focusing on management activities of systems that are operated by the irrigators themselves. These range from case studies spanning several agricultural years to rapid appraisals completed in a few days (Yoder, 1994).

Locally managed systems have several attractive features. The most obvious is that in many countries they have drawn on few public resources for their creation and, to a large extent, are self-supporting in their continued operation. In agency-managed systems tight operation

and maintenance budgets together with poorpayment of irrigation fees by irrigators have given policymakers in many countries reason to press consideration of options other than agency management of irrigation. Another attractive feature of locally managed systems is their decentralized self-management. In some circumstances, this has gained them recognition as a viable alternative to agency management. Though there is some question as to whether new locally managed systems can be created, policymakers generally agree that the existing systems should continue to operate independently. At a time when weak management is cited as a possible reason for less than optimum performance of agency-managed systems, the participatory management style of locally managed systems is sometimes held up as a model.

The various FMIS scattered throughout the Nepal, Sorah Chhattis Mauja Community Irrigation System (SCMCIS) is one of the renowned irrigation system among them. This is located at Rupandehi District in Western Tarai. The system was initiated by the Tharus, the original inhabitants of Tarai some 150 years back. Residents of the area report that the system was built during the1846-63, period of Rana Prime Minister Janga Bahadur Rana, under the leadership of a prominent Tharu landlord from the area. During 1950s successful malaria eradication program in the Tarai encouraged rapid migration into Sorah Chhattis Mauja command area. Most settlers moved into the area were from the hills. They acquired land by clearing forest by 1958. The Tharus who developed and managed the system for more than 100 years were completely dominated by the hill migrants (Pradhan, 1998).

The Sorah Chhattis Mauja Community irrigation scheme diverts water from the Tinau River that locates in Butwal in the Terai region of

Nepal. The length of main canal is 15 km, and has 44 branches. Irrigation water is supplies to about 2,500 households living in the 3,500 hectors command area. The scheme was originally constructed by local landowners in the 1880s. From the late 1940s through the 1970s, migrants from the hilly region cause deforestation of the dense jungle and settled in the upper command area. Diversion of water into the canal is accomplished by two temporary stone and brush structures (Kannya Dhunga and Ittabhond) on the alluvial fan at Butwal town. Because the fan is continuously reshaped by floods, the temporary wing walls must frequently be modified and maintained. A farm household in the command area contributes the necessary labor and resources for maintaining the scheme, in return for which they obtain the right to use irrigation water. Monsoon rice is the most important irrigated crop; during the monsoon season the whole command area covers with rice. Wheat is the most important winter crop, but lentil and mustard are also grown in winter (Zwarteveen and Neupane, 1995).

Tinau River**:** the elevations of the headwaters of the Tianu River's tributaries vary from 1000 m amsl to 1700 m amsl. The total catchment area of Tinau basin within Nepal is about 1100 km2 of which 550 km2 is located in the hills and the rest in Tarai. *Present Water Use Status*: The Tinau river water is extensively used along its entire reach as well as along its tributaries. Uses include irrigation, hydropower and domestic consumption "Workshop note on Rohani, Danda and Tinau River basin area water partnership" (Friends Service Council Nepal, 2003).

The condition of the Tinau is become worse day by day due to the recent Urbanization and industrial activities. Tinau River is located at the mid part of the major industrial city Butwal and Bhairahawa. City's' poor urban settlements and impact of industrial activities' were making

Tinau River less irrigation system friendly. Many River-based industries were established within last few years in Tinau River. River based industries exporting Stones and Sands from the River as raw materials and products of them. Therefore Tinau River is going to deeper than every year. Industries chemicals are mixing in the river without clarification. So far, here we are going to explore information about Impact of Urbanization on Sorah Chhattis Mauja Community Irrigation Systems various aspects. Which provides us benchmark information regarding Sorah Chhattis Mauja Community Irrigation System and Impact of Urbanization on it, but most of the literatures are unable to touch the specific case of Rupandehi District.

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter describes the method, which have been adopted for the presentation of the study. This includes rationale for selecting the study area, research design, sampling procedure, method of data collection and analysis and limitation of the study.

3.1 SELECTION OF THE STUDY AREA

Initially there were 52 Mauja in this irrigation system of Rupandehi District but now it represents 92 Mauja by increasing the command area. Among them, Sorah Mauja represents 33 Mauja and Chhattis Mauja represents 59 Mauja. In a unite form Sorah Chhattis Mauja Irrigation System, which can represents all the command area of this Irrigation System.

3.2 RESEARCH DESIGN

In this research descriptive designs have been adopted to describe the Impact of industrial activities' and urbanization on SCMCIS of Rupandehi District. To develop better understanding of industrial activities' and urbanization impact on SCMCIS and to explore an action plan for enhancing their Irrigation System and by collecting primary data with field survey, focus group discussion and interview.

In addition, secondary data have been used to make comparisons and draw conclusions. The research is both qualitative and quantitative in nature.

3.3 NATURE AND SOURCES OF DATA

Qualitative and quantitative information collected to present in the thesis. Primary data have been collected from the field by group interview, personal interview and key informants interview with the stakeholder of such System. Similarly, focus group conducted with the Executive Committee of SCMCIS, Meth Muktiyar, Muktiyar and Farmers of the sample area. In addition, the secondary data have been collected by Review - previous studies, published book, journals, case studies, news, articles, document and other related materials under the secondary sources and use both formal and informal methods for the collections of both quantitative and qualitative data.

3.4 UNIVERSE AND SAMPLING

Sorah Chhattis Mauja Community Irrigation System (SCMCIS) is a biggest irrigation system of the Rupandehi district. According to Upreti (2008) it is four tier-based irrigation System, but it is five tier-based irrigation system they are: Sorah Mauja, Chattis Mauja, Joint Sorah Chhattis Mauja, regional level and village level organization system. The head office of the joint system is located at Butwal and Sorha Mauja's office is at Anandban-7 and the office of Chhattis Mauja is located at Shankarnagar VDC (Premnagar). Now, It has serving 33 and 59 mauja respectively with about 10000 household's people

providing water in more than 5000 hectare of command area for irrigation purpose.

The system will be purposively sampled because SCMIS is the biggest irrigation system managed by farmer of Rupandehi, geographically located in the Terai region and the features of this system very much represents to other FMIS. So the finding of this system would represent or mostly represent and would be applicable to most of the Terai irrigation systems. The Total Irrigation System constitutes 92 Mauja of 7 VDCs and 1 municipality of Rupandehi District as the sample universe of the study. I have taken 5 Maujas among these 92 Maujas as sample unit by their water sharing proportion as 40:60. It based on judgment sampling system used to select 2 Maujas by selecting Head and tail of Sorah Mauja and 3 Maujas of Chhattis Maujas as a sample unit by selecting of Head, mid and tail. 10 Farmer of each Mauja have been sampled using judgment sampling methods.

3.5 DATA COLLECTION TECHNIQUE

Several data collection methods and tools were used for study such as participant observation, focus group discussion and key informant interview with some working institution. Secondary sources and existing records also used for clarification of collected and supplemented data. Secondary sources including government policy and acts related to irrigation System as, various journals, research articles of various institutions regarding irrigation System have been used.

3.5.1 Key Informants Interview

Interview have been conducted with those organization and individuals involved to the Farmer Managed Irrigation Systems welfare and development. Key informants of the study were staff of the Sorah Chhattis Mauja Community Irrigation Systems, Consumers, Local leaders, President of the Executive Committee, personnel of government agencies, who was directly or indirectly involved in the Sorah Chhattis Mauja Community Irrigation System.

3.5.2 Participant Observation

Participant observations have conducted at the time of *Kulahi.* Direct observation is conducted to the participant of canal repair and maintenance system. In order to observation canal, Joint Canal, Intake, Water Flow, Urbanization wastages, water sharing proportion etc.

3.5.3 Focus Group Discussion

Focus group discussions are done with The Meth Muktiyar of Both of the Sorah and Chhittis Mauja Community Irrigation System, Muktiyar of sample Maujas, Executive committee member of such Irrigation systems, other related stakeholder.

3.6 METHOD OF DATA ANALYSIS

Field notes and field diary used for recording and organizing field data. The purpose of the field notes is to flesh out and to conceptualize what researcher observed during the field. Field notes have been maintained in chronological order. On the regular basis field notes have been written in detail expanded form, which guide me for further what information collected and what has been already collected. The collected data entered in to the computer and I used to Excel to generalize it. Personal feelings, opinion and observation have been

documented in the field diaries. Presentation of the data done in tables after analysis and examine its appropriateness in the particular situation of the presentation.

3.7 LIMITATION OF THE STUDY

The study had undertaken within a fixed timeframe. Similarly, the study based on the field works of sample area of Sorah Chhattis Mauja Community Irrigation System. Findings of the field may not be generalized for other systems. Primarily, this study has been focused on existing urbanization impact on Sorah Chhattis Mauja Community Irrigation System. Thus it will not cover other aspect of Sorah Chhattis Mauja Community Irrigation System.

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF DATA

This chapter includes analysis of primary as well as secondary data focusing on Impact of urbanization on Irrigation system in Rupandehi District. The chapter begins with discussion about Rupandehi district and then goes on describing about impact on the irrigation system.

4.1 BACKGROUND OF THE STUDY AREA

4.1.1 Rupandehi District:-

Rupandehi district, which has been selected for this study, is one district of Lumbini zone. Its total area is 1360^2km and the elevation of the district is 100-300m above mean sea level. The latitude of the elevation of the district is $27^0$20'-$27^0$45'. The climate is tropical. Nawalparasi District and Uttar Pradesh (India) have been bordered in East, Kapilbastu District in west, Palpa District in the north and Uttar Pradesh in the south from the District. Baghela, Danab, Koilajham, Kanchan, Kothi, Mahab, Rohini and Tinau (Tilottama) are the rivers of the district. Siddharthanagar (Bhairahawa) is the Headquarter of the district. There are seven constituencies in Rupandehi. Administratively

the district divided into 69 VDC and 2 municipalities has total population of 7, 08,419 and sex ratio(M/F) is 1.04 among which under 14 population is 39.5% and Elderly population(60+) is 6.4%.

Urban population of district is 18.6% and Annual Growth rate (1991-2001) is 2.97%. The density of population of this district is 521 persons per square Km and average household size is 6.01where as Number of household 117856. The literacy rate is 65.95% for both in which male is 75.84% and Female is 55.71%. Primary level Education is 73.9%, Lower secondary level education is 28.1% and secondary level education is 16.4%. Population with access to safe drinking water is 89.49% and population influenced per Km is 1956. Total road in the District is 267 Km. Human development index is 0.361. Population per Hospital bed 4920 and population per Doctor are 18643. Household with access to toilet facilities is 59.14%.

Various ethnicity such as Brahmins (hill) 15.19, Tharu 10.57, Muslim 8.87, Magar 8.79, Yadav 7.69, Chhetri 5.81, Chamaar/Harijan 3.91, Lodh 2.89, Gurung 2.79 Kurmi 2.25, Newar 2.23, Bishwakarma 2.11% etc. are inhabitants of the district, among them Tharus are indigenous settlers, so Tharu speakers have dominance over other language speakers.

The district is located within the monsoon belt. Winter is quite dry and warm while summer is very hot and humid. Like other Terai of Nepal, the Bhairahawa-Butwal area has three distinct seasons, a warm wet season from mid-June through September, a cool dry season from October through February and a pre-monsoon hot season from March to mid-June.

The average annual temperature in the area is about 24^0C, Temperature are high between March and October when the mean monthly range is

between 22 and 30^{0}C. November to February is winter months with mean monthly temperature between 14 and 22^{0}C. The average rainfall is about 1700 mm per year. The average numbers of rainy days are 82, the peak season being June-September when 85% of the rainfall accrues.

4.1.2 Butwal

Butwal is located in the Rupandehi district, Lumbini Zone, western development region of Nepal and at the crossing point of two major highway viz. East-West and Siddhartha highway. It is one of the oldest municipalities of Nepal established in 2016 B.S. in the beginning it had only 12 wards. It was expanded in 2053 B.S. to cover more areas lying in the west up to Tamnagar. Now it is divided into 15 wards. The largest among them is ward no. 15 and smallest ward no. 3. Butwal is bounded by Dobhan VDC of Palpa District in the north, Shankarnagar and Motipur VDC in the south, Devdaha VDC in the East and Semlar and Paroha VDC in the west. The nearest city is Siddarthnagar Municipality located some 22km in the south. Locates in the foothill of Chure range and on the bank of Tinau River, Butwal is comparatively moderate from climatological aspect. It is slightly hot in summer and moderately cool in winter. The highest temperature so far recorded is 44^{0}C and Lowest 11.5^{0}C. Butwal is a historical place well known for a battle with British troops. In this battle British troops were defeated by comparatively a smaller group of committed Nepalese soldiers commanded by Col. Ujer Singh Thapa in 1829 AD. The remains of Jitgadhi (Jit- win and Gadhi- fortress in Nepali) fortress are still there and are well preserved to demonstrate the braveness of Gurkha solders. Jitgadhi fortress now is

the landmark of Butwal. The Total population of Butwal is slightly more than hundred thousand and about 24% of them are poor residing in 21 squatters' settlements and 17 slums including clusters of individual households. Butwal has developed its own vision since 1996 as "Literate, Skilled, Healthy Clean, Green and Beautiful City of Butwal". Also Butwal is first municipality to have its own strategy for poverty reduction. Butwal is also looking forward to make the city as a city of zero illegal settlement by 2014 A.D. (www.butwalmun.org.np).

Fossils of ancient hominoids Ramapithecus were found near the Tinau (Tilottama) River as early as 1932, including a 10.1 million year old tooth. Historically Butwal connected Nepali people with their Indian Neighbors. As the British East India Company annexed Awadh from hereditary rulers while Shah Dynasty attempted to annex the Terai, Butwal became one of bones of contention leading to the Gorkha war 1814-16.

When King Tribhuvan fled to India in 1950 during the revolt against the Rana Dynasty he travelled through Butwal. Then it was little more than a village on the western bank of Tilottama River also known as Tinau River with completion in 1968 of Siddhartha highway from the border at Sunauli through Butwal to Pokhara and then in the 1990s Mahendra Highway across the full east-west expense of Nepal's Terai, butwal has developed rapidly. The economy of Butwal centers on education, trade and transportation. Butwal has always been a major trading center for pahari (hill people) from district to the north, as it evident form the establishment of Batauli Bazar at the edge of the hills in old Butwal. Butwal also has small and medium scale manufacturers of woodwork, iron sheet, metalwere and aluminum sheet. There are many rice, floor and oil mills. Butwal is also famous for gharelu udyog.

4.1.3 The Tinau River:

Tinau River, also known as River Tilottama, is a lifeline of the Rupandehi District. The River Tinau is originated from the River Madi and Kachal in Baldhengadhi, locates in Palpa District. Both of them Madi and Kachal joint Dobhan in Palpa district. Finally this river enters in Uttar Pradesh state of India. This river normally has high flood during monsoon period and low flow during dry season. The water source of this river is used for irrigation in increased population of Terai area after the eradication of Malaria. Rupandehi became famous by the Tinau River and Birth place of Lord Gautama Buddha. In some historical holy books says that Gautama Buddha himself involved sharing water for the people. Tinau River is the source of drinking water, irrigation source and water source for other purpose.

4.1.4 The Sorah Chhattis Mauja Community Irrigation System (SCMCIS):

The Sorah Chhattis Mauja Community Irrigation System is one of the largest Farmer Managed Irrigation System (FMIS) of Nepal. The elderly local farmers reported that in the beginning Chhattis Mauja Community Irrigation system was built by the local Tharus under the leadership of Chhedi Tharu of Kumari Village during the regime of Jung Bahadur Rana (1946-63). This *Kumari Kulo* served Kumari village at its initial stage. The Mallas were settled in Kumari village when Colonel Tej Bahadur Malla received tax free land grant from the Rana Prime Minister Chandra Shamsher Ja Ba Ra. Chandra Shamsher also granted approximately 1200 hectare of Birta to Ram Mani Acharya Dixit in the Manigram area, about 8.0 km south of Butwal, within the present irrigation systems. The man is brought many contract labors from the

hills of Nepal and from along the Indian boarders to deforest the Manigram area for settlement between 1935-45. They opened an outlet from the main canal in 1947. The irrigation system command area expanded quite fast in the head end selection after Malariya eradication and migration of hill people after 1956.

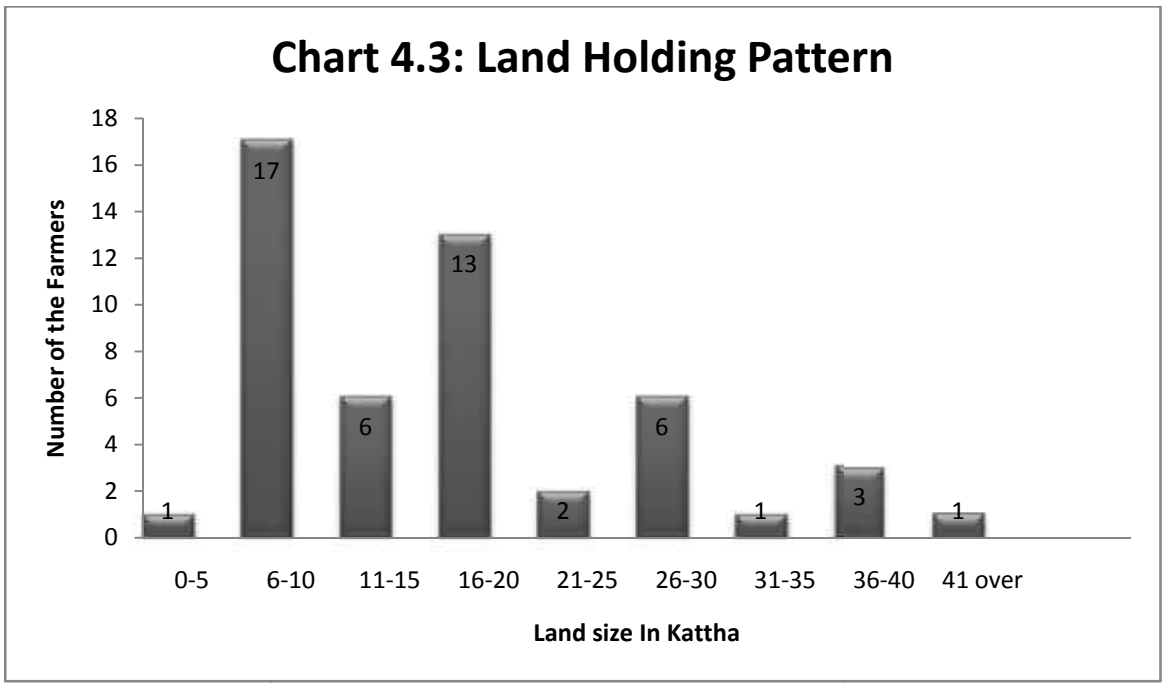
In 1965 the Sorah Mauja Irrigation system joined with the Chhattis Mauja System in diverting water from the same intake at the Tinau River after a dam was constructed with Indian aid near the Chhattis Mauja System's main intake. From there they divert water on the basis of command area and participation i.e. 40:60. Therefore both the Sorah Mauja and Chhattis Mauja cooperated to operate and maintain the main canal from the Tinau river intake to division weir for the two systems at Tara Prasad Bhond or IttaBhod but now it is Kanya Dhunga (upper side of the Tinau Bridge). The section of the main canal is under the control of the joint committee. They share the water from the Kalikanagar (nearby New-Horizan School).

The source of water for the system is the perennial Tinau River whose flow fluctuates greatly from the monsoon to dry season. At the head of the town of Butwal, The river changes from narrow to wide banks and enter the lowland plain, deposition large boulders and heavy silt making water acquisition for irrigation extremely difficult. The SCMCIS is a run-off-river gravity flow using a temporary brush diversion along the upstream portion (563m) is changed and reconstructed each year according to fluctuations in the flow. In the winter when the flow in the Tinau is low, the brush diversion is extended up-stream as far as the farmers think necessary to capture sufficient water. The length of the brush diversion is reduced and shifted downstream in the rainy season due to the high flow of water.

The total command area of the present system is estimated to 3500 hector (Source air-photo maps of 1964 and 1978 ground checking), which includes 54 villages. There is a joint operation system for water acquisition as well as for water sharing with the Sorah Mauja System which presently covers 33 villages. The drainage water from the both system is used by some farmers in proportions of Bhairahawa-Lumbini Underground Water Project (BLUWP) so the south boundary of the Sorah Mauja overlaps with BLUWP command area. To the North, the command area extends almost to Butwal City near foothills and in the south it extends to Gangauliya VDC. In the west the command area separates from Tinau River and in the east by Rohini Khola.

In the beginning the system was built by cleaning the dense forest by participation of 36 villages. Previously the system was serving 36 vilages, so it known as the Chhattis Mauja (meaning "36 villages"in Nepalese language) Irrigation system. Similarly, Sorah mauja was serving 16 villages. Presently this system serves 59 Mauja and 33 Mauja respectively. Where 16 Mauja constituted with the some parts of Butwal Minicipality, Shankarnagar, Anandban, Tikuligadh, Chilhiya and Padsari VDCs and Chhattis Mauja constituted with some parts of Butwal Muncipality, Shankarnagar, Anandban, Karahiya and Makrahar VDCs.

4.2 Land Holding Pattern



Source: Field Survey, 2011.

Land is major property of people in the rural areas. Land holding size of a particular person shows his/her economic wellbeing.In the study area most of the farmer have 6-10 Kattha of Land, 34 percent of the people have to rely on 6-10 Kattha of land. Where, the mean household population is 5. So they have to subsistence up on almost 10 Kattha of land it means the productivity of this study area is very high, that's why they are living with having small plot of land. Then 26 percent of population has 16-20 Kattha of land. Among them 2 percent of population have only 1-5 Kattha of land which is very less to survive for a whole year. Similarly, only 2 percent of farmers have more than 41 Kattha of land.

Table 4.2: Land holding pattern

S.N.	Holding land in Kattha*	Number of farmer	Percent
1	1-5	1	2%
2	6-10	17	34%
3	11-15	6	12%
4	16-20	13	26%
5	21-25	2	4%
6	26-30	6	12%
7	31-35	1	2%
8	36-40	3	6%

9	Over 41	1	2%
	Total	50	100

* Kattha = 0.033 hector

Source: Field Survey, 2011.

4.3 Irrigation Facility

During the study it was found that Sorah Chhattis Mauja Irrigation System is major source of Irrigation in this area. Somehow, all of them are depending on this system for the irrigation. But there is lack of irrigation facility in most of the part, have not an access of sufficient water so the farmer of that area are still using alternative means of irrigation and some of them are have to rely on rain.

Table 4.3: Irrigation Facility

S.N.	**Facility**	**Number of the farmer**	**Percent**
1	Sufficient	10	20%
2	Substantial	40	80%
Total		50	100 %

Source: Field Survey 2011.

From the field survey, it was found that only 20 percent of farmers have sufficient volume of water during a whole year and 80 percent of farmer have substantial portion of water. Though within the 80 percent of

farmer have access of sufficient water during monsoon and have a very poor access of water during winter.

4.4 Alternative Means of Irrigation

Table 4.4 Alternative means of irrigation

S.N.	Alternative facility	Number of farmer	Percent
1	**Underground water**	**27**	**67.5**
2	**Monsoon**	**13**	**32.5**
Total		40	100

Source: Field Survey 2011.

During survey total 50 household of farmer among them only 10 farmers are getting sufficient volume of water for the irrigation On the other hand 40 respondent not getting sufficient volume of water for the irrigation purpose. Hence, they are compelling to use alternative source of irrigation. Among of 40, 27 are using the Underground water as their alternative source of irrigation; similarly 13 of them are bound to depend on monsoon rain.

4.5 Impact on Agriculture

Table 4.5: Flow of Water

S.N.	Water Flow	Number of farmer	Percent
1	Increasing	9	18%
2	Decreasing	41	82%
Total		50	100 %

Source: Field Survey 2011.

From the field survey 18 percent of farmers said that the flow of water is increasing on the canal since last decade and 82 percent of farmer said that the flow of water on irrigation canal is decreasing.

4.6 Quality of Water

Table 4.5: Quality of Water

S.N.	Quality of water	No of farmer	Percent
1	Good	13	26%
2	Worse	37	74%
Total		50	100 %

Source: Field Survey 2011.

From the prospective of agricultural purpose during the field survey 36 percent of farmer said that the water of this system is good and more of them 64 percent of farmer expressed that water of this system is worse.

4.7 Impact on Production

Table 4.7 Impact on Production

S.N.	Impact on production	Farmer	Percent
1	Decreasing	37	74 %
2	General	13	26 %
Total		50	100 %

Source: Field Study, 2011

My data shows that 74 percent of respondent said that due to the absence of quality of irrigation water the production is decreasing. Likewise 26 percent of respondent said due to the quality of water no negative impact occurs on agricultural production.

4.8 Multiple Water Using Pattern

Table 4.6: Multiple water using pattern

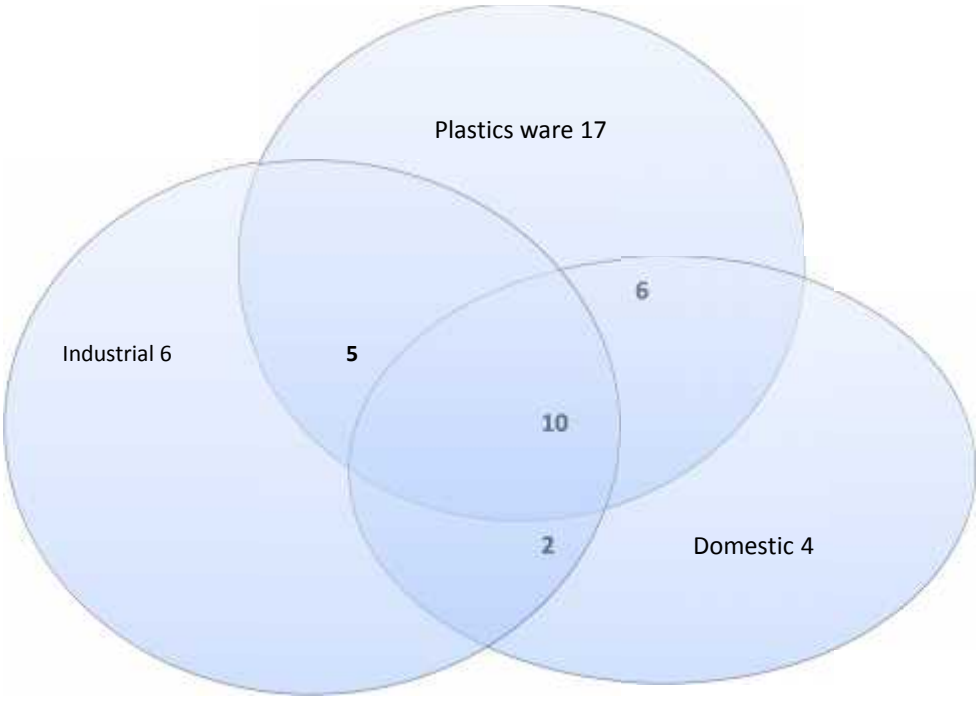
S.N.	Water using pattern	No of farmer	Percent
1	Feeding animal	11	22 %
2	Washing clothes	NA	
3	Bathing	NA	
4	Etc.	2	4 %
5	Can't use	37	74 %
Total		50	100 %

Source: Field Survey, 2011.

From the prospective of multiple uses of water of SCMCIS is using to Feeding the animal is 22 percent, similarly only 4 percent of people using on other uses likewise for industrial purpose and in addition, 74 percent of farmer said that they unable to use water of this Systems' canal.

4.9 Wastage mixing pattern

Venn diagram 1: Wastage mixing pattern



Source: Field Survey 2011.

From the field survey most of the people there, 17 farmers said that plasticware garbage is mixing in the canal of irrigation system and which is the major problem of the agriculture similarly, among them including plasticware garbage, 5 of them said that plasticware and industrial wastage is mixing in the canal. Likewise 10 of them said that plasticware, industrial and domestic garbage is the most influential garbage for their system. 6 of them said plasticware and domestic garbage is mixing, 2 of them said domestic and industrial both mixing in the canal and likewise 6 of them said industrial garbage and 4 of them said domestic garbage is mixing in the systems canal. Which shows that plasticware garbage is mostly thrown in the systems canal.

CHAPTER FIVE

SUMMARY OF MAJOR FINDINGS, CONCLUSIONS AND RECOMMENDATION

5.1 MAJOR FINDINGS OF THE STUDY

5.1.1 Land Holdings

In the study area most of the farmer have 6-10 Kattha of Land, 36 percentages of the people have to rely on 6-10 Kattha of land, where the mean household population is 5. So they have to subsistence up on almost 10 Kattha of land it means the productivity of this study area is very high, that's why they are living with having small plot of land. Than 26 percentages of population have 16-20 Kattha of land. Among them 2 percent of population have only 1-5 Kattha of land which is very

less to survive for a whole year. Similarly, only 2 percent of farmers have more than 41 Kattha of land.

5.1.2 Irrigation Facility

During the study it is found that Sorah Chhattis Mauja Community Irrigation System is major source of Irrigation facility for this area. Somehow, all of them are depending on this system for the irrigation. But most part of land is not having an access of sufficient water in whole year. So the farmers of the study area are forced to use the alternative means of irrigation such as underground water and have to rely on rain.

From the field survey, it is concluded that only 20 percentages of farmers have sufficient volume of water during a whole year. Most of them are from the head areas of the system. On the other hand 80 percent of farmers have using substantial portion of water. Though within the 80 percent of farmer have access of sufficient water during monsoon and have a very poor access of water during winter. Study access that most of them farmers are from the middle and tail parts of the irrigation system. System is less effective tail and mid side then head side. Due to weak structure of canal water is pouring beside the canal. So Middle and tail parts farmers are bound to manage alternative means of Irrigation.

5.1.3 Flow of Water

Field survey assess that the flow of water is decreasing on the Systems' canal since last decade. During the study it is found that the main cause of decreasing flow of water is increasing the command area. The command area is increasing continuously so the water is sharing all of the expanded Maujas. Canal capacity is limited but Maujas are

increasing so volume of the water per farmer is decreasing. On the other hand canal is blocked by garbage in many places so water runs out of canal. Among them little number of farmer said that flow of water is increasing by some years because of canal is maintained and restructured by the irrigation system. They are mostly from the head side of the system. So study access that flow of the water is decreasing.

5.1.4 Quality of Water

From the study it is found that the quality of water of this irrigation system is poor. Before 10 years farmer used to bathing, feeding animals, washing clothes by this water. They can use this systems water in multiple purposes. But nowadays they can't use in multiple purpose due to quality of water of this Systems. Industries mixing their wastages in the system canal, head sectors people washing their clothes on the canal, Hotel, restaurant, Motel, pub are used to dumping their wastages in the Tinau river and irrigation canal due to all of this activities quality of this Systems' water is very polluted. Within the flow of water all of garbage used to go to farmers land.

5.1.5 Wastage Mixing Pattern

From the field survey most of the farmer said that plastic ware is major garbage which is used to mix in the canal of irrigation system and Industrial wastage and domestic garbage is also used to mix in the systems' irrigation canal. Plastic ware garbage likewise Bottle of the mineral water, Packets of noodles, fast foods, snacks, Cold drinks, juice, wines, sandals, shoes, etc. were used to dump in the canal. Similarly, industrial wastages likewise pieces of glasses, wires, wood, chemicals etc. were used to dump in the canal and in addition domestic wastages

likewise dead animals, wastage food, drainage, used furniture, etc. were used to dump in the canal.

5.1.6 Impact of Urbanization on SCMCIS

Due to the poor urban waste management the Sorah Chhattis Mauja Community Irrigation System became polluted. Because of household garbage, industrial wastage, glasses, plasticwares, un necessary wastage that blocks Culvert, Hume pipe which is used in designed and constructed canal. During the field survey it is found that the Culverts and Hume pipes were blocked by the wastages. Everywhere, in the irrigation canal used to dump wastage. Drainages were mixing in the river and irrigation canal. Still Municipality is unable to make dumping site in Butwal city to manage the all cities' wastages. All of the cities' wastages is through up in the Tianu river so not only river but also irrigation system is becoming worse day by day.

5.1.7 Impact of Industrialization on SCMCIS

Butwal is one of the major industrial areas of the country. In the industrial area of Butwal many industries are establishing around here since long time. Similarly, outside of the Butwal Industrial area also running many woodwork, metalwere, Crusher industries, soap, Chemical industries, Rice, Floor and Oil mills. Especially, Crusher Industries were established within last few years in Tinau River. Those industries used to export Stones and Sands from the River as raw materials and products of them. Therefore Tinau River is being deeper than previous years. It affects the natural water flow of river. Industries chemicals are mixing in the river without clarification. So water flow of this SCMCIS is being polluted by the industries activities.

5.1.8 Impact on Agricultural Production

Furthermore we have discussed about the impact of Industrialization and urbanization on the SCMCIS. For instance the flow of water is blocked by the wastage so the water flows over the canal. Due to this blockage the access on the water of the farmer is decreasing. Farmer can't access on the sufficient volume of water. During the irrigation, water used to carry harmful wastage within it. Plastic ware, glasses, metals are very harmful for the agricultural purposes. These unrotten wastages reduce productivity of the land. Similarly, polluted water with full of chemical, these reduce the fertility power of land. It affects in production which may cause starvation.

5.2 CONCLUSION

Irrigation is the main factor for Agriculture. Irrigation is the independent variable for the Agriculture. So irrigation determines the productivity of the crops. Where there is facility of irrigation the production increases and where there is lack of irrigation the production decreases respectively. Since long time Sorah Chhattis Mauja Community Irrigation System has been serving to the farmer of the Rupandehi district. It is conducted by the self-management of local farmer themselves.

This study attempts to explain the impact of urbanization on Sorah Chhattis Mauja Community Irrigation System of Rupandehi district. Especially this study focuses on the irrigation practice, Cities'

garbage management, garbage disposal practices, major wastage problem and steps taken by the stakeholders to the conservation of their economic lifeline the Tinau River and the Irrigation system. For this study, 50 samples household from the 5 Mauja equally from each Maujas have been taken by simple random sampling technique. To analysis this study, the primary source of data information is taken, which has collected by researcher himself with the help of structured questionnaire. Similarly different techniques such as field visit, household survey, interview, observation and focus group discussion processes are used to collect primary data, for data analysis descriptive as well as quantitative statistical method have been used. Initially, the system had provided sufficient irrigation facility for the farmers but nowadays this facility has been deducting because of poor management of urbanization and process of industrialization. The wastages from urban areas mix into the canal and block it, which arouse the problem of outer flow of water. Likewise water of the canal flows with unusual wastages and mix up in the field, which effect the fertility power of land and it gives the negative impact to the farmers.

The main findings of the study are as follow:

- The Sorah Chhattis Mauja Community irrigation system is running since more than 100 years under the management of local farmers.
- The Sorah Chhattis Mauja Community irrigation systems total command area is expanding in the seven VDCs' and one municipality of Rupandehi district.
- The field survey shows that 33 Maujas is the total command area of Sorah Mauja Irrigation System. Similarly, 59 Maujas is the total command area of the Chhattis Mauja Irrigation system.

- The water allocation proportion is fixed on the 40:60 to Sorah and Chhattis Mauja Community Irrigation system.
- The field survey shows that Among 50 household, only 2 percent of population are holding more than 41 Kattha of land, about a percent of people are holding 1-5 Kattha, 34 percent people are holding 6-10 Kattha of land, Similarly, 26 percent of people are holding 16-20 Kattha of land and 6 percent of people are holding 36-40 Kattha of land.
- Among them 20 percent of water users have got sufficient water for the irrigation. On the other hand 80 percent of water users don't get sufficient water for the irrigation.
- The survey shows that 80 percent of farmer said that the flow of the water on the system is decreasing.
- Among 40 household 67.5 percent of respondent express that they are using underground means of irrigation. Similarly, 32.5 percent of respondent express they are depending on monsoon.
- 26 percent of farmer said that the quality of water of this system is good and more of them 74 percent of farmer express that water of this system is worse.
- Among 50 household, 22 percent of the farmer used this water to feed animal, similarly only 4 percent of people using on other uses likewise for industrial purpose and in addition, 74 percent of farmer said that they were unable to use in other purposes.

5.3 RECOMMENDATION

This research on Sorah Chhattis Mauja Community Irrigation System of Rupandehi district had found major irrigation problem interrelated to the urbanization and process of industrialization. On the basis of the above findings, conclusion and the field survey experiences,

the following recommendations have been presented for the future improvement of the existing situation.

1. Waste management is the most important factor for the keeping quality of irrigation water. Therefore, awareness program should be managed by the Irrigation system.
2. Butwal municipality has to build the dumping site for the proper management of wastages.
3. Among most of them are involved in agriculture they are well known in the agricultural field so the government should provide the special knowledge of using fertilizer, seeding and manage waste to made compost manure production for the improvement of agriculture production.
4. Special packages of the program should be made by the government as well as the private organizations and agencies for the conservation of Tinau River and its natural water flow.
5. Lack of proper management of industrial outcomes is the one of the major problem for the irrigation system. Therefore, provision of safe waste disposal and clarification process should be managed by the both government and industrial sector.
6. The Irrigation infrastructure is very weak so that Government agencies and related stakeholders should start maintain and restructure program of the system infrastructure.
7. The government should develop strong policies for conservation of river and irrigation systems.

Finally, the findings, conclusions and recommendations, derived above are expected to be a useful feedback to the concerned.

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Questionnaire

Name of the Respondents: Date:

Address:

Village: Occupation:

Age: Sex:

Education: Ethnicity:

Interview Start Time: Total Family Member:

S.N.	Questions	Answer	Remarks
1.	Are you a farmer?	Yes No	
2.	What is the area of your land? Specify		
3.	Are you using water of this SCMCIS?	Yes No	
4.	Does this system provide you sufficient water?	Yes No	
5.	If Not, how much it provides? Specify		
6.	How do you manage water for rest of the land?	Underground Rain Etc.	

7.	How this systems' canal Connected to your field.	Rcc Non Rcc	
8.	Since how long you are applying this system?	75 over 25-75 10-25 1-10	
9.	How was the systems' Canal in beginning?	RCC Non RCC	
10.	How was the water flow at that time?	High Low	
11.	How? Specify		
12.	How is the water of this system for Agriculture?	Good Worse	
13.	What are the causes of water pollution?	Industrial wastages Plasticwares Domestic wastages Other	
14.	How is the impact of water in agriculture production?	increasing Decreasing General	
15.	Is there any provision implemented for the Canal conservation from the wastages?	Yes No	

16.	Do the process of industrialization effect in agriculture?	Yes No	
17.	What are the effects of process of industrialization?	Wastage Disposal Chemical mixing Leakage of drain Effects in river	
18.	Is the water of this systems' canal is useful for alternatives purposes?	Yes No	
19.	What is the purpose?	Bathing Washing Clothes Feeding Animal Other	
20.	What is the impact of urbanization? Specify		

Origin of the system located in Butwal

Water distribution Site of the System, Ittabhod

Farmer participating in Kulahi

Staffs of the Chhittis Mauja Community Irrigation System

Conducting the meeting in the office of Sorah Mauja Community Irrigation System

Researcher with respondent in the study area