WATER AND THE BRITISH RAJ IN UNITED PROVINCES: A CASE STUDY OF SARDA CANAL

THESIS

SUBMITTED TO

BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY

(A CENTRAL UNIVERSITY)

LUCKNOW

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Archana Pandey

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Prof. S. Victor Babu

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CERTIFICATE

This is to certify that the thesis entitled **"WATER AND THE BRITISH RAJ IN UNITED PROVINCES: A CASE STUDY OF SARDA CANAL"** submitted by **Ms. Archana Pandey (Enrolment No. 218/11)** is an original work and has not been previously submitted in part or full for any other degree or diploma in this or any other University. The thesis submitted to Babasaheb Bhimrao Ambedkar University is in fulfilment of the requirements for the Award of the Degree of ***Doctor of Philosophy in History.***

Prof. S. Victor Babu
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DECLARATION

I hereby declare that this thesis entitled **"WATER AND THE BRITISH RAJ IN UNITED PROVINCES: A CASE STUDY OF SARDA CANAL"** submitted by me for the degree of Doctor of Philosophy in History, is a record of bonafide research work carried out by me during the period August, 2011 to June 2015, under the guidance and supervision of **Prof. S. Victor Babu**, Head, Department of History, Babasaheb Bhimrao Ambedkar University, and that the thesis has not formed the basis for the award of any degree or diploma. I also declare that it is has not been submitted previously in part or in full to this University or any other University or Institution for the award of any degree or diploma. It is my independent work.

(ARCHANA PANDEY)

Place: Lucknow

Date:

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(ARCHANA PANDEY)

PREFACE

British colonial rule has initiated a significant shift in management of natural resources in general and water in particular . The entire colonial process in India is linked with generation of resources and revenue to the British. This being the objective, wide range of policy and institutional arrangements had been used to maximize utility from water. The irrigation works in British India started with renovation and improvement of existing works. Benefits from irrigation works soon realized and good revenue were earned on invested capital. In 1823 first irrigation office was opened at Saharanpur for the remodelling of the old Mughal canal which was put into commission under name of eastern Yamuna canal in 1830.Subsequently construction of Ganga canal was taken up in 1840 and it was ready in 1854.These works were followed by commissioning of the Agra canal in year 1874 and the lower Ganga canal in1878 .Capitals shift to India in the 1850s came in the wake of financial failures in the United States and growing competition for the city on continental Europe .

Canals were more likely to pay their way in lands that were already productive rather than in famine prone dry areas. A combination of famine and disease meant that India's population growth rate slowed considerably in the decades in which the British were engaged in India's improvement. Not only did canals fail to prevent famine, they even made things worse for those social groups most susceptible to food scarcity.

In the environmental History of India forests are given more priority and history of water need to be explored thoroughly. British large irrigation canals were one of the important cause of salinization, silting, leaching, malaria and famines etc that were triggered by general environmental collapse. It raised the average living standards and encouraged limited industrialization, especially sugar refining. If canals help in over

cropping then question arises why economy of United Province faced decline? What was the impact of irrigation development on environmental distortions?

OBJECTIVES OF THE STUDY

The Colonial State followed different policies which were intended to enhance the revenues of the state. Irrigation system is one such policy which meant to bring revenue to the state and provide irrigation facilities to the peasants. Although the primary objective of the British in introducing irrigation was revenue generation, yet the peasants of British India also got benefitted from it. However, it had adverse impact on the environment. Present work is a study of Canal Irrigation system of Sarda Canal of Oudh region. In this work, an attempt is made to explain how the British tapped this natural resource for their profit and consequent environmental impact it had. The work is done with the following objectives:

1. To study the Hydraulic past of India and different irrigation techniques;
2. To give a detail geography of Oudh region;
3. To discuss economy before and after the advent of British in Oudh region;
4. To explain the motive behind the starting of the Great irrigation works in India during British period;
5. To give detailed description of Sarda Canal constructed by British from Historical Perspective;
6. To explain the peasants reluctance in taking up the new methods of Irrigation;
7. To Focus on the change and continuity of the irrigation system from pre-colonial to colonial to post-colonial India in the context of canal irrigation with respect to their availability and maintenance;
8. To study the impact of the change of irrigation system on the environment of Oudh region;

The aim of the study is to evaluate the environmental history particularly in context of water resources, both in its material and perceptual sense. An attempt has been made to analyse the subject not just from an ecological standpoint but also from popular perceptions and experience based on socio-economic conditions of Oudh region.

RESEARCH METHODOLOGY

Methodology used in this study is Historical, Qualitative and Interdisciplinary. The study is based both on Primary and Secondary sources which include archival and governmental records. Besides, data were also obtained by using questionnaire technique as one of the research tool. Review of literature is done in order to contextualize the study and identify the importance of water resources at the local, national and international levels. For Primary Sources matter was collected from the Archives (State and National), Teen Murti Library. The records from the Irrigation Department, Revenue Department, Agriculture Department, General Administrative Department, Public Works Department, and Financial Department, Forest Department and Appointment Department were consulted. Material from District Gazetteers and Settlement Reports and Native Newspapers are also consulted. Structured and Non- Structured interviews were taken from the Farmers of the districts of Rae Bareli, Jaunpur, Sitapur, Faizabad etc. Interview was also taken from the Engineers presently working on Sarda Canal in Lucknow Division.

The collection of secondary data consisted of the reviews of relevant literature, books, journals and magazines, newspapers, research papers and survey conducted by various organizations, published and unpublished articles and government records and through internet. Archival sources are juxtaposed with o oral histories on water resources. Since the study was conducted to explore, examine and analyse the management of water resources

against the backdrop of the colonial intervention, the approach throughout the study was analytical and evaluative.

PLAN OF THE WORK

Chapter 1 gives the detail description of the Hydraulic past of India. The hydraulic system of India during the pre and post-colonial period was very different. India is a vast country, its economy revolve around the agriculture, therefore irrigation system become very important. This chapter mainly focuses on the irrigation system and particularly the Canal Irrigation in India. It is a comparative study of India during different phases.

Chapter 2 entitled "Geography and Economy of Oudh" mainly deals with the topography of United Provinces. It explains the different nomenclature of Oudh region. It further gives detailed description of the economy prior and after the advent of British in India.

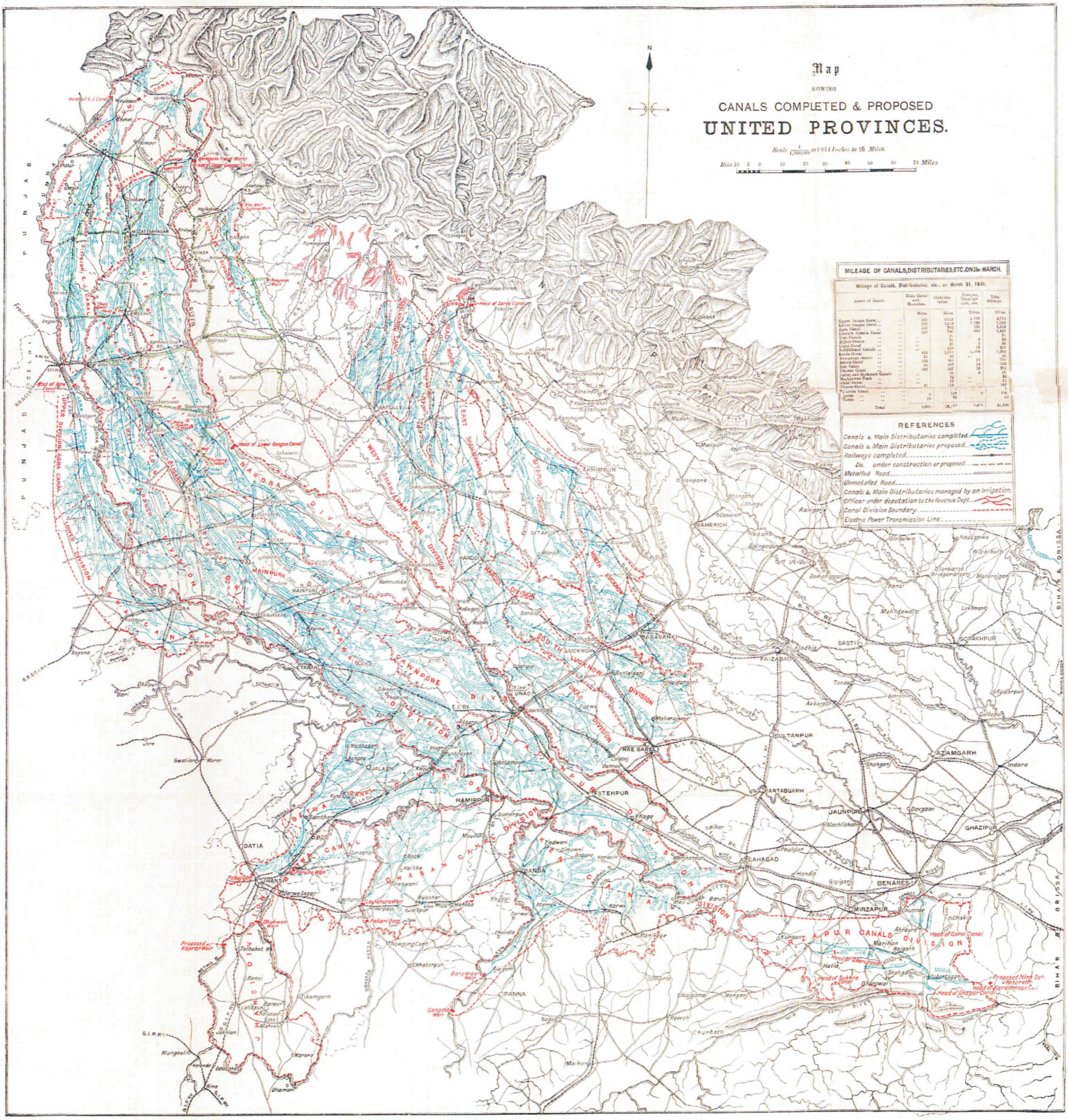
Chapter 3 entitled "Dynamics of Indigenous Irrigation Technique" deals with the irrigation system that was prevalent in India during Ancient, Medieval and Modern times in different region of the country. It is an attempt to explain that the irrigation system adapted to a particular place was according to the geography of the place like tank irrigation which suited South Indian topography. Similarly it explains about wells, canals, dams and Persian wheels system which were highly prevalent in late ancient and early medieval times. A particular technique faces several challenges in different periods of time.

Chapter 4 "Sarda Canal: Historical Perspective" explains Sarda Canal from Historical point of view. It gives detailed information of Sarda Canal origin and its course from primary as well as secondary sources. It further explains the British and Native peoples apprehensions regarding the construction of this canal. It further explains only from Historical point of view

about the failures in achieving the primary objectives of this canal construction. This canal do have some achievements to its credit, this is also explained in this chapter.

Chapter 5 entitled “Impact of Sarda Canal which is an attempt to deal with contemporary issues because this canal still exists. It definitely has its impact in present scenario. It explains basically the environmental impacts of this canal in Oudh region. It focuses the impact of the canal on the cropping pattern, ecology, indigenous irrigation techniques. Further it discusses the environmental issues related to canal irrigation as waterlogging, salinization, seepage etc.

The study ends with Conclusion which sums up the discussion in the above chapters which dealt with environmental impact of the canal irrigation and the economy of the region.


Map
showing
CANALS COMPLETED & PROPOSED
UNITED PROVINCES.
Scale 1.014 Inches to 16 Miles.
Miles
70 Miles
MILEAGE OF CANALS, DISTRIBUTARIES, ETC. ON 31st MARCH.
Mileage of Canals, Distributaries, etc., on March 31, 1931.
REFERENCES
Canals & Main Distributaries completed
Canals & Main Distributaries proposed
Railways completed
Do. under construction or proposed
Metalled Road
Unmetalled Road
Canals & Main Distributaries managed by an Irrigation Officer under deputation to the Revenue Dept.
Canal Division Boundary
Electric Power Transmission Line
PUNJAB
UPPER DIVISION AGRA CANAL
LOWER DIVISION AGRA CANAL
NANRORA DIVISION
MAINPURI DIVISION
CAWNPORE DIVISION
SOUTH LUCKNOW DIVISION
WEST SHAHJAHANPUR DIVISION
EAST SHAHJAHANPUR DIVISION
HARDOI DIVISION
NORTH LUCKNOW DIVISION
KEN CANAL DIVISION
DHASAN CANAL DIVISION
MIRZAPUR CANALS DIVISION
Head of Upper Ganges Canal
Head of Lower Ganges Canal
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BAHRAICH
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LUCKNOW
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HAMIRPUR
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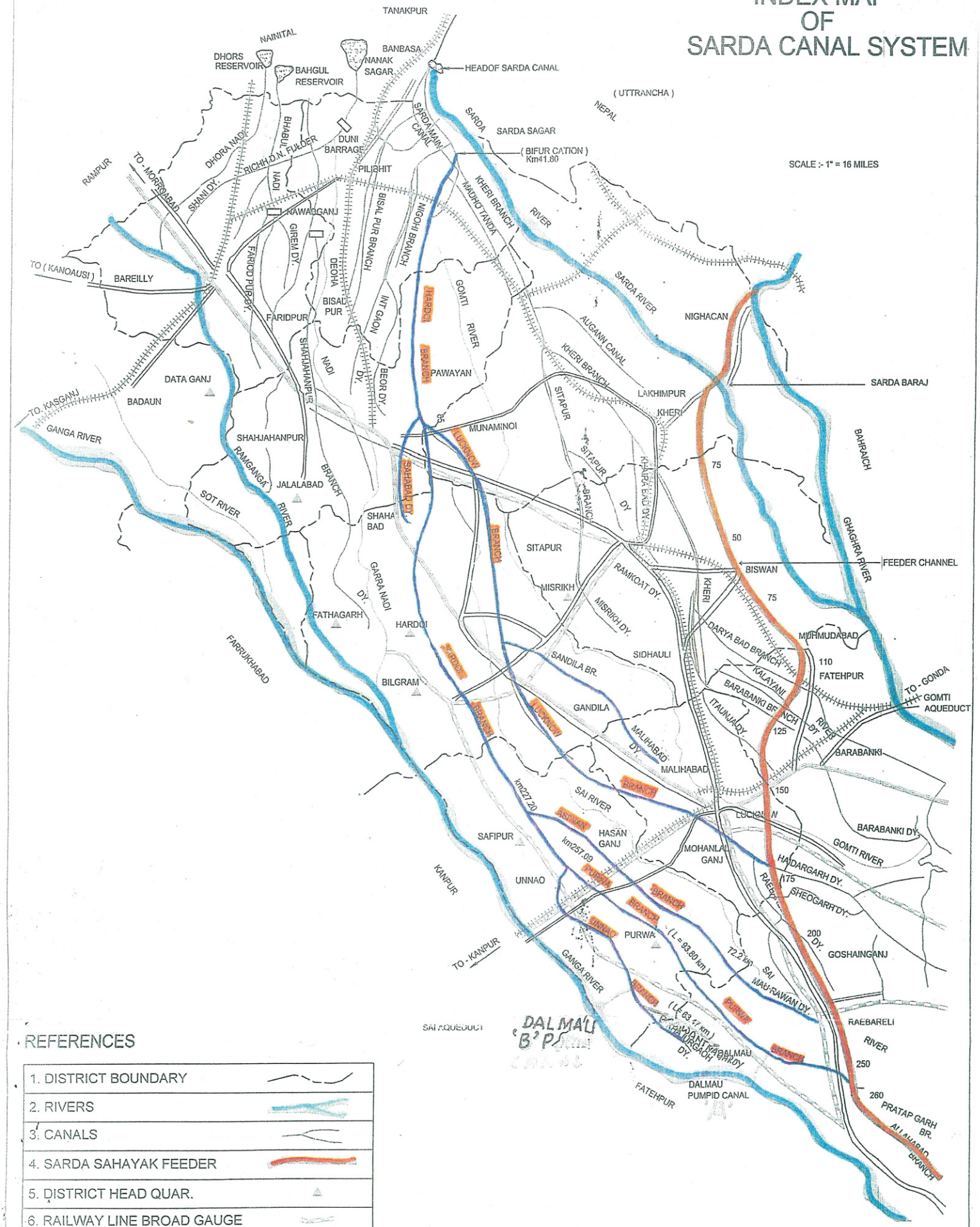
BIHAR & ORISSA

INDEX MAP OF SARDA CANAL SYSTEM



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1. DISTRICT BOUNDARY	
2. RIVERS	
3. CANALS	
4. SARDA SAHAYAK FEEDER	
5. DISTRICT HEAD QUAR.	
6. RAILWAY LINE BROAD GAUGE	
7. RAILWAY LINE MTR. GAUGE	
8. ROADS	

Chapter -1

Introduction

All that is wanted is water and this want supplied, everything else will almost follow of course…

Sir Arthur Cotton

Water is highly sacred since ancient times as it is one of the richest natural resource on earth. In early civilizations, water played a relatively simple role. It was needed for transportation and drinking and it provided fishing and hunting source. Overtime, sedentary agricultural societies evolved and water use became more important as it played a dominant role in terms of irrigation. Families began settling near springs, lakes and rivers to supply livestock and crops with water, gradually developing technologies to divert water for irrigation and domestic purposes. In the process of developing economy in present scenario earth is facing several environmental threats. An attempt is made to study one such threat posed, by the developing economy, to environment, the agricultural field and its production in Oudh region. Deterioration of environment was prevalent in the society since the time of its existence of human but it was in a controlled manner, later on with the growth in economy and several stages of human life this deterioration had a global impact. Therefore an attempt is also made to study the environmental history which focuses on the impact of the man's activities on environment.

The emerging significance of environmental history to human affairs cannot be overlooked. In its initial stages the study of environmental history appeared to be a plan to stir public consciousness to environmental crisis identified by the scientist, engaged in

diverse branches of environmental science and ecology . However it is increasingly being acknowledged now that the recent environmental crisis calls for a new and independent role of the historians to develop a new paradigm for the future including studies of the interactions and activities of man and the environment ; the significant role of man as both the maker and the unmaker of the nature.[1] This study is therefore, a modest attempt to address a relatively new area of research namely Sarda Canal in United Provinces during the British Raj.

Environmental History continues to evolve and share and undefined perimeter with other social histories and various other disciplines such as economic Histories', History of Science and Technology, Disease History etc. Whatever the approach, the complexity and unpredictability of nature and human societies are inescapable themes in environmental history. Environmental history is thus of growing interest and value to many other disciplines, to policy makers, restoration ecologists and a variety of cultures and societies around the world.[2] The formation of the American Society for environmental history in 1977 marked the birth of environmental history as a formal discipline. Since the 1970s an explosion of scholarship on United States environmental history has taken place. In Europe the Annals School (a group of French historians who published in the journal Annals) examined environmental changes in Europe, such as forest clearing and wetland drainage in response to population's fluctuations. [3] It has been noted currently that the academic centre of gravity has shifted firmly away from North America and Europe to South and South East and Africa. [4]

Despite the interest in the promising growth of environmental history in the region; pioneers of the ecological history of India such as David Arnold and Ramchandra Guha, have

[1] D. Arnold. & R. Guha (eds.). *Nature , Culture and imperialism : Essays on the Environmental History of South Asia*, p.3
[2] S. Krech, J.R. McNeill, c. Merchant, *Encyclopaedia of World Environmental History, Vol –I A-E, p XI.*
[3] Ibid
[4] R.H. Grove, *Ecology, climate and Empire, the Indian legacy in Global Environmental History, 1400-1940,* p. 4.

however remarked that in South Asia as well as in India, environmental history is by and large underdeveloped.[5] It has only been in last few past decades that we have seen a proliferation of writings by scholars in almost all aspects of environmental History. Interest in the subject has increased double fold due to scarcity of resources, affecting both social and political syndromes within the state and also across national frontiers. Alarming developments all over the world have compelled serious scholars to voice their concerns and examine some critical features of this problem.

In this scenario as a subject water history has gained significant attention of environmental historians in recent years although conflicts over and use of water have existed historically, and continue to exist across local, institutional and international boundaries. It occupies a vital place in the scientific debate relating to conservation and the management of nature with concern to human societies across the world and the complex patterns of their interactions with the environment. In India the subject itself has had much impetus from the writings of individuals some of them who have had started off their careers as environmental activists. This interest has prompted a large body of research work to be written primarily on the relationship between water and humankind; illuminating the multifarious processes shaping water resource use and reveal interrelated aspects or historical contingencies and precedents.

Since centuries the economic prosperity of India has been linked with water resources particularly of river waters therein. Vagaries of rainfall have time memorial underscored the need for irrigated agriculture. In the early centuries, demand for water was mostly for drinking purposes. As the empires grew, flourished and perished mostly along the river banks, inundation canals were the first of their kind to develop irrigated agriculture. Irrigation

[5] D. Arnold & R. Guha, (eds.) op.cit, p. 3-4

works thus received a major fillip during the early British regime. It received greater attention after independence as a measure to meet the food deficit and strengthen the rural economy.[6] British colonial rule has initiated a significant shift in management of natural resources in general and water in particular . The entire colonial process in India linked with generation of resources and revenue to the British. This being the objective, wide range of policy and institutional arrangements had been used to maximize utility from water. The irrigation works in British India started with renovation and improvement of existing works. Benefits from irrigation works soon realized and good revenue were earned on invested capital. In 1823 first irrigation office was opened at Saharanpur for the remodelling of the old Mughal canal which was put into commission under name of eastern Yamuna canal in 1830. Subsequently construction of Ganga canal was taken up in 1840 and it was ready in 1854. These works were followed by commissioning of the Agra canal in year 1874 and the lower Ganga canal in 1878 . Capitals shift to India in the 1850s came in the wake of financial failures in the United States and growing competition for the city on continental Europe. It is noted that conservation and forest regulations of the colonial government started with the establishment of an all India forest department in 1865. Furthermore the earliest British statutory water law in India was introduced roughly around 130 years ago.[7] This initiation led to measures covering all aspects of the environment including forest, land and water resources. A major objective of this study therefore is to critically examine the degree of transition and complexity of changes involved in the irrigation techniques of Oudh region.

[6] Patel, V.B. & B.B.Karajagi. 1992. *Water Resources Administration in India*. Seminar on Irrigation Water Management (WMF). New Delhi p 12-19

[7] Singh, Chattrapati. (1992). *Water law in India*, Annexure I of Siddiquis, '*History of water laws in India'* places the earliest water law enactment at 1864. 9 73-92

Hydraulic Past of India

In societies of food gatherers, humans protected their environment because that was their resource base. Trees, groves and water bodies were seen as sacred. As society evolved specific trees and ponds were seen less as supernatural and the focus shifted to the earth, fire, wind, water and sky. Varuna was the God of waters and Indra was the God of thunder and rain. This often accompanied agricultural development that led to deforestation and changes in land use and forests. Agricultural was the principal source of employment and fields often required irrigation. Between 500 BCE and 300 CE, the large food surpluses implied no real shortage of water and supported trade development along water channels. At this time, Jainism and Buddhism were born as counter religious forces to conservation of natural resources. With the spread of agricultural settlements along the banks of rivers and on fertile lands, labour was needed to undertake specific tasks. Food gatherers were incorporated into the settled system of agriculture through conquest or otherwise as the lowest castes. By 400 CE, there was a decline in Buddhism and Jainism and this was accompanied by a decline in agricultural production – possibly because of water shortages, decline in soil fertility, and / or the growth of human population. During the reign of the Guptas and thereafter until about the 1000 CE, the lack of resources led once more to worshipping individual animals and trees and a focus on conservation. This was a period of low trade and urbanization. From around the ninth century, the development of new tank technologies and improved dams and canals in South India paved the way for the development of large scale peasant agriculture that displaced pastoralism. The laws of Manu within this tradition provide indications of the water law of the time. Water was considered indivisible. Those who could were obligated to develop water works for the benefit of others. King should collect public waters and collect fees for crossing waters. Diversion or obstructions of waters was discouraged and the laws imposed a system a social reprimands and punishments for those who polluted the water or

who stole or diverted. Destruction of embankments was illegal. The law encouraged the use of water bodies as boundaries between villages to ensure that as many villages as possible had access to water. Water bodies of enemies, however could be destroyed in times of war.

Arthasastra discusses the use of water for the development of water works irrigation and transport specifying that all water belonged to the king and those users were to pay a water tax to draw water from irrigation systems installed by the king. There were limited provisions for private ownership also.

From tenth century onwards, Islamic rulers governed Northern India. Subsequently, the Mughals came to power in the sixteenth century and stayed in power until European colonialists took power. Islamic law principles include that water is a gift of God, that no ruler or individual can own water and that everyone should have access to water. The influence of Muslim rule in India on water regulation has not been conclusively ascertained. Islamic rulers refrained from significant intervention in existing arrangements, generally applying Islamic law to the Islamic population while allowing non - believers to follow their own systems.

From the sixteenth century onwards, European colonialism began in India. Colonialization brought three major influences - a transformation from resource gathering and food production economy to commodity oriented economy; a change in long standing social relations and customs as local social relations became less important and social cohesion declined; and the development of the market and the importance given to wealth. Commercial production became more important than subsistence, exploitation more important than conservation and the individual more important than community. While Colonialization in India was less aggressive than in Africa, the British deforested large tracts in order to access coal and timber and to promote agriculture. The state gradually took

ownership of forests and community irrigation and usufructuary schemes were dismantled. Water-logging and salinity problems increased and small scale irrigation schemes broke down leading to impoverishment of the small farmers.

The British introduced the concept of government control over surface waters. In the early stages, legal and administrative changes were motivated by the need for colonial expansion and to amass wealth the East India Company focussed on advancing trade and traffic, and law developed through practice and the judicial process. Until 1857 the British did not interfere with local rulers and customs unless it interferes with their policies. The presidency areas were completely subject to British rule, mofussil areas experienced a plural system of law, and further away local systems of law existed. A few laws were enacted such as the Bengal regulation VI of 1819 to regulate ferries and the charter act of 1833 was an initial attempt to codify the laws in India. Following the 1857 revolution, the British began to consolidate power focusing both on famine relief and the need to maintain the resource base of trade. The British began to invest in and regulate canals and irrigation facilities.

British colonial water law had two main strands. First, control over water and rights to water were regulated through the progressive introduction of common law principles, emphasizing the rights of landowners to access water. For surface waters, riparian rights allow a landowner the right to take a reasonable portion of the flow of a water course. For groundwater landowners had virtually unlimited right to access water under their holdings. Common law principles enshrined in the Indian easements act (1882) evolved over time but have substantially survived until the present day. Second a series of regulatory statutes were enacted including laws to protect and maintain embankments, to acquire land for embankments and to entrust the controller for implementing such laws. Other laws regulated canals for navigation purposes and levying taxes on the users, river conservation and rules on

ferries and fisheries. Regulations recognizing local practices and rules in villages were also enacted.

One of the most important enactments was the Northern India canal drainage act (1873), which regulated irrigation, navigation and drainage. While this act did not directly assert the state's ownership over surface waters, it recognized the right of the Government to 'use and control for public purposes the water of all rivers and streams flowing in natural channels, and of all lakes'. This led to the progressive strengthening of state control over surface water and the concomitant weakening of peoples customary rights. This tendency was progressively strengthened. The Madhya Pradesh Irrigation Act (1931) provided that all rights in the water of any river, natural stream or natural drainage channel, natural lake or other natural collection of water shall vest in the government.

Colonial legislation also introduced the division of responsibilities between the centre and the region /states with regard to water. The government of India act (1935) empowered the provinces to take decisions on water supply, irrigation canals, drainages and embankments, water shortages and hydropower. Conflicts between provinces and /or princely states were subjected to the jurisdiction of the governor general who could appoint a commission to investigate the sufficiently important conflict.

Water law in the post-colonial period is shaped by the legacy of colonial times, constitutional and federal developments. Specific rules on surface and ground water irrigation, human rights, social and environmental issues, issue about dams and questions of water cooperation with neighbouring countries.

Since independence in 1947, most states have regulated territorial water bodies, embankments, drinking water supply, irrigation, floods, water conservation, water pollution, rehabilitation of the displaced, fisheries, and ferries. While significant novel aspects were

introduced, the evolution from colonial water law was slow. Many colonial acts have not yet been comprehensively reworked. Since the early 1970s signs of more fundamental changes have emerged, possibly attributable to the fast decreasing per capita availability of water, increasing pollution of existing water supplies, the fast increasing use of water for irrigation and increasing competition among water users for a large share of finite supplies. Another colonial trend that has continued in the increasing displacement of customary and local rulers and practices by formal state or central laws. While formal law and policy making does not directly relate to customary practices new water rules and policies have the direct or indirect effect of displacing or replacing existing local institutional arrangements and rules. [8]

This research work is a modest attempt to address the issue. The study highlights the indigenous irrigation techniques of the Oudh region and then the degree of shift in these irrigation techniques from pre-colonial to colonial to post-colonial period after the construction of Sarda Canal in Oudh region. The case study is restricted to Oudh region of United Provinces comprising of twelve districts. Canals were more likely to pay their way in lands that were already productive rather than in famine prone dry areas. A combination of famine and disease meant that India's population growth rate slowed considerably in the decades in which the British were engaged in India's improvement. Not only did canals fail to prevent famine, they even made things worse for those social groups most susceptible to food scarcity. It has its impact on the current scenario. Currently speaking India accounts for one-sixth of the world's population already faces water stress that is likely to exacerbate in future. Of the 20 major river basins in India, 14 are already water-stressed. Nearly three-fourth of India's population lives in water-stressed regions (where per capita availability is less than 2,000 cubic metres per year) of which one-third of the region is in water, scarce

[8] Philippe cullet and Joyeeta Gupta. *Evolution of water law and policy in India*. International environmental law Research centre, p 8-16

areas (where per capita water availability is less than 1,000 cubic metres per year). In short, inefficiency in water use and irresponsibility in the management of water resources pose a serious threat to our water security and sustainability. The system of surface water resource in India comprises of 20 major river basins. Seven rivers and their tributaries feed these river basins. Of these 20 river basins, 13 are large comprising an aggregate catchment area of 2.6 million square km. These 13 major river basins together are spread over about 81 per cent of the geographical area of the country. There are, however, substantial challenges and variations that these river basins face in their water availability.[9]

Irrigation System

Irrigation can be defined as the provisions, measures and activities, of a temporary as well as permanent nature, aiming at the supply of water, in some cases together with other matters, to the soil, respectively to the plant in order to maintain or promote the growth of crops.

Irrigation in tropical, developing country like India has been practised over centuries. Irrigation spanning thousands of years, necessarily led to the development of highly skilled and scientific understanding of land and water use. It has evolved over time in response to material developments and the changing requirements of society. It has meant adaptation to the monsoonal or flood waters as also the transfer of water from a water rich basin to a water scarce one - in the form of tapping underground water aquifers and directing channels from a surface water stream.

It can thus be argued that monsoon water which is allowed to flow unrestricted in the valley is not irrigation. If however terraces and ridges are formed to tap the monsoon water, this act of utilizing monsoon water and making provisions permanent and temporary, to harvest water should be called irrigation. The process of Irrigating then is not only the

[9] India infrastructure Report, 2011: *Water: Policy and Performance for Sustainable Development* ,p 1-13

transfer of water but also the construction of structures which store harvest or hinder the natural flow of water. Any human intervention in the natural hydrological flow for the purpose of providing water to the soil or the plant for crop production has to be included in the definition of irrigation. [10] In order to cope up with this increased demand of food production, various irrigation techniques are introduced. Irrigation is an artificial application of water to the soil usually assisting in growing crops. Civilization has risen and fallen with the growth and decline of their irrigation systems. In crop production irrigation is mainly used to replace missing rainfall in periods of drought but also to protect plants against frost. Irrigation is typically applied in those arid (semi) areas where evaporation considerably exceeds rainfall, little natural leaching occurs and salts tend to accumulate. The groundwater in these zones is generally mineralised and the substrata may contain considerable geochemical salt deposits. The introduction of irrigation may lead to more deep percolation of both irrigation and rain water, recharging the ground water reservoir. As a result water table will rise until such levels at which discharge is again in equilibrium with recharge.

Irrigation has two primary objectives first, to supply essential moisture for plant growth, this helps in transporting essential nutrients and secondly, to leach or dilute salts in soil. Beside this irrigation provides number of side benefits such as cooling the soil and atmosphere to create more favourable environment for crop growth, it supplements the supply of water received from precipitation and other types of atmospheric water, flood water and ground water. Irrigation has acquired increasing importance in agriculture the world over. From just 8 million hectares in 1800 , irrigated area across the world increased fivefold to 40 million hectare in 1900 to 100 million hectare in 1950 and to just over 255 million hectare in 1995. With almost 1/5th of that area India has the highest irrigated land in the world today.

[10] Singh Satyajit. 1997. *Taming the Waters: The political Economy of Large Dams in India*. Pp.7-8. Oxford University Press.

Historically civilizations have been dependent on development of irrigated agriculture to provide agrarian basis of a society to enhance the security of people. Close to 19th century canals irrigated 45%, wells 35%, tanks 15% and others 5% approximately. Due to Green revolution in India during 1970s there was a continuous expansion of formulated and dual cropping system on existing farmland occurred in the north west of country. This generated the need for more canal water for irrigation as rainfall in the area is not sufficient to satisfy crop water demands. Hence various irrigation techniques were introduced to meet the demand of increasing population, one such techniques that became highly prevalent was canal irrigation system. But besides being a boon, canal irrigation has also brought the inherent attachments of several problems like salinity, water-logging etc.

Canal Irrigation

Canals can be an effective source of irrigation in areas of low level relief, deep fertile soils, perennial source of water and extensive command area. Therefore, the main concentration of canal irrigation is in the northern plain of India, especially the areas comprising Uttar Pradesh, Haryana and Punjab. The digging of canals in rocky and uneven areas is difficult and uneconomic. Thus the canals are practically absent from the Peninsular plateau area. However, the coastal and the delta regions in South India do have some canals for irrigation.

Broadly speaking, canals in India are of two types, viz., (i) inundation canals, which are taken out from the rivers without any regulating system like weirs etc. at their head. Such canals provide irrigation mainly in the rainy season when the river is in flood and there is excess water. When the rainy season is over, the flood in the river subsides, the level of water falls below the level of the canal head and the canal dries up. Some canals taken off from the Satluj in Punjab were of this type. Since irrigation from this type of canals is uncertain, they have been converted in perennial canals. (ii) Perennial Canals are those which are taken off

from perennial rivers by constructing a barrage across the river. Most of the canals in India today are perennial.

Canals constitute an important source of irrigation in Uttar Pradesh. The state is drained by perennial rivers originating in the snow covered Himalayan ranges and is blessed with fertile soils. But the amount of rainfall, especially in western parts of the state, is not sufficient for sustained agricultural growth.

Large scale canal irrigation was a trend introduced by British and continued in free India. It is an important means of irrigation and is more common in northern plains because rivers are perennial, water is stored in reservoirs by building dams across rivers and then this water is distributed to the field by a method of canal. Canals can be an effective source of irrigation in areas of low level relief deep fertile soils, perennial source of water and extensive area. Therefore these are common in northern plains in the states of U.P., Punjab, Haryana, Rajasthan and Bihar which account for about half of canal irrigated areas of the country. It was during green revolution new crop varieties were introduced and it also leads to the increased use of inorganic fertiliser and pesticides and frequent irrigation. No doubt it has its advantages that it brings down a lot of sediments from the river which makes the soil fertile, most of the canals provide perennial irrigation and supply water as and when needed, although initial cost is much higher, canal irrigation is quite cheap in the long run. But it do have its demerit also as canals are generally not deep and since they are open they may dry up. And the water soaks into the ground and leads to the problem of water-logging, the marshy areas near the canals act as breeding grounds for mosquitoes, and the excessive flow of water brings the salt to the surface making the soil infertile. Water-logging and salinization are some of the major problems of Canal Irrigation.

The intensive irrigation, need of green revolution agriculture has created a largely wasteful water requirement in the hope of increased food production in limited areas where

irrigation has reached. On the other hand the ecological impact of intensive irrigation has been large scale waterlogging and development of wet deserts in fertile agricultural lands. Further this agriculture is so precariously dependent on irrigation that any delay in supply either due to actual water scarcity or due to mismanaged distribution will cause soil water droughts. On the whole this method of agriculture has increased its vulnerability to drought in many ways.

Canals account for 27.6% of the net irrigated area of the state most of which lies in the Ganga Yamuna doab, Ganga-Ghaghara doab and western part of Bundelkhand region. The total length of Canal is about 50,000Km which provides irrigation to about 70 lakh hectares of the cropped area.

Review of Literature

Although globally speaking, the past 50-100 years have witnessed dramatic changes in agricultural production and productivity, driven to a great extent by public and private investments in agricultural research, with profound implications especially for the world's poor. Environmental history may be said to have come to age in recent years, in South Asia it remains by and large in its adolescence. Environmental history in this region has yet to develop a firm intellectual base, a solid scholarly foundation. Since this study attempts to deal with a variety of key issues related to the agriculture such as the role of different indigenous irrigation techniques with special focus on Canal Irrigation in the colonial period in Oudh region; in addition to Archival sources secondary sources have been consulted as a useful source of information on historical, political and administrative matters, and the Geography and economy of the Oudh. In view of the fact that in the context of Sarda Canal in Oudh region, practically no work devoted to its history exists; information and statistics required

for the study have been acquired through consulting a large number of official reports and documents.

For a comprehensive view of environmental history and to taper it down specifically to the Indian context, a wide range of works by eminent environmental historians have been consulted. Hughes, J.D. (2001). *An Environmental History of the world: Humankinds changing role in the community of life*. J. Donald Hughes writes extensively on nature's role in the unfolding of human events. This work places the humans within the community of life and views the correlation between humans and the environment. He emphasizes the importance of environmental history and argues for its importance in understanding the present state of the world's ecological problems. Since the fields inception in the early 1970s both in the US and Europe the focal point of most environmental histories has been on regional and national issues. This work exhaustively deals with how natural forces and resources have shaped societies on a global extent and about the reciprocal relationship shared by people and the environment. He specially points out the giving and taking between the two elements, but often in imbalanced amounts. While numerous studies tend to emphasize either human impacts on the environment, or environmental influences on social behaviour, Hughes depicts a tidy interrelationship between the two.

Krech, S., Menieill, J.R., Merchant, C. (Eds) (2004). *Encyclopaedia of World Environmental History, 3 vols.* The three volume set is an analytical handbook of natural phenomenon and events and their impact on human societies. Many articles in the encyclopaedia are written in a spirit of commodity with environmentalism, but without dogmatic commitment to any one specific school of environmentalism, therefore it is useful both for environmentalist and environmental historian's coverage on how human beliefs and actions have altered the natural world, but also covers the latest advancement in the field.

Simmons, I.G. (2008) *Global Environmental History*, Simmons follows a multidisciplinary approach and with a humanistic perspective furnishes an enormous amount of details, theoretical concepts and trends. With a time frame ranging from 10,000 BCE to the modern day to present, he brings under consideration how human technological evolution changes over the years have affected the natural world and goes on to assess the response to conditions such as climate change. By putting todays environmental preoccupation into a long term perspective, Simmons reveals the history of some current anxieties. The work provides an incredibly rich and deep time overview of how we have come to our current state of ecological crises.

Lot of works have been done in all India context. Ramachandra Guha's, work (1989), *The Unquiet Woods: Ecological change and peasant resistance in the Himalayas* is a pioneering work and sets the agenda for literature on the environment as a critique of colonial policies. Guha painstakingly documents the nature of peasant society and aspirations found in the Chipko movement in the Himalayas against commercial forestry which dates from the earliest dates of state intervention, i.e. the closing decades of nineteenth century. Though his work was on the conflict between state forestry and peasantry who lost their traditional rights over the surrounding forests , yet also casts a reflection on similar issues played out (with variations) in other regions of the subcontinent as well.

In his work, (2000), *Environmentalism: A Global History*, Guha mentions the various facets of the environmental movement worldwide and three distinct schools within the movement. This has been helpful to understand how the environmental historians of India have certain themes in preference to others in writing environmental history.

Gadgil, M. & Guha, R. (1992). *This Fissured Land: An Ecological History of India*, specifically reflects on the ecological change and social conflict in India brought about by

British conquest and control and the evolving environmental debate which begun as a result of the British attempt to assert state monopoly through the imposition of the Indian Forest Act of 1865 and the revised and more comprehensive and stringent legislations that followed over the years. This point is important to note because the protagonist of the earlier debate put forth arguments strikingly similar to those advanced by participants in the contemporary debate about the environment in India.

Gadgil M. & Guha, R. (2000) in their work *The Use and Abuse of Nature* speak of the resource use and abuse in a post-colonial India; This work explores the history of Indian economic development in terms of the contest over resources between socio ecological classes. It addresses the environmental movement in India which begun in the early seventies, having a dominant debate on the forest related conflicts. However , the significant aspect of the book is that it also brings to attention the prominent movements in the 1980's and 1990's such as the Narmada Bachao Andolan and the Kerala Fisher folk struggle which brought the question of appropriate uses of water and fish to centre stage. The author provides a mapping of resource conflicts in contemporary India: conflicts over water, fish, forests, minerals and so on. Moving beyond the protest, the book explores the activities of groups and communities that have been engaged in ecological restoration.

David Arnold and Ramchandra Guha,1995, *Nature, Culture and Imperialism*, introduce reflective essays by eminent historians on the role of both forests and water which has played an important role in shaping South Asian History . In their own different ways virtually all the essays in this book examine and address the significance of the state as a leading, often, the principal actor in the environmental history of South Asia. The essays also highlight the powerful influence of colonial and post-colonial states in environmental change by formulating legislation pertaining to, and assuming control over resources which were earlier under more informal and decentralized systems of management; by developing and

implementing technologies that have dramatically altered the physical environment, as in irrigation works and dam constructions; and by creating a transport and communications network that, in aiding the process of commodification, has greatly increased the spatial scale of resource flows.

Water Management across space and time in India by Naz, F, Saravanan V. and Subramanian, attempts to give a spatial and temporal overview of water management in India. It traces how people and the successive regimes made choices across space and time from a wide range of water control and distribution technologies. The water management in India is divided into four periods: (i) the traditional system of water management before colonial times. (ii) Response from the colonial rulers to manage the complex socio-ecological system; (iii) large scale surface water development after independence; and (iv) the small scale community and market led revolution. Hence it describes the water management over the four periods, which has transformed the irrigation and water management and its scenario in India. Moreover it shows how development of water management and its practices are linked with the social, religious, economic development with the rise and fall of the ruling regime.

Despite the importance of the need to study the water and environmental policy of the colonial period, available literature is scarce and far in between. Since the colonialists have annexed Oudh in 1856, it has been important to trace the history of Oudh region which was dominated by Taluqdars. The work *Taluqdars of Oudh* by Singh Manoj gives detailed description of Oudh region and its virtual rulers popularly known as Taluqdars who dominated the state and its revenue system.

Secondly this work is a study of irrigation system particularly of canal irrigation so it is important to traces the genesis of colonial interest which was mainly economical in the

region by consulting literature covering British policy in totality in United Province particularly of Oudh region. Some of the important works in these contexts are Whitcombe, Elizabeth (1975), *Agrarian Conditions in Northern India: Volume 1, The United Provinces under British Rule* (1860-1900), Whitcombe has drawn extensively from a bibliography of these government records – on agriculture, famine, finance, railways, revenue, public works, trade, law and especially the comprehensive land revenue settlements reports for each of the nearly 40 districts covering the region. Her study focuses on the institutional development out of which modern agrarian problems have evolved. Six substantive chapters move clearly from agrarian subjects to tangentially related problems of administration: the pattern of agriculture and structure of rural society, development of agricultural resources through public works and improved agricultural technology, changes in assessment and collection of land revenue credit needs and the growth of indebtedness, modernization of legal structure pertaining to debt and finally in the changes and efficiency of administration.

Stone Ian's *Canal Irrigation in British India: Perspectives on technological change in a peasant economy* has undertaken the first full scale study of the qualitative and quantitative affects on local economies of the different irrigation schemes. It examines in detail the response of the peasant economy to this important and pervasive form of technological change. Ian Stone said that colonial irrigation when viewed primarily in the context of the peasants adaptation to new technologies , capacity for rational decision making and the quest to maximize output , canals became a source of economic dynamism and constant innovation . Consequently for Stone , despite several negative externalities , the canals released positive 'expansionary forces'.

Comparative study was done by comparing the irrigation system of Oudh (Central part of united province) with other states under colonial government. Such scholarly efforts include *Agrarian Transition under Colonialism: Study of Semi-Arid regions of Andhra* by

G.N.Rao. V. Ratna Reddy's paper *Irrigation in Colonial India: A Study of Madras presidency during 1860-1900* gives a detailed description of the development of Irrigation system done by British which neglected the backward regions. It is an attempt to analyse the colonial exploitation policy and their gradual way of tapping the natural resources of the country for their economic gains . It explains that how the objective of state Irrigation development changed from 'Protective to Productive goals'. Charles Clift in his paper *Progress of Irrigation in Uttar Pradesh: East -West differences* has done a comparative study and examined mainly three things that is the historical development of Irrigation Facilities in Uttar Pradesh in the post-independence period. Secondly it focuses on the salient differences among the different regions of Uttar Pradesh in the nature and extent of irrigation and lastly the causes underlying these regional differences. He has done a comparative study of the east and west part of the province. Mridula Mukherjee in her book *Colonizing Agriculture: The Myth of Exceptionlaism* attempts a study of the agrarian economy of Punjab under colonialism. This work of her focuses on the economic facets of the life of the Punjab peasants. Because there was notion of Punjab as "the land of the peasant proprietors", where indebtedness was a result of prosperity and not poverty, nor the newer theories that heralded the rise of the rich peasant, seemed to quite match the peasants' political behaviour. A closer examination of the impact of colonialism on the agrarian economy as a whole, and on the agrarian class structure in particular, thus became imperative. An attempt is made to delineate the nature of the forces that were buffeting the peasants once they became part of the modern world of colonialism. It examines the nature of the burdens of the peasantry, and the impact of the markets in produce, credit, land and labour. Analysis has also been made regarding the degree to which the peasantry had been differentiated and whether or not this process had led to the emergence of classes or groups capable of and willing to invest in agricultural production. A comparison is made between the

Punjab with other regions of colonial India, and especially with its supposed "polar opposite", Eastern India, to test the validity of the notion that Punjab deviated sharply from the typical colonial pattern. The Introduction to this volume sets out in greater detail the framework and context of this study of the colonial agrarian economy. This volume presents one part of a larger study of the political and moral economy of Indian peasants during colonial rule.

The literature on economy during colonial period is also important. *The Cambridge Economic History of India* by Kumar Dharma and *The economy of modern India 1860-1910* by B.R. Tomlinson. *The Making of Agrarian Policy in British India 1770-1900* by Stein Burton. *Indian Economy under Early British Rule 1757-1857* by Irfan Habib. This work seeks to present a coherent description of the changes in Indian economy brought about by the pressure for tribute, the British land settlements and the triumph of free trade. It surveys pre-colonial economic conditions there are special notes on current interpretations of 18th century history.

Most of the themes have focussed on: British policy and administrative measures, the society and culture of Oudh like *India its Administration and Progress* by Sir John Strachey. *Population and Agriculture in Northern India 1872-1921* by Klein Ira and Tushaar Shah's *Taming the Anarchy: Groundwater governance in South Asia*.

The only published book on the concerned subject is by Singh Baljit and Sridhar Misra *Benefit cost analysis of the Sarda Canal System*. (1965), this was a Project for the evaluation of Sarda Canal Progress. Basically it emphasizes on the impact of the Sarda canal construction in Oudh region it investigates the irrigation benefits and cost of the Sarda Canal System in Uttar Pradesh. It was a Project conducted by the Research Programme committee, Planning Commission of India. *A history of water management and hydraulic technology in*

India (1500 B.C. to 1800 A.D.) by M.S.Mate. The author highlights all aspects of ancient and medieval hydraulic technology as well as social management of water resources. *Managing Canal Irrigation in India* by Sib Ranjan Misra covers another aspect to give an account of the status of water distribution and examine some of the issues associated with water management in irrigation projects.

Nevertheless , it is evident that there is a dearth of written works on the subject of water from Oudh leaving the field wide open for researchers to fill in the gap by writing about the multiple facets of water , its changing value and the role water has played to influence and shape the history of Oudh. W. Crooke in his book *The North Western Provinces of India* describes about the History, Ethnology and administration that is covering basically the social aspect of the province. This book discusses some of the chief social problems which the Government has attempted to sole – that is the Repression of Crime , the Crusade against the Filth and disease, the relief of famine , of the depressed classes , the development of Agriculture aid tax. This is followed by an account of the people themselves, largely based on information collected in the course of the Ethnological Survey of the Province. It discusses about the tribes, religious beliefs, and peasantry. Lastly it discusses about the Revenue that how it was settled and collected, how the peasants are protected from extortion, how they farm the land and makes their living.

Deepak Kumar in his work *Science and Empire* focuses on the role of Science and technology in the history of Imperial expansion. It is a compilation of different papers like Worboys finds actual expression of two important characteristics of modern Science – Utility and Universalism –former involves question of colonial development and latter explains only selective experiments were undertaken and they invariably create the prefix tropical . Tropical disciplines did not embrace all tropical disease problems nor all tropical crops but only those relevant to British interests. For example tropical agriculture was nothing but cash

crop science. Deepak Kumar explains that eighteenth century had integrated science firmly into productive mechanisms. The intellectual atmosphere of 19th century dominated as it was by the rising class of manufacturers ; favoured the adventure of science – gave birth to a phenomenon – " the phase of colonial Science." It is a dependent science wherein the result oriented research is applied science supersedes the curiosity – oriented research of pure science. Colonial Science practised in non-European hemisphere was focussed. It was imperial science seen from below. "It meant Derivative Science", done by lesser minds on problems set by servants in Europe. India was found suitable only for field research. He further explains that Colonial Science is advance over Pre-colonial science – more systematic, methodological penetrative and pervasive.

B.L.Bhadani in his work *Water Harvesting, Conservation and Irrigation in Mewar (800-1700 AD),* makes an in depth study of the methods of Water Harvesting and conservation system in Mewar. What use was made of collected and conserved water is extensively examined in the light of extant structures (dams, wells, Step wells, and Tanks) supplemented by contemporary documents , historical epics , inscriptions, letters , revenue records and so on. The techniques to extract underground water and use of surface water for religious as well as secular purposes such as drinking and irrigation are examined. This work also questions the statement of the British and Indian authors about the non-use of water bodies for irrigation in medieval times, which were constructed by sisodia rulers. The volume also delves deep into the methods of water harvesting and conservation in the urban sector. This well researched study enhances our understanding of the methods of harvesting rain water and the techniques of extracting underground water and would be indispensable to researchers working on agrarian economy and environment in the Indian subcontinent.

Patrick McGinn in his article , *Capital ‚Development' and Canal Irrigation in Colonial India* has used 'Development' , in a very critical manner and discusses that

how British utilized the natural resources of the country, in the name of Development ,for their own economical profits . He further explains British attempt in making India a tributary province and how far they were successful in doing so .

Rudrangshu Mukherjee explains in *Trade and Empire in Awadh1765- 1804* that how British used Awadh as a buffer state . British acquisition of Awadh cannot be described only as political expansion , it was mainly a commercial penetration, because after Buxar , British wanted themselves at a safer pace . For regular subsidy they annexed Awadh , whose revenue was equal to its subsidy . Thus from 1780 , the political and economic dimensions of colonialism in Awadh tended to be closely interrelated .

Tirthankar Roy wok aims to show how history can explain the roots of Economic growth and stagnation in South Asia . On the one side India was changing rapidly under the impetus of commercialization , a strong state , modern infrastructure , government intervention in agriculture , and other changes brought on by colonialism . But these changes , both political and economic intensified competition and produced both segments of growth and segments of decline.

Research Assumptions/hypothesis

The study adopted the following Assumptions:

- Colonial intervention in the unrestricted right over the natural resource water and other resources had a deeper motive more complex than that of conservation and other regulations.
- Contestation of water began when indigenous techniques of irrigation were disturbed by the colonial government.

Chapter – 2

Geography and Economy of Oudh

In its present Geographic position, the Indian subcontinent is a renegade landmass. The Indian subcontinent has three distinct geological surfaces: the peninsula in the south, the extra peninsular region comprising the young folded Himalayan ranges with eastern and western extensions, and the Indo Gangetic alluvial plains. Here the focus is on the great alluvial plains of the Gangetic basin, largely defined as United Provinces (comprises of Oudh), have rivers constitute links rather than obstacles.

Nomenclature of Oudh

From the pre-historic period to the time of Akbar, the limits of the province and its internal divisions seem to have been constantly changing. It has not only faced geographical changes but also in different periods it was referred with different name. The name *Oudh* (mentioned as in British records) seems to have been applicable to as one of the ancient Mahajanpadas known as *Kosala* (the word is used in the sense of a political unit in early Sanskrit and Buddhist texts), *Saket* (the word used mostly in Buddhist and Jain texts from Sunga period onwards), *Awadh* (used in medieval texts, the word is derived probably from Ayodhya, representing the territory speaking the Awadhi language).[11]

Administrative division of Oudh in 1872 - comprises of two divisions that is Lucknow and Faizabad division. It consist of twelve districts- Kheri, Hardoi, Sitapur, Bahraich, Gonda, Fyzabad, Barabanki, Lucknow, Unnao, Raebareli, Pratapgarh, and Sultanpur. These all

[11] Singh Manoj. 2013. *The Taluqdars of Oudh,* p 1- 14

districts were under British control and there were no princely states.[12] The North West provinces (so called because the districts lay North West to the capital, and formed what was then the North West frontier of the empire) were at first part of the Bengal presidency but they were separated in 1834-35, and a Lieutenant Governor was appointed. A legislative council has existed since 1866. The province of Oudh was annexed in 1856 and placed under a 'Chief Commissioner'. In 1877, this office was combined with that of the Lieutenant Governor of North West provinces[13] , comprising of two princely states and 35 British districts. In 1902 North Western provinces was renamed as United Province of Agra and Oudh. In 1935 it was again renamed and termed as United Province.[14]

United province is today known as Uttar Pradesh (in 1951 it was named so). In different periods of time it was named differently but there were very slight changes in the Geographical boundaries. But this is also true that the economical State of affairs since ancient till today faces a drastic change.

Geographical Description of Oudh

Yet theoretically and historically what came to be the Mughal *suba* of Oudh (in the United Provinces), with its capital as Ayodhya, stretching from Ganga to the Gandak, entirely consisting of alluvial plains. By and large it corresponded to the 15th century Sharqi kingdom with its capital at Jaunpur on the Gomti and to the ancient Kosala, with its earlier capital at Sravasti and later at Ayodhya. [15] With the changing period its boundaries were changed, rivers were the links to the different states, later Oudh region was roughly described as the

[12] Banthia, Jayant Kumar (IAS). 2001. *Indian Administrative atlas -1872 -2001 A Historical Perspective*. Registrar General and Census Commissioner , India

[13] Powell, B.H.Baden. 1894. *Land revenue and tenure in British India*. Clarendon press. P. 15

[14] Banthia, Jayant Kumar (IAS). 2001. Indian Administrative atlas -1872 -2001 A Historical Perspective. Registrar General and Census Commissioner, India.

[15] Jafri, Saiyid Zaheer Husain. 1998. *Studies in the anatomy of a transformation Awadh, from Mughal to colonial rule*. Pg17

country between Ghaghara and Gomati west to the line from Ayodhya to Sultanpur, this division included present district of Faizabad (including Ambedkarnagar), some portion of Lucknow, Sitapur, Barabanki and north of Sultanpur).[16] To the east and west it is enclosed by the older acquired districts of the North West provinces - with Jaunpur, Basti, Azamgarh on one side and Sahajahanpur, Farrukhabad and Kanpur on the other.

Oudh is situated, a little westward of the centre of that portion of the Gangetic plain. With a total area of 23,930 square miles[17] may be considered as a plain, having in a length of 1050 miles, a rise of only 1050 feet from the sea level.[18] Oudh lies between the extreme latitudes of $25^0 34'$ and $29^0 6'$ north and longitudes of 79^0 45' and 83^0 11' east.[19] It was bounded on the east by the province of Bihar, and to the north laid the northern mountain; sarkars Manikpur of *suba* Allahabad was situated on the south of the province, while on the western side was sarkars of Kanuuj of *suba* Agra. The distance from the limits of sarkars Gorakhpur to Kanuuj was computed at 135 Kos; while only 115 Kos were said to separate the northern mountains and the southern boundary of the suba.[20]

Physical Features and its impact on climate

To some extent, the boundaries of the suba took into account the physical features of the upper Gangetic plains. Besides the Himalayan barrier to the north , the river Ganges separated it from the Mughal province of Agra and the river Sarju fixed the boundary line between *sarkar* Gorakhpur of Oudh and sarkars Jaunpur of *suba* Allahabad.[21] In total Sarda Canal cover sixteen districts have much diversity of physical features. Districts like

[16] Singh, Manoj.2013. *Taluqdars of Oudh* p 8-12.
[17] Op.cit Pg10-19
[18] Donald Butter, 1893. *Outlines of the topography and statistics of the southern Districts of Oudh, and the cantonment of Sultanpur*, Calcutta. P 28-32.
[19] Gazette of Oudh. Volume 1- A to G.
[20] Jafri Saiyid Zaheer Husain,1998. *Studies in the anatomy of a transformation Awadh, from Mughal to colonial rule*. Gyan Publishing House .P 25
[21] Ibid p 20-29

Sahajahanpur, Hardoi, Unnao, Sitapur and Barabanki are level tracts well wooded with groves and scattered trees and topographically divisible into *Banger* or uplands and *Khadar* or lowlands. There are level plains devoid of hills or eminences as in the case of Lucknow. Allahabad lies in the *doab* area between Ganga and Yamuna. The other districts are also level plains richly covered with trees. Broadly speaking, the western division is a sloping plain and the slope is inclined towards south –east. The slope of the central division which is a level-plain is also towards south east. In the east, land is generally level – plain but the slope is from the north- west to south –east. [22]

A narrow strip of government forest runs along the north, and the whole of the rest of the province is a fertile plain, with less than 1,500 square miles or only about 6% of the area, unfit for cultivation. The surface here and there is varied with almost imperceptible undulations, but there are nowhere any striking features to break that level horizon, or any obstacle but the rivers to the straight lines of communications. A number of rivers and their tributaries flowed through the province. There are some principal rivers traversing the plains Taluqdars of Oudh of the province, they are Ganges, Deoha [23](Ghaghara), Gomti, Sai, Tons, and Lon rivers as the main water channels. The Ganges and the Ghaghara had a low bed with an average width of four miles; and alterations occurred in the channels almost annually so much so that within a span of four or five years the rivers considerably shifted their courses. Compared to these rivers, the smaller rivers had almost fixed narrow channels and little change occurred in their courses, few of these rivers had depth enough to avoid overflow during the rainy season. The banks of these rivers were made up of high *Kankar* ridges

[22] Singh Balajit & Shridhar Misra. 1965. *Benefit – Cost Analysis of The Sarda Canal System*. Asia Publishing House. P 60-83

[23] The major tributaries—the Kuwana, the Rapti, and the Little Gandak rivers—all flow into the Ghaghara from the mountains to the north. Together with the Ganges and its tributaries, it has helped form the vast alluvial plain of northern Uttar Pradesh. Along its lower course it is also called the Sarju River (the Sarabos of the 2nd-century-ce Greek geographer Ptolemy) and the **Deoha**.

making them navigable; but it was noticed that as a result of the diminishing of these ridges during the summer, the depth of these rivers was adversely affected. [24]

This orienting of the great physical features of the surrounding region has a powerful influence on the climate of Oudh. It changes the north east and south west monsoon which under other geognostic arrangements, might have maintained thus far their original directions into irregularly alternating currents of air, which follows the general configuration of the plain and the water lines; the westerly winds coming generally dry and cold or intensely hot according to the season of the year and when dry and very strong always loaded with fine sand – from the arid plains of the north west[25] while the easterly winds bring them the tepid dampness and the malaria of Bengal and Assam. These observations are necessary for the elucidation of the climate of Oudh. Talking about climate particularly in the context of the region between Ghaghara and Ganges. Both climate and rainfall show considerable variation in different areas of the Sarda canal. Damp and unhealthy climate is the characteristic of tarai areas. Climate in other portions of the zone is congenial and similar to that found in the northern India. Rainfall is uncertain and varies from district to district. Accordingly, the entire areas may be dividing into two zones.[26]

The province has a gentle slope from the North West to the South East frontier. This slope determines the course of the drainage. The principal of these – the Ganges , the Gomti , the Ghaghara and the Rapti – have an aggregate dry weather discharge of 18,800 cubic feet per second and it has been estimated that the entire river discharge including the smaller streams , rather exceeds 20,000 cubic feet. But this estimate is probably rather too low. All

[24] Jafri Saiyid Zaheer Husain.1998, *Studies in the anatomy of a transformation Awadh, from Mughal to colonial rule.* Gyan publishing House. P.25

[25] The desolation, which a prevailing current of west wind loaded with fine sand has wrought in Idumea and in the oases of Libya, will in time find a counterpart, in upper India. Two great rivers Ghaggar and saraswati have already disappeared; their extinction having probably been accelerated, by the diffusion of their water for irrigation in canals like those now drawn from the Jumna.

[26] Singh Balajit & Shridhar Misra. 1965. *Benefit – Cost Analysis of The Sarda Canal System*. Asia Publishing House. pp. 55-64.

along the north the surface is being gradually raised by fluvial action. All the main rivers with the exception of the Gumti and many of the smaller streams have beds hardly sunk below the level of the surrounding country; they carry destruction to the villages to their bank. The drainage is further provided for by countless jhils or ponds. These *jhils* are usually merely shallow depressions, caused some of them by the actions of the rains on pre-existing inequalities of the soil and some of them proved by their shape to be the remains of former river beds and they are invaluable not only as a preservative from floods but still more so as reservoirs from which the neighbouring fields are irrigated for the spring harvest, and the cattle provide with water during the dry months.

An important feature of the natural Geography of Awadh in the 16^{th} - 18^{th} centuries was the presence of large forest belts. Forest is important source of rain. If forests are cut it always has an adverse impact on the rainfall thus affecting the irrigation of the province. For example the City of Gorakhpur was surrounded by forests. Pilibhit, Bareilly and Kheri are a vast plain with gentle undulations frequented with stretches of forests and numerous rivers and other streams of water. Gorakhpur was desolate owing to the scarcity of peasants, the denseness of jungle and the inroads of the wild elephants. Owing to the depredations of these elephants, the peasants abstained from cultivation of the sugarcane. Francis Buchanan who surveyed the district in 1807-11 estimated that out of the area in the district of 7,438 square miles, about 1,450 square miles were covered with forest. In order to increase revenue and perhaps, remove Zamindar hideouts the clearing of the forests for the purpose of the cultivation was generally encouraged by the government. A number of incentives were given to the peasants for carrying the work of reclamation. In these lands the irrigation facilities were available abundantly as the water table was found just at the depth of 10 feet, and wells and tanks could be dug quite easily. However due to the unremitting destruction of the forest adverse effects were produced on the general climate. Butter thought that the annual average

rainfall declined and the water table went down, thus creating difficulties for irrigation. This situation could have certainly been controlled by a "systematic artificial planting to counteract the parching effects produced by the removal of these natural protectors of the soil". But reclamation continued unabated. The agricultural statistics of 1885-86 show no forest area in those districts where, sleeman estimates forest areas as 882.5 sq. miles. It may be assumed, then, that by 1885-86 such extensive tracts of forest comprising about half a million acres had come under cultivation. In 1836 Butter was convinced of a "great change in the climate" by which he perhaps meant a decline in rainfall. Butter has appended tables showing the diminishing pattern of the *Rabi* as well as *Kharif* crops. At the time of his writings the reports (1836) even the "produce in a good year 'was much less than what it was before the great change in the climate.'

The average rainfall in Oudh according to him followed a very irregular pattern. At the same time it was," steadily decreasing on an average of 5 or 6 inches year." Butter attributed such a change to the destruction of the 'sylvan vesture' by the peasants in order to bring more land under the cultivation. It was predicted that the country was under the slow but definite process of becoming 'barren ravines' as there were no forests left 'to ward off' the 'fierce rays of the sun' and 'dew deposition' thus creating springs of running water . The green belts of the region had detained water in meshes, but such land was now 'ploughed into barren rivers'. As a result the province lost "its springs and perennial streamlets … the distance of water from the earths increased – and its rainfall and the volume of its rivers diminished.

Soil is another important feature of ecology which deserves to be mentioned. Soil related human relationship to environment. Most part of Oudh, soil was productive, while, it diverse in its contents and quality. The soil of the province was composed of different varieties. On occasion, it contained siliceous and calcareous earth, the latter in the form of

Kankar which occurred in the limited horizontal layers at a depth of six to eight feet. The *Kankar* ridges were generally found along the right banks of the rivers. At many places *Kankar* constituted the surface of the soil as well the sites of the primeval forests of Oudh 'and the region between Ganges and Ghaghara had the rich and dark soil. In the southern districts of Oudh, the soil of pargana salon, jais, Rampur, and Manikpur was judged as the best and very productive in different varieties of the grain. [27] Region between Ghagra and Ganges is the Sarda canal command area exhibits a striking diversity of soils. Generally speaking, land is fertile and well suited for the cultivation of practically all important crops. The soil in the western districts like Kheri and Pilibhit is made up of silt carried down by rains and rivers from the mountains. The soil in Sahajahanpur and Bareilly consist of thick clay. In the central zone, it varies from pure sand to highly sticky land. In the east, soil is partly sticky and partly clay and loam. The more common types of soils found in the whole area include *bhur* or sand, *matiyar* or clay, *dumat* or loam. Generally, bhur is found in the elevated area and on the high banks of rivers. The uplands have dumat and the depressions are found the matiyar soil. There are also rich alluvial formations in the area.[28]

Political History

Oudh under Mughals and Nawabs

Awadh remained a relatively trouble free province of the empire throughout the seventeenth century. The limits of Oudh from 1801 onwards down to its annexation (1856) remained more or less fixed. The total area was computed at 23,923 square miles. As part of the Mughal Empire, Awadh had little reason to appear prominently in political or military history as it did not lie directly on any axis of Mughal expansion and thus remained in

[27] Donald Butter, 1830. *Outlines of the topography and Statistics of the Southern Districts of Oudh and the Cantonment of Sultanpur*. Calcutta. Pp. 10-14

[28]Balajit & Shridhar Misra. 1965. *Benefit – Cost Analysis of The Sarda Canal System*. Asia Publishing House. P. 55-64.

political backwaters. But things began to change during the second quarter of the eighteenth century, when Burhan ul mulk Saadat khan was appointed the governor of the *suba* in 1722. With the general deterioration and slackening of central control, Burhan ul mulk (1739) and later on his two immediate successor Abul Mansur Safdar Jung (1739-56) and Shuja ud Daula (1756-75) were able to assert their independence from imperial control. Oudh was the first to get the independence from the imperial (Mughals) control. However, this was a slow process.[29]

The 18th century saw a transformation in the position of Oudh, for two different reasons. As the Mughal emperors more or less confined their courts to Delhi from the time of Farrukh siyar (1713) onwards, holding possession of adjacent provinces became very important for exerting influence at the court. Thus the three successive governors of Awadh Saadat Khan (1722-39), Safdarjung (1739-54), Shuja ud Daula (1754-75), sought to use their control over Oudh and its resources as springboard for pursuing their ambitions at Delhi. Secondly as the Mughal Empire began to contract, Awadh became subjects to threats from the Afghans, Marathas and finally, the English. For both these reasons Awadh re-entered and remained in the realm of political annals with a new prominence.[30]

Oudh became part of Mughal Empire during Humayun's reign in 1555. During Akbar's rule Oudh was one of the twelve (or fifteen) subahs into which he divided the Mughal Empire as it stood in the year 1590 A.D. It seems to have been of nearly the same extent as the Province of Oudh at the time of annexation to British India in 1858, and to have differed only in including Gorakhpur, Basti, and Azamgarh, and in excluding Tanda, Aldemau, Rajesultanpur and Manikpur, or the territory to the east and South of Faizabad, Sultanpur, and Pratapgarh. During Emperor Jahangir's rule, an estate was granted in Oudh to

[29] Jafri Saiyid Zaheer Husain, *Studies in the anatomy of a transformation Awadh, from Mughal to colonial rule.* P. 15-16
[30] Ibid p. 17-18.

a nobleman, Sheik Abdul Rahim. He built Machchi Bhawan in this estate; this later became the seat of power from where his descendants, the Sheikhzades, controlled the region. Until 1719, Subah of Oudh was a province of the Mughal Empire administered by a Nazim or Nawab (Governor) appointed by the Emperor. In the absence of expeditious transport and communication facilities, they were practically independent rulers of their territory. Sadat Khan also called Burhan-ul-Mulk a Persian adventurer was appointed the Nazim of Awadh in 1722 and he established his court in Faizabad near Lucknow. The Nawab of Lucknow were in fact the Nawab of Oudh, but were so referred to because after the reign of the third Nawab, Lucknow became the capital of their real.

As the Mughal power declined and the emperors lost their paramountcy and they became first the puppets and then the prisoners of their feudatories, so Awadh grew stronger and more independent. Saadat Khan, the first Nawab of Awadh, laid the foundation of Faizabad at the outskirt of ancient city of Ayodhya and made it the capital. He took advantage of a weakening Mughal Empire in Delhi to lay the foundation of the Awadh dynasty. His successor was Safdar Jung the very influential noble at the Mughal court in Delhi. Until 1819, Awadh was a province of the Mughal Empire administered by a Nawab. Awadh was known as the granary of India and was important strategically for the control of the Doab, the fertile plain between the Ganges and the Yamuna rivers. It was a wealthy kingdom, able to maintain its independence against threats from the Marathas, the British and the Afghans. The third Nawab, Shuja-ud-Daula was comprehensively defeated in the Battle of Buxar by the British East India Company, after which he was forced to pay heavy penalties and cede parts of his territory. The British appointed a resident in 1773, and over time gained control of more territory and authority in the state. They were disinclined to capture Oudh outright, because that would bring them face to face with the Marathas and the remnants of the Mughal Empire. Asaf-ud-Daula, the fourth Nawab and son of Shuja-ud-

Daula, moved the capital from Faizabad to Lucknow in 1775. In 1798, the fifth Nawab Wazir Ali Khan alienated both his people and the British, and was forced to abdicate. The British then helped Saadat Ali Khan to the throne. He was a puppet king, who in the *treaty of 1801 ceded half of Oudh to the British East India Company* and also agreed to disband his troops in favour of a hugely expensive, British-run army. This treaty effectively made part of the state of Awadh a vassal to the British East India Company, though they continued to be part of the Mughal Empire in name till 1819. The wars and transactions in which Shuja-ud-Daula was engaged, both with and against the British East India Company, led to the addition of Kara, Allahabad, Fatehgarh, Kanpur, Etawah, Mainpuri, Farrukhabad, Rohilkhand, to the Oudh dimensions, and thus they remained until the treaty of 1801 with Saadat Ali Khan, by which province was reduced considerably as half of Oudh was ceded to the British East India Company.

The treaty of 1801 formed an arrangement that was very beneficial to the Company. They were able to use Awadh's vast treasuries, repeatedly digging into them for loans at reduced rates. In addition, the revenues from running Awadh's armed forces brought them useful revenues while it acted as a buffer state. The Nawabs were ceremonial kings, busy with pomp and show but with little influence over matters of state. By the mid-19th century, however, the British had grown impatient with the arrangement and wanted direct control. They started looking about for an excuse, which the decadent Nawabs readily provided.

Oudh under the British

In 1856 the East India Company first moved its troops to the border, and then annexed the state in the name of maladministration, which was placed under a Chief Commissioner. The rebels took control of Oudh, and it took the British 18 months to reconquer the region, months which included the famous Siege of Lucknow. Wajid Ali Shah, the then Nawab, was

imprisoned, and then exiled by the Company to Calcutta. In the subsequent Revolt of 1857 his 14-year-old son Birjis Qadir son of Begum Hazrat Mahal was crowned ruler, and Sir Henry Lawrence killed in the hostilities. Following the rebellion's defeat, Begum Hazrat Mahal and other rebel leaders obtained asylum in Nepal. Oudh was placed back under a chief commissioner, and was governed as a British province. In 1877 the offices of lieutenant-governor of the North-Western Provinces and chief commissioner of Oudh were combined in the same person; and in 1902, when the new name of United Provinces of Agra and Oudh was introduced, the title of chief commissioner was dropped, though Oudh still retained some marks of its former independence. In 1932 it was renamed as United Province. There are eight divisions in United Provinces- Meerut Division, Rohilkhand Division, Agra Division, Allahabad Division, Banaras Division, Faizabad Division, Sitapur Division, and Rae Bareli Division. Whereas Awadh has two divisions – Lucknow division & Faizabad Division. Lucknow Division consists of Lucknow, Unnao, Rae Bareli, Sitapur, Hardoi, and Kheri. Faizabad Division consists of Faizabad, Gonda, Bahraich, Sultanpur, Pratapgarh, and Barabanki.

Economic Conditions of Oudh: Revenue collection system before British

Oudh is a highly fertile region, as it lies in an alluvial plain. Therefore agriculture is the main economy. Land revenue is a major source of income for the state. Thus understanding the land revenue system is very important. And as the basis of the political and economic structure of the kingdom was land revenue. It was therefore natural for the British to suggest a number of reforms in this sphere from time to time. [31]

The history of Oudh can be seen as a series of struggles for hegemony over a vast stretch of agriculturally fertile alluvial landmass irrigated by the rivers Ganges, Gomti,

[31] Jafri Saiyid Zaheer Husain,1998 *Studies in the anatomy of a transformation Awadh, from Mughal to colonial rule*. Gyan Publishing House . Pg 148

Ghagra, Sai, saryu, and Rapti. All thought the ages Oudh struggled against foreign elements, and it was the place of the stiffest resistance to Mughal forces from the sixteenth to the eighteenth centuries; to the Lucknow Nawabs during the eighteenth and nineteenth century and to the British during the revolt of 1857-58. The impostors had no greater effect than a series of bad harvests. When they were gone, all the old elements of society resumed their various functions and repaired a desolation which could only last for a time. It is this stability rendered by the institutionalisation of local elements and its fertile plains which have saved Oudh from the fate inflicted by the hostile foreign elements. It was basically a hostile environment imposed upon this stable agrarian system that bred the creed of the Taluqdars. The Mughals dreaded them; the Nawabs of Oudh were unable to contain them and the British were humbled and made to recognize them. [32] They were none other than *Taluqdars* of Oudh.

The foundation of *Taluqdari* system lay in the land revenue collection mechanism of the sovereign authority that ruled over the land. The need of the agrarian system requiring the collection of revenue led to creation of the institution of *Zamindar* from the rural landed aristocracy to collect the revenue for the sovereign. Later on the *Zamindar* gained power and evolved itself in due course of time into *taluqdari*. Literally speaking, *taluqas* or *mutaliq* mean 'pertaining to', while *taluqas* clearly means *ilaqa* (region) or *jagir* (grant) or a *Zamindari* territory ; thus *taluqdari* means holder of an *ilaqa* or grant or a *Zamindari* territory and the term can be freely associated with the territories of the *tankhwah jagirdars* , *khalsa* officers , *Zamindars* and *ijaredar* (contract system). But in the technical territorial sense, the term *taluqdar* or *tauqedar* connote only the holder of a *Zamindari* territory. [33]

In another record of the Punjab settlement report of 1862, great landlords were appointed *Taluqdars* over large number of villages during the Mughal era. The *taluqas* or

[32] Singh,Manoj. 2013. *Taluqdars of Oudh* p 30-45
[33] Ibid

district usually comprised over 84 villages and a central town. The *Taluqdars* was required to collect taxes, maintain law and order and provide military and manpower to the provincial government. In United Provinces *Taluqdars* were much more powerful and were directly under the provincial governor. The late Mughal era saw the rise of powerful *Taluqdars* in Oudh who seldom paid any collected revenue to the central government and became virtual rulers of their districts. They were basically countryside clan – heads/ rural rajas / agrarian elites, who held varying degree of financial administrative and political powers over their *taluqas*.

At the beginning of sixteenth century, the sultanate documents and texts speak of the *Iqta* (province) of Oudh consisting of administrative units known as *pargana* or *qasba* meaning thereby an aggregate of *mauzas / mahals / tappas* (villages) whose boundaries represented the area of the dominant clan. Akbar administratively divides the empire of Hindustan into *subas, sarkars, and parganas.* Akbar recognised the potential authority of these parganas which existed in India and by his imperial Farman's created a body of imperial officers called *Chaudhary or Zamindar.* From the local rajas and chiefs of the parganas of each suba, these Zamindars collected revenue (*jama*) of their own *mahals* as well as of the other tenants, and deposited the collected amount (*hasil*) in the royal treasury. It was a big indication of the gaining of momentum of the agrarian clan heads of Oudh, as the seventeenth century witnessed high economic growth and prosperity due to flourishing of trade and artisanal production followed by increase in agriculture production. The available *jama* figures suggest a remarkable rise in revenue from the end of sixteenth century. However the *hasil* figure or the payments to the state was not increased much, which proves that the *Zamindars* collections from the peasants had risen more substantially making them more powerful.

In the taluqdari tenure in Oudh, the superior proprietary rights rested in one single person - the Lord of the domain. The law of primogeniture was generally applicable for succession in the Taluqdari tenure. The *Taluqdars* were entitled to deposit the revenue through government offices, namely the *Nazim* or the *chakladar* stationed at the *sarkar*. The exploitative outlook of the *Nazim or chakladar* rendered it impossible to collect revenue from the *Zamindars* who often turned hostile and refractory. It was mainly due to the high handedness, corrupt and exploitation of *Zamindars* by *Nazim / chakladar* that the British government introduced the concept of tehsil where *Zamindars / pattidars* of various parganas of the tehsil could deposit the revenue. British introduced several reforms in the local revenue system; it was a sort of experiments because British were themselves not aware of exactly the land revenue system of India. British initially came to India as traders. Then they started gaining grounds and became empire settlers and their motive changed and focussed, they started focussing on major source of the income for the people as well as for the state that is Land revenue that is how to increase the land revenue of the province. Therefore they started commercialisation of Agriculture because agriculture was the main employment of the people. Before explaining the certain reforms that were introduced by British in this sphere, let us know that how gradually British aim changes from traders to rulers.

Onset of colonial rule: Commercial Interests

Since 1498, when Vasco da Gama sailed from Portugal to India around the Cape of Good Hope, he opened a new sea route for the trade between India and Western Europe. Simultaneously, the age of colonialism dawned as the Portuguese established coastal fortresses in India and levied tribute on Indian and other Asian shipping, and on the territories they occupied. This was the beginning of the practise of European powers of financing their trade by tribute extracted from Asian territories and commerce. Early in the 17th century

Portuguese hegemony were overthrown by Dutch and English. Both the English and Dutch companies attempted to control or impose tribute over India's Arabian sea trade, but by and large their commercial interest in the Mughal Empire put some restraint over their propensity to use force against Indian shipping. Throughout the 17th century, the major channel for commerce with Europe still continued to be the red sea route, with large numbers of Indian merchants, besides those of Iranian, Armenian and Turkish nationalities, engaged in it. Talking of 1755 English company had to advance low interest loans of large amounts to the British government to preserve its monopoly of Asian trade and thwart all aspiring rivals within Britain, while it was also obliged to increase its expenditure on military establishments in the east to keep its European rivals at bay, especially French whose profit was initially better than English. In such circumstances the temptation to make use of its military and naval power to secure financial gain was irresistible. If tribute could be levied by force on Indian rulers and their territories, this could save the company its expenditure on the large quantities of treasure that had annually to be sent from England to India and in effect secure to it imports from India with the costs paid out of India's own resources. So followed the Carnatic wars (1746-61) and the battle of plassey (1757) and thereafter the onset of colonial rule. [34]

England has to fulfil a double mission in India: one destructive, the other regenerating - the annihilation of old Asiatic society, and the laying of the material foundations of Western society in India. The nineteenth century saw a rich debate on the impact of colonialism on the colony. Two journalistic pieces written by Karl Marx in 1853 for the New York Daily Tribune on British rule in India raised some key issues concerned with this debate which are of relevance even today. Marx in these articles wrote about the "destructive" and the "regenerative" role of colonialism. He saw in the very process of destruction by colonialism

[34] Habib Irfan. 2013. Indian Economy under Early British rule 1757-1857.p 2-8. Tulika Books.

of the pre-colonial Indian society, the regenerative role of colonialism, as it opened up the possibility of growth of capitalism and industrialisation in the colony. This was because Marx, on the basis of information then available to him, erroneously characterized Indian society as a 'changeless' 'Asiatic society' which needed to be destroyed, even though the process was painful, before any social progress could occur. Further, along with the destruction of the old 'Asiatic' order he expected that new elements introduced by British rule, such as electric telegraph, railways, steam navigation, private property in land, western education, free press, political unification, etc., would create the conditions for the evolution of a modern western type of society.

It must be noted that when Marx talked of the 'regenerative' role of British rule he was conscious that only the conditions of regeneration were being created under British rule and not regeneration itself. He was talking of a potential which had not yet emerged from the ruin brought on by British rule which he often described so graphically. He wrote, in June 1853-58 England has broken down the entire framework of Indian society, without any symptoms of reconstitution yet appearing. This loss of his old world, with no gain of a new one imparts a particular kind of melancholy to the present misery of the Hindoo and separates Hindustan, ruled by Britain, ... from the whole of its past history.[35]

With the onset of colonial rule, the process of conquest and the increasing scale of tribute started. The one thing that was happening at a greater pace was an overwhelming impulse towards increasing the flow of wealth from India to Britain - the so - called *tribute*- which made constant territorial expansion in India an inescapable pursuit for the East India Company, whatever are the public and parliamentary professions made on behalf of the British nation. The battle of buxar (1764) was followed in 1765 by the so called *'grant of*

[35] Mukherjee, Aditya. 2008. The Return of the Colonial in Indian Economic History: The Last Phase of Colonialism in India. Social Scientist , Vol. 36, No.3-4, pp. 3-44

diwan' whereby the company formally received power over the entire finances – and thereby, in effect over the government of Bengal, Bihar and Orissa. In 1772 the company directly took over the entire government of the three provinces. A deep intrusion into northern India followed with the *Rohilla war (1774), which established English supremacy over Oudh*, a new found ally. In 1801 the Carnatic was annexed and Awadh made to cede half its territory. So began the *'private' drain of wealth* from India that was practically to last all through British rule. The company monopolized the trade to its benefit.[36]

A basic shift in the position of Oudh took place with the battle of Buxar (1764), where after the centre of power under which Oudh worked was Calcutta, not Delhi. Under the new regime, Oudh became a veritable milch- cow for the English East India Company. More than half of the area of Oudh was annexed by Wellesley in 1801. In the political and Economic sphere, Oudh offered an example of abject tutelage, where the *British had power but no responsibility*. British ambitions, both political and financial grew apace, until Dalhousie enforced the annexation in 1856, and eliminated a state that, since 1764, had never given any occasion for offence to the paramount power. [37]

In a long span of time from the advent of British to India as traders till the time they left the country can be defined as a transformation of colonialism from mercantilist system into free trade imperialism and then finally as rulers. India was converted into a captive market for Britain. [38]This was a slow and well organised process. The land revenue administration and management was an important branch of administration by which any government controlled and ruled the subjects of that country. It was the basic tool which controls the monetary and fiscal movement of the country and establishes a direct link

[36] Habib Irfan. 2013. Indian Economy under Early British rule 1757-1857.pp 2-8. Tulika Books.
[37] Jafri Saiyid, Zaheer Hussain. 1998. Studies in the Anatomy of a Transformation Awadh, From Mughal to Colonial Rule . Gyan Publishing House. P.18.
[38] Op.cit. p 2-8.

between the government and subjects. Therefore, the British government of East India Company, after acquiring the Diwani rights of Bengal, Bihar and Orissa in 1765, too paid greater attention and continuously attempting to establish a sound land revenue administration which ensured a fixed, regular and permanent source of income for the company. In that process, they introduced various land revenue settlement one after another in a series of experimentation. One such land revenue system was Mahalwari system introduced in northern India after Permanent Settlement and ryotwari settlement.

Initially, the Mahalwari system covered the most fertile tract of British India including Ganga-Jamuna Doab, major areas of Agra and Oudh Provinces, North Western Provinces, old Benares, the Ceded and Conquered districts and later on it was extended to Central Provinces and the British Punjab. Till 1857, the operation of the Mahalwari system was more or less confined up to the regions of the North Western Provinces. North Western Provinces with Oudh (added to the North Western Provinces administration after T. C Robertson's recommendation) under the Company administration was slightly more than the present day area of Uttar Pradesh. Under the East India Company administration, the entire territorial boundary of the state was categorized into six divisional heads, viz., Benares division, Ceded and Conquered districts, Oudh, Regions acquired after Nepal wars in 1816, and Princely States during the British rule. It was an end result of the integration and consolidation process of different parts of the Himalayas foot-hills region under Company rule.

The Mahalwari system of land revenue settlement for estates of proprietary bodies was the final attempt in that process. The original design was to extend permanent settlement to the areas ceded by Oudh in 1801 and seized. Unlike the ryotwari settlements, it was not

intended to make direct arrangements with the actual individual cultivator.[39] Here, the settlement was directly made with the village or Mahal by the Settlement Officers, who fixed the rent with the consultation of *Lambardar* and the rent to be paid by the cultivating tenants. The system was known as *Mauzawari* in United Provinces, *Malguzari* in the Central Provinces, and village or *mahali* settlement in pre-independent Punjab. It was hybrid form of both the previous land settlement, i.e., *Zamindari* and *Ryotwari*. In all *Mahalwari* operated regions, the land revenue was revised periodically. *Mahal* simply defined as a fiscal unit, was a local area coincides with a large or forms a part of village or includes several parts of villages. In this system, *Shijra* and *Khasra* records were the foundational pillar and basis of all land revenue assessment. The proposal and suggestion of Mahalwari or village-wise System was first presented by Holt Mackenzie, then Secretary to the Territorial Department, Board of Revenue, in the Minute of 1st July1819 who declared permanent Zamindari Settlement as a "Loose Bargain"[40] for the British Empire. Holt Mackenzie's recommendation incorporated in the Regulation VII of 1822 which attained maturity under the Regulation IX of 1833 under the supervision of R. Marttins Bird. The study of Mahalwari System acquired immense importance in the context to analyse the agrarian structure and relations of nineteenth century Indian society.[41]

By the introduction of Mahalwari system, the Colonial government of the Company tried to divert the attention from '*Talukdars'* to *Khudkasht* or primary resident Zamindars and the village communities. In Mahalwari mode of land revenue settlement, the groups of cultivated holdings were shared among themselves and the payments which *Biswadars* or inferior cultivators made to them as overlords for the right of occupying the remaining lands of village. In most of the instances, however, the settlement had been made with single

[39] Ibid
[40] Neither profitable to British nor to the peasants
[41] http://shodhganga.inflibnet.ac.in:8080/jspui/bitstream/10603/13529/14/14_abstract.pdf

individuals –either temporary revenue farmers or more established local magnets termed as *Talukdars* who contracted the whole group of villages or mahals for the revenue payment.

Further, the interest and concern of the introduction of new land revenue system in India was not only because of Company's financial irregularities and shattered economy but the occurrence of Industrial Revolution in England which raised the demand of raw materials to run Birmingham and Manchester industries without any pause. As Industrial Revolution got pace by the coming of 19th century, England made a drastic shift in their land revenue policy and management. They shaped it accordingly to the need and necessities of their industries. The end of the monopoly of opium trade with China and exigency to introduce railways in India under the different guarantee system was also a big concern for the introduction of new land revenue settlement. The administration of East India Company could not able to devise a sound land revenue system even after utilizing all the skills and experiences of their officials which promisingly fulfilled all the pressing need. Introduction of a sound land revenue system in the Provinces proved a daunting task for the Company administration. However, at some extent, they got success in that task by the year of 1822 when Regulation VII of 1822 was incorporated as a law for new land revenue system. The system was very much similar to the *ijarahdari* or revenue farming system and so that the preference were always be given to highest bidders amongst the local inhabitants.

The Regulation gives a comprehensive and detailed scheme of local inspection. Under the Regulation, the rent-rates should be fixed on the basis of fiscal capabilities of the field. When Lord William Bentinck became governor-general of India, he found a depressed and shattered economy in the region of Western provinces and so he gave full attention to the improvement of existing land revenue settlement. Lord William Bentinck made a tour of the North-Western provinces to examine the revenue administration and its progress made since the implication of the Regulation VII of 1822. He noted that the settlements were not working

smoothly because “different officers had adopted different practices”. For example, in one district, “the practice seems to have been assessing with reference to the produce of the land alone, by fixing rates for each description of crop, while in other, the capacities of the land alone looked into, and then the soil being classed and assessed accordingly”. Mahalwari chain of working could be depicted in the following chart:

Actual proprietors

↓

Tenure-Holders

↓

Cultivating Peasants

The settlement’s failure lies in its process of land revenue collections and assessment which usually appeared to be defiant. The burden of too much work and distinct duties at one time on the settlement officers proved to be exhaustive and they were not remaining fit to their excellence. They were not fulfilling both the duties to investigate into the process of revenue collection and assessment and also because they accurately did not finalized its records-of-rights. It failed totally because of its corrupt local machinery at pargana and village level. It proved too harsh for peasants because of excessive state demands. The settlement failed also because it tried to impose double task at a single time on the settlement officers. The system proved uneconomical for the company and unpopular for the natives and so placed as the most oppressive land settlement among all British settlement in colonial India. The working and operation of 1822 settlement of land revenue came under review when Holt Mackenzie passed an amending Regulation IX of 1825. He believed that the settlement officers had ignored the net produce criterion and their ground work being no more than various estimates of the actual payments made by the immediate cultivators. The aim appears to have been more strongly pursued when Mackenzie presented a new

memorandum of October 1826 about the land revenue management. In this minute, Mackenzie suggesting amendments to the statistical record compiled by settlement officers by which he proposed that enquiries should be carried out into the yields and the costs of production on the lands of a native cultivators. The most significant and notable amendments regarding the land revenue system of northern India was made, when the Regulation IX of 1833 had been passed under the supervision of Robert Marttins Bird, a member of the Board of Revenue with a view to evolve a practicable scheme of land revenue assessment. The main purpose of passing the Regulation IX of 1833 was to abbreviate and simplifies the business of land revenue administration. Robert Marttins Bird, under whom supervision the Regulation IX of 1833 had been passed, observed that *Talukdars* did not have original rights to hold property in land and they were the 'host of unproductiveness'. Further, he suggested that all the engagements with the *Talukdars* must be withdrawn immediately for the betterment of revenue administration. In place of short intervals adopted in the Regulation VII of 1822, the assessment was settled for a term of twenty years which was finally extended up to thirty years. For the very first time, Hindustani language was introduced in place of Persian as the medium of official transactions and ledger keeping to the land revenue administration. In the settlement of 1833, total attention was concentrated on the existence of village proprietary bodies which was not handled by a single landlord but a group or corporation of landlords, who were settled jointly and severally as a responsible unit. Through this system the East India Company tried to end the abnormal superiority enjoyed by the *Zamindar* over their ryots. The term of the settlement should be deduced on the basis of *jamabandi* or the gross revenue assessment. After passing this Regulation, the professional survey of land became mandatory and it became a regular and integral part of the land revenue assessment process. Under the Regulation, an important measure was adopted which provided the scientific recording of all the productivity and potentiality of the soil. The regulation put *patwaris*

duftar on efficient footage under the superintendence of the *Qanoongoes* and *Tehsildars*. In the making of new settlement, officers experimented with the general capabilities of the soil which proved harmful for both the agriculturist and fertility in the long run. In all, the settlement under the new Regulation, classify the mahals according to their productive capacity and quality of the soil/land. The regulation upgraded rent rates which took into account by various factors affecting local productivity such as the facilities of irrigation, fertilization and local situations. By the new settlement, for the first time in the history of land revenue administration, British tried to determine the cultivators rent directly in cash. Mr. Bird cites the reason of it in these words 'it is impossible to fixed grain rate directly in kind in this region' because there were no clear rule or system prevailed which determined the fixed quantity of produce during that time.[42] The finest approach to such a system was found in various kinds of batai system of land revenue in which the total production of grain was divided in certain and accurate proportion between the government and the cultivating peasant. The Mahalwari system attained its final form under the supervision of R.M Bird but concluded by James Thomason in 1849.

However, the system never runs successfully for its full allotted term of thirty years. Mr. Stakes, a revenue officer, asserts that land settlements under the Mahalwari operation proved successful as a whole, and the original proprietors disappeared under them in many districts, but cultivation generally increased. The new pattern and method of land revenue administration or management destroyed the old and traditional set-up of agrarian society and established a new material based society in the agrarian villages. The new system of land revenue made land a commodity for market which might easily be sailed and mortgaged with a proper value. It created new social class and order in Indian rural society. . It affected all the section of agricultural population involved in cultivation either directly or indirectly. As all

[42] Marx. Karl. 1959. *The Future Results of the British rule in India*, New York daily Tribune, in Marx Engels (ed.) *The First Indian War of Independence* 1857- 1859, Moscow, p. 86

the land revenue settlement under the Company Government have been formulated with the two basic objectives, viz., (i) to extract maximum revenue with a provision to revise the rates on periodic basis, and (ii) to meet the rising demand of raw materials for the English industries definitely forced the Indian peasantry to grow commercial crops. The agrarian consequences of all land revenue settlement so of Mahalwari system proved inhuman. The high demand of land revenue by the state made cultivation uneasy, uneconomical and depeasantised the agriculture. The consequences of Mahalwari operation was very much determined by the procedure of land revenue assessment and realization. The operation of new land revenue systems resulting into the breakdown of customary relationship and conventions within village society, transfer of land through sale, mortgage or leasing; eviction of peasants, and changes in contractual arrangements with labour. The excessive state land revenue demand and exactions of the Zamindars drove the peasant into the clutches of the money lender and the trader. Absentee landlordism, parasitical intermediaries, the avaricious moneylender, and the proprietors' all combined to force the peasants into a position of tenants- at- will and push them deeper into the depth of poverty. The creation of proprietary rights in land brought an effective, extensive, and melancholy revolution in 'landed property' in India. In totality, it 'disjoint the whole frame of the village social order, deprive the multitudes of property and their property claims which their families had held ancestrally for ages, and reduced a high- spirited and committed class of men for their society from the pride of independence to the situation of labourers on their paternal fields/lands. The governing objective of the East India Company was not the immediate creation of a market for the British manufactured goods but 'to secure a supply of the products of India and East Indies, which found a ready market in England and Europe. Therefore, they introduced various land revenue settlements with a prime motive to achieve the target of more raw materials for their industries and turn India into the 'agricultural farm of England' The

introduction of new pattern of property distribution in land and land rights destroyed all the traditional set-up of land revenue collection rights which had been held and carried on privately and defined properly itself by the Taluqdars. The Colonial administration of East India Company created proprietary rights in land because they wanted to introduce the concept of private property in land which helps them in the maximization process of land revenue and so optimum exploitation of Indian peasantry. The creation of property rights in land was the prime concern and motive of all types of British land revenue settlement through the permanent limitation of the state demand and the relinquishment of a private rent to the proprietor. They directly linked it with the long term economic improvement of the country. In reality, however, British created Proprietary rights or claim in land with a single motive to raise the economic gain through the set- goal to collect the optimum possible land revenue from the agricultural population without any barrier and so established the political supremacy of British Empire in India.

This introduction of proprietary rights or claims in land caused all misery and impoverishment of Indian peasant yeomanry which brought the following changes in Indian agricultural scenario:

1. Land made a private and personal property of individuals which could be sold and purchased easily by the holders at will. Now all the rights, interest, and privileges vested in the hands of distinct individual holders of land with whom the settlement engaged for land revenue payment.

2. It shifted the mode and basis of production in agriculture. It brought a capitalistic form of production in Indian agriculture which hastened the progress and growth of agriculture and cultivation in the long run.

3. Land now treated as a commodity of market which having proper exchange and transfer value.

4. It established a new social order which was determined by materialistic approach and perspective of economical basis started Compartmentalism[43] in Indian society.

5. It destroyed the whole basis of village economy carried out by the institution of village community of joint proprietary body. Therefore; it transformed the cooperative based society into the competitive based society.

6. It commercialized the agriculture of India which forced the Indian peasantry to grow commercial crops having greater market value instead of subsistence and traditional crops to feed themselves.

7. Confiscation and sale of lands due to non-payment, default, and big amount of land revenue arrears happened very often throughout the region of Mahalwari system.

8. Moneylender class of absentee landlordism and urban merchants like Seths, sahukars, and mahajans, got promoted. As it increased the agricultural and rural indebtedness of the cultivator class.

10. Starvation and poverty became widespread and known phenomena due to commercialization of agriculture and famines.

11. Rack-renting and usury of peasants in case of non- payment and default became a common practice in the whole mechanism of revenue collecting agents. It spread a wave of insecurity and fear among all the agricultural class of the region of the North Western Provinces.

[43] Marx described this Compartmentalism as the *'dissolution of Indian society'* into stereotyped and disconnected atoms. It became the source of discontinuity between the social base and the political superstructure. It changed the whole basis of agrarian relations and structure.

12. *Patta* or lease system based on open auction of landholding distribution was promoted at a greater extent. In most cases, the contract was given to the highest bidder.

13. Peasants were now a community targeted by both the government as well as the intermediary group of land revenue collecting agents.

14. The operation of new land revenue system i.e., *Mahalwari* settlement brought a new form of landlordism called Capitalist landlordism which developed a bourgeoisie sense of land ownership in India.

15. In the long run, the operation of new land revenue system 'depeasantised' the Indian agriculture and also raised the magnitude of 'tribute'.

Among the entire above outcome due to the creation of proprietary rights in land, the changes made in the mode and pattern of production was of primary importance. The company administration of land revenue management created pre-requisite for the capitalist development of agriculture when they introduced individual ownership in land, namely peasant ownership and big landlord ownership. And by this creation British ended the feudal economy and established the platform of capitalist economy. The operation of Mahalwari system brought a *'capitalistic mode of production'* [44]in agriculture where cultivation basis was to made profit by growing crops which have commercial and market value. Now, land became a commodity which could be sold and purchased easily in the market. Marx believed that 'property relation' is simply the judicial expression of the term 'production relation'. Thus the Mahalwari settlement of 1822 appeared well in theory and principle but failed practically at all front and did not worked properly. The settlement officers faced a lot of

[44] Marx in Das Capital, volume-1, explicitly described the two distinctive and important characteristic of capitalistic mode of production. He said that 'Capitalistic Production' is distinguished from the outset by two characteristic features. First, it produces its products as commodities; and Second, making of surplus values as the direct aim and determining motive of production here. Both the two criteria of capitalistic mode of production have been found in the cultivation pattern throughout the Mahalwari operated region.

practical difficulties in its modus-operandi which became the reason of settlement broke down.

The new form of property relations altered the pattern of cultivation where concentration of production was based on market concern and benefit. Destruction of the Village Community was one of the worst results of the operation of Mahalwari system. It led to the breakup of the Asiatic mode of production that was carried out by the institution of village community. It spread out a wave of fear, uncertainty and sense of insecurity among the agricultural communities because of no other alternative.

Karl Marx, greatest communist of the world, believed that by breaking the institution of village community British annihilated the old economical basis of the village economy in India. Sir Charles Metcalfe, who succeeded William Bentinck as Governor- General, has opinion that the institution of village community was the heart and soul of the then Indian village economy and so of land revenue administration. Marx highlights that the pace of destruction due to British rule was far greater in comparison to the regeneration process. In other sense, he points out that the development of India through the regenerative processes was nothing but a process to fulfil their target of exploitation and destruction. Marx asserts that the breaking up of the institution of village community broke the self –sufficiency of village economy and destroyed the whole inertia of village economical basis. He asserts that the introduction of railways and improved system of communication played a prominent role in the destruction of the village community. The situation of the villages worsened because of their peculiar features; viz., (i) the dissolution of the society into stereotype and (ii), disconnected atoms had survived their vitality. He pointed out that the village isolation produced the absence of roads in India, and the absence of roads perpetuated the village isolation. It affected the whole village as well as agrarian set- up of India and altered the inward- oriented peasant community into an outward- oriented community. Before the

consolidation of the British Empire, the village organization of northern India was in the form of local government controlled fully by a landed aristocracy.[45] In the villages, the lower castes managed their own social affairs by panchayat system, which was an important feature of the village community. However, the higher the institution of village community sustained, with some basic changes in its rigidity, and could be witnessed even in the thirties of the twentieth century. According to the Report on the Moral and Material Progress of India, 1930-31, 'throughout the greater part of the country the typical self- contained Indian village community, which has been maintained without any modification for centuries, still exists as an interesting and surprisingly intricate social organism'. The rigidity of village community swept away by the occurrence of a world-wide Great Depression in 1929-33. Further, the outbreak of the Second World War changed the whole set-up with the introduction of intensified commodity production which intensifies the existing money economy. After independence, Indian government tried to re-establish the institution of village cooperative societies with the establishment of three-tier Panchayati Raj system. The British government of East India Company replaced the community feeling by materialism and individualism which harmed the village societies at greater scale in the long run. They destroyed the self- sufficient village economy and turned India into a single economic unit with the introduction of capitalist forms of private property. This transformation was not progressive for their subjects but subjected to the economic requirements of British trading and industrial concerns.

These land settlement impeded the economic development of Indian society. Thus the impact of British land settlement proved more destructive than the regenerative. And the process of regeneration took place only on the cost of destruction in the form of maximum exploitation and exhaustion of India's agriculture resource and wealth. R.C. Dutt, the well-

[45] Nevill.H.R, Imperial Gazetteer of India, Provincial Series, Uttar Pradesh, Government Press, Vol -1, p. 101

known economic historian and President of Congress in 1899, argued that in the settlement and survey operations, the real position of the cultivator was lost sight of and rules were introduced to secure an increase of land revenue without an adequate consideration of the rights of the cultivator. The cultivator was subjected to revenue enhancement at each recurring settlement, "and has been reduced to a state of poverty and indebtedness which makes him an easy prey to famines in years of bad harvests."[46]

Commercialization of Indian Agriculture

The other important economic ramification of the operation of Mahalwari system was the introduction of commercialization in Indian agriculture (forced not progressive). As British historian claimed that they raised the productivity of peasants in Mahalwari region through the improvement of irrigation channels. David Ludden gave very account of irrigation development in the North Western Provinces. Their claim might be right but they provide irrigation facilities to those peasants who were ready to produce commercial crops. Therefore the only positive result of irrigation appeared in the name of commercialization of agriculture. Commercialization of agriculture could be defined as the technique of cultivation where peasants start producing primarily for sale in markets, rather than to meet their own needs and necessities of food. In broader sense, Commercialization was the transition process of pre-capitalist agriculture and cultivation into capitalist modes of production. In general, it was essentially a tool by which specialization was promoted in agriculture and raised its productivity, could be unavoidable in an industrializing nation but in British India it commenced as surprising element to support the British industries and protect the Britain's commercial and trading concerns at the cost of India's resource exploitation at optimum possibilities. It took place with two concerns viz., first, to grow more and more goods of

[46] Suri.K.C. 1987. *The Agrarian Question in India during the National Movement, 1885-1947.* Social Scientist, p 129-136

commercial value, and second, to realize land revenue demand in cash. It facilitated by both the demand and supply factors. The demand for raw materials as well as food was immensely stimulated by the commencement of Industrial Revolution in England. The purpose of cultivation and agricultural produce became market oriented. Now, the production and produce of the agricultural field were now determined by new objective of, that of sale which changed the character drastically. The rental demand of government strictly in cash forced peasantry to grow commercial crops. The other important reason for the enforcement of the agricultural commercialization was the occurrence of the industrial revolution in England. The British Colonial Empire forced peasants to grow commercial crops like cotton, indigo, and jute etc. to meet the necessities of English industries running in Birmingham and Manchester city. In order to promote commercial cropping and to make effective use of the investment made by the British in canal construction, they have ruined the natural irrigation system of villages that is well irrigation and farmers were reduced to canal irrigation.[47] Canal irrigation was not befitted to the central region of Province that is Oudh. Peasants have lost their entire *Kharif* owing to flood water as the canals interfered with the natural drainage.

The overwhelming majority of the population – the peasantry relied on the *Kharif* millets, principally *Jowar* and *Bajra* and the various pulses for staple food grains. Whereas the expansion of irrigated and irrigable areas through the introduction of canals resulted in the increase in production of these 'valuable' crops – principally cotton, indigo, sugarcane and wheat- mainly used for exportation in European Market. [48] The Commercialization of Indian agriculture refers to the process of crops production for market concern not for subsistence purpose. It describes the extension of trade and money relations in India's countryside. This process commenced by the ending year of 18th century but got pace only after the second half of the 19th century. It happened according to the will of imperial country not for the

[47] Guha Ramchandra, *Social Ecology*, general editor T.N.. Madan . 2008. Oxford university press. P. 137.
[48] Ibid P. 138.

welfare of the colonies ultimately brought poverty, Starvation and the situation of Famines in India more especially in Mahalwari region. The rising value of land and the expanding opportunities of trade for agricultural produce with the implementation of free-trade concept definitely proved a big cause for the happening of agricultural commercialization which attracted the investors outside agrarian society. There were various reasons for the transition of Indian agriculture towards commercialization like need for cash, activities of the new emerging class of commercial middlemen, Connectivity of village market with the world market, agrarian policies of the government, development of roads and railways etc.

The agricultural commercialization of India was not a normal process but a 'forced and artificial' one and that artificiality had much to do with the 'dependence' and 'subordination'. The notion of 'forced commercialization' have been traced out first by the R.C Dutt in his masterpiece work 'The Economic History of India', Volume-II; when he sorts out that how commercialization of agriculture adversely affected the 'Balance of India's trade. There were two important reasons which prompted the farmer to produce crops for market…., first, to realize maximum cash for the payment of the land revenue, second, to meet the debt claim of moneylender in whose hands they subsequently fell. The process of agricultural Commercialization lessens the production of food grains and that brought an obvious shortage of food grain items. This situation naturally increases the prices of food grains in items. The less availability of it has made it dearer for the peasantry and other low status agricultural population that directly affected the consumption capacity of them. The high prices of food grain items forced the peasantry to live with the starvation and poverty. It increased the mortgage and sale value of land which promoted land transfer in the region at greater extent. It resulted in the creation of middlemen and moneylender class who ruthlessly exploited the Indian peasants' yeomanry. The negative effects of agricultural commercialization were greater on Indian peasantry than the positive one. Therefore, the

commercialization of Indian agriculture in colonial rule was typically an involuntary process not welcomed happily by the peasants. In the long term, it broken the unity of village agriculture with handicrafts industries carried out by the village artisans. The process of agricultural commercialization fastens the cases of land transfers from cultivating class of peasants to non-cultivating class of moneylenders and urban merchants.[49] This process bowed the seed of inequality among the agricultural class and community.

Increment in the Magnitude of Tribute

The operation of Mahalwari system raised the magnitude of 'Tribute' too. The concentration of Tribute was the prime concern of British India conquest. The British rule in India raised the drain through two important sources of income and wealth….first, the collection of maximum possible land revenue in the name of surplus; and second, comes as profits made from duty free inland trade. The realization of maximum possible land revenue from agricultural class contributes a definite share in the magnitude of Tribute. The collection of the land revenue attained the level of extortion under the British Empire. It raised the magnitude of Tribute in the name of *Laissez-faire* policy of free-trade. The concept of mercantilism together with the imperialism of Free- trade fastens the transfer of tribute from India to England. It increased India's Export without any *quid pro quo*. India did not enjoy any benefit from these exports but brought too many negative results on their economy. The concentration of Tribute made India a playground of plunder and turned India into an 'agricultural farm of England'.[50] It prevents India from making any capital. By draining India continuously England made their capital and secures the monopoly of trade and industries that became the basis of India's further exploitation**.** The magnitude of Tribute increased because the area of assessed land had been far extended by 1830s in comparison to the end of

[49] Habib Irfan. 2008. *The Coming of 1857;* In Shireen Moosvi (ed.) *Facets of the Great Revolt 1857*, New Delhi, 2008, p. 6 -8

[50] Dutt.R. P. *India Today*, Manisha Granthalaya, Calcutta, 1949, p.123.

18th century. R. P Dutt estimated that the land revenue rose from 4.2 million pounds in 1800-1 to 15.3 million pounds in 1857 -58 mainly by the extension of the empire but also by increased assessment.[51] The implementation of Mahalwari system by 1822 raised the amount of land revenue and increased the assessed land as well. According to Dada Bhai Nauroji, the tribute or drain consists mainly of two elements….first, arising from the remittances by the European officials of their savings, and for their expenditure in England for their many wants both there and India; from pensions and salaries paid in England; and from government expenditure in England and India. And the second, that too, arising from similar remittances by non-official Europeans.[52] The Tribute was a process of 'continuous plunder' of India's raw materials, natural resources and wealth by the Colonial Empire to enrich itself at the cost of India's growing poverty. The flow of Tribute from India to England was an extreme form of injustice brought harsh and many-sided economic exploitation of India in every field. Immediate effect of this flow displayed in the form of poverty and famines. The commercialization of agriculture with the flow of tribute brought scarcity in the availability of food grains. The shortage of food grain items comes due to extension of commercial cultivation which naturally reduces its production. The less availability of food grains made it costly. Therefore a wave of starvation and poverty spread out in the region of North western provinces.

Female Infanticide

It was noticed that the operation of Mahalwari System in the North Western Provinces, the only region where the settlement was implemented at full scale before the revolt of 1857, increased the cases of 'Female Infanticide' on the same pattern as the introduction of Permanent *Zamindari* Settlement increased the cases of 'Sati-dah' in the

[51] Ibid. P. 226
[52] Nauroji. D. B. 1988. *Poverty and Un-British Rule in India*, First Published 1901 (London),Commonwealth Publishers, New Delhi, 1988, p. 34

Bengal Presidency. It was a worst social outcome of the operation of the Mahalwari settlement.

Female Infanticide was the practice of killing infant girls prevailed especially among the Rajput's tribes and clans. Simply it describes a sex selective abortion. The phenomenon of female infanticide is as old as many cultures and has likely accounted for millions of gender- selective deaths throughout history. Although the killing of female child declared illegal by Bengal Regulation XXI of 1795 and Regulation III of 1804 but the inhuman practice continued in the 20s and 30s of 18th century. W. Bentinck took vigorous steps to suppress this immoral and inhuman practice. There were various dubious methods used to destroy female child; some neglected to suckle the girl baby, others administered poisonous drugs (most often opium) through the nipple of the mother's breast and some threw the baby into the Karamnasa River. The killing practice of new born girl baby appeared as the victims to the pride and honour concern of their parents in Rajput's families.162 Rajput's claimed themselves as the warrior and protector class of Hindu society. They believed that the born of girl baby degraded their status, power and prestige in the society. According to Charles Raikes (collector of Mainpuri during the course of the Revolt of1857) about the prevalence of Female infanticide, 'no man is more impatient of female disgrace than your Rajput's or Brahmans, but no man is more incredulous of female fidelity. The killing of infant girls was a world- wide phenomenon of then society at variation. But in Mahalwari region it was in cursive situation. [53] Further, he mentioned about the sufferings and miseries of the women in North Western Provinces and then he quotes, 'to the fair other hands the fate of the Rajpotnee must appear one of appalling hardship. In each stage of life death is ready to claim her…by the poppy at its dawn, by the flames in riper years; while the safety of the internal depending on the uncertainty of war, at no period is her existence worth a twelve months purchase. The

[53] Raikes, Charles.1957. *Notes on the North Western Provinces of India,* London, p. 2; Raikes was the collector of Mainpuri during the course of the Revolt of 1857. 161

loss of a battle or the capture of a city was a signal to avoid captivity and its horrors, which to the Rajpotnee are worse than death'. He pointed out three basic reasons of the prevalence of female infanticide in India more particularly in the North Western Provinces which were the following:

1. In the Hindu society daughters did not given proper rights and shares in the ancestral property. There were no proper patterns of wealth distribution for the daughters even today.

2. Second important reason of female infanticide comes to the fore through the marriages of Hindu society. Marriages in Indian Hindu society especially in twice- born caste always be an expensive deal and tied with the taboos of Gotras. The peasantry of first half of the 19th century was not capable to bore the heavy expenses of marriage ceremony at own. Intermarry in one's own subdivision is impossible and marriages with the men of inferior rank brought disgrace to her family. The position of a father-in-law in Hindu society was always supposed to inferior against son-in law according to customs and tradition. Therefore, they committed that inhuman practice for their own pride and honour concerns.

3. The third reason of the crime was related to the honour, pride and prestige of the family in the society. There is a perception in the Rajput's society that the births of female child weaken their status and brought mourns to the family. But there were some other reasons too for the happening of those ill practices. Some of them were the following:-

1. Most important reason for the appearances of female infanticide cases seems to be the realization of maximum land revenue from the peasants. The administration of East India Company always increased the effective amount of land revenue at every new revision in all temporarily settled areas. It increased the amount of land revenue arrears and agricultural indebtedness naturally burdened the peasantry.

2. The other reason appeared to be famines which were the worst result of the operation of new land revenue system. The situation of famines in Mahalwari region was appeared due to agrarian depression caused the scarcity of food grains and starvation in the region. The crisis of food grains happened mainly because of commercialization in agriculture.

From the beginning of 11th century to the end of 17th century, there were fourteen famines. The frequency of famine showed a disconcerting increase in the 19th century. In a period of about 90 years, from 1765 when British East India Company took over the Diwani of Bengal to 1858, the country experienced twelve famines and four "Severe Scarcities". After a long study it has been concluded that the nature of famine in latter half of 19th century had changed from a shortage of food supply, as in the past, to lack of purchasing power with those who suffered starvation. Thus instead of absolute lack of food in one region famine under the new conditions assumed the form of a sharp rise in prices. Even as early as 1861 Baird Smith noted the feverish speculative activity in grain trade that was going on during the famine in North Western Provinces as also the strange phenomenon that "prices had risen, on account of active export trade , to the famine levels even in districts having most bountiful crops." [54]

3. Strictness in the distribution of *Taqqavi* and *Ujuhat* (or *wajuhat*) loans also contributed greatly in the cause of female infanticide cases. Taqqavi and Ujuhat given to peasants as help in the cultivation for the repairing of wells, tanks and canal's embankments. In Mughal India, peasants used these loans often in marriage and birth ceremonies without any fear. But the flexibility of these loans distribution had been tightening even ended by the Company administration of British Empire. Now, peasants face a number of problems to got

[54] Bhatia, B. M,. 1967. *Famines in India: A study in some aspects of the economic history of India (1860-1965).* Asia Publishing House. P. 9.

sanction of those loans. Obviously, peasants worried about their family's livelihood ultimately preferred to have small family and ultimately starting sacrifices of girl baby against boy because of the fear of expensive marriages.[55] Raikes observed that every magistrate of the British administration had tried hard to stop the incidents of female infanticide at regular intervals. Much attention about the incidents had been given only after the availability of statistical inquiry which provides the disproportion rate of male and female infants. The session courts started trial against the committal parents. It was Jonathan Duncan, a British resident at Benares, noticed about this incidents but he did not take any preventive measures against the crime. But the real effort had been made by the R. Montgomery, then the magistrate of Allahabad, when he, in an article published in Calcutta Review, 1841, no. 2, earnestly suggested to officers to work hard to put down the cases of female infant killing. He appointed *chaukidars*, midwives and *Chuprasis* in the villages and Parganas to give information about the birth of every new female baby. He also assigned duty to every *thanas* (police posts) to report about each and every new birth of girl baby. Tehsildars were instructed to provide all assistance to the *thanadars* in getting that information. He also declared reward for the officers who stopped these horrible practices. He got great success but the situation demands more work to stop these crimes completely. Mr. Unwin, collector of Mainpuri, also made great attempt to stop these incidents. The cases of female infanticide came to an end after 1930s. However, this crime resumed the character of female foeticide in independent India.

As the Mahalwari system possessed the combined features of Zamindari and Ryotwari both then the agrarian consequences of it should be the mix outcome of both. The British started this system as the middle path between the Zamindari and Ryotwari and tagged that system as an ideal one for the peasants. They tried to make happy to the larger

[55] Raikes, Charles Raikes.1957. *Notes on the North Western Provinces of India*, London, pp. 16; Raikes was the collector of Mainpuri during the course of the Revolt of 1857. P.161

section of agricultural community by the introduction of that new system. The British implemented the Mahalwari system at those places which came to the British paramount only after the expeditions in 1830s and 1840s. The agrarian consequences of new land settlement were almost the same on India's socio- economic structure what the Zamindari and Ryotwari possesses in combined. [56]

Many of the evils besetting Oudh and the consequent disruption of local agrarian life during the first half of the 19th century arose as a result of British presence (and interference) in the administrative, military and economic spheres of the kingdom though this might not be only explanation for the distress and miseries to which the peasants in Oudh kingdom were subjected to.[57] The administrative machinery of the Oudh Kingdom was so thoroughly controlled by the British officials as to leave little discretion with its rulers. To quote colonel Southland: *"There is no state in India with whose government we have interfered so systematically and as uselessly as with that of Oudh… This interference has been more in favouring of men that in favour of measures".*[58]

The British Government in India launched all sorts of baseless propaganda against the Nawab of Oudh for many years with a view to grab the territory of Nawab, which they finally and formally did in 1856. Here is the testimony of Bishop Heber, who toured the country in 1823-24 - *"I was pleased, however and surprised, after all which I have heard of Oudh, to find the country so completely under the plough, since were the oppression as great as it sometimes stated, I cannot think we should witness so considerable a population and so much an industry."*

[56] http://shodhganga.inflibnet.ac.in:8080/jspui/bitstream/10603/13529/14/14_abstract.pdf
[57] Jafri, Saiyid Zaheer Husain. 1998, *Studies in the Anatomy of a Transformation Awadh –From Mughal to Colonial Rule*,.Gyan Publishing House, pp-61-70
[58] Lawrence. Henry. 1845. *The kingdom of Oudh*, Calcutta Review, III ,p . 414-15

After the British took over Oudh , what happened to *"one of the most fertile, and , one of the most flourishing provinces in all India"* is stated by A.J.Wilson: *" just before the mutiny (1857) it became ours , and in little more than twenty years we have reduced it to such a state of poverty that its inhabitants are all in the grasp of the usurer , ("a harpy largely of our breeding") its estates encumbered, and its land owners so hopelessly ruined…"* That is how British have brought destruction to the rich economic affairs of the Province. Economic policy was based on the need to generate wealth in ways that did little to disrupt the social and political order, but instead use the state to source and secure tribute rather than development.[59]

A report from British Commissions upon the North West Provinces, 1808, is cited below: "In passing through the Rampore territory, we could not fail to state the high state of cultivation to which it has attained … If the comparison for the same territory be made between the management of the Rohilla and that of our own Government, it is painful to think that the balance of advantage was clearly in favour of the former."

There was a committee appointed by the council of the provincial congress committee, dated July 28, 1931 in order to give report on the agrarian situation of the United Provinces. This council has appointed committee of Messrs' Govind Ballabh Pant, Rafi Ahmad Kidwai and Venkatesh Narain Tiwari with Mr. Mohanlal Gautam as Secretary to prepare a report on the Agrarian situation in the province. [60]

In explaining the chronic poverty of United Provinces peasants committee stated that "The Indian cultivator is notoriously poor". This fact is admitted in the official publication, 'India' every year. In the latest volume for 1929-30, published this year it is said that "the

[59] McGinn Patrick. *Capital, 'Development' and Canal Irrigation in Colonial India.* p 1- 12
[60] Pant. G B. 1931. *Agrarian Distress in the united provinces.* Being the report of the committee appointed by the council of the U.P. Provincial Congress Committee to enquire into the Agrarian Situation in the province, Published by Sri Prakash, General Secretary United Provinces, and Provincial congress committee. P 1-16

most characteristic feature of the rural classes of India is, of course their poverty. While this is true of the whole of India, the condition of the United Provinces is relatively worse. The census returns indicate that the people here have the lowest vitality. Both in 1911 as well as in 1921 these provinces showed a marked decline in population; although there was a definite increase in the whole of India as well as in other provinces and states as compared with the previous census. The bulk of the population somehow manage to extract a meagre subsistence out of land, as agriculture is practically the sole industry. The density of population is very high. The pressure on land is ever increasing. There is no room for extension of cultivation except in very unhealthy tracts. Large numbers have only uneconomic holdings; the size of the average holding is continuously going down, and owing to the destruction of indigenous arts and crafts and the dumping of cheap articles from abroad, agriculturists are continuously losing their subsidiary vocations and there is an incessant flux of people from industries to agriculture. The indebtedness of the agricultural classes is another serious handicap. Most of the people somehow manage to exist and very few are possessed of any resources on which they could draw in times of stress. As a rule the agricultural classes are dreadfully poor, deeply in debt, and illiterate.

Agriculture is precarious industry, and in these provinces the fate of the agriculturists depends, every year, on the monsoon which is very often erratic and capricious. In addition several unforeseen causes such as drought, hail, frost, locusts, may balk him of the fruits of his hard labour. The out turn of crops is usually below the normal. And nature has been particularly cruel to the agriculturists in these provinces for the last several years in succession. The memorable floods of October 1924 affected 29 out of 48 districts, completely destroyed the *Kharif* crops over thousands of acres, washed away hundreds of homesteads and did considerable damage to cattle. Again in 1925, floods caused severe losses in several districts and hailstorms damaged crops over a large area. The rains in 1925 ceased early and

the following early winter rains were short. There was abnormal rainfall in February 1927 accompanied by wind and hail in certain places. Rainfall in august and September was very scanty and serious damage was done to the crops all over the province. The year 1928 was particularly bad. In fact famine works had to be started in certain districts. The year was marked by serious calamities; the Kharif crop suffered seriously from drought and the Rabi from frost. There were visitations of locusts all over the province and hailstorms and floods as well in some parts. The years that followed were equally unfortunate. The situation was quite grave and gave serious cause for anxiety. The last Kharif and Rabi were similarly disturbed and the out turn was equally poor. From the statement published in the united provinces gazette dated May 16 last a copy of which was annexed it is evident that the rabi out turn in some districts was as scanty as 7 or 8 annas in the rupee, and in one district only 5 or 6 annas, and generally between 9 and 12, and out stripped this limit only in a few cases. The magnitude of the mischief resulting from local calamities can be gauged by the remissions and the suspensions earned by the afflicted areas under the revenue code. In 1928-29, government remitted about sixty lakhs in land revenue and suspended twenty lakhs. In 1929-30 there was a remission of 33 lakhs and suspension of 24 lakhs. In 1930- 31 there were similar remissions and suspensions amounting to 31 lakhs. As the rules relating to remissions and suspensions are very stringent and can come into effect only when there is acute distress and the position cannot be retrieved otherwise, there can be little doubt that the condition of agriculturists in the affected parts bordered on complete helplessness during these years. [61]

Financial status of a peasant with the passage of time was deteriorating. As a matter of fact, in many places, the prices that the cultivator could get for his produce at harvest time were appreciably less. The following figures of prices per maund in rupees bring out the gravity of the agrarian situation:

[61] Pant, G.B. 1931. *Agrarian Distress in the United Provinces*. P. 1-7

(Rupees per maund)

Year	wheat	Barley	Gram	Rice
1873	2.41	1.9	1.39	3.12
1914-15	5.00	3.0	3.3	5.7
1916-20	5.39	4.0	4.56	6.24
1931	2.3	1.5	2.1	4.25

The above figures show that the peasant was at the verge of destruction. This unparalleled slump, as was but inevitable, completely shattered him. Another figure of the commercial crops further explains the economy of peasants. The prices in the case of sugar cane and cotton commodities must have been much higher than the present rates. Comparing the figures after ten years the value of sugar cane and cotton was reduced just half in case of sugarcane and more than half in case of cotton, shows the deplorable condition of the cultivator.

Year	Sugar-Cane	Cotton
1916-20	8.82	36.64
1931	4.5	12.0

As it is very clear from above detailing that the British main motive was to introduce reform in the land revenue system so as to increase the land revenue income of the state. No doubt this was a Basically the British were not very well aware of this system that's why they experimented several land revenue settlements in different provinces but it always contained some or the other flaws in it and ultimately the sufferer was the peasant.

Besides introducing new settlement of revenue collection, British also made efforts to tap the natural resources of the state like Forest and Water. ***"Water"*** is one such natural resource easily available and can be tapped. Main purpose of water is not only for domestication work but it can be used economically. That is it can be used as a commodity, which British did in India. They have used water to increase land revenue of the state by renovating the old canals and at some places they have constructed some new canals also. British effort was to provide irrigation facilities to the farmers so that they should not suffer at the time of drought or rain failure. But how far they were successful in this attempt will be discussed next chapter. The basis of the irrigation administration of India is cooperation between Government and Cultivator. Up to a certain point government retains control; beyond that point matters are left to the users of the water. The headwork's of the canal, the main line and branches , the distributaries and minor distributaries are all constructed and maintained by government , but the field channels or watercourses by means of which the water is finally conveyed on to the fields are usually constructed and invariably maintained by the cultivators themselves. Water is emitted from the Government canals through outlets built in their banks, and it is in general at these outlets that the responsibility of Government ends and that of the cultivator begins.[62] This distribution of responsibility was one of the important reasons for the peasant's sufferings because in case of canals it was the farmers of the tail end region were not getting sufficient amount of water whereas water was available in plenty in Head end area. This mismanagement created chaos among the cultivators. The responsibility for the distribution of water is similarly shared between government and the irrigators, the former distributing the water as far as the outlets, and the latter doing the final distribution from the water courses to the various fields. In cases in which a watercourse is shared between two or more cultivators and they are unable to agree as to an equitable

[62] Harris, D.G. 1923. Irrigation in India. p 90-120. Oxford University Press

distribution of the water between them, a right of appeal lies to the irrigation officer who can then step in and enforce suitable arrangements for the sharing of the supply. [63] The canal water is distributed through the branches and distributaries constructed and maintained by the government. The cultivators take water from these through outlets or kulabas to their own channels or guls. These latter are reported to be in a very unsatisfactory state. They are inadequate in number and even those that exist are not properly maintained. They are not cleaned regularly and consequently silt is deposited and free flow of water throughout the channel is prevented. At times, the mouth of an outlet is found silted and the flow of water is completely stopped. In fact these channels constitute the most important link between the government channels and the cultivator's fields and should therefore receive great care both at the hands of the government and cultivators. [64]

Tapping of natural resources –Water

Water is an ancient resource not in terms of chronology but its use and related customary rights. Customary Rights over water were enjoyed by user communities for centuries and have evolved over a long period of time. This is not to glorify the irrigation institutions that existed in the past. Indeed, the kind of irrigation institutions that were controlled by kings or local chieftains was nothing but hydraulic despotism and reflected very much the local power structure and production relations at any given point of time. Nevertheless, there existed some organized and codified rules and regulations, customs, roles and mores, legislations, notifications etc., which not only defined access over water for a community, but also subsumed all critical functions of water management. And, given the local power structure unequal access to means of production, these institutions performed well in protecting the water rights of 'user communities'. These informal rules and regulations, which evolved over

[63] Ibid. p 12-13
[64] Singh Balajit & Misra Shridhar. 1965. Benefit- Cost Analysis of The Sarda Canal System . Asia Publishing House p. 1-7

a long period of time, reflected the socio-economic and political structure of society at any given point of time. They were also influenced by factors such as geo-physical and climatic conditions, socio-economic and political conditions and level of technological development at a given time. In India the emergence of colonialism and formation of welfare state have altered the power relations and have contributed to disintegration of these rights over natural resources, in particular water. Urbanization triggered by post-independence industrialization, gave the state rights to extend cities and towns, and extend irrigation systems to bring more area under their command. The state has virtually taken away the existing rights of the people. Water law in India has been closely associated with land. The policies of the colonial period speak volumes about such nexus. Since 80% of the farmers do not own land, the same percentage is denied right to water. Further, more development projects such as dam construction and rehabilitation and resettlement plans of the governments from time to time have taken away the customary/user rights to water, which the inhabitants of the particular area were enjoying since ages. Consequently, marginalized people, whose rights have been appropriated, are defenceless and cannot seek justice in a court of law as there is no legal framework which talks about customary rights of water and community control of water resources in India. The issue of development and the duty of the state to distribute equitable water control over resources speak of how the customary rights were pushed away by state institutions.

Talking in context of tapping of natural resource that is water is not the case sof only colonial period. Our ancients have also does the same, but it was up to certain limit. Colonialists have crossed boundaries in exploiting this natural resource. Coming chapters will define that how Water was exploited by the locals and their rulers by taking utmost care of the topography of that place. Whereas British exploited the resources, no doubt it was fruitful in some places, but at some places it was not very much helpful to the peasants. For example

Sarda Canal of Oudh region was initially not a great success but in contemporary period it is running much better than before.

Customary Rights of the User Communities

Human settlements at the dawn of the civilization were close to the river because irrigation technology was not developed in those times. However, water use for agriculture has run parallel with the formation of village societies. These rights, which were not given to its users but acquired over a long period of use. Water rights can be understood in the context of riparian rights i.e. rights gained or acquired/gathered over time and rights gained due to access to resources. "Urban industrialists controlling water resources in the rural areas by sinking deep tube wells (much deeper than the existing ones in a village) are a classic case in support of rights gained due to control over resources. Customary rights are well recognized in the International law, Hindu law, and later by the English laws in India. As stated, due to geo- climatic diversity, customary laws varied from state to state. These laws had common element of community recognition of rights and informal arrangement for the settlement of disputes relating to rights. The prevalent practice of informal dispute settlement at the local level in some of the rural areas of the north eastern states is the result of the customary practices. These customary laws also had other advantages. They were compatible with the needs of the people. The rule of sovereignty over the water resources was not so rigid as far as its utility to the user community was concerned. If compared with the statutory rights conferred by the various state governments in respect to water allocation and distribution, customary laws were dynamic and broader in approach than the statutory rights ("Customary law has been dynamic more in tune with the needs of the people than dogmatic about certain fixed notions of territorially or ownership right.... Limitless to space and quality, they are broader in approach than the legal systems"). Customary, traditional, and indigenous rights

over water in India provided for groundwater management and water harvesting systems. The customary rights also defined self-created institutions and rules which helped the traditional system of groundwater harvesting and management work successfully over centuries. The evolved customary set up also provided a mechanism for conflict resolution for groundwater disputes at the local level. Since the country is rich in natural diversity (and cultural as well), the customary rights were geographical zone specific, and depended on the traditional inhabitants of the area (These rights were common in most states in terms of the sanction that they provided to the local inhabitants of the area to access, control and manage community resources). The important areas where customary water rights were set up, had been adversely affected due to government control over water resources including hilly areas, Gangetic plains and other river basin, semi-arid zone of the Deccan plateau, coastal areas, arid areas like Rajasthan and Gujarat, wetlands, flood prone areas. It is interesting to learn that the British government made efforts to codify customary laws relating to water.[65]

[65] Siddiqui, Mohammad Siddiqui. *Water policies and legal framework in India* p 73-112

Chapter - 3

Dynamics of Indigenous Irrigation Techniques

The importance of water to human, animal and vegetal life can hardly be overemphasized. Yet its significance in human evolution and history was not always recognised. The relations between water supply and human settlement through the ages have not by any means been simple; on the contrary, they have been essentially reciprocal subject to perpetual readjustment. If on the one hand settlement may be restricted by shortage, on the other human requirements may lead to an increase in the supply of water made available. Nature imposes certain limits, but within these there is scope for a wide range of adjustments.[66] Adjustment is necessary because there is limited quantity of water is available. Water management in a well organised manner becomes important. Indigenous irrigation techniques are local techniques that are they are meant according to the topography of the particular place. People adapt those techniques according to the field, climate, soil etc. Since ancient till modern times several irrigation systems are evolved according to the need of the environment, sometimes defined as indigenous irrigation technique.

Indigenous Irrigation techniques in India

From time immemorial efforts are made to enhance the security of people by every means and one of the major among securities for the people is the agricultural development in the society either by introducing new irrigation techniques or by adding more land under cultivation. India is a vast country with unique geography. It is the topography of that place

[66] Mate. K.S. 1998. *A History of Water Management and Hydraulic Technology in India (1500 B.C. to 1800 A.D.).* p. 1- 9. B.R. Publishing Corporations.

which defines the irrigation system to be adapted for applying to the place, which can be defined as ***"indigenous irrigation"***. Investments made hundreds of years ago can be almost as good as new, if properly maintained. It is an indigenous tradition of irrigated agriculture that contains the technical and managerial expertise to keep the physical infrastructure functioning and the crops growing. More to the point, indigenous systems of irrigated agriculture represent sustainable solutions to the demands of intensive crop production. These systems as a group represent successful adaptations to local environments. They have proven themselves over the course of centuries to be environmentally sustainable, productively viable, and (not least) politically manageable. But today the sustainability of indigenous irrigation systems is being severely threatened, not by natural forces, but by the outside government sponsored intervention known glibly as agricultural development. The same indigenous irrigation systems that are so nicely adapted to the local environment have become a favourite target of development planners. The fact that indigenous, traditional systems are using technology that has worked fine for centuries is seen from a development perspective as the use. Of technology that is centuries out of date. Earthen channels will convey water, but not as efficiently as concrete. Mud can be used to block the water flow into one channel and divert it into another channel, but steel gates, preferably with built-in flow meters, are a more modern solution. Indigenous knowledge, however, is not only social software; it includes engineering knowledge that often only other engineers can appreciate, and understandings of crop-water-soil-pest relationships that only agronomists can fully appreciate. There are many potential categories of knowledge that pertain to indigenous irrigation. Engineering features of indigenous system such as river diversion weirs, intake canals, structures to control the flow within the canal, tunnels through high ground, elevated channels, and division structures to divide the flow in fixed proportions are evidence of sophisticated technical knowledge. Less obvious but equally challenging engineering features

include the degree of slope, the alignment and layout of canals, and the precise designs of structures which may appear ad hoc but contain particular design principles (e.g., the angle, depth, and construction materials used in a river diversion weir). [67]

The knowledge reflected in the physical features of indigenous irrigation systems and in their management software is the product of a centuries-long learning process by which the irrigated farmers have come to terms with their environment. We cannot say that indigenous irrigated agriculture is necessarily sustainable into the indefinite future; each case has to be judged on its own merits. But we can learn a great deal about the elements of sustainable production systems by looking at the indigenous irrigation sector as a knowledge resource. Unfortunately, indigenous irrigation systems are not easily transposed into terms that are immediately transferable to the design of new systems.

Irrigation in Ancient India

An attempt has been made to define this indigenous irrigation technique in ancient and medieval times in India. Ancient Indian literature and history refer to different irrigation techniques as wells, tanks and canal and the importance given to their construction by the rulers for the welfare of the people. The first source to be taken into account is obviously archaeological. Major civic centres of the Harappans were located on the banks of rivers that supplied a major share of their water requirements. They also used wells and tanks. As a corollary drains utilising well baked bricks and bitumen as a water- proofing agent were laid through the cities. This carefully laid and executed drainage system indicates that the

[67] Groenfeldt, David J. 2004. *Building on Tradition: Indigenous Irrigation and Sustainable Development in Asia*. Water, Cultural Diversity and International Solidarity, Symposium Proceedings edited by Corinne Wacker. P. 10-19

Harappans were not only hygiene conscious but were also consuming huge quantities of water. This made the use of wells as an additional source necessary.[68]

The ruins of Indus valley civilizations in Harappa, Mohenjo-Daro (of the Sindh province of Pakistan), Lothal (Gujarat), Inamgaon (Maharashtra) and other places in the northern and western India, provide evidence on irrigation practices in the form of *bundhs* (small dams) and canals. By about 3000 B.C. the Mohenjo-Daro civilization of the Indus valley , spanning part of present day Pakistan and India, had developed a variety of tanks and canals for irrigation. These works were destroyed by the invaders from central Asia sometime around 2000 B.C. while the fall of the Mesopotamia civilization has been due to mismanagement of irrigation systems, the ancient Indus Valley civilizations fell due to the wanton destruction by the invaders.

From the Arthasastra of kautilya, the advisor of the legendary Gupta ruler Chandra Gupta we get a vivid description of the administration, people and laws in ancient India. Irrigation systems were mostly state owned, though private irrigation facilities were also in existence. Farmers were required to pay tax for utilising the irrigation system. The amount of tax depended upon to extent of area irrigated and amount of crop produced. A quotation from Pali works and epics refers to the prosperous irrigated agriculture which prevailed in the kingdom of Meghatha (Bihar) in 550 B.C.:

"The Khettas of Magadha (the land of Buddha) were intersected by network of canals and ridges …watering projects were undertaken by specialists who conducted the water as they pleased".

[68] Op.cit

The importance given to efficient water management in ancient India is seen from the following writings of Megasthenes, the Greek ambassador in the court of Emperor Chandragupta in about 300 B.C.:

"The whole country was under irrigation and very prosperous because of two crops grown in a year with irrigation facilities …The district officers measure the land and inspect the sluices by which water is distributed into the branch canals (water courses) so that everyone may get his fair share of the benefit."

There are several evidences in the form of inscriptions found in the literature mentioning the well managed and constructed irrigation system in ancient India. For example Edicts of emperor Ashoka contain the earliest references to administrative action to provide water to the population. Inscriptions in the Buddhist caves record donations for '*Podhis'* or cisterns while a Nasik cave inscription mentions '*Odayantrikas'*- water or hydraulic engineers, mechanics. The Inscriptions from Porumamilla in Andhra Pradesh and Kankroli in Rajasthan give detail descriptions of the process and the technique of building dams.[69]

Only the ruins of most of the ancient irrigation works are found now. The most famous one still functioning is the Grand Anicut on the Kaveri at the head of its delta in Tamil Nadu. A Stone masonry weir (Anicut) was originally built in A.D. 46 by the ancient Tamil King Karikala Chola. The diversion weir was subsequently enlarged in A.D. 1880. With the massive irrigation distribution system from the head works, an area of 400,000 ha is being irrigated for centuries. [70]

There are several examples to be learnt from the experience of irrigation works of the ancient times. Irrigated agriculture which flourished in Mesopotamia in Iraq is almost extinct,

[69] Mate. K.S. 1998. *A History of Water Management and Hydraulic Technology in India (1500 B.C. to 1800 A.D)*. B.R. Publishing Corporations. p. 11-20

[70] Michael, A.M. 1978. *Irrigation Theory and Practise* .Vikas publishing house . p.19

but for the new works introduced by the government in the 20th century. The loss of the once fertile lands may be attributed to faulty irrigation methods and inadequate drainage. Different irrigation system needs different techniques of construction, a proper study is needed for all around of the place. None of the system is without flaws. Taking it into consideration, engineers should work accordingly so that it should not lay any future long term problems to the surrounding particularly to the land and the peasants. There are also many other regions of the world which experienced a decline in productivity in irrigated agriculture. This has given rise to considerable debate on the long term effect of irrigation, unless adequate protective measures are provided. The lessons of the past point to the need for a strong government to ensure integrated planning of irrigation systems and control of irrigation water to prevent waterlogging and salt accumulation. The fact that good crop yields have been maintained under irrigation for a period of more than 4000 years in Egypt and china and about 2000 years in the Kaveri delta in South India, support the view that irrigation can be permanent and productive, provided the system is planned and operated efficiently. Major countries including India, China, Egypt, Indonesia and Pakistan depend on irrigated agriculture for more than half of their domestic food production.

There are several examples of indigenous irrigation system in India. Artificial reservoirs or tanks, usually constructed in the Central region of the country and in Rajasthan area, were built for irrigation purposes, often through damming smaller streams. One may also note here a series of tanks excavated at the site of Sringaverapura, near Allahabad (of 1st century BC). This remarkable example of hydraulic engineering entailed a tank described as "*…the longest of its kind discovered so far- more than 250m long*". The Sringaverapura tank complex obtained water from the nearby river Ganga during the monsoon season. As a result, excess water used to spill over from the Ganga into an adjoining stream (nullah). From this stream, an 11m wide and 5m deep canal carried the water further into the Sringaverapura

tanks. The water first entered a settling chamber to enable silt and debris to settle so as to get the clean water which is used for ritual bathing and prayers. And excess water was returned to the tank. A series of wells in the bed of the tank allowed access to groundwater even during the hot summer months.

Besides canals and tanks, artificial ponds and lakes were created too during ancient times by stopping the outlets of streams and rivers. One of the earliest artificial lakes known from ancient India is the '*Sudarsan Lake'* (3rd century BC) in Gujarat's Girnar area. This was first excavated by an officer, Pusyagpta during the reign of Emperor Chandragupta Maurya. Supplementary channels were later added by 'Yavanraja Tushaspha during the reign of emperor Ashoka. Nearly four centuries later the lake was repaired by the Saka King, Mahakshatrapa Rudradaman of Ujjain (recorded in Junagarh or Girnar inscription of 150 AD). The lake continued to exist over the ensuing period, as is attested by an inscription of AD 455, dating to the reign of Emperor Skanda Gupta of Gupta Empire. This records that when the embankment dam at Girnar broke, it was rebuilt in 455 AD by the local city Governor, Chakrapalit, son of Skanda Gupta's provincial governor, Parnadatta. Much later, the great embankment, over 100 feet thick at its base, holding back the waters of the lake at Girnar finally gave way sometime in the 9th century AD. It was never again repaired. From such water bodies, water was lifted by counterpoised 'sweeps', or other devices, and fed into smaller channels. These in turn, carried the water into fields. Such methods have been used in Indian agriculture up to contemporary times. Another largest known artificial lake of India was created in the middle of the 11th century. Numerous other examples of artificially fabricated lakes are known it has been estimated that, over time, there have existed nearly 1.3 million human-made lakes and ponds across India. Among such lakes, those known is from the State of Rajasthan is the Ana Sagar Lake(Ajmer), the Ghadsisar reservoir-lake built at Jaisalmer in 1367 AD by Bhati ruler, Rawal Ghadsi; and various lakes at Udaipur city.

Another artificial lake is the Raj Samand Lake, built at the command of Maharana Raj Singh of Mewar (1676 AD). It is created by damming the waters of a small rivulet, and augmented by excavation of a large tract in which rain-water could be collected.

The tradition of water conservation is as ancient as Indian civilization. This is witnessed by the innumerable extant structures of pre-colonial period in different parts of the country. Undoubtedly, the role of geography and ecology plays a prominent role in adaptation of the Irrigation techniques. The civil engineers appear s to have thought of developing a kind of structure which would utilise both underground as well as rain water. The *step wells* seem to have been the fruit of this thought. The hydraulic engineers designed these structures in such a way that they could protect stored water from all kinds of impurities. Therefore they made narrow stairs going deep down in order to expose as little surface area as possible to the sun and to provide large areas of shade in the various storeys and galleries of the step wells. Countless step wells are found all over Mewar. All these structures always remained full of water because of the high water table caused by the existence of large lakes and tanks in the vicinity such as Rang Sagar, Pichhola and Fateh Sagar. [71]

One of the finest examples of Kashmir which reflects India's rich, technologically excellent and varied hydraulic tradition which is mentioned in Kalhan's 12th century text, the 'Rajatarangini' of Kashmir, describes a well-conceived and maintained irrigation system through various canals, irrigation channels, embankments, aqueducts, circular dykes, barrages, wells and waterwheels, it also details numerous hydraulic works executed during the reign of various different rulers of Kashmir. These include a vast embankment, known as the *'Guddasetu'*, built by king Damodar II and the construction of series of *Arghat* or

[71] Bhadani ,B.L. Water Harvesting, Conservation and Irrigation in Mewar (AD 800- 1700) Manohar , 2012 . p. 120-122

waterwheels, by the 8th century AD king Lalitaditya Muktapida of the Karkota dynasty. These waterwheels were constructed in order to lift the waters of the river Vitasta (Jhelum), and channelize their distribution to villages near Chakradhara (now called Tsakdhar). One of the most notable names of an irrigation engineer that is recorded in the 'Rajatarangini' is that of Suyya. He is credited with ‘draining the water of the Vitasta river and controlling it by constructing a stone dam, and clearing its bed'. Suyya also 'displaced the confluence of the rivers Sindhu and Vitasta', and constructed stone embankments for seven yojans along the Vitasta in order to dam the vast Mahapadma lake (now famous as the Wular lake). In fact, Suyya is credited with having made, *"...the streams of Indus and Jhelum flow according to his will, like a snake-charmer his snakes*". The system of irrigation established by Suyya was designed in such a way that everyone was supplied with a fair share of water.

Other parts of India, similarly, developed traditional mechanisms for collecting and accessing water over the ages. The southern part of India, under the Chola, Pandya, Pallava, Chera, Vakataka, Kakatiya, etc. dynasties, developed a vast network of tanks and canals, famed the world over, that served to irrigate crops and enhance agrarian production. Irrigation tanks were built by developing large natural depressions. Pallava dynasty expanded the irrigation system in 7th century AD. The famous Cauvery Anicut was built during this period. Large scale construction of Tanks for tapping rain water was also done in Tamil Nadu. The Chola dynasty (985- 1205 AD) witnessed the introduction of quite advanced irrigation system, which brought prosperity in Deccan region. This included not only Anicut across rivers and streams but also chain-tanks i.e. a number of tanks with connecting channels. This new system was more reliable in terms of water availability and provided better flexibility in water distribution. Anantraj Sagar tank was built with a 1.37 km long earthen dam across the Maldevi River. The well-known Korangal dam was built under King Krishnadevraya.

One of the oldest water harvesting system is found about 130 km from Pune, a long a place known as Naneghat, Situated in the Western Ghats. A large number of tanks were cut in the rocks to provide drinking water to tradesmen who used to travel along this ancient trade route. Each fort in the area had its own water harvesting and storage systems in the form of rock cut cisterns, ponds, tanks and wells that can be seen in use even today.

Though the large number of reservoirs and tanks built in different times by the Kings, village communities and individuals were mainly for irrigation, these also provided water for the cattle and domestic use either directly or indirectly through charging of wells. In fact, wells were invariably built close to the tanks, lakes, canals etc. In the arid and semi-arid areas of northwest India, rain water was collected in underground storage tanks called *Tanka*, *Kunds* or *Kundis*. For example in ancient times houses in the western part of Rajasthan were constructed in such a way that each had a roof top water harvesting system. Though scanty, rain water from these roof tops was directed into underground tanks – this system can be seen in use even today in all the forts, palaces and dwelling houses of the region. Underground pipes and tunnels were built to maintain the flow of water and besides transporting it to distant places , they were used for conserving and storage of water .They are still functional at places like Burhanpur(Madhya Pradesh), Golcunda (here it is known as Capillary system-Andhra Pradesh), Bijapur(Karnataka), Aurangabad (Maharashtra).

Water harvesting system is the most prevalent techniques of ancient times. Because the climatic condition of the place demand such system. It is the collection of runoff for productive purposes. Instead of runoff being left to cause erosion, it is harvested and utilized. In the semi-arid drought-prone areas where it is already practiced, water harvesting is a directly productive form of soil and water conservation. Both yields and reliability of production can be significantly improved with this method. Water harvesting technology is especially relevant to the semi-arid and arid areas where the problems of environmental

degradation, drought and population pressures are most evident. While all systems which collect discharges from watercourses are grouped under the term. The method of rain water harvesting it is especially beneficial in the areas, which faces the scarcity of water. People usually make complaints about the lack of water. During the monsoons lots of water goes waste into the gutters. And this is when Rain water Harvesting proves to be the most effective way to conserve water. We can collect the rain water into the tanks and prevent it from flowing into drains and being wasted. It is practiced on the large scale in the metropolitan cities. Rain water harvesting comprises of storage of water and water recharging through the technical process. For example, in the desert areas of the Thar region of what now constitutes the State of Rajasthan, and in its neighbouring State of Gujarat, where water is a scarce and much valued commodity, tanks, *kunds*, step-wells or *baolis*, wells, ponds etc., were built. This led to systems like *johadhs, anicuts, check-dams, khadins, tankas, adlaz, jhalara, modhera, vapi, medhbandhi* (earthen structure on fields to prevent water from flowing out), the virdas of the Kutch region, etc., being developed and maintained. Water-lifting devices like draw-wells, *'rahat'* and *'dhekli'* systems were developed too. Between them, these systems met the drinking water, irrigation, agricultural and other water-related needs of the people of the area even in years of lesser than usual rainfall.

In a similar manner, in north-eastern areas of the Sub-Continent, and the foothills and lower slopes of the Himalayas, different local communities devised indigenous methods of collecting and channelling rainwater to meet their agricultural and drinking water requirements. Here, and elsewhere, practices like contour-bunding and local-level lift-irrigation schemes have used available water-resources in ways suitable to the local terrain and economy. Most of these devices and systems remained in use, with modifications, over the ensuing centuries. These include the khadin-based cultivation, *tankas*, *nadis* etc of Rajasthan, *bandharas* and *tals* of Maharashtra, the *bundhis* common to Madhya Pradesh and

Uttar Pradesh, and Bihar's *ahars* and *pynes*. These also include the *kuhls* known in Himachal Pradesh and the kuhals of Jammu & Kashmir, the ponds used in the *Kandi* belt of Jammu, the *eris* of Tamil Nadu, surangams of Kerala, and the kattas of Karnataka, which are still in use today. As many of these were the result of local community action, their management and maintenance often vested locally.

Irrigation in Medieval India

The Islamic rulers of the later medieval period were keen on providing irrigation facilities to the Peasantry. These appear to have been in the nature of canals mostly originating from the major rivers of Hindustan. The first Delhi Sultan whose handiwork is recorded is Firuz Shah. He founded the cities of Jaunpur and Hissar. The city of Hissar was founded on two villages viz. Great Laras and Little Laras. But villages were deficient in water. This problem was solved by digging of the now famous Western Jamuna Canal. In harnessing the flood waters of Jamuna and Sutlej, by the construction of the western Jamuna canal, Firuz Shah was a pioneer in the history of canal irrigation. This canal was constructed in 1355 A.D. to provide water to Hissar and his hunting grounds at safidon. In aligning it, advantage was taken of natural depressions of drainage channels whose slope and directions were found suitable. The channel thus took the form of a linked series of drainages and depressions rather than a canal as the word is understood today. Numerous water courses were brought to these places and an extent of from 80 to 90 Kos in these districts was brought under cultivation. Contemporary writer’s state that the irrigation facilities provided by Firuz Shah lead to greatly increase agricultural produce and in consequence the revenue realised was much greater than any of the earlier Monarchs.

Next ruler of Delhi Shershah Suri caused wells to be excavated all along the trunk roads he had laid out. It appears that after Firuzs death his network of canals fell in disuse. A

provincial official under Akbar try to repair the main canal but he was unsuccessful. Shah Jahan decided to repair the main canal and to extend it to Shahanjahanabad, a distance of thirty kms.[72]

The Bari Doab Canal or Lahore Canal was dug during the regime of Shah Jahan himself and was far more successful a project. It was dug at the initiative of Ali Mardan Khan who was governor of Lahore from 1637 to 1644. The Canal was 110 miles – 177 km in length and came to be known as the Hasli Canal. It was about 30 metre wide. A small branch of this canal was later dug to carry water to the Golden Temple at Amritsar. [73]

During the later years of Aurangzeb's reign, in 1660 and then in 1670 famine had broken out in large parts of northern India. Mohammad Shah therefore got constructed, what came to be known as Eastern Jumna Canal. It started from the Eastern bank of the river near Naushera in Uttar Pradesh. The decline of the Mughal Power resulted in the abandonment of the project and it was left to the British rulers of the nineteenth century to complete it and get it in working order. Of the provincial sultanates of the medieval period, the Deccan sultanates stand apart, not for their irrigation works but for their efforts in the directions of urban water supply.

Ancient techniques of irrigation were followed in the medieval period with some modification. Different techniques were evolved and modifications were made according to the changing time. The nature, types and varieties of the mechanical devices used in water lifting, water storage and water distribution form an extremely important aspect in water management. The most elementary method adopted for drawing water was to collect it in a pot and carry it to the intended place on one's head. The next step is to tie the pot or bucket to

[72] Mate. K.S. 1998. A History of Water Management and Hydraulic Technology in India (1500 B.C. to 1800 A.D.). B.R. Publishing Corporations. p. 57-69
[73] Ibid

a rope, lower it to the level of the water, get it filled up and haul it up. This process is much facilitated by the use of the pulley. A wheel or pulley is set in a wooden frame projecting on the water, the bucket and its rope are overthrown it. A much enlarged and much more efficient device is what is known as in the Deccan as '*rahat'*, it is a reel or a wooden drum fixed on an axle in a wooden frame similar to the one used for the pulley. The spokes of the wheels on either side project forth and serves as handles with which the drum can be rotated. Both the pulley and the *rahat* are used on wells, and are basically domestic devices. They can draw only small quantities of water needed for household purposes.

For large scale lifting of water, such as needed for irrigation purposes , the most elementary device used was the '*yatam'* or '*shadof'*. It works on the principle of fulcrum but is normally used only where the level of water is not too deep. A water wheel generally termed as "*Noria*" by historians of technology has various incarnations. In its simplest form it is wooden wheel around which a series of pots and tied, all facing in a same direction. The lower part of the wheel is submerged in the water and the wheel or the pots are pushed up the current. When the pots move up they collect water and empty it in a trough when they take the full circle. An addition to this was introduction of wooden peddles that would take the force of water better and thereby ensure more efficient working of the wheel. The introduction of these peddles perhaps suggested that human energy could be used instead of depending on the force of the running water. The water wheel with peddles was soon improved to turn a chain of pots suspended from moving along it and, instead of a rope fixed on the rim. This increases the efficiency of the operator and also ensured greater and continuous supply of water. This water wheel is known as '*Sakiya'* (it involves a different and advanced technology). Finally comes a *Sakiya* or the *Persian wheel*. It has two distinct parts – wheel with a chain of pots around it; and the mechanism to rotate it. A number of authors, including Irfan Habib, and Randhawa have discussed the origin of the Persian wheel.

Major efforts in irrigation development during the medieval period were construction of numerous tanks and dug wells in Peninsular India and Rajasthan by local rulers.

Irrigation in Colonial Period

There was substantial increase in irrigation in India in the nineteenth century. At the beginning of this century, the net irrigated area was estimated at 0.8 million ha. This rose to 13.3 million ha at the close of the century when 16% of the gross sown area of 82.2 million ha was brought under irrigation. Of this 45% was irrigated by canals, 35% by wells, 15% by tanks, and 5% by other sources.

Irrigation development in India in the nineteenth century, under the British rule was essentially a part of the famine relief works. No doubt that British motive in India was mainly focusing on the economic gains but one very important fact cannot be avoided that their attempt whether it is railways construction or canals construction were helpful to the natives of this country. One very important point to be discussed here is that British do not have an idea or it can be said that their knowledge about the topography of the country was not very good. For example in case of Sarda Canal, one Chief Engineer, H. A. Brownlow got confused between the topography of Eastern Jamuna Canal commanded area and Proposed area to be irrigated by Sarda Canal. [74] The climatic, soil texture and rainfall of both the areas were different. Sometimes it is said that colonies are meant to be exploited for the benefit of the rulers or the foreigners but they have over exploited the things which compiled to the reasons for their demand of expulsion from the country.

They have designed several projects which proved to be successful like Upper and Lower Ganga canal etc but there were some projects which failed miserably like first private irrigation company of British made in India. Some projects were designed to provide

[74] File 373, *Revised Sarda Canal Project*. Financial Department

protective irrigation to as many areas as possible. The major irrigation projects constructed during the first half of the nineteenth century included the Kaveri delta system in Tamil Nadu in 1834 to irrigate 0.6 million ha, the Godavari Anicut and canal system in Andhra Pradesh in 1846 to irrigate 0.4 million ha, and the Krishna Delta system in Andhra Pradesh in 1852 to irrigate 0.5 million ha. The major credit for the massive delta projects goes to Sir Arthur Cotton, a great engineer. Cotton is held in high esteem in India for his spectacular contributions in irrigation development. The other major irrigation projects of the nineteenth century are Upper Ganga Canal System in Uttar Pradesh commissioned in 1854, the Sone canal in Bihar (1879) and the Orissa Canal system on River Mahanadi (1895).

A definite policy for the construction of irrigation works was introduced in 1854 with the setting up of the public works department by the then government of India. The government of India appointed the first Irrigation commission in 1901 to report on irrigation as a 'means of protection against Famine in India'. A few Famine Commission had been set up by the government and there commissions had also recommended the development of irrigation works to contain the adverse impact of frequent famine in India. In its recommendation to the government in 1903, the irrigation commission suggested definite policies regarding the selection, financing and maintenance of productive irrigation works. Apart from the remunerative works, the commissions recommended the extension of irrigation as a means of protection against famines in areas of insecure and precarious cultivation. The commission observed that such irrigation works may not be directly remunerative to the government, but are important to mitigate the miseries caused by famines.

Such works were also the need of an hour. In accordance with the recommendations of the first Irrigation commission, several productive and protective irrigation projects were undertaken in the early part of the twentieth century. Prominent amongst them are the Sarda

Canal in Uttar Pradesh (1926) to irrigate 0.6 million ha , Ganga Canal with dam and weir on satluj river (1928) to irrigate 0.3 ,million ha in Rajasthan , Damodar Canal (1935) to irrigate 0.1 million ha in west Bengal , Ken Canal (1915) to irrigate 0.1 m ha in Uttar Pradesh ; Nira Left Bank Canal (1906), and Right Bank Canal (1938) and Pawara Canal (1938) in Maharashtra with a total irrigation potential of 0.1 m ha; Mahanadi Canal (1931) in Madhya Pradesh with a total irrigation potential of 0.2 m ha.

Here is the list of canals constructed during the British regime in the United Province of Agra and Oudh.[75] At present times several of the following canals have lost its existence and only few have survived so far. There can be several reasons why some of the following canals have lost its existence, it can either be faulty, mismanaged, or may not be suitable enough to sustain that place.

Serial No.	**Canals**	**Year of compensation**
1	Ganges Canal	1854
2	Lower Canal	1878
3	Agra Canal	1874
4	E.J.C	1830
5	Dun Canal	1863- 64
6	Bijnor Canal	1858 – 59
7	Garai Canal	1917-18
8	Rohilkhand Canal	1893-94
9	Betwa Canal	1885- 86
10	Ken Canal	1908- 09

[75] Revenue (A) Department File 421 Box 400 (A)

11	Dhasan Canal	1910-11
12	Pahuj & Garhmare Canal	1910-11
13	Ghori Canal	1915-16
14	Ghagar Canal	1917-18
15	Bharwar Canal	----------
16	Ghazind din Haider Canal	----------

A detailed study of some of the canals mentioned in the list has been done. There are some canals of United Province, presently known as Uttar Pradesh, running successfully but there are some who have lost its existence.

Upper Ganga Canal

The Upper Ganga Canal System is the largest perennial and oldest irrigation system of India. This canal takes off from the Ganga at Kankhal (Haridwar). The construction of this canal commenced in 1842 and completed in 1854. This project was constructed under the guidance of Eminent British engineer Colonel Sir Probey Cautley. The main canal is 342 km long while the length of its distributaries is about 6,200 km. During the first 32 km of its course, between Haridwar and Roorkee, it passes through a broken country so that at some places it is taken over the rivers and at others below the rivers. It irrigates about 7 lakh hectares of land in the upper part of the Ganga-Yamuna Doab. Districts of Saharanpur, Meerut, Ghaziabad, Bulandshahar, Aligarh, Mathura, Etah, Kanpur, Mainpuri, Farrukhabad and Fatehpur get benefit from this canal. Its main branches are Devbandh, Anupshahar, Motta and Hathras. It joins with the Lower Ganga Canal at Mainpuri and the water in this canal is considerably increased. Further beyond, these two canals flow separately.

The last branches of this system - Kanpur and Itawa branches outfall in river Ganga and Yamuna in district Kanpur. The total catchment area of the river Ganga above Haridwar is approximate 20,000.00 Sq. Km in Himalayan Mountains. The river Ganga flows through the plains of U.P. from the North West end to south east end portion of the state of Uttar Pradesh. This river is the life line of large fertile agricultural track of the adjoining districts on its both banks. The economy of the inhabiting farmers mainly depends on the irrigation water which is supplied from the river Ganga. The oldest culture of India also developed in the river Gangetic plains. Originally the Canal was designed with a head discharge of 6750 cusecs capacity (192 m3/s), which later on in 1938, was increased to 8500 cusecs (242 m3/s) and in 1951-1952 it was again increased to 10,500 cusecs (300 m3/s). Presently its design head discharge capacity is 10,500 cusecs. In the beginning the water from the river Ganga was diverted in the Ganga canal with the help of temporary bunds constructed every year after the end of the monsoon.

Later on, in 1920, a pucca weir was constructed at Bhimgoda across river Ganga and the weir was replaced by a barrage in the year 1986 to meet out the regulation requirement of the Ganga canal.

The current details of the main canal, branches, distributaries, minors and the escapes of the system are as follows.

S.No.	Details	Length
1	Main Canal	291.96
2	Branches	562.36
3	Distributaries	3299.95
4	Minor	2427.95
	Total	6582.22

The main beauty of the Ganga Canal System is that the canal which was planned about 154 year ago is still able to cater to the current needs of the population of the Ganga canal command area, where the current population has increased several times the population of 1840. After construction of Tehri Dam Project on river Bhagirathi, major part of the year, the river Ganga will have water more than the capacity of the Ganga Canal i.e. 10,500.00 cusec.

The water in the Ganga canal is full of natural ingredients (silt in particular). One important aspect is that all the agricultural fields where the Ganga Canal water is applied for irrigation, normally no growth/infestation of white ants/termite occur. This is an additional advantage to the farmers of the Ganga canal command. In other canal system's command areas, farmers are using pesticides for stopping the growth of the white ants.

The Ganga canal water is also used for drinking purposes mainly by Delhi, Noida, Ghaziabad, Meerut, and Greater Noida etc. and for industrial purposes by the so many thermal and atomic power plants. There is huge demand of water from different districts for drinking purposes.

Total Culturable Command Area (CCA) of the Ganga Canal System is 907,690 hectares. The Proposed Protected Area (PPA) for Rabi is 404,353 Hectares and for Kharif 429,612 hectares. Out of which the maximum area irrigated in the Rabi is 425,141 hectares and in Kharif it is 451,046 hectares. The sample distributaries selected for studies in this workshop are off taking from a place named Bhola regulation point at 135.670 Km on the Upper Ganga Canal. These distributaries cover irrigation in the district Meerut and Ghaziabad. These canals are lined in considerable length in head reaches. The details of these

distributaries are given below. There are large differences between area proposed and actually irrigated as a result of:

i. Urbanization and industrialization of the irrigated area
ii. Damage of the irrigation guls due to the land disputes between the farmers and in consolidation process.
iii. Increased consumption of water as the number of crop per year is increased as planned at the time of planning and construction of the canal in 1850s.
iv. The PPA is designed as the 3 core week. This means that the area in the command of one outlet will get water in a span of 3 weeks. But this concept is not acceptable to the farmers of the head reaches of the canal. They try to irrigate the crop in all the three week of the canal running by unlawful means, which creates water scarcity in the tail portion of the distributaries/minors.
v. The farmers are using hybrid varieties of crops and chemical fertilizers, resulting in increased water requirement many fold.
vi. The farmers are mostly growing sugarcane in the command of the canal system .They are not following the crop rotation system and growing the sugarcane regularly. This has also increased the consumption of water and reduced the fertility and caused damages to the overall wealth of the land in the command.

These systems are being maintained by the U. P State Irrigation Department from its construction time. In the current socio-political network the maintenance officers are facing following problems in maintenance of the channels are as follows:

i. The farmers do not want to go to the fields for irrigating the fields during night hours due to poor law & order situation and large risk to the safety.

ii. They do not agree to practice crop rotation as suggested by the agricultural department especially due to problems in availability of quality seeds and financial return of the produce.

iii. They opt for unlawful means such as cutting of banks, increasing the size of outlet over sanctioned size, using the pipe as siphon, putting obstruction in the canal for raising the F.S. L. to increase discharge in outlet and to irrigate the higher fields, etc., disturbing the availability of proposed water supply.

iv. Withdrawing water by installing unauthorized outlets at their liking place and damaging the outlet guls for the balance command.

v. Damage of the outlet guls due to mutual rivalry and in the process of the consolidation ignoring the established rules of distribution and use of irrigation water.

vi. Encroachment of the canal banks by the adjoining farmers resulting the thinning of the bank resulting into chances of frequent breaches.

vii. The domestic animals (Cows and the Buffalos) of the farmers enter in to the canal for drinking and bathing damaging the earthen canal banks at these locations .Due to this reason, the running of canal get disturbed due to frequent breaches.

viii. The misconception of the paddy growers of the area, to replace standing water in the fields with fresh water every week arguing that fresh cool water will increase the yield. This has also increased the water consumption during Kharif and over use of water may result into loss of production.

Lower Ganga Canal

The opening of Ganges canal had shown that there were certain defects in its design and in 1866 a committee was appointed by government to decide as to the remodelling necessary and also as to the possibility of increasing the irrigated area in the Ganges Jumna

watershed by means of a second canal from the Ganges with its head further down the river. Ultimately it was decided to construct such a canal by making a weir across the Ganges but the committee suggested that it might be wise to postpone the consideration of project until the value of water for irrigation had risen. The failure of rains in 1866 demonstrated however, that the protection of the tract was a matter of urgency, and in 1868 the preparation of a detailed scheme was undertaken. The project was actually sanctioned in 1872 and work commenced in that year but during construction its scope was considerably modified and it was not until 1879 that sanction was communicated to the revised scheme as actually built. The Lower Ganges canal was opened in 1878, it intersected two of the main branches of the upper canal and the tail portions of these are now included in the lower Ganges system. This canal was taken from the Ganga near Narora (Bulandshahar) in 1878. The length of the canal including its distributaries is about 6000 km. Its main branches are Etawah, Kanpur and Fatehpur. It irrigates about 4.6 lakh hectares in the districts of Bulandshahar, Farrukhabad, Mainpuri, Aligarh, Etah, Etawah, Fatehpur, Kanpur and Allahabad.

The most interesting work on the system is the aqueduct over the Kali Nadi and the failure of the original work after seven years after its completion seriously retarded the development of irrigation from the canal. As there were no actual floods measurements were available. Local inquiry indicated 18,000 cubic feet a second as a liberal allowance. A depth of not more than 13 feet being anticipated. Work was finished on these dimensions in 1878 and stood for six years, though in 1880 for a short time a flood of 16 feet occurred.

In 1884 a flood of 22 feet came down, the discharge amounting to over 4,000 cubic feet a second and being headed up 3.5 feet by the aqueduct, tore away one- fourth of it. The fact that earlier bridge levels could not be relied upon was demonstrated by the carrying away of their approaches so that a great portion of the stream went round them at both ends. It was evident that even if old work is if restored, was insufficient in discharge capacity. So an

estimate for a new one, capable of carrying the 1884 flood was prepared and meanwhile the injured one- fourth was temporarily replaced. The aqueduct over the Kali Nadi which was built to replace that destroyed is one of the finest works in India and is probably the largest of its kind in the world. It has 15 arches each of 60 feet span with a width of 150 feet. The abutments and piers are based upon 268 wells sunk over 50 feet below the river bed. 4000 people were engaged in its construction. The canal was reopened at the latter end of 1889, the aqueduct being finished within four days of the date fixed for its completion four years before. The lower Ganges system comprises 662 miles of main canal and branches and 3,314 miles of distributaries. It irrigated over a million acres in 1919- 20 and returned nearly 7.5 % on a capital outlay of over 4 million pound. [76]

Eastern Yamuna Canal

When British came to India, it is not surprising that the first efforts of the British engineers should have been directed to the improvement of the existing indigenous works rather than to the construction of new irrigation projects. Three of these improvement schemes, which were taken in hand early in the last century are especially worthy of note , since they have resulted in three most lucrative systems in India, these being the western Jamuna canals in the Punjab , the Eastern Jamuna Canals in the united provinces and the Cauvery delta system in Madras.[77] It takes off from the river Yamuna at Faizabad. It was constructed in 1831. The main canal and its distributaries cover a distance of 1,450 km and irrigate about 2 lakh hectares of land in the districts of Saharanpur, Muzaffarnagar, Meerut and Ghaziabad. It again joins the Yamuna River at Delhi and irrigates a part of the union territory also.

[76] Harris, D.G. 1923. *Irrigation in India.* Oxford University Press pp. 28-42
[77] Ibid., pp 14-15

Sarda Canal

As its name indicates, this canal is taken from the Sarda River at Banbasa near the Indo-Nepal border. The construction work on this canal was completed in 1928. The total length of the main canal and its distributaries is 13,624 km. It is thus one of the longest canal systems of the world. This canal system irrigates about eight lakh hectares of land mainly in Allahabad, Sultanpur, Pilibhit, Bareilly, Hardoi, Sahajahanpur, Sitapur, Lucknow, Barabanki, Rai Bareli, Unnao, Pratapgarh and Kheri, districts.

The scheme consists of two parts: the Sarda canal proper and the Sarda Kichha feeder which leaves it at about 11 km. The former comprises a comprehensive project for irrigation of the north western districts of Oudh, while the latter assures a supply to the extension of the existing Rohilkhand canals. The head works and the first 11 km of the canal are common to both. Thereafter, the Sarda canals run in a southerly direction, while feeder flows through the tarai, the low lying land at the foot of Himalayas.

The head works of the combined project are situated on the Sarda River a few km below the point where it debauches from the hills. At this place the river forms the boundary between (British) India and Nepal ; the government of Nepal had courteously consented to a small exchange of territory so as to permit the British government jurisdiction over the land upon which left abutment of weir and left bank training works are situated . A channel is built on the left flank to irrigate certain area of Nepal. The weir and sluices have been designed to pass a maximum flood of 11,300 cusecs. The head regulator and first 11.26 km of combined canal were constructed to carry 233 cusecs. The Sarda canal proper below the bifurcation consists of main canal with a length of 28.15 km, after which it bifurcates into three branches.

The project comprises 769.10 km of main canal and branches 5, 42,233 km of distributaries and 1, 60, 90 km of escapes or 6, 35,233 km of channel in all.[78]

Sarda Canal is an important canal of Oudh region; the detailed study of this canal is conducted in chapter four and five. This discusses about the Historical perspective and its impact of the cropping pattern and environment of the region.

Agra Canal

The acceptance of the secretary of state of the principal of financing productive works by loans raised in the open market naturally gave a great stimulus to the development of irrigation in India. For the first time money was available in reasonable and regular amounts. The direct result of this new policy was the inauguration of five works of great magnitude and several smaller ones. The five larger being the Sir hind, Lower Ganges, Agra (United Province), Lower Swat and Mutha Canals.[79] This canal is taken from the right bank of the Yamuna at Okhla (Delhi). It was built in 1874 and irrigates about 1.5 lakh hectares in Agra and Mathura in U.P., Faridabad in Haryana, Bharatpur in Rajasthan and also parts of union territory of Delhi.

Betwa Canal

Betwa canal was built in the Third Five Year Plan; this canal takes off from the Betwa River about 56 km south-west of Jhansi. It irrigates about 1.2 lakh hectares in Jhansi, Jalaun and Hamirpur districts. Apart from the above mentioned major canals, some other canals such as Ken, Chambal, Dhasan and Son canal also irrigate some areas in the southern part of Uttar Pradesh.

[78] Jain, Sharad K., Pushpendra K. Agrawal. & Vijay P. Singh. 2007. *Hydrology and water resources of India*. Springer. Pp. 372-378

[79] Op.cit

The accord of sanction to the estimate of the Betwa canal in 1881marked the opening of yet another and a very important era in the history of irrigation works in India, namely the era of protective works or the works designed primarily for the protection of precarious areas against famine, the direct return obtainable from them being the secondary consideration.

The Betwa canal was the first protective work in India which was constructed in the United Provinces. This project was first mooted in 1855, but no definite proposals were put forward until, in 1868, a report was prepared which established the practicability of such a canal for the irrigation of the triangular areas in the Jalaun district formed by the three rivers Jumna, Pahuj and Betwa. The sub soil water throughout this tract is at immense depths, making the cost of well irrigation prohibitive, and consequently, at the approach of drought, the people were in the habit of emigrating for the time to more favoured quarters. There was, in such circumstances less accumulation of capital and less ability to tide over seasons of difficulty, and, when drought and famine did come. The miseries of want and depopulation were experienced with an intensity and duration quite unknown in the more secure districts of the province. In such a tract the expenditure of public funds upon famine protection was clearly justifiable [80]

The project was completed in 1893. The head works of the canal are situated on the Betwa River near Parichcha, 27 Km from Jhansi. The river at this point has a discharge of 23,000m3/s. Canal regulator has five bays. This weir forms a reservoir in the river channel and impounds 48 MCM of water at crest level. Its length is 4,261 feet and its greatest height 60 feet. In 1899 automatic shutters were erected which increased the capacity of reservoir to 61 MCM.

[80] Harris, D.G. 1923. *Irrigation in India*. Oxford university press. P. 61-63

The history of the Betwa canal has been a very chequered one. Its construction was followed by a cycle of years of exceptionally good rainfall, and irrigation developed extremely slowly. This cycle was succeeded by a series of dry years , and a mark expansion took place; the main canal is 30 km long was consequently to be remodelled so as to enable it to carry the double quantity of water for which it had originally be designed. That is at the end of the main canal it was bifurcated into Hamirpur and Kathound branches[81]. It irrigated no less than 163,000 acres being irrigated in the famine years of 1905-06. In 1904-05 Kathound branch was remodelled to carry discharge of 17.0m3/s. But the greatest weakness of the canal lay in the genera inefficiency of its cold weather supply and in 1905 works was commenced on the construction of the supplementary reservoir at Dhukwan 40 km above the Parichcha. The Dhukwan weir is 1,196 km long and has maximum height of 17.4 m. The work was completed in the year 1910 [82]

The total cost of the system which comprises 168 miles of main canal and branches and 573 miles of distributaries, now amounts to 830,000 pounds. Financially the canal is not a success; it does little more than pay its working expenses, the return on capital being less than one per cent. In a normal year it irrigates somewhat more than 100,000 acres. But its value as a productive work is undoubted. It has yet to experience the test of a really severe famine (the Dhukwan dam was not in operation during that of 1905-06), but in such circumstances it could almost certainly irrigate and mature over 200,000 acres of crops, sufficient to save the tracts commanded. A proposal was there to construct a third reservoir in order to increase its efficiency and scope of the system.

[81] Sharad Kumar Jain (Author), Pushpendra K. Agarwal (Author), Vijay P. Singh (Author), *Hydrology & Water Resources of India*, 2007 springer, p. 374

[82] Ibid

Dhasan Canal

With the recommendation of the irrigation commission a special attention was needed to the area lying to the south of the Jumna and Ganges in the united province. The geological formations of this area are much more likely to the rock formations of central India than to the alluvial formations met with throughout the province. There occurred a famine in 1896-97. At this time when commission reported the only large work in this portion of province was Betwa canal, but since then great activity has been displayed in the matter of the initiation of the new projects. Of these works the most important was the Dhasan and Ken Canal. Each provided with two large reservoirs formed by massive masonry dams ranging from 26 to 54 feet in height.

Dhasan and Bearma are tributaries of Betwa, flowing from the east. The canal lies in Hamirpur district between triangular areas made by above rivers. The project was sanctioned in 1905. Two dams have been constructed upon Dhasan River, the upper one at Pahari, the lower at Lachaura some 11 km further down. Both dams have same maximum heights of 16m, the Pahari dam is 580m, the Lachaura dam 542 m long. Gates 2.5m high are erected on the crests and effective storage of 78 MCM at Pahari and 15 MCM at Lachaura are thus obtained. Both dams are of concrete, with masonry facing up and downstream. Dhasan canal has a head discharge of 20 cumecs and a bed width of 13.7m. With its three branches, it has a total length of 170 km and feeds 300 km of distributaries. There is only one masonry work of importance on the main line the Kohina Nala aqueduct. The canal was opened for irrigation in 1910 [83]

[83] Jain, Sharad K., Pushpendra K. Agrawal. & Vijay P. Singh. 2007. *Hydrology and water resources of India*. Springer. Pp. 372-378

Ken Canal

This canal was also a protective work. To irrigate the watershed between the Ken and the Bhagin, the Ken Canal has been constructed. It was sanctioned in 1903 and came into operation in 1908. It consists primarily of a weir across the Ken at Bariarpur, some 100km south of Banda, a main canal 59 km long and two branches with a connected distributary system.

The Bariarpur weir has a crest length of 512m and a maximum height of 8.0m above the solid rock on which it is founded. The weir is capable of impounding 14 MCM of water. The canal takes off direct from this reservoir and is designed to carry a normal supply 22.5 cusecs which can be increased to 28 cusecs at time of intense demand. The steep slope of the country necessitated a large number of masonry falls – there are 22 such falls in the first 13 km of the main canal. Two principal works for cross drainage being Majhgawan and Mawapura aqueduct.

To supplement the supply in canals, the Gangao dam has been constructed, this dam is situated on the Ken River some 50 km above the head works of the canal. The work was taken up in 1911 and was completed in 1917. The Dam is of the masonry of the same design as those in the Dhasan and Bariarpur. It is 740 m long with a maximum height of 16 m and is capable of 76 MCM of Water at crest level. Ken is very formidable river, carrying in flood a discharge of 17,000 cusecs and consequently both at Bariarpur and Gangao the works are on a scale of considerable magnitude. The canal system has 138 km of main canal and branches and 413 km of distributaries. In addition to large works smaller storage schemes were also provided in Bundelkhand area.[84]

[84] Ibid

Ghaggar Canal

Construction of the Ghagar canal was commenced near the end of 1912 and completed in 1918. The main feature of the scheme is the masonry dam at Dhandraul, which has been constructed across a gorge where Ghagra River pierces a low line of hills on its way to join the Sone. This dam which is 305 m long and 20.72m high forms in conjunction with an earthen embankment, 5.23 km long of a mean height of 7.6 m , a reservoir capable of storing more than 140 MCM of water.

Two low saddles in the hills provide means of escape with their crests at the full supply level of the lake while the third which forms the main escape is divided into 12 bays each of 6. 1 m span. A supplementary dam, 152m long and 13.7 m high, of the neighbouring Karamnasa River diverts the water of that river also into the reservoir through the so called Karamnasa cut, there by supplementing the supplies in the Ghaggar. From this reservoir, the canal system consisting of 100 km of main canals and branches and 120 km of distributaries is fed. The canal is crossed by 48 drainages. The steep slope of the country necessitated the provision of numerous masonry falls in the beds of various channels.

Rohilkhand Canal

After the experienced gained by the British in western part of the united province, Rohilkhand, a tract in the united provinces then came under the notice of the government. Rohilkhand had from the time immemorial been the field of very extensive irrigation and still preserved vestiges of its ancient canals, dams and watercourses; a “superintendent of canals and embankments in Rohilkhand “was appointed in 1843, under whose direction two small

canals were constructed in the bijnor district, and to whom was entrusted the renovation and improvement of the old Rohilkhand canals.[85]

Canal is successful form of irrigation at many places but it do have its merits and demerits which should be taken care of.

Merits of Canal Irrigation

i. Most of the canals provide perennial irrigation and supply water as and when needed. This saves the crops from drought conditions and helps in increasing the farm production.

ii. Canals carry a lot of sediment brought down by the rivers. This sediment is deposited in the agricultural fields which add to the fertility of soil.

iii. Some of the canals are parts of multipurpose projects and, therefore, provide cheap source of irrigation.

iv. Although the initial cost involved in canal irrigation is much higher, it is quite cheap in the long run.

Demerits of Canal Irrigation

i. The canal water soaks into the ground and leads to the problem of water-logging along the canal route.

ii. Excessive flow of water in the fields raises the ground water level. Capillary action brings alkaline salts to the surface and makes large areas unfit for agriculture. Vast areas in Punjab, Haryana and Uttar Pradesh suffer from the problem of 'reh' caused by canal irrigation. About 36,000 hectares have been rendered useless in Nira Valley

[85] Harris, D.G. 1923. *Irrigation in India*. Oxford university press. P. 61-63

of Maharashtra due to high concentration of salts in the soil resulting from canal irrigation.

iii. The marshy areas near the canals act as breeding grounds of mosquitoes which result in widespread malaria.

iv. Many canals overflow during rainy season and flood the surrounding areas

v. Canal irrigation is suitable in plain areas only but only if it is well managed and properly drained out.

British investment in Irrigation in India was full of challenges, because tapping of Water for economical use particularly at a place where such irrigation system does not exist. Like in Oudh region wells and jhils were highly prevalent, but British effort of introducing Canal to this region was a great challenge. No doubt they were successful in several attempts but they have also faced failures. Next chapter of Sarda Canal is an attempt to explain one such effort of British in Oudh region.

Chapter – 4

Sarda Canal: A Historical perspective

History of Sarda Canal

The first scheme for utilizing the perennial supply of water in the Sarda River was drawn up in 1856-1857 by Lieutenant Anderson of Madras engineers. Most of their records were destroyed during the mutiny, but his diary was preserved. Since then 13 projects have been prepared and submitted to government. [86]

One project prepared by Captain Forbes, R.E. in 1871, was approved by the Government of India and sanctioned by the Secretary of State. This scheme provided for the irrigation of the whole of the country between the Gogra (Ghaghara) and the Ganges. It was however foreseen by captain Forbes that water might not be required by the whole tract, and it was proposed to be divide into four sections allowing nine years for the construction of each. It was also recommended that the scope of the canal should in the first instance be restricted to the north west of a line drawn from Fatehgarh to Faizabad, thus leaving out part of Hardoi and the whole of Unnao , Raebareli , Pratapgarh and Sultanpur in Oudh; and Benares , Ghazipur , Azamgarh and Jaunpur in the North Western Provinces. This recommendation was supported by the Inspector General of Irrigation and in September 1871 Captain Forbes submitted a revised scheme, amounting to 301 lakhs for the above tract. The scheme was approved by India and Sanctioned by Secretary of State.[87] Preliminary work was started, and after 103 miles of centre line had been marked, but it was suddenly stopped in September 1872, apparently as a result of a memorial submitted by the Taluqdars of Oudh to

[86] File No. 263 W/ 1938, *Extension of Sarda Canal* , PWD department
[87] File No. 449 B, /1899. *Sarda Canal, Oudh,* Revenue Department

the Viceroy. It was to some extent supported by chief commissioner. The Taluqdars feared that the canal might cause water-logging in some places and be deleterious to the soil and health of the people. Other Projects were framed to irrigate different areas, for instance Rohilkhand, the Ghagra, Gomti tract, but the proposals were not accepted by the local government or by the Government of India on account of administrative and engineering difficulties, the fear of increasing malarial fever, the doubt of the need of protection in the areas concerned and the fact that the scheme would not be productive. [88]

Till 1879 nothing was found on record in relation to this canal. But in 1879 a report was submitted by Major Forbes for the irrigation of Hardoi, Kheri, Sitapur, Lucknow, Barabanki and Faizabad in Oudh, with possible extension to Azamgarh and Jaunpur in the North Western Provinces. Major Forbes also suggested that the scheme should at first be still further reduced, so as to provide only for the Ghaghara Gomti Doab. This time proposal made was for different districts proposed earlier. But the district officers in 1879 and 1880 were generally adverse to the constructions of the canal. In the meantime Sir George Couper, formerly Chief Commissioner of Oudh and then Lieutenant Governor, North western Provinces and Oudh, in acknowledging receipt of the project, intimated his unwillingness to proceed further with the elaboration of the scheme until driven to do so by the necessity of putting it in hand as a work of famine relief. [89]

After district officers opinion in November 1880 Colonel Brownlow, the Chief Engineer of Irrigation, wrote a note on the advisability of carrying out the surveys for the completion of the revised project, after a deficient Kharif harvest and having regard to the low supply in the wells and to the emptiness of the *jhils* and *tanks* in Oudh. Sir George Couper wrote a minute on this, accepting, with evident reluctance, the necessity for providing work in case of a possible failure of the winter rains. The survey and the completion of the

[88] File No. 263 W/ 1938, *Extension of Sarda Canal* , PWD department
[89] Op.cit p. 4

project were accordingly carried out by captain Clibborn and Mr. Garstin, and the final estimate was submitted in September 1881.[90] It was evident that some of the English officials were too reluctant in carrying out the project of Sarda Canal.

The revised project provides for the irrigation of the Gogra-Gumti doab only. The financial prospects of the canal have been worked out by Captain Clibborn in the usual way. This project was considered in, local financial department in 1882. Government came to the conclusion that "the Sarda Canal Project can only be carried out from imperial resources as an imperial work". [91] But the local government is unwilling to guarantee to finance the scheme and India declines to treat the project as a "Protective work". Finally it was decided that "The question regarding this canal may be left in abeyance until the next canal compact is about to be considered. In order to arrive at a logical conclusions that whether Sarda Canal should be constructed under any circumstances or conditions and if so under what circumstances. It was suggested to depute an officer to visit all the districts concerned and enquire very carefully into the sufficiency or otherwise of existing means of irrigation. A most suitable officer will, with the sanction of the government of India, be available in Mr. M.King, Superintending Engineer. He would march from Allahabad to Jaunpur and thence up the line of canal as far as the head of the Lucknow branch. He would give special attention to the *jhils* and *tanks* from which irrigation is practised, with a view to deciding whether it will be necessary to drain them. The present Jhil irrigation is effected, it is believed by blocking up the minor drainages of the country and we know by experiences that these drainages will have to be opened out if a canal comes very close to them. And in many cases it is probable that compensation will have to be paid. According to F.V.Corbett, Chief Engineer Irrigation branch, it is quite possible that the Sarda canal is not required and should not be made. But to

[90] Ibid.
[91] File 373, *Revised Sarda Canal Project*. Financial department

determine this, an irrigation expert should examine the country in close communication with the district officers and Zamindar and others interested in the question. [92]

The **Irrigation Commission in 1901-1904** considered Sarda Canal project at great length and in their report stated:

> *"There is probably no scheme for the introduction of canal irrigation into any part of India which has formed a subject of so much discussion as that for the canal from the Sarda river for the irrigation of Oudh , Nor has any more difficult problem been laid before us during the course of our enquiries than that of deciding whether the numerous objections which have been raised to the scheme , are sufficient to prevent the utilization in the Ganges Gogra doab of the enormous volume of water which now runs to waste in the Sarda River."* [93]

After a review of the facts of the case and of the objections urged by the Taluqdars, the commission refused to recommend the introduction of canal irrigation, outside the district of Hardoi and those parts of Barabanki and Lucknow Districts, lying South of Gomti. They suggested that further investigation should be made in Sahajahanpur and Unnao, and perhaps Raebareli. They added the following criticism:

> *"We are not convinced that there were really any grave and conclusive objections to the introduction of canal irrigation into other parts of Oudh. Many of the objections which have been laid before us might have been applied with equal force to more than one large tract where canals have, as a matter of fact, proved of great benefit to the people."*[94]

They summed up the situation in these words, "*Hardoi and parts of the adjoining district stand for more urgently in need of protection than the irrigation of the remainder of the tract ; and we cannot recommend that the measures necessary for their protection should be postponed until the general question of protecting the whole tract by carrying out the main Sarda Canal scheme has been investigated and settled , until all local prejudices have been overcome and until all protective works which are considered more urgent than this general*

[92] File No. 449 B, /1899. *Sarda Canal, Oudh,* Revenue Department, 11
[93] File 263 /W *Extension of Sarda canal* 263 W/ 1938. Public Works Department.
[94] Ibid.

scheme have been completed whatever the results of the investigations may be, that scheme , as a whole , must take a much lower place in order of urgency of protective works that can be assigned to any fairly promising scheme the protection of Hardoi and adjoining districts." [95] In conclusion, the commission recommended the investigation of an additional scheme for diverting any surplus water of the Sarda into the Ganges Canal the Agra Canal and the Western Jumna Canal in the Punjab.

In accordance with the recommendation of the commission, three projects were prepared between 1903-1911 for the Sarda Ganges – Jumna feeder to supplement the supplies of water in the Rohilkhand, Ganges and Jumna Canals and to introduce canal irrigation in Moradabad and Badaun. The third and final detailed project of 1911 indicated a return of 7 % on the capital outlay. The main proposal was to feed the lower Ganges canal with Sarda water and thus release considerable supplies now given by the upper to the Lower Ganges canal.

The 1911 Sarda Jumna project was submitted to the government of India for sanction but in the meantime there were unmistakable signs of a change of feeling in Oudh. The Taluqdars were beginning to realize that with the increasing cost of Labour, well irrigation was no longer profitable and that their crops were inferior to those grown on the canal irrigated lands of the Ganges Jumna Doab. Since 1908, a gradual fall in spring level had been noticed in certain large tracts in Oudh. The Taluqdars association submitting a strong representation in April 1913, in favour of reviving the scheme for the Sarda Canal in Oudh. A deputation of Taluqdars waited on the Lieutenant Governor in August 1913 and urged the construction of Sarda Oudh Canal. [96]

Sarda Oudh and Sarda Kichha project were accordingly prepared and submitted to the Government of India and the Secretary of State for sanction in 1916. Both schemes were returned by the secretary of state for further information. The Great War delayed the

[95] File 263 /W, *Extension of Sarda canal* 263 W/ 1938. Public Works Department.
[96] Ibid.

resubmission of these two projects which were eventually sanctioned by secretary of state as follows:

The Sarda Kichha project – 2,00,56,566

The Sarda Oudh project - 7,50,30, 917

Total - 9, 50, 87,483

Work was begun during the cold weather of 1919-1920 and by 1927 it was possible to make a fairly accurate forecast of expenditure. Accordingly a revised estimate combining the two projects was prepared and in due courses this revised estimate was sanctioned by the Secretary of State for Rs. 9,50,80, 068 , a saving of Rs. 7415 on previous sanctioned estimate. The Sarda Canal was opened on December 11, 1928. [97]

Course of Sarda Canal

Sarda River flows from Almora district of tarai regions to Nainital and it further flows to Pilibhit, Kheri and Sitapur District and in Sitapur District Sarda River merges with Gogra River (Ghaghara) and after its merger it is referred to as Gogra[98] or Ghaghara river and it continue to flow Barabanki, Faizabad, Azamgarh and Ballia District.[99]

Sarda canal was built by British in 1928. Captain Clibborn and Mr. Garstin, the executive Engineers were deputed to complete these estimates. The channel for the canal takes off from Sarda River at Kataiya ghat in Kheri district (about 50 kms. below Banbasa, nainital, the site originally fixed on for the head works of the canal).[100] The length of the canal with its distributaries is 12,368 Km. It irrigates about 8 lakh hectare of land in district

[97] File 263 /W *Extension of Sarda canal* 263 W/ 1938. Public Works Department.
[98] In British records Ghaghara is mentioned as Gogra
[99] Banthia, Jayant Kumar, *Indian Administrative Atlas 1872-2001, A Historical perspective.* Census of India 2001.
[100] Note by Chief Engineer of Irrigation – NWP and Oudh No. –C.407,1-2,W, dated Nainital , 28th September 1881.

of Sahajahanpur, Barabanki, Pilibhit, Sitapur, Kheri, Hardoi, Lucknow, Unnao, Raebareli, Pratapgarh, Sultanpur and Allahabad district. Its main branches are Deva, Bisalpur, Nigohi, Kheri, Sitapur, Lucknow and Hardoi.

Another canal Sarda Sahayak takes off about Sarda sagar about 20 km below Sarda canal headwork's near Indo-Nepal border and augments the supply in Sarda canal. It irrigates about 7.5 lakh hectare land in Jaunpur, Azamgarh, and Ballia district canal. This canal flows in all the 14 districts of Oudh region

Apprehension of the Taluqdars

A *Taluqdars, Ta'lluqdar or Talukdars* is a term used for Indian landholders in Mughal and British times, responsible for collecting taxes from a district (*ta'alluqa*). According to the Punjab settlement report of 1862, great landlords were appointed as Taluqdars over a large number of villages during the Mughal era. He is required to collect taxes, maintain law and order and provide military supplies and manpower to the provincial government. In most cases they are entitled to keep one – tenth of the collected revenue. In United Provinces Taluqdars were much more powerful and were directly under the provincial governor. The late Mughal era saw the rise of powerful Taluqdars in Oudh who seldom paid any collected revenue to the central government and became virtual rulers of the districts. They were basically countryside clan heads / rural rajas/ agrarian elites, who held varying degrees of financial, administrative and political powers over their taluqas.[101]

In the taluqdari tenure in Oudh, the superior proprietary rights rested in one single person- the lord of the domain. The law of primogeniture was generally applicable for succession in the taluqdari tenure. The institution of taluqdari has been viewed differently from time to time by the British authorities, who became the master of north India after the

[101] Singh, Manoj. 2013. *The Taluqdars of Oudh.* P 12- 26

battle of buxar (AD 1764). As the British gained the province of Bengal after this battle. Taluqdars main view was to hold the privy and purse that is farmers. Wells were generally under the control of farmers whereas Canals will be the states responsibility, in some or the other way it will be beneficial to them.

The Taluqdars of Oudh however opposed the construction of the canal at that time mainly on the ground that it would cause waterlogging and malarial problems. Because of their opposition canals construction was stopped in 1875. Nevertheless, the Taluqdars gradually realized that well irrigation was becoming increasingly expensive and at the same time their crops were inferior to those grown on canal irrigated lands in the western districts. It also happened that the spring level of wells showed signs of fall in large areas of Oudh, particularly after 1908. It caused anxiety. There was a severe drought in 1913, when many sources of water almost dried up and famine was only by chance averted. The need of a canal became so strong that the Taluqdars, who were very much opposed to the construction of canal at one time, sent a representation to the Government and also waited on the Governor to impress upon him the urgent need of a canal of Oudh.

Apprehension of British towards its construction

Sarda Canal was one of the very controversial canal of British India. It has faced several arguments and discussions, as there were differences of opinion among the British themselves. The time when the proposal for this canal was placed before the Government, at that time English were at the zenith of its development, construction of railways, its success , large amount of export of raw material from India to England, developing economy of England etc were taking place. At this point of time proposing a canal construction in all together a different and unknown geography was not acceptable to some of the British Officials. But there were some officials who were of the opinion that the canal will prove

fruitful for increasing states revenue. As the canal in western part of the United province proved beneficial. Major Forbes initially suggested scheme for the Gogra Gomti Doab. The opinion of District officers were called for. They were generally adverse to the construction of canal. In the meantime Sir George Couper formerly chief commissioner of Oudh and then Lieutenant Governor, NWP and Oudh in acknowledging receipt of the project, intimated his unwillingness to proceed further with the elaboration of the scheme until driven to do so by the necessity of putting it in hand as a work famine relief. In November 1880 Colonel Brownlow, the chief engineer of irrigation , wrote a note on the advisability of carrying out the surveys for the completion of the revised project after a deficit Kharif harvest and having regard to the low supply in the wells and to the emptiness of the *jhils* and tanks in Oudh . Sir George Couper wrote a minute on this accepting with evident reluctance, the necessity for providing work in case of a possible failure of the winter rains. [102]

Secondly, the project for the Sarda canal was considered in the local; financial Department in June 1882 and Government came to the conclusion that "the Sarda canal project can only be carried out from imperial resources as an imperial work." Whereas the Local government is unwilling to guarantee to finance the scheme (i.e.to be responsible for the annual interest on capital expenditure), and India declines to treat the project as a '*Protective Work'*. Finally it is decided that 'the question regarding the Sarda canal may be left in abeyance until the next canal compact is about to be considered'.

Railways construction sanction has already been accorded to the commencement of the Bareilly, Pilibhit railway and the government will probably determine to complete this line as soon as measures are ripe for the profit, which alone will absorb a large portion of surplus. The policy of prosecuting vigorously a comprehensive scheme of light railways (as Pilibhit, Lucknow, Sitapur, Raebareli, Patna and Bahraich branches) throughout the province

[102] File No. 449 B. *Memoranda on the project for the Sarda Canal*. Revenue Department

has been framed upon the conviction that these railways connecting trade centres, opening out remote tracts, facilitating traffic and intercourse and allowing for rapid and easy transport of food in time of scarcity, are on the whole the projects on which expenditure of provincial money is most useful and justifiable. Administratively, these railways are certainly a great advantage to the country and it is believed that they will be remunerative financially. It is clear, however that the polity of extending railway communication will absorb all the available resources at the disposal of this government and it would be very difficult under existing circumstances to prosecute these schemes and at the same time to meet the heavy initial loss consequent on becoming responsible for interest on the enormous capital required for the Sarda canal Project and for working expenses in its earlier stages. [103]

Railways construction profit was predefined and well known to them but there was a risk in the Sarda canals construction and in its outcome. Nor are the circumstances such as to justify the suspension of railway operation in favour of the proposed canal. The papers before the Government do not support the conclusion that the canal is urgently required on general grounds. The paper says that the country through which it will pass is well cultivated and fairly irrigated already. Except with in the limited areas in the district of Lucknow, Barabanki and Faizabad, there was no very serious scanty, in the tract to be traversed during the great droughts of 1877, 1878, and 1879. The rainfall along the line of the proposed canal is no doubt capricious, but the same may be said of almost any portion of northern India. The Taluqdars have been wither to almost unanimous in opposing the scheme and thought their objection may be overcome and their opposition eventually withdrawn, yet so long as their antagonism remained it would undoubtedly influence the tenants the bulk of whom are

[103] File 373, *Revised Sarda Canal Project*. Financial department

holders at will, on whose support the financial success of the canal must to a great extent depend. [104]

It has been suggested that under the secretary of state's despatch No1- 6th Jan/ 881- this government, having accepted responsibility for the project and borrowed the capital from imperial funds, might be relieved of the payment of interest as it accrued , the arrears being subsequently added to the total amount of capital expenditure . Assuming that such a course would be permissible (which is doubtful in view of the ability of the provinces to meet the demand for interest from balances at credit as it accrues), the lieutenant governor and chief commissioner is not prepared to adopt it. Such a plan would involve the payment of compound interest without any compensating advantage; would merely postpone the day of account, while adding yearly to the ultimate liability; and would virtually hypothecate the provincial revenues of future in liabilities for an undertaking the financial success of which is by no means fully assured, instead of meeting the responsibility at the outset and arranging for payments as they fall due. This honour considers that to employ this expedient would be unsafe and imprudent as it would involve the financial status of the province in risks which the circumstances do not justify. [105]

Numerous other obstacles have presented themselves during the course of this discussion in connection with the carrying out of this project. Such as the improbability of securing the very large yearly grants / (amounting in some years to 60 lacs) contemplated in the estimates , from the limited amount for expenditure on productive public works at the disposal of the supreme government and the difficulty of obtaining the services of a competent staff for the efficient carrying on of the enormous operation involved. As the large number of staff was involved in railways construction. It is possible that the obstacles may be

[104] Ibid.
[105] Ibid.

overcome and the difficulties solved but in considering a question with issues so important to provincial interests, they cannot with prudence be overlooked or underrated.

Summing up, the lieutenant governor and chief commissioner is of the opinion that this government cannot accept the responsibility for the project now under consideration:

On General Grounds

a. Because the initial loss must extend beyond the period of the present financial contract with the supreme Government
b. Because the local government cannot , in view of the inevitable initial loss, undertake the project in addition to railway extension , even if its financial independence were assured for a longer period than five years , all available resources being needed primarily for railway and secondarily for extension of existing canals which are now paying their way under provincial management.
c. Because the local government is unwilling, even were it able to adopt a course which , by postponing for the present the payment of interest , would throw on the provinces some years hence a burden which might seriously impede their administrative and financial progress. [106]

On Special Grounds

a. Because the project is not urgently needed administrative : while its financial success is so far problematic and the calculations on which it is based pervaded by an element of uncertainty that the local government cannot prudently undertake the very serious responsibilities an consequences that would be involved by the failure of so large are investment of the limited provincial revenues.

[106] Ibid.

Sarda canal and the Sarda kichha feeder in the united provinces, has been perhaps the most contentious question in the history of irrigation in India. "There is probably no scheme for the introduction of canal irrigation into any part of India, which has formed the subject of so much discussion as for a canal from the Sarda River for the Irrigation of Oudh. Nor has any more difficult problem been laid before us during the course of our enquiries than that of deciding whether the numerous objections which have been raised against the scheme are sufficient to prevent the utilization, in the Ganges- Gogra watershed of the enormous volume of water which now runs to waste in the Sarda River" reported the Irrigation Commission of 1901-1903.[107]

Reasons for Construction of Canal

After a long discussion among the British officials and several apprehensions of Taluqdars it was finally decided to construct the Sarda canal. There were several reasons which resulted in the construction of this canal.

Every irrigation system or technique have their pros and cons, in the same way Canal Irrigation anywhere in the world do have some of the common problem such as Waterlogging, Malaria etc. but there are some points which strongly favours canals construction in Oudh region , if these mentioned above objectionable features are eliminated . Canals provided unlimited supply of the water in comparison with the area commanded. Initially it was built in some districts of Ghaghara Gomti doab; their it provided full protection as far as it can be full of four districts from the effects of drought. It will also help in increase of wealth by increased facilities for irrigating and for pushing the irrigation of Sugarcane, Indigo, and perhaps Rice and Cotton. It will be further helpful in reclamation as

[107] Harris, D.G. 1923. *Irrigation in India*. Oxford University Press. p. 87

regards the *Rabi* crop) of some 170,000 acres of land now covered with water in ordinary years.[108]

As it is mentioned that initially it was in some districts of Gogra – Gomti doab, their unirrigated area (cultivated +culturable) in the Gogra-Gumti doab is 2,880,255 acres. It is proposed to irrigate about one-fourth of this say 720,000 acres. The irrigated area in the doab is shown as 2,093,262 acres, but there is reason to suppose that this is considerably in excess of what is irrigated in any one year. Also of this irrigated area five- eighths is from *jhils* and tanks which more or less fail in dry years. The water supply as mentioned before is absolutely secure the volume required being only half of the usual minimum (6000 cusecs in March), and only three- fourths of the actual minimum of 4000 cusecs in March 1869. It would see, then that if there are no special reasons against introducing canal irrigation in this tract, the construction of canal would both protect it against the effects of drought and add greatly to the wealth of the country.[109]

Tanks and *jhils* were good source of irrigation but if season faces any problem for example the following Monsoon of 1911, 1912 and 1913 was a partial failure in Oudh and Famine was narrowly averted. The existing sources of irrigation both wells and tanks, dried up. The lieutenant governor, therefore ordered the preparation of a combined scheme for a canal into Oudh, called the Sarda Oudh project, and a feeder canal called the Sarda Kichha project running west wards across the tarai to kichha. The Sarda Kichha Project was considered essential to ensure a permanent and sufficient supply of water in the Rohilkhand canals which suffered from totally inadequate supplies particularly during the early summer months, when water was in great demand for large areas of Sugarcane.[110]

H.A.Brownlow, Colonel, R.E. Chief Engineer, utterly disbeliefs in a scheme of well sinking as a means of protecting any large tract in Oudh from the effects of drought. He says

[108] File No. 449 B. *Sarda Oudh Canal*. Revenue Department. Point 13. May 1899
[109] Ibid Pp. 2
[110] File 263 W. *Extension of Sarda canal*. Public Works department. No. 6

“ that if the Government were so ill - advised as to embark in the construction of 60,000 wells or even half that number, it is absolutely certain that an average of Rs. 400 each would barely cover the cost of making than. The average rate of Rs. 200 for each well, assumed by the Oudh revenue secretary in his note takes for granted very cheap rates of work and small quantities of it and makes no allowance for the losses arising from uncertainty of finding water or from dishonesty in the native supervising agency or for the very large increase in rates certain to follow immediately the increase demand for materials and skilled labour (masons, well sinkers etc), arising from undertaking a scheme for sinking wells by the thousand. The initial cost of the wells would be much nearer 250 lakhs of rupees, than 127 lakhs entered in Major Erskines note.

Secondly supposing the wells sunk, where is the water to come from? Again reference was asked in support of an assertion that the subsoil water is even now insufficient for the existing wells during anytime of drought and would ask what chance is there of the supply improving when the drain upon it is doubled ? Water is not produced by any mysterious subterranean alchemy, and all that there is in the subsoil has found its way there by percolation from above. The conditions of the problem assume that no rain has fallen on the surface of the land and yet with their supply entirely cut off, the land springs are expected to yield quantities of water double and treble of those which they would yield under the most favourable conditions.

Thirdly, supposing the wells sunk and the water there in the subsoil how is it to be raised? Another problem discussed by the secretary to government to Oudh Revenue Department, difficulty in the way of supplying water to the land from any widely extended scheme of well sinking. Where are the bullocks to come from? And even supposing them there, how are they to do the work required of them? Everyone acquainted at all with Indian agriculture knows what a bullocks allowance of food is during any season of drought and

knows also that the complaint of the well bullocks giving in is one of the first that is heard during any time of scarcity. As Mr. Nilson has been quoted already in the Oudh Revenue Secretary Note, "In the cold weather after good rains bullocks are well off. They have had and still get good grazing and are in capital condition for work. It is in the hot weather that well irrigation seems to fail. I went to Banda last May and never saw the country look so deserted as fatehpur did. There were numbers of wells, but hardly one of them was being worked. The people seem to know that cattle cannot keep the wells going in the hot weather. In 1877, men who had kept their sugarcane irrigated from wells up to the end August asked for canal water in September, saying that if they could not get it, they must cut the cane for fodder, as their bullocks could work no longer. As this was in a canal irrigated country, there must have been bullocks belonging to other cultivators available, but apparently they were not to be hired."

And even supposing the wells sunk, the water in the subsoil and men and bullocks working, two great objects to well irrigation still remain: it's prohibitive cost and the multiplication of months to be fed during the time of scarcity. Several jokes have been heard made at the expense of a pamphlet by a well-known and able officer of Government who demonstrated that cultivation in district Cawnpore was carried on at a loss to the cultivators; but there can be no doubt that in any serious drought , crops maintained by well irrigation are so maintained at a dead loss to the cultivator ; and that any frequent recurrence of drought in a tract protected by wells alone would end either in a total collapse or hopeless indebtedness of the cultivating community. That is surely not a desirable consummation of a great Government scheme of protection from famine, nor is it desirable that during famine number of men and cattle to be supported by the land should necessarily be multiplied. But this is just what well irrigation requires owing to the enormous amount of labour it absorbs. Canal irrigation, on the contrary liberates labour and enable a given amount of it to cultivate much

larger areas of land than before its introduction, so that during the time of scarcity and drought the support of the men and cattle is rendered an easier task. Brownlow further argues that Sarda Canal will prove a source of overflowing abundance and prosperity to the tract which it will water, increasing immensely the agricultural wealth of the community and adding largely to the Government Land Revenue.

There was dissimilarity of opinions among the officials regarding provincial finance. Lieutenant governor and chief commissioner is unable to undertake the project on the guarantee of provincial finance. But as J.R.Reid (Official Secretary to Government , North Western Provinces and Oudh.) says that, "His honour is of the opinion ,that, as a protective work, the Sarda Canal would be very valuable in case of prolonged and extensive drought, while its construction would afford useful employment as a relief work were such found necessary in time of scarcity. It is in this (protective) aspect that the Betwa Canal has recently been put in hand from imperial funds and his honour would be glad if the Government were disposed to deal in the same manner with the Sarda project. In the remarks on the suggested extension of irrigation, the famine commission wrote as under, "The adjoining fertile province of Oudh is capable of extensive irrigation from the River Sarda … The drought of that year (1877-78) was felt through Oudh nearly as severely as in any part of North Western Provinces, and it cannot be doubted that the Sarda canal would have been as valuable there as the Ganges canal was in the doab." These remarks refer to the layer project of a canal system estimated to cost over 6 million sterling and calculated to irrigate the greater part of Oudh and a considerable portion of the North western province. In the country to be traversed by the smaller project now under consideration, the stress of drought and scarcity was not so severe and the remarks quoted above must therefore be somewhat modified in their application to it. With reference to these lesser projects the famine commission recorded an opinion to the effect that a return of 5% might safely be anticipated and that the scheme ought not to be

rejected unless grave and substantial objections to it could be established. Sir Alfred Layall, concurring generally in these views, is not prepared gainsay the opinion, thus authoritatively expressed, that the project will be remunerative eventually : and if the Government of India should decide to accept it as coming under the category of productive public works , the expenditure of the large capital involved would be thoroughly justifiable. The lieutenant Governor and chief commissioner would be glad to see the project taken up by the Government of India as an imperial work either (1) on the sound and strong basis of protection against drought, or (2) in view of the benefits to be derived from the canal to the people on the one hand in the shape of an assured and copious water supply and to government on the other in the way of a fair ultimate return on the expenditure incurred. It may be repeated, in short, that the view taken in this resolution is not that the canal will certainly be unremunerated or that its construction is in expedient, but that the project is altogether on too ambitious a scale for the local government to take in hand. And under present circumstances the lieutenant governor and chief commissioner cannot avoid the conclusion that so far as the Government of these provinces is concerned having regard to its limited financial tenure, the heavy calls on its current revenues and the other schemes to which it is practically committed the Sarda Canal project can only be carried out from imperial resources as an imperial work. [111]

The reasons mentioned above was mainly from the official records and from the Government, but there are some reasons in its background which cannot be under estimated such as India as a Colony and British initially as traders and later they became Empire settlers. In order to satisfy their financial needs British introduce Railways in India, its introduction resulted in the form of Famine.

[111]File No. 373, Box – 2. *Revised Sarda Canal Project*. Financial Department, No.8.

Famine was always a major obstacle in the development of the Provinces. Because it directly hits the agriculture and Land revenue of the states. Sometimes it is said that the history of British in India is a history of the deliberate creation of famines. A severe famine struck the Oudh region in 1914. Studies suggest that these famines were the result of British policies. The policies were so created that it not only compelled Taluqdars but also the Farmers to think for the construction of the canal because they were initially very much against the construction of the canal as they were aware of the pros and cons of the canal. The topography of Oudh region does not support the canals in this region. Only some districts of the upper Gogra Gomti region was in need of canal. Such famines resulted from the policies of the East India Company. Like British constructing of railways has created famine. Other policies included looting through "tax farming", "usury", and "outright slavery" of the indigenous population. British policies were such which created the circumstances for famine in India from 1764 to 1914, and they deliberately used famine and food control as the principal means of rule. As B.M. Bhatia rites in his 1967 book, Famines in India: "…beginning of the eleventh century to the end of the eighteenth there were 14 major famines in India." This is roughly two per century.[112]

Sixteen major famines occurred during East India company's rule from 1765-1858, eight times higher than before. Then during colonial office rule from 1859-1914, there was a major famine in India on an average of every two years or 25 times the historical rate before British rule. The rest of the world's population was growing due to technological progress, but the population of India remained at approximately 220 million for over a century prior to 1914. Deliberately inducing a major famine more or less every two years was, for over half a

[112] Glumaz, Paul. 2008. *Then and Now: British Imperial Policy Means Famine*. EIR. April 25, 2008 www.larouchepub.com

century, the backbone of British colonial policy in India. Mason (2006) argues that canal irrigation made famines History.[113]

British exploitative policies resulted in sepoy mutiny. Following that revolt, a new policy was developed revolved around creating famines in selected regions on a continuous basis, with the goal of creating a mass of starving people who could be used as slave labour, needed by the British to build the infrastructure of British rule. As tax collectors, the previous supposedly "rapacious" Mughal agents had collected the marketable equivalent of £ 818,000 sterling from the areas of Bengal. In 1765-66, the first year of East India Company diwanship, the company was able to collect the equivalent of £ 1, 47,000 and by 1790-1791; this figure had risen to £ 2,680,000.

According to Jean Beauchamp's British Imperialism in India, Warren Hastings, the company's chief officer in India wrote the following to the company's board of directors in London "Notwithstanding the loss of at least one third of the inhabitants of the province, and consequent decrease in cultivation, net collection of the year 1771 exceeded those of 1768…. It was naturally to be expected that the diminution of the revenue should have kept an equal place with the other consequences of so great a calamity. That it did was not owing to its being violently kept up to its former standard." The great calamity mentioned was perhaps the worst famine in Indian History, which struck the provinces of United Provinces, Bengal, Bihar and Orissa. It is estimated that no fewer than 10 million perished from starvation. The severity of this famine was a direct result of East India Company looting.

Secondly the British Tax farming system was a disaster in itself because Company wanted to increase the tax revenue and for this they set up a system of outsourcing the right to tax the land. That is what is known as "tax farming". The tax collector had the right to obtain as much tax as he could get since he had bought these rights at auction. In turn the one who

[113] Shah, Tushaar. 2009. *Taming the Anarchy: Groundwater Governance in South Asia.* Routledge Taylor and Francis group. p. 63

was taxed, the registered landholder called Zamindari was allowed to extract whatever he could for himself and from the tax collector from the poor peasants who worked on land . Zamindar had complete power over all the land and its cultivators. Through this looting system, the company left nothing in reserve for the times when the monsoons would fail. In addition little or no maintenance was there in the cultivator's infrastructure, such as the irrigation works. The result was horrible as most of India's land area came under company rule. The drain of wealth from India based on a tax farming system, the destruction of native textile industry by the "free market' dumping of British textiles and the plantation economy of opium, led eventually to a fierce resistance from the communal based population. This finally led to the sepoy mutiny of the Zamindari and others, especially those who lived in areas not totally under company control. It almost broke the British Empire.

In the end the East India Company was relieved of its rule in India and was replaced by governor general and colonial administration. The commission which recommended this change concluded that there were two problems – one was the lack of transport and communications infrastructure, necessary to hold subjects such a vast country. Secondly there was a need for an Indian ruling class that would function as intermediaries for the British colonialists. Realizing the above two problems, after 1857 revolt Britain's colonial oversees agreed on the need for the development of a rudimentary infrastructure to increase the efficiency of their rule, and looting of India. But the empire had a problem. The proposed grid of railroads and large scale irrigation works was too expensive, from the colonialist's point of view. So the decision was made to force the already plundered Indian population to pay for these development projects. This presented another serious problem. India, at that time did not have a landless labouring class which could provide a pool of cheap labour for such projects. The caste system of India was all encompassing. As Bhatia documents, the ritual distribution of goods at the communal level based on caste and guild relations, made it

undesirable for families and individuals to leave this system especially to become slaves for the British railroads and irrigation projects. The British solution to this problem was “famine relief”. To build the railroads, the British set up “Famine relief works”. A famine would create such a worse condition that will force starving Indian to “choose” to go to a famine relief centre. However, once having done this the individual lost his caste relations and privileges. Then he was told that if he wanted to continue to eat, he must work, building the railroads in exchange for food.

At these projects, less than minimum subsistence was the norm much like a Nazi forced labour concentration camp. With the advent of railways, it became easier for traders to buy up food and other goods when they were cheap, and in some cases, even when costly, and export them to England – much in the same manner as the British let the Irish starved during the potato famine, rather than allow the Wheat, Barley, and Rye grown in Ireland for England to be used to feed the Irish. Under these conditions, the nature of famines and scarcities began to change. Whereas in the past, famine had been a regional phenomenon, under this British policy food became scarce throughout the country, hitting the poorest in a devastating manner. It was this famine stricken poor who then continued to supply the Labour for the relief works. The development of the railroads and irrigation projects also helped to develop a class of Indian money lenders, who became the intermediaries for the British. This allowed for the British to control even areas which were not affected by crop failures. Such areas were hit with multiple increases in prices because of the demand placed on their food from other areas of the country. Money lenders would then sell British goods to Indians at inflated prices and buy their grains at low prices. Then they would sell that grain at high prices, either on the international market or back to the same people in times of famine. Since these transactions were carried out largely on a credit basis, vast segments of the population became debt slaves to the money lenders, if they were fortunate enough to escape

having to work on famine relief project. This system brought to the force a class of money lenders who became the power through which the British were able to rule in India.

Chinas Sun Yat Sen writes, in his work *The Vital Problems of China*, that "India is not suffering from underproduction. The fact is that what India has produced for herself has been wrested away by England …Nominally of course the British are not plundering but in fact the exorbitant taxation and tyrannical rule in India are such as to make it impossible for the natives to maintain their livelihood ; it is nothing but plunder on a grand scale."[114]

With the expansion of railroads and famine relief which built the railroads, the export of food grains rose rapidly. The export of rice grew from 12,697,983 hundred –weight in 1867-1868 to 18,428,625 hundreds weight in 1877-1878. Wheat exports grew 22 fold during this same period from 299,385 hundred weights to 6373,168 hundred weights. The criminal nature of this policy is clearly seen, since 1876-78 were major famine years. The export of rice and wheat both reached 30.3 million hundred weight in 1891-92.

The worst famine was in 1896-1897, which affected 62.4 million people. This resulted, among other things according to Bhatia, in "civil commotion and unrest in Bombay against continuing exports of food grains from the presidency at a time when the people faced the threat of famine. The government of India however refused to change its food policy and steadfastly clung to the view so far held that, 'even in the worst conceivable emergency, so long as trade is free to follow its normal course, we should do far more harm than good by attempting to interfere…'[115]

The British had difficulty at home in getting raw cotton for their own textile industry. Japan and USA had developed their own textile industries and the British were faced with difficulty of getting raw cotton. The British now felt that vast uncultivated areas in Sindh could be profitably utilized for raising cotton as dry climate of Sindh could be profitably

[114] Yat, Sen Sun. 1953. *The Vital Problems of China.* China Cultural Service
[115] Glumaz, Paul. 2008. *Then and Now: British Imperial Policy Means Famine.* EIR, April 2008 www.larouchepub.com

utilized for raising cotton as dry climate of Sindh combined with adequate heat days was most suitable area in the sub-continent for raising cotton. Hence for the quick decision for executing Sukkur Barrage were motivated by the British interests [116].

Failure to achieve primary objectives

Initially when British started investing in canal irrigation, they started with the renovation of the old canals of western part of the province. Their they were successful but in comparing Western United Province with the Eastern part of the Province, the Topography is altogether different. Even some of the British officials realises this flaws in the soil and climate of the region but some other officials as Mr. Clibborn and Mr. Garstin wished for the success of the canal in the state. Ultimately British decided to construct Sarda Canal after facing lots of ups and downs. British motive behind the construction of Sarda canal was obviously to prove it valuable in case of prolonged and extensive drought; therefore it was defined as a "Protective Work". Its construction will further provide employment as a relief work were such found necessary in time of scarcity. Last but not the least increase in agricultural production was also the aim so that it will lead to increase in major source of income of the State. There are several evidences shows that the British were not successful in increasing the production of the province.

Government's introduction of canal has neither increased the cultivated area nor there and increase in agricultural production because this canals construction resulted in the loss of 12500 ha of land, in terms of cultivated land, Forest land and Grazing land. It even created ecological imbalances, which is against the principal of soil conservation and it is a permanent loss that cannot be revived. The loss of the cultivated land is 8000 hectare out of 12500 ha. The average yield per hectare for all crops is supposed to be 21 quintals (2.1

[116] Panhwar, M.H. *Early Irrigation Under The British*, 1843-1932; www.panhwar.com

tonnes) per annum. The total loss in production per annum will thus be 16800 tonnes. It is doubtful that this loss will be compensated by increased production. The total compensation paid to farmers for their land is in terms of seven million rupees. These huge investments may not yield expected returns. This canal was constructed over the most fertile land of the Province. Besides several resources of minor irrigation have been or will have to be destroyed, because of their existence in the area or vicinity of the canal. The construction of this canal also leads to the displacement of human inhabitants and wildlife.[117] Not only this even Sarda Sahayak canal built in 1970s is not only constructed over the fertile land of the province but also several indigenous irrigation systems as wells and tanks have lost its existence under its construction as told by the farmers of the some districts in an interview (Bachrawa village , Raebareli District).

Evidences from the official records also shows that the growth of irrigation will not be as rapid as was anticipated in 1928 and that the ultimate yearly irrigated area of 1,350,000 acres will not be attained earlier than 1942-43, five years later than was estimated in 1928. A revised estimate of the growth of irrigation by the major crops has therefore been prepared in consultation with director of agriculture. The annual increase in irrigation is now estimated at about 60,000 acres as against 1,00,000 acres in the 1928 project. The chief reasons for the anticipated slower development of irrigation are:

a. The agricultural depression which unfortunately began a year after the opening of the Sarda canal on Dec 11, 1928. Prices have recovered to some extent this year but nevertheless the cultivators in the semi tarai areas of Pilibhit, Bareilly, Kheri, Sitapur, and Hardoi districts refrain from taking canal water for their Rabi crops until they have abandoned all hope of winter rains.

[117] Singh & Afroz. 1985. *Evaluation of Environmental impacts of Saryu Canal in India*. Environmental Conservation. Vol 12.Issue 04

b. One important point to be notice was that the Sarda cultivators have never grown early Kharif crops such as millets, fodder crops, cotton and rice and consequently Kharif irrigation in normal years is really confined to sugarcane. Kharif irrigation is therefore much below the estimated areas and in order to develop these crops and improve the quality of wheat a special staff has been appointed under the director of agriculture. Unfortunately, however the funds allotted are so tight that the development scheme is confined to only four main centres – Haidergarh, Unnao, Nigohi and Bisalpur. Early rice of the improved varieties has done very well particularly around Haidergarh and Bisalpur and the demand for seed is now difficult to meet. Early cotton, C- 402 has not done well and this type is being replaced this year by a hardier variety C-520, but a marked expansion of early cotton is doubtful because the September rainfall is frequently too heavy. Sugarcane is developing very satisfactorily and the average area irrigated during the last six seasons averaged 147,920 acres as against 56,500 acres proposed. The estimated area of cane irrigation in 1935 is 2,50,000 acres as against a proposed final area of 125,000 acres. This shows a marked increase in Sugarcane cultivation (a form of commercial agriculture). The development of early and late Kharif irrigation is of the greatest importance on the Sarda canal and unless the director of Agriculture is given the necessary staff, it will be difficult to attain the proposal final area of 13,50,000 acres on the Sarda Canal.[118]

The Sarda canal was opened in December 1928. It was at that time estimated that when fully developed in 1937-38 an average area of 7,50,000 acres of Rabi and 6,00,000 acres of Kharif crops or an annual total of 13,50,000 acres would be irrigated and the channels were designed to irrigate a maximum area of 8,41,386 acres in rabi and 7,03,896 acres in Kharif.

[118]. File 263 W/ 1938 *Extension of Sarda canal* Revenue Department

The area recommended by the Sarda system is divided by nature into two distinct parts which differ widely from each other in soil and climatic conditions. In the more northern part, covered by the fifth circle and compromising the Bareilly, Pilibhit, Sahajahanpur, Kheri districts and the upper parts of the districts of Hardoi and Sitapur , the Rainfall is high , the soils are retentive of moisture , and the climate is more or less semi- tarai . Except in very dry years occurring once in ten, demand water for irrigation, other than for sugarcane, is never very keen. In the more southern part of the area, however covered by the sixth circle and consisting of parts of the Hardoi and Sitapur district and the district of Lucknow, Barabanki, Unnao and Raebareli soil and climatic conditions are such that the demand for water is usually strong except in wet years. [119]

From a careful study of the actual area irrigated during the last eight years the following conclusion can be drawn:

1. That sugarcane has developed satisfactorily in both circles. In the fifth circle it has now reached full development, while in the sixth circle further expansion is still possible.
2. That Kharif crops in the fifth circle afford little hope of development the average area irrigated during the last four years being 51, 513 acres against 1,75,000 acres anticipated . In the sixth circle Kharif crops are slowly developing, the maximum area in 1933-34 being 1,39,400 acres against expected figure of 2,25,000.
3. That the development of Rabi crops in the fifth circle is very poor, the area in a normal year only being 1,18,865 acres against 2,76,000 acres anticipated. In the sixth circle the irrigation of rabi crops is now fully developed , the area irrigated in normal years such as 1935-36 and 1937-38 being 4,86,892 acres and 4,59,947 acres respectively against an expected area of 4,74,000 acres.

[119] Ibid.

4. It is unlikely that the rabi area in the fifth circle will ever exceed an average of about 1,50,000 acres and allowing 4,74,000 acres for the sixth circle , that the total rabi area will exceed 6,24,000 acres against 7,50,000 acres originally anticipated and for which supplies exists . At the same time, it is anticipated that there are at present 600 cusecs of water available and that this figure is likely to increase as time goes on and channels clear themselves with fine silt and thus reduces losses. In order to make up this shortage and fully utilise the water available it is very necessary to extend the Sarda system, as there is very little scope for expansion in the area at present commanded.

In order to attain the proposed estimates of cultivation proposal was made for the extension of the canal. Extensions into the following tracts are possible:

a. The Gogra Kaliani doab by extending the Biswan distributed of the Kheri branch- Spring level in the Gogra Kaliani doab is high and this area is at present served by the newly constructed Gogra Canals which can be extended as occasion demands.
b. The Gomti Sai doab by extending the Haidergarh branch of Lucknow branch
c. The Sai Ganges doab by extending the purwa branch of the Hardoi branch [120]

The National Council of Applied Economic Research[121] has reported that the Sarda Canal system, has not led to any increase either in the area under cultivation or in double cropping. It concluded that the introduction of Sarda canal has not brought benefits by way of increasing the gross area under cultivation and the distribution of the sown area between Kharif and Rabi. The only change that has been brought about in the crop pattern is an increase in the area under sugar cane which occupied nearly 3 per cent of the net area

[120] File 263 W/ 1938. *Extension of Sarda canal* .Revenue Department
[121] See criteria for fixation of water rates and selection of irrigation projects pp. 54-58

cultivated in 1921-26 and now occupies about 5-6% of it. But the total area under cash crops including sugar cane has remained limited to 7% of the net area cultivated which means that sugarcane has largely replaced the other cash crops particularly poppy and indigo . They also report no significant change whatsoever in the average yield per acre or in the total area under irrigation. It is pointed out that, "The introduction of the Sarda canal has given benefits in two respects:

i. It has increased the area under sugar cane from 3-7% of the net cultivated area.

ii. It has made it possible to irrigate land by canal instead of wells or tanks.

A study was conducted in the cultivated and irrigated area since the introduction of the canal in the 14 districts irrigated by it and have analysed the changes separately for those districts where there is substantial[122] canal irrigation and others where canal irrigation is limited [123] to 6% or less of the cultivated area. For conditions before the introduction of the Sarda canal an average was taken of three years before its construction and has compared these with the averages of the cultivated area in the three years. For comparing the changes in respect of five yearly averages from 1921-26 has been taken as the base and compared with the last two years. It was observed that after introduction of Sarda canal the net cultivated area has registered an increase of nearly 12 per cent in all the 14 districts taken together during the last 30 years. But the increase has been greater that is 13.1 % in the 5 districts with little canal irrigation than in the other districts (11.1%) where there has been substantial canal irrigation. The conclusion is inescapable that the introduction of the Sarda Canal irrigation has not led to any increase in the net area cultivated. [124]

The impact of canal irrigation on the double cropped area has also been negligible. The double cropped area has registered an increase of 13.6% in all the 14 districts taken

[122] Bareilly, Shahjahanpur, Lucknow, Raebareilly, Sitapur, Hardoi, Barabanki, Unnao and Pilibhit.
[123] Pratapgarh, Allahabad, Kheri, Sultanpur and Jaunpur.
[124] Singh Balajit & Shridhar Misra. 1965. *Benefit – Cost Analysis of The Sarda Canal System*. Asia Publishing House. p. 55-64.

together. The increase in 5 districts with little canal irrigation is, however, very much higher amounting to 22.4% than in the districts with substantial canal irrigation, where it is only 3.7%. This shows that people still prefers indigenous irrigation technique.

Apparently canal irrigation has restricted the growth of double cropping though actually it may be due to certain other factors. In any case it is obvious that there has been no increase in the double cropped area due to irrigation provided by the Sarda canal. We, therefore, conclude that the gross cultivated area has remained unaffected by the introduction of the Sarda canal.

Statistics regarding changes in the irrigated area are even more revealing. The area irrigated from all sources in these 14 districts increased from some 2.24 million acres in 1921-26 to 2.31 million acres in 1955-57 that is by 3.0 % only. But the increase in the 9 districts irrigated mainly by the canal was 8.0 % in contrast to a decrease of 2.03 % in the rest of the districts with the preponderance of well and tank irrigation. A detailed break up however indicates that the extension of canal irrigation has led to a corresponding decline in well and tank irrigation and resulted in little net addition to the total irrigated area. In the nine districts where canal irrigation is predominant the area irrigated by the canal is now about 7 lakh acres. At the same time, since its construction, the area irrigated by wells and miscellaneous sources including tanks declined by 3.68 lakh acres respectively or a total of 5.81 lakh acres . The net addition to the total irrigated area that can be attributed to the canal system is only one lakh acres. Hence it is clear that the Sarda canal has largely replaced the existing sources of irrigation rather than supplemented them.[125]

[125] Singh, Balajit & Shridhar Misra, 1965. *Benefit Cost Analysis of the Sarda Canal system,* Asia publishing House,p.57.

During the debate on the irrigation branch budget in March 1935, several honourable members enquired why the Sarda Canal was not paying its way. A large canal system like the Sarda cannot be developed under even favourable circumstances within ten years and owing to the unfortunate sluming in prices and several wet years, the development of the Sarda Canal will be retarded by five years. The main finances affecting the finances of the Sarda are:

i. The high rate of interest at which the capital was borrowed from the government of India. The rate varies from 4.75 to 6.5%. The average annual interest changes debited to the project up to march 31, 1934 amounted to Rs. 48,28,793; the accumulation of interest charges on that date was Rs. 4,08,22,889. Owing to the conversion loans the interest charges from April 1, 1934 will amount to about 48.5 lakhs a year. Theses recurring interest charges are a very heavy burden on the project.

ii. The water rates (Occupancy rate) levied on the Sarda are with the exception of the Sugar cane rates, 20% to 50% lower than the corresponding rates on the older western canals.

iii. Owners rates should have been levied in accordance with the project from 1934-35, but this could not be done until section 50 of the Oudh rent act was amended. A draft bill was submitted to the council in December 1933, for suitably amending this section, but it was rejected.

iv. Cultivators in the grain rented villages in Oudh are not keen irrigators because their share of the additional produce just covers the water rate which is paid by them. Irrigation in these villages will not develop until the Taluqdars agree to pay their fair share of the Occupiers water rates. [126]

[126] File 263 W/ 1938. *Extension of Sarda canal*. Public Works Department. Point 12

Classification of Sarda Canal from 'productive' to 'unproductive' works

In the year 1939 – 40, this project has yielded highest revenue. The total contributions from all the districts irrigated by this canal are not expected to be so large as to make up the loss of over 23 lacs, which this project may sustain each year. An application for transferring canal from 'productive' to 'unproductive' class with effect from 1941-42. [127]

Change in classification from productive to unproductive , when the construction of the Sarda canal was sanctioned it was expected to be "productive" that is to yield at the end of ten years of working , after meeting working expenses , an annual interest of 5% of the capital cost. The canal cost about Rs. 10 crores and the construction estimated was closed on 31/3/1930. The productivity test was applicable in 1939-40 and it was found to yield only 1.4% Government had accordingly transferred the project to the category of unproductive works.

This is attributed chiefly to the development of irrigation being slower than originally anticipated due to adverse economic and climatic conditions and to the impossibility of levying owner's rates.[128] In 1935- 36 the monsoon was weak and stopped early. Rabi season was normal in the whole of Sarda Canal area. 1936-37 was a wet year, which accounts for the decrease in irrigation. In 1937-38, Rabi season was dry especially in Rohilkhand area.[129] It is hoped that with the extensions of the project either recently completed or under execution and intensive agricultural demonstration and larger supplies of seeds of good quality by the agricultural department; the canal may came back in the course of some years in the list of productive works.

[127] File -100W/1940, Box – 84. *Classification of Sarda Canal* PWD (C)
[128] Ibid.
[129] File 263 W/ 1938. *Extension of Sarda canal*. Public Works Department

The rules for classifying canal from productive to unproductive is that according to these rules a work after its construction is allowed ten years to retain the classification first assigned to it, unless it becomes apparent earlier that a change is called for. After the expiry of ten years, a change in classification is considered on the basis of three consecutive years that is 11^{th}, 12^{th}, and 13^{th} years return. If in these three years a productive works falls to yield the proper return it should be classified as 'unproductive. The determining returns for productivity are 4% for works sanctioned before April 1,1919, 5 % for works sanctioned between April1, 1919 and August 1, 1921 and 6% for works sanctioned after the last date. Financial statements shows that the highest revenue yielded by the system was during the year 1939-40 and that was only 1.4% of the capital invested while in order to retain its classification as 'productive' the return from this canal should be 5%.

Second rule - work which has been classed as productive during the first ten year can retain that classification during the 11^{th}, 12^{th} and 13^{th} year also. The A.G. has however, pointed out that in view of the fact that the results obtained so far do not indicate that there will be any improvement in the next three years, there does not appear to be any justification for retaining the appear classification any longer, chief engineer agrees with this view and recommends that Sarda canal system should be classified for the present as an 'unproductive' work with effect from the year 1941-42.

Chief Engineer has shown that in spite of the disadvantages under which the Sarda canal system had to work, its development has been better than that of the Ganges canal. Its comparison is hardly justified as apart from other considerations the time when the Sarda project was launched cannot be compared with that over 60 years ago in respect of demand or need for canal irrigation. Chief engineer is hopeful that Sarda Canal will after some years

come back to the list of productive works as he expects that irrigated areas will expand considerably helped by the extension projects.

Development of the canal has certainly been disappointing. Mr. Lyle in his note on correspondence letter has given various reasons for this. Other reasons might be suggested. The canal irrigates an area which ordinarily has an adequate rainfall and there is therefore, less inducement for the cultivators to purchase water. The cultivators of this area are also generally distinctly less well off than those in the area irrigated by the Ganges Canal and therefore less able to pay for irrigation. The economic slump also became very soon after the opening of the canal and continued for a considerable number of years. [130]

Assessment of Agricultural department about the crops

The Agricultural and Irrigation department have different motive in concerned to the canal. Agricultural department's interest is in with more intensive development. An irrigation department interest is in selling its water and the creation of direct revenue. They are interrelated but work differently.

Water by itself and unassociated with advances in other direction cannot lead to the permanent economic gain of a tract into which it is introduced , in particular a tract which unlike the canal areas of the Punjab and Sind is able to produce crops in varying degrees without this water. To secure the full advantage that perennial water may provide several other requisite are essential. Some of them are:

1. The introduction of suitable crops
2. Increase in intensity of farming both in regard to time and character of cultivation and to manuring.

[130] PWD (C)file 100 W /1940

3. The balancing of the cropping and system of farming under new condition to the available labour days which the cultivator has at his command and which are those prevalent before the water came. This includes the alteration of existing farming practise so as to adjust it to the condition under which irrigation water can be provided. And the creation of market facilitates to meet increased production.[131]

Agricultural department made assessment of certain crops before the proposal was made by the director of agriculture. That the sugarcane cultivation has developed well. This is undoubtedly due to the experimental sugarcane farm at Sahajahanpur. There are however, certain district in which these are immense possibilities of expansion, particularly Barabanki (10,000 acres), Unnao (7000 acres), Lucknow (2500 acres) and Raebareli (1500 acres). The areas in bracket are the approximate areas of sugarcane irrigated this year.

In order to irrigate these small areas, vast quantities of water are at present wasted. Propaganda and efficient arrangements for the distribution of improved varieties of cane are urgently required in these districts.[132]

Year	**Crop**	**Estimated Acres**	**Actual Acres**
1928 – 29	Sugarcane	Nil	Nil
1929 – 30	Sugarcane	26000	105000
1930 – 31	Sugarcane	45000	150000
1931 – 32	Sugarcane	55000	160000
1932 – 33	Sugarcane	70000	190000
1938 – 39	Sugarcane	125000	Up to July 1932

[131] File No. 327/1932. Box – 105. *Agricultural development in the Sarda Canal.* Agricultural department.
[132] Ibid

` In relation to *Kharif crops*- these are not being irrigated at present to any appreciable extent and there is no possibility of attaining the results forecasted unless cultivators are persuaded to grow improved variety of seeds. The most important crops under these heads are rice, cotton, maize and fodder crops. The success of the Sarda canal depends very largely on the introduction of improved varieties of these crops and it is only with the assistance and cooperation of agricultural department so that satisfactory results can be obtained.

Year	**Crop**	**Estimated Acres**	**Actual Acres**
1928 – 29	Kharif	Nil	20000
1929 – 30	Kharif	110000	95000
1930 – 31	Kharif	160000	100000
1931 – 32	Kharif	215000	30000
1938 – 39	Kharif	490000	

For Rabi- In view of the fact that the canal was opened a year before the proposed date, the results obtained so far are disappointing. There has been a negligible increase in the Rabi area irrigated during the last three years which were particularly wet season.

To increase from 3,60,000 to 7,40,000 is a very formidable problem and it is only by means of propaganda demonstration and to issue of improved varieties of seed that the increase can be expected ; for these the irrigation branch is very largely dependent on the Agricultural department.

Year	**Crop**	**Estimated Acres**	**Actual Acres**
1928 – 29	Rabi	Nil	315000
1929 – 30	Rabi	165000	395000

1930 – 31	Rabi	245000	290000
1931 – 32	Rabi	325000	360000
1938 – 39	Rabi	740000	-----

Total crops- During the last three years the total area irrigated has remained practically stationery and there are only seven years in which to increase from 6,00,000 to 13,50,000 or at the rate of roughly 1,00,000 acres /year. Assuming an average rate of Rs. 5/- /acre the enhanced revenue will amount to from five lakhs in the first year to 35 lakhs in the seventh year. If these results can be attained by incurring an additional expenditure of Rs. 57,676/- per annum , as proposed by the Director of Agriculture , the results combined with general enhanced propriety in Oudh should prove the expenditure to be fully justified.

Year	**Crop**	**Estimated Acres**	**Actual Acres**
1928 – 29	All Crops	Nil	335000
1929 – 30	All Crops	300000	600000
1930 – 31	All Crops	450000	540000
1931 – 32	All Crops	600000	600000
1938 – 39	All Crops	1350000	

Agricultural department assessed the financial forecasts and the results obtained shown in following table. The actual assessments in the table in 1931-32 were below the estimated assessments because the water rates in force during the first five years are approximately three quarters of the final water rates.

Year	Estimated Gross Assessment (In Rs.)	Actual Gross Assessment (In Rs.)
1928 - 29	Nil	11,00,000
1929 - 30	13,00,000	21,50,000
1930 - 31	20,00,000	21,50,000
1931 - 32	27,00,000	23,75,000
1938 – 39	74,00,000	----------

The director of Agriculture has made certain proposal regarding the development of irrigation on the Sarda canal based on above mentioned figures.

Firstly, he proposed to change the boundaries of Deputy director of Agricultural circle because the district covered by Sarda are at present in charge of three departments of director of Agriculture as in some canal decision the executive engineer has to deal with all three . The proposal will reduce the number to two which should make cooperation and development much easier.

Secondly, he proposed of demonstrating outfits and agricultural experiments because demonstration and experiments must be carried out in the villages of improved methods and improved seed are to be introduced rapidly and the recurring expenditure was around Rs. 9,400. (Proposal of five new farms of 30 acres each has already been disused.

Thirdly he made proposal of appointing a Propaganda officer so that an officer will be specially deputed for propaganda work in the lower district of the Sarda. An officer capable of delivering forceful lectures combined with a cinema is available and should do most valuable work. An appointment of additional staff including rent of office was next proposal made because additional subordinate staff is essential if the work is to be effective.

Need of additional mechanics was there because these men are required to assist the public in the maintenance of Agricultural machinery such as cane crushers and centrifugal which are essential in places where improved varieties of cane are grown in large quantities.

He further talks of Director Reserves of Rs. 4000/- to provide for a manorial village campaign. Rs 10,000/-is provided for insurance against loss as it is intended that cultivators who used improved varieties of seed and who carry out construction should be compensated if the yield obtained is not equal to the yield obtained from the present seed. This reserve is unlikely to be used.

With above proposal the following conclusion and figures were obtained from the season and crop report for 1930-31 and the irrigation for the same year compare the Sarda canal results. With the results obtained in certain district on western canals and indicate the possibilities of the Sarda canal if the director of agriculture scheme is accepted. [133]

Table showing results from above crop reports – 1930-31

	Sarda(Whole)			Western Canals			
Crops	Area Sown (acres)	Area irrigated (acres)	%age	Area Sown (acres)		Area Irrigated (acres)	%age
Sugarcane	365419	150033	41.1	303863	(i)	207816	73.2
Rice	1373750	68746	5.0	233649	(ii)	135530	58.0
Cotton	31394	1180	3.7	409369	(iii)	261625	63.9
Maize	458809	1752	0.4	460301	(iv)	115195	25.0

[133] File No. 327/1932. Box - 105. *Agricultural development in the Sarda Canal*. Agricultural department.

Notes:

(i) Muzaffarnagar, Meerut and Bulandshahar

(ii) Saharanpur, Muzaffarnagar, Mainpuri & Kanpur

(iii) Meerut, Bulandshahar, Aligarh, Muttra & Agra

(iv) Meerut, Bulandshahar, Aligarh, Mainpuri and Itawa

Figures such as those attained in certain district on western canals can only be attained on the Sarda if a Scheme on the lines proposed by the director of agriculture is introduces. Last cold weather, a considerable number of indents for improve seeds such as cotton, Rice, Maize, and juar were received. These were passed to the director of agriculture concerned, but in several cases no seeds were available the need for additional farms is urgent.

It was recommended that the director of agriculture scheme should be introduced with the least possible delay and if possible by Sep. 1932. But even after large number of proposals recommended by the director of agriculture Secretary to the Government was not ready to accept it and he further gave a motto for the last year – ***" No New Expenditure"***, and said "***Sorry***" and argued to maintain the same position. (13.08.1932)[134]. Therefore, F. Anderson, (C.I.E., ISE, Chief Engineer, Sarda Canal) was also disappointed indeed to find that the proposal of the director of agriculture was rejected.

Success of Canal

It is proposed to open three farms on leased land in three district with a view to develop the agricultural resources in the area served by the Sarda Canal as well as to raise the income of the irrigation department by increasing the area under profitable and intensive crops which require irrigation for successful cultivation. The aims of these farms is to bring within cultivations reach improved seeds, improved implements and improved methods of

[134] Ibid

cultivation so that they may satisfy themselves of their utility with other demonstration . These farms are expected to be self-supporting and will be worked from savings already affected by retrenchment in the cattle breeding and the Agricultural College.

Regarding the demonstration far in Sarda area- four agreements (Patta and qabuliyat) was signed for the lease of land in the Unnao district for starting a demonstration farm duly executed by the lessors (peasant) and to request that these may be completed by Government and returned to this office for registration at an early date. In total 68 bighas, 7 biswa, and 5 biswani. Later the owner agreed to lease out the land at enhanced rate for two to three year and then after it will be released to him after its expiry.[135]

The farm is working as a seed and district demonstration farm and excellent development and propaganda work is being carried on. The department has invested heavily in the repairs of the farm buildings. Mixed farming has also been recently introduced on this farm and it is also running successfully.

The profits at the farm have been as:

1943-44	991/-
1944-45	1946/-
1945-46	3808/-
1946-47	2951/-

It is therefore , be seen from the above that the point made out by the commissioner that Government will lose more than 700/- in rent has not much force as the Government is earning about 3000/- during the last two years . From this farm in addition to its serving as a very useful centre of demonstration and propaganda.

The success of farming system motivated them to made new proposal of five new farms of 30 acres each. Because at present there are only four farms in the ten districts

[135] Ibid

commanded by Sarda situated at: Sahajahanpur, Nawabganj (Bareilly), Hardoi and Raebareli (17 acres only). The five extra farms proposed will enable a farm to be opened in every district (excluding Pilibhit) and should do most valuable work in acting as demonstration and in supplying pure seed of improved varieties. [136]

[136] Ibid

Chapter -5
Impact of Sarda Canal

The historical study of natural resource conflict and the anthropological study of indigenous conservation systems are two important ways in which we can construct a lineage for Indian environment.[137] In present scenario the preservation of natural resource is a challenge to the society an in order to cope up with this, study of Environment is very important, secondly, indigenous conservation system has its own priority in this study.

Natural resources are essential for the survival of all forms of life on planet earth. The unsustainable use of these resources in all forms (due to increase in human population and consequential increase in demand) has intensified the competition for multiple uses of Natural resources leading to limitless depletion. The ever expanding rift between availability and use has resulted in a wide spread threat to the ecosystem. Water policies in the past two decades have focused more on the expansion and physical availability of water without regard to sustainability. This approach has led to poor management of institutional structures and water resources. Current practices in water management may not be enough to meet the water challenges of the next century. There is a need to re-examine these institutional structures.

Water rights in India are closely linked to property rights in land. At an aggregate level, the implication of this is ground water over exploitation. Agriculturally important states in India are witnessing phenomenal fall in water table. Traditional water harvesting has taken

[137] Guha, Ramchandra. 1992. *Prehistory of Indian Environmentalism: Intellectual Traditions*, Economic and Political Weekly, Vol. 27, No. 1/2 , pp. 57-64

a back seat. Rural drinking water is an issue. Panchayat have deprived local people of control of traditionally managed tanks and other Common pool resources (CPR's).

Water in any civilization was always a very important source of subsistence as these civilizations are evolved in the vicinity of river. India is an agro based country, thus water plays a very dominant role in its economy. When we talk in context of British in India they have actually tapped this natural resource to an extent that it ultimately wiped out the indigenous irrigation techniques as wells, tanks ponds etc to a larger extent. Despite many failures of canal irrigation badly managed irrigation projects are still being developed for short term economic gains and political popularity. The UP government in India has recently undertaken a canal project named the saryu canal project, at a total cost of Rs. 40 million (ca 4 million US dollars). We have never made studies of the project the results of which are presented in this communication. Here an attempt is made to understand one such investment made by British in Oudh region that is in the field of Canal irrigation popularly known as ***Sarda Canal.***

In the last chapter overall figure shows that the large parts of the canal occupied area are not very much fit to its surroundings and study was mainly done in context of the Cultivation and Irrigation only and mainly during the British period. But this chapter focuses on other aspects of Canal Irrigation that is its impact on environment, in Oudh region. For example impact on the ecology, cropping pattern, replacement of indigenous technique as wells and tanks, water-logging and seepage and salinization problem to such a great extent that the cultivated land has been turned into a barren land. This chapter basically explains the impact of the construction of the Sarda canal in Oudh region.

Table: Mileage of Canals, Distribution of Sarda Canal in March, 1931.

CANAL	LENGTH (miles)
Main	913
Distributaries	2,979
Escapes , drainages, cuts etc	1,468

Although the geography of a place is already discussed but it is important to give brief information about the region. The topography is equally important for the selection of techniques adapted to a particular place. In the Indo-Gangetic plains the colour of the surface soil may be any shade between light fawn and brown. The soils vary in consistence from drift sands to clays so stiff that drainage is entirely prevented, and in certain cases injurious salts of soda and magnesia accumulate, which appear as efflorescence (reh) on the surface of the sterile soil. Soils in Bengal are distinctly lighter in colour and denser than those in north-western India. The latter have particles in a fine state of division, but may contain nodular limestone or Kankar; found in beds or layers at various depths. The soil may extend, unaltered in colour and consistence, to a considerable depth; but commonly substrata are found in well- defined layers of sand, clay, and loam. The depth to subsoil water is in many places very moderate, but in some parts of the Punjab and the United Provinces the wells are deep. Alluvial soils which are not too dense in consistence, and are naturally drained, can be irrigated with great advantage, the surface being usually flat or only slightly undulating. With moderate and well-distributed rainfall, the alluvial soils of the Indo-Gangetic plains are capable of growing a great variety of Kharif and Rabi crops, for the depth of soil secures great natural fertility. The amounts of nitrogen and organic matter in alluvial soils vary, but

are generally low. The potash is adequate, and the phosphoric acid, though not plentiful, is generally less deficient than in other classes of Indian soils.[138] Inadequate technique impacts adversely to the environment which is discussed throughout this chapter.

Impact on the Ecology of Canal construction

In framing of the laws or even the policies in relation to water, Ecology was given the low priority and has always been given recognition indirectly for its importance for the management of fresh water. National Water Policy 2002 envisages that water is the part of larger ecosystem, realizing the importance and the scarcity attached to fresh water it has to be treated as an essential component for the sustenance of life. The policy states that the management of the quality of the environment and management of the ecological balance should be the primary consideration.

Large-scale irrigation projects are being criticised for creating many hazardous environmental impacts such as increase in water-logged and saline lands, sedimentation in reservoirs, damage to forest areas, breeding of mosquitoes, depletion of fish population, displacement of wild life from the reservoir areas, etc. Even in the last phase of the 19th century, it was acknowledged that large tracts of land which was once fertile deteriorated because of the salinity and the water- logging created by the construction of big canals and the extensive use of irrigation water. It was observed that a short time after the commencement of canal irrigation in Punjab, water-logging and salinity appeared in the canal tracts.[139] These are the main reasons for the disturbance of the ecology of the place.

Occupying of the forest area for some other purpose is also not healthy for the ecology of the state. For example in Tarai and Bhabar estates, large amount of acres of land

[138] The imperial gazetteer of India , the Indian empire vol. iii economic, clarendon press 1908
[139] Letter No 3235/XI, File 293- 18.06.1926

is occupied by the irrigation department for the construction of Sarda Canal. According to the Remote Sensing Agency, in India from 1972 to 1982 an average 1.5 million hectare of forest cover has been lost annually. From 1951 to 1980 about 1,50,000 hectare of forest land was every year diverted to agriculture. Deforestation leads to changes in micro climate, hydrology and soil which together make eco-disasters. The UP plains have 6.9 per cent area under forest, whereas the satellite imagery shows that the actual forest cover is only 2.5 per cent. The 1952 Forest Policy had recommended that 20 per cent land should be under forests.[140]

It is very obvious that canals are constructed at the cost of lands, but care should be taken for other natural resource. Motive behind the construction of the canals and the underlying assumptions is that from investment of such magnitude a great and overall increase in wealth must necessarily result, contrasted sharply with the consequences, so as to compensate the loss. Whilst the expansion in irrigated area seems to have been general, if talking in context of Sarda Canal, the increase in acreage under the various crops was highly selective. (Mention from revenue scarcity department about this). The Kharif crops of millets and the pulses on which the overwhelming majority of the population depended for its staple food grains and fodder were not adapted to artificial irrigation. Wheat however increasingly important as an export staple from the mid-1870s, benefited consistently, as did other "valuable crops" – most notably sugar cane and cotton, indigo and opium. The immediate impact on ecological conditions was more disturbing. The burden on the land through persistent heavy cropping under the stimulus to cultivate the "valuable" produce increased the threat of deterioration in fertility noticeable earlier in the century wherever the intensification of the agriculture, particularly in the mid doab regions had brought over cropping in its wake.

[140] Jafri, S.S.A. 1994. *Uncultivated Plains of Uttar Pradesh: Ecological Problems*. Economic and Political Weekly, Vol. 29, No. 40 , pp. 2588-2589

Most serious of all however was the effect of the canals on the delicate mechanism of hydrological cycle. It led to a sharp increase in the rate of evaporation moisture from the soil. Intensifying capillary action in the sub-surface layers. Alkali Salts, which owed their original presence in the soil to its geological composition, were brought up in solution nearer to the surface by increased capillarity. During the long, dry months following the summer rains, evaporation transformed them into a grey – white crystalline efflorescence, inimical, in the patches of its greater intensity, to plant growth. Prior to the introduction of the canals, however, the quantity of moisture in the surface layers of the soil and, more important, the distance from surface of the spring level, was chiefly a function of the annual monsoon: a fluctuation in rise and fall of up to ten feet was commonly recorded between the monsoon and the winter months. Well irrigation could neither bring about a significant rise in the spring level on its own account nor, at the maximum irrigating capacity of one – and one half acres per well, result in an excessive application of water at surface.[141]

Further complications arose where the embankments, of roads and railways in addition to canals, insufficiently supplied with the expensive devices of culverts, obstructed surface runoff and led to the progressive formation or intensification of swamps. Age old tracts of grey balding earth, known as *usar* (barren), and of the white saline efflorescence, reh increased in area, whilst new patches appeared in former cultivated land. [142]

Ecological imbalance is largely the result of the area particularly occupied by this canal. As mentioned in the last chapter about the 8000 ha land area which was highly fertile for cultivation was occupied by this canal. Beside this, 1250 ha of forest land is also occupied

[141] Whitcombe, Elizabeth. 1972. *Agrarian conditions in Northern India: United Provinces under British Rule*; 1860-1900. Pp. 7-9. University of California.
[142] Ibid

by this canal[143]. These forests form a major source of timber and are managed for commercial timber production to increase revenue. Sal forests were the most affected forest. Sal forests yield non-timber forest products, including fodder, seed for oil, tannin and gum from bark and leaves for platemaking. Dominant distribution of Sal was observed in alluvial soils and red loam soils in northern India, indicating the suitability of the soils due to higher water holding capacity and greater moisture content. Sal species exhibits semi evergreen habit and hence cannot survive in the drought conditions.[144]

This canal has also covered around 3200 ha of grazing field. This was a permanent loss. Several resources of minor irrigation have been destroyed, because of their existence in the area or vicinity of the canal. The construction of this canal also leads to the displacement of human inhabitants and wildlife. The removal of trees during the canals construction will adversely affect the Motipur wildlife sanctuary which is rich in animal wildlife including Deer and Tiger. There is a great apprehension that the area might become devoid of Deer, which are the main animal wildlife inhabitant's conditions.[145] In an interview with the farmer, it was said that the canal has covered large number of wells and tanks under its constructed area. Beside this he further said that if any pond or tank is in its vicinity also than that is also not useful for irrigation because the alignment of the canal is such that pond lie as a waste to them. He further says in the context of feeder canal that there are several villages from where this feeder canal is passing but its water cannot be used because that canals work is to supply water to Main canal. The water of feeder cannot be used by the farmers for irrigation purposes.

[143] Singh & Afroz. 1985. *Evaluation of Environmental impacts of Saryu Canal in India*. Environmental Conservation. Vol 12.Issue 04
[144] Chitale, V.S & M.D. Behera., 2012. *Can the distribution of Sal (Shorea Robusta Gaertn. f.) shift in the North Eastern direction in India due to changing climate? C*urrent science, vol. 102, no. 8,
[145] Op.cit

For the construction the Sarda Canal some record from the revenue department were obtained. These records give the detail description of the transfer of certain land at Banbasa in Tarai and Bhabar government estates to irrigation branch for the head works of the Sarda Canal. On Sep 1923 commissioner, Kumaon division solicits sanction to the permanent transfer of 398.32 acres of land at Banbasa. Deputy Secretary has no objection to the transfer of land to the irrigation department, this land was in the interest of the state but it is not understood why one department of the government should be required to pay another department for the tress standing on the land, especially when both are reserved department. No doubt any income realised but the forest by irrigation department will be credited to provincial revenues.[146]

P.Windan, Esqr. CBE.CIE.ICS, commissioner of Kumaon division Nainital further added that the proposal was also made that whatever land is not required for bonafied canal purposes when the construction of the head works is finished should be retained (Returned) by the irrigation department to government estates. Irrigation department have agreed to pay in five yearly instalment Rs, 175000/- for the Sal Tress standing on the land which is been given free.[147]

Beside this further additional allotment of 75.9 acres of land in Tarai and Bhabar estates was made the irrigation department to the Sarda canal construction. This time compensation amounting to Rs. 240/10/- for the tress standing on the land will be recovered from the Sarda canal authorities when transfer is sanctioned[148]. Again 512.41 acres of land was transferred for Sarda canal head works. Further sanction of 22.029 acres of land was

[146] File 397; Box -368. *Transfer of certain land at Banbasa in Tarai and Bhabar government estates to Irrigation Branch for head works of the Sarda Canal*. Revenue (A) department
[147] Correspondence Letter No. 5727/XI-164 (Revenue (A) department file 397
[148] Correspondence Letter No. 5268 – 8 Sep 1923. Revenue Department

made to PWD Irrigation branch for the construction of the Bisalpur branch of Sarda Oudh canal.[149]

In serial No. 60 of Forest department the conservation of forest, eastern circle, has recommended the transfer of 99.810 acres of land to PWD, Irrigation Branch in Pilibhit forest division and transfer was sanctioned on the condition that Irrigation Branch will pay forest department, for the land at the rate of Rs. 10/acre. It was written in report that out of the 99.810 acres only 77.047 acres be transferred to PWD IB. It is now requested, that 22.029 acres which lies in the Tarai and Bhabar govt. estates may also be transferred to Irrigation Branch [150] for construction of Bisalpur branch of canal.

In one letter it has been found that the transfer of 172.143 acres of land was made to irrigation department from Tarai Bhabar Government estates. Transfer was sanctioned with the agreement of the finance department but, the irrigation department was not than asked to pay for the land at the rate of Rs 10 / acres and it has now been reported that the land actually taken over by the irrigation department Was 172.199 acre against 172.143 acres sanctioned. An additional land of 0.056 acres was later transferred for the construction of Sarda Deoha feeder head works division Sarda Canal.

Revenue (A) Department. G.O. No. 1912/IA-131-1924 1st May say that the Sarda canal has paid heavily for all timber standing on the plots of land taken over from Tarai and Bhabar Government estates as shown below.

Area of Land	Authority	Compensation
392.32 Acres	Rev. Dept., GO No. 4982 Dated 1st Sep. 1923	Rs. 175000

[149] File No.271/1926. 429 , Revenue (A) Department
[150] Correspondence Letter No 3235/XI, File 293- 18.06.1926

75.9 Acres	Rev. Dept., GO No. 5268 Dated 8th Sep. 1923	Rs 240/10
512.41 Acres	Rev. Dept., GO No. 7374 Dated 23rd Oct. 1923	Rs. 14000
	Total	Rs. 189240/10

Irrigation department protested against the payment for Land which has been transferred to them from Tarai and Bhabar Government Estates. They argued that they had already paid the estates very heavily – Viz 450/- Per acres for the timber standing on the forest land and lost heavily, Since, we subsequently got at most 250 per acres for this timber when we sold it later. However there is also another land when we paid considerable less and therefor have no objection. They further said that land itself has no potential value being situated in the centre of the forest and cannot the worth more than 1 Rs, or Rs. 2 / acres. Ultimately it is clear from above description that no compensation was made for the forest land acquired by the Irrigation department for the construction of the canal. Occupying of the forest area was a loss to the ecology in addition to it non-payment of the compensation is the financial loss to the locality's.

Impact on Cropping Pattern

These rivers play a dominating role in the maintenance of the topography of a particular place, the right bank of the Ghagra also is high, while the left, to the distance of many miles from the river , is low, and full of springs , permanent pools and streams.[151]

[151] Donald Butter, 1830. *Outlines of the topography and Statistics of the Southern Districts of Oudh and the Cantonment of Sultanpur.* Calcutta. Pp. 10-14

The primary objective of irrigation is to provide necessary moisture to the soil for plant growth. In addition it involves the draining away of excess water from the soil. In this way irrigation is man's effort to acquire control over the soil-moisture regime. The efficiency of an irrigation scheme depends on its ability to provide the right quantity of water at the appropriate time and place for the required crop. Irrigation supplements other sources such as rainfall. The demand for water resources varies spatially and temporally. Irrigation fills the gap between supply and demand of the water resources and this can be done through the following methods:

i. Adoption of appropriate agronomic practices.
ii. Utilisation of local level water harvesting systems like tanks, ponds, lakes and small reservoirs.
iii. Conjunctive use of surface and ground water of micro-basins.
iv. Medium or major storage or diversion schemes.
v. Augmentation from nearby basins. [152]

Cropping pattern depends on the topography, climate, and soil texture of the particular place and farmer's sown seeds accordingly. Agricultural crops are broadly divided into food and non- food crops. In the context of Sarda canal 93 % of the cultivated area is under food crops among which rice and wheat are the most predominant. Barley, bajra and juar come next. Sugar cane is the main non-food crop grown in this area and occupies about 5 % of the total cultivated area. [153]

In an interview conducted with some farmers in Raebareli region, Maharajaganj Village, Hardoi tehsil, their farmers said that earlier the land was so fertile that they were

[152] V. Santha Kumar and R. Rajagopalan. 1993. *Technological Prejudice: Case of Indian Irrigation*. Economic and Political Weekly, Vol. 28, No. 14. pp. 586-594
[153] Singh Balajit & Shridhar Misra. 1965. *Benefit – Cost Analysis of The Sarda Canal System*. Asia Publishing House. P. 34

capable enough to carry on large amount of '*Dalhan'* (Pulses) cultivation and even seasonal vegetables. But now the land is not worth enough to grow such crops. Because of seepage and salinization problem, land has become even barren at some places. Now they can sow only rice and wheat. Earlier Crops like *Juar, Bajra, Barley* and other pulses were grown demanding average amount of water for cultivation but now because of the presence of this canal seepage is the major problem in the adjacent lands because of which water table goes high and reaches the field, thus unsuitable for such cultivation. With the seepage from canal the four metre area around the length of canal is converted into waste land because of the lack of lining beside the canal. On an average of the whole Sarda Canal if we see, then there is no significant change but when we look on the main canal command area there is reduction in crop cultivation. On the other side irrigation officers opines that farmers are still attached to the traditional system of cultivation that is they opt for water intensive cultivation. A clash of opinion is their between peasants and officers.

A farmer who is running a cooperative society even told that some scientist from Canada came to do the survey of the land around this canal and they even with the help of Gram Sabha and the cooperative society took 100 hectare land and did the survey but ultimately they reached to the conclusion that this land will never be able to become a cultivable land.

The cultivated land occupied by the canal is a major loss for the peasants. According to the farmers this loss will never be compensated by increased production. The total compensation paid to farmers for their land is in terms of several million rupees. This huge investment may not yield expected returns. The land loss is also against the soil conservation. Besides several resources of minor irrigation have been or will have to be destroyed, because

of their existence in the area or vicinity of the canal. The loss pointed out above is a permanent loss that cannot be revived. [154]

Third a very important point to be discussed upon is the growth of elephant grass. These grasses have become a shelter home for some animals like "Neel Gaye" (Neel Cow). These animals are very harmful for the standing crops because they don't allow it to grow and before harvesting they even eat these crops. Nilgae are found in herds all over the province, and it is frequent complaints that their numbers and depredations they commit on the crops have much increased since the villagers have been disarmed.[155]

Decline of Tube well irrigation

Mr. M. King a superintending engineer who inquired before its construction said that during forty years of British rule one real famine occurred and wells were not failed. And that well irrigation was until the need of it was removed by rain, supporting a large number of labourers. [156]

British were themselves in a state of dilemma. Some argues that there was one point to be considered is the great extent to which the people of Oudh have secured themselves by wells. The number of the old and new wells that have been built with in last thirty years (before 1896) are:

Table showing the status of wells in four districts of Oudh in 1896 administrative reports. [157]

[154] Singh & Afroz. 1985. *Evaluation of Environmental impacts of Saryu Canal in India*. Environmental Conservation. Vol 12.Issue 04
[155] Gazetteer- Province of Oudh Vol 1. A to G.
[156] File No. 449 B. *Sarda Canal Oudh.* Revenue Department. Pp.4.
[157] Ibid

Districts	Old	New	Total
Sultanpur	8992	7461	16453
Lucknow	1967	2985	4952
Barabanki	2549	7664	10213
Fyzabad	8460	8075	16535

This shows that in Oudh region number of wells was increasing year by year. That is this was the main irrigation system in the area. But on the other hand the other group of British argued that the wells demanded large investment of capital.

In western part the facilities for irrigation were already in existence in western part of the province for example in Meerut and Agra Division (1896).

Division or District	Total cultivated (acres)	Irrigated(acres)	%age of irrigated
Meerut Division	4394509	770523	23
Agra Division	3813195	563681	15
Lucknow Division	346809	113216	32
Faizabad Division	675416	326957	49
Sultanpur Division	609488	274050	45

Figures are from land records shows that the %age of area irrigated in Lucknow, Faizabad and Sultanpur division before the construction of canal was comparatively high and was done all from the indigenous irrigation technique.[158]

[158] ibid

Area cultivated by Sarda canal is said to be increased at some places, because farmers at some places were not left with other option of irrigation because their older techniques as wells, tanks or ponds have been occupied by the Canal. It has largely replaced the traditional and local sources of irrigation particularly well. The total number of wells has declined from 4.75 lakhs before its introduction to 3.03 lakhs at present. In other words, as many as 1.72 lakh wells have been lost in its reign during a period of 30 years that is 5722 wells per year. Assuming the irrigable area of a well at 10 acres it may be calculated that this corresponds to a loss of an irrigation potential of 1.72 million acres which corresponds almost exactly to the irrigation potential created by the Sarda canal. This explains to a considerable extent as to why there has been little increase in the total area under irrigation from all sources in spite of the addition of such a high irrigation potential of the canal. Besides all the wells that are available are seldom used for irrigation. The percentage of wells not in use has tended to register an upward trend suggesting further the replacement of well irrigation by canal irrigation.[159]

Huge investments are made in different irrigation systems but sometimes they may not yield expected returns. The land loss is also against the principle of soil conservation. Several resources of minor irrigation and indigenous irrigation have been or will have to be destroyed because of their existence in the area or vicinity of the canal. Problems expected after coming into operation.

The above table shows the status of wells before canals construction and the table below shows the status of wells after canals introduction.

[159] Singh Baljit & Sridhar Misra. 1965. *Benefit and Cost Analysis of the Sarda Canal*. Asia Publishing House. P. 58

Decline of wells in the District of Sarda Canal

(Quinquennial averages for 1928- 57)

Period	Total Wells Available	Wells not in use	Wells in use	% of wells not in use to total available
1928- 33	474365	65530	408835	13.81
1933-38	445837	80365	365572	18.03
1938-43	440938	64781	376157	14.69
1943- 48	398772	77349	321423	19.40
1948-53	361276	86550	274726	23.96
1953-57	302698	62796	239902	20.75

Replacement of Tanks and Other Sources

With the introduction of Sarda Canal in Oudh region several indigenous irrigation techniques lost its existence. Tanks and other minor sources of irrigation have also been replaced besides the wells by the Sarda Canal. Irrigation by these sources has declined by almost 40 percent on the whole. In certain district the decline has been even more marked. For instance in Kheri these sources accounted for 42 % of the total irrigated area in 1921-26. At present their relative contribution has been reduced to less than 15 % and the total area irrigated by these sources by about 62%. Such large declines in irrigation from minor sources due to replacement by canal irrigation have occurred in several other districts. [160]

[160] Ibid

In Oudh province, south of Gomti River the general character of the country is superior to that of North. The Upper part of the track between the Gomti & Ghagra consisting of the main part of the district of Kheri whole of Sitapur, a part of Lucknow and upper part of Barabanki is generally sandy; therefore the crops are mainly irrigated, In the centre of this tract there a few jhils especially in the lower part of Sitapur, Lucknow and Barabanki where the soil is more clay and the crops are more irrigated and finer, but it's generally character is as described. The lower part of Barabanki district and Faizabad are better there are more jhils and more irrigation and all the finer crops are produced. The finest part of this tract is in the district, of Barabanki, Lucknow Faizabad and river Gomti. Here the population is dense, the soil excellent and kacha well irrigation. The tract between the Gomti and Ganga is the finest part of Province of ours. There lies a string of Jhils especially in Lucknow and Unnao District. In these tracks are to be found some of the finest villages in the province, producing magnificent crops all irrigated and interspersed with fine grooves of trees. In some part of these tracks there is much Rice cultivation and the water is always near the surface. But, Kacha wells do not stand here, wells made of large burnt bricks moulded into segments of the circle of the well and laid on one another without mortar.[161] Secondly, Oudh has a large number of Tank Irrigation systems. In Agra and Meerut irrigated area from this source is only 23,892 acres against a total cultivated area of 8,207,706 acres or less than 3%. The significance of this fact lies in its indicating a most material difference in the physical features of the two tracts. The whole of this part of Oudh is intersected by Jhils and chains of jhils, such as are almost unknown in the Western Doab. The sub soil water is generally near the surface and the climate and soil are much moister. The drainage which would be required if a canal is made is likely to be very expensive, and there is a fear of waterlogging; that what

[161] V. Santha Kumar and R. Rajagopalan. 1993.*Technological Prejudice: Case of Indian Irrigation*. Economic and Political Weekly, Vol. 28, No. 14 . pp. 586-594

is now flourishing cultivation may be turned waste and that the people may be decimated by material fever.

Thirdly the average size of a holding in Meerut is more than twice the average size in Oudh, and three times what is in Faizabad. Small Farms like those in Oudh barely give the cultivator sufficient occupation for himself and for his cattle. Practically Irrigation cost him nothing or little in addition. And the superior cheapness of canal would be no recommendation to him; in fact it might be advantageous to him that he and his beasts should be kept idle.

Another thing came out in survey was that nearly the whole of the present cultivation is paying very high rates of rent, which are indeed about as much as the cultivators could pay for irrigated land. If canals are made than in the same way as the irrigation from canals was substituted for irrigation from wells and tanks irrigation so the profits from wells and tanks irrigation would be transferred to profits on the capital invested in canals. The people would themselves instead of gaining would be losers. If the rents were reduced by the occupier's rate or even if they remained the same the landlords would not be able to pay an owners rate. In fact in the former event they might justly claim to have their present revenue reduced.

Economically Mr. W.C. Benett, Settlement Commissioner of Oudh opines that the disadvantage would largely preponderate over the gains. But in the periods of prolonged drought when both wells and tanks were exhausted there is of course no doubt that a canal would be of greatest benefit.

The present Jhil irrigation is affected, it is believed by blocking up the minor drainages of the country, and we know by experience that these drainages will have to be opened out if a canal will come very close to them [162]

Farmers Opinion after twenty years of its construction :

- Supply of Sarda canal is not adequate and timely
- Number of Breaches has increased
- There is substantial loss of irrigation water due to lack of culverts, syphons and proper repairs and proper alignment of guls.
- Osrabandi are not being speedily made
- There is no compensation for failure of crops due to lack of irrigation
- Area under irrigation is being extended every year without in any way adding to the volume of water available for irrigation

Waterlogging

The environmental problems such as waterlogging and salinization are some of the major drawbacks of Canal Irrigation. These problems are extremely widespread in the vicinity of irrigation canals. It is also known that about half of the worlds irrigated areas has already been damaged to some degree by waterlogging and salinization and that much of the additional land which is expected to be irrigated in the future is highly vulnerable to similar damage.

[162] File no. 449B. *Sarda Canal Oudh*, Revenue Department

In Pakistan out of a total 15 million ha of irrigated lands as many as 11million ha are already suffering from waterlogging or salinization, Egypt, Syria, Iraq, Iran, USA, Afghanistan and Sudan also have similar stories to tell. India also has not lost only at least 7 million ha of land but large additional areas are being affected by a rising water table and salinification – year after year even in areas of comparatively new irrigation projects. The Man and the Biosphere programme (MAB, 1976), has emphasized the ecological effects of irrigation derived from large river basins.

W.A.Dexhiemer, the president of the International Commission on Irrigation and Drainage observed in 1957 that in India "the irrigation department was mostly concerned about the creation of irrigation supplies and the drainage aspect has received too little attention. The problem of water-logging has also been widely discussed among policy-makers. Jawaharlal Nehru, in his inaugural address to the 29th Annual Meeting of the board in 1958, said that it was far better to stop every irrigation work than allow water-logging[163]

An agricultural land is said to be water logged when its productivity gets affected by high water table as the root zone of plant gets flooded with water. More than 33% of the worlds irrigated land is affected by salinization and water logging. In India alone, 8.4 million hectare are affected by soil salinity and alkalinity, of which about 5.5 Million hectare are waterlogged. Ministry of water resources' working group (1991) had adopted the following norms for identification:

Waterlogged area –

- water table within 2 metres of land surface (due to rise in water table)
- **Potential areas of waterlogging** - water table between 2 and 3 metres of land surface

[163] V. Santha Kumar and R. Rajagopalan. 1993. *Technological Prejudice: Case of Indian Irrigation* . Economic and Political Weekly, Vol. 28, No. 14, pp. 586-594

- **Safe area** - water table below 3 metres of land surface. [164]

Water logging is mainly the result of increased water table and it occurs due to excessive or intensive irrigation in poorly drained soil where water can't penetrate deeply and enters the soil faster than it drains away. It occurs even worse where there is compaction of subsoil layers, where water quickly enters the topsoil but is then blocked by water – resistant clay layer, which may occur naturally or may be induced through excessive use of agricultural machinery. There are many ways which increases the water table like water from canals may seep through beds and sides of canals reservoir etc or seepage of water from adjoining high lands into subsoil of affected land or because of inadequate drainage system soil having less permeable substratum below topsoil will not be able to drain water deep into ground causes high water table. In steep terrain water is drained quickly but in flat terrain drainage is poor which raises water table. When the water table rises it fills up the air spaces in the soil, plant roots in effect suffocate from the lack of Oxygen, limiting the plant growth in those areas. About 10% of all irrigated lands suffer from water logging. It occurs mostly on flat floodplain areas or gently sloping landforms with high rainfall and red duplex or heavy clay soils.

In Indo-Gangetic plain main reason for water logging is flood in the rivers. Rainfall in this region is very uncertain in quantity and distribution. More than 90% of the precipitation occurs in a short time span. This results in occurrence of flood. Rain water is stored in low-lying areas and deteriorates soil in the long run. Water logging causes damage to the soil structure, suffocates plant roots, and leads to the fall of productivity by about 20% in affected areas, pasture loss through drowning, fungal diseases, nitrogen deficiency, erosion in higher rainfall areas and soil structure decline, as soil is washed away. Farmers need to manage and

[164] Sengupta Nirmal. 2002. *Traditional vs Modern Practices in Salinity Control* . Reviewed work(s). Economic and Political Weekly, Vol. 37, No. 13, pp. 1247-1254

plan their irrigation properly so that they do not over water the soil and suffer with this problem. Sarda Canal is one of the important examples.

The problem of water logging started emerging on the large scale in the North West India during the last century with the growth of canal system. New areas have been affected by water logging in post-independence period when major irrigation projects were executed. Chambal in MP and Sarda Canal in UP etc are examples of this canal which leads to the problem of water logging and subsequent salinity through seepage as well as obstruction to the rain water run-off. The problems has been further aggravated by the process of new construction of roads railways, urban sites etc which have obstructed the natural flow of water. In other parts the problem of water logging is caused by the swelling of the rivers during monsoon which inundate large area. Areas suffering from bad surface drainage system and water logging in Punjab and Uttar Pradesh taken together amount to about 13.8 Lakh hectares.

Before the construction of the Canal, the Revenue secretary of Oudh was also unsure about the after effects of the canal. As he says that it will not be as easy as elsewhere to ensure the complete fulfilment of this absolutely essential condition of safe and beneficial irrigation from the proposed canal. There were large number of Major and minor drainage lines of the country traversed by the canal and its various branches, the Oudh revenue secretary writes in his note that in the tract commanded by it 509, 185 acres are watered from "*ponds*". These "*Ponds*" are for the most part shallow swamps produced by obstructing the minor drainage courses of the country and any attempt to remove these obstructions that is drainage courses will meet with the most virulent opposition[165]. Oudh gazetteer gives an idea of the nature of these irrigation reservoirs. This record further discuss about the embankment in Lucknow districts, and he further says "about 5.5 % of the total area of the district is

[165] File No. 373, Box – 2. Revised Sarda Canal Project . Financial Department , No.8.

covered with water in the shape of the shallow swamps of not more than 3 Feet deep in the centre of the 54 Sq. Miles so lost to cultivators, at least 30 might be reclaimed; the area of the 'Jhils' would be circumscribed, the effect of evaporation lessened…. And the unhealthy stagnation of shallow swamps water decreased." Compensation would off course have to be paid to all persons now interested in the maintenance of these swamps and Rs. 10,00,000 have been provided in the estimate for the purposes of drainage and compensation but whether it will prove sufficient seems to me almost impossible to say at this time.[166]

H.A.Brownlow, Col. RE Chief Engineer favour canal construction Oudh region because he has observed the success of eastern Jamuna canal. He was convinced that irrigation from Sarda canal in Gogra Gomti doab will resemble that of eastern Jamuna canal. In a map of annual rainfall (published in 1879) NWP and Oudh given by Mr Hills report shows that whereas greater portion of the tract watered by eastern Jamuna canal lies in the belt having an average annual fall of 25 to 40 inch, the average fall in the tract that will be irrigated by the Sarda canal in the gogra Gomti doab in from 35 to 40 inches. But the amount of annual rainfall is not the only point to be considered in estimating the influence of rainfall in canal irrigation we have also to consider its distribution. The irrigation from a canal of sugarcane and the better classes of rice which are transplanted from seed beds is practically influenced by rainfall in these provinces; but good rain in September and October followed by a fall of 2 or 3 inches in end of December or beginning of January will seriously check canal irrigation of wheat and entirely prevent that of Barley and pulses[167]. This shows that prominent cultivation during pre-canal period was Wheat, barely and pulses and bad quality of rice later British focus on good quality rice and sugarcane cultivation. It seems that British got confused with the topography of Oudh region, as they compared it with the Eastern Jamuna Canal commanded area.

[166] Oudh gazetteer, volume 2 page 323
[167] Op.cit

Mr Hills report further shows that the average winter rainfall on eastern Jamuna canal varies from 1.5 inches. Near Delhi to 4 inches. In Saharanpur; that of the Gomti Gogra doab averaging from 1 – 2 inches. Average rainfall of under mentioned district in September, October, December, January (Eastern Jamuna Canals)[168]

	Rainfall in			
Name of District	**September**	**October**	**November**	**January**
Saharanpur	4.73	0.72	0.58	2.15
Muzaffarnagar	4.68	0.53	0.48	1.16
Meerut	3.95	0.56	0.39	0.77
Averages	1.05	0.60	0.43	1.36

Average rainfall of under mentioned district in September, October, December, January (Area proposed to be irrigated by Sarda Canal).[169]

	Rainfall in			
Name of District	**September**	**October**	**November**	**January**
Sitapur	8.48	1.18	0.46	0.78
Hardoi	5.74	1.32	0.59	0.85
Lucknow	7.31	1.03	0.44	0.73
Barabanki	9.83	1.14	0.36	0.68
Sultanpur	8.96	1.74	0.14	0.66
Faizabad	8.45	1.48	0.15	0.70

[168] Op.cit
[169] File No. 373, Box – 2. Revised Sarda Canal Project . Financial Department , point 12

Jaunpur	7.84	2.48	0.11	0.71
Azamgarh	7.64	2.10	0.15	0.59
Averages	8.03	1.56	0.30	0.71

From these facts it is justified to infer that on the proposed Sarda canal irrigation of the inferior Kharif crops will very rarely be necessary and that as a general rule the spring crops (Wheat, Barley, and Gram etc) will be sown without the aid of canal water. But Mr. Brownlow opines that canal water will be required afterwards to mature the crop, he further says that the demand for this subsequent watering of the spring crops will be even more certain than on the eastern Jamuna canal

National commission on Irrigation 1972 gives an estimate of waterlogged area of 8.10 Lakh hectare for UP and 0.57 Lakh hectare for MP. These figures were also accepted by national commission on agriculture, 1976.

Canals are wonderful source of irrigation only if extra precautions are taken care of. This system has several side effects but it can be controlled through proper management. Certain anti water logging measures are needed to reduce the inflow or increasing the outflow of water from the affected area the former are mainly preventive in nature for e.g., checking of application losses, lining of canals and water courses and provision of intercepting drains along canals, Provision of drainage, improvement of natural drainage and pumping from wells etc.

Checking of application losses is one of the important anti water logging measure. It accounts for about 17 % of water supply reaching a field (National irrigation commission 1972). These losses are mostly due to faulty irrigation practices and can be reduced by measures like volumetric charging for water to check over irrigation; Provision of field

irrigation channels so that each field would have direct access to irrigation water, thereby avoiding irrigation by inundation from field to field as to leads to non-uniform distribution of water amongst the field and causes loss of water as well as fertilizers, Grading and shaping of field to provide for proper alignment of channels and fields drains; consolidation and rectangulation of land holding mainly for reducing the length of irrigation channels and increasing the effectiveness of field drains.

In 1974 ‘command area development program (CAD)’has done a case study of an area in village Pakhrauli in Rai Bareilly district in Uttar Pradesh, The area covers 120 ha, out of which 97ha was brought under consolidation. Realignment of irrigation and drainage channels was carried out in accordance with the topographical features of the area. The average size of holdings before consolidation was 0.35ha varying between 0.05 and 3.00 ha and the individual plots rather much scattered were as small as 0.01 ha. This operation took three years in completion. Pre and post consolidation condition is given below:-

1. Length of irrigation channels (m/ha) 140 (Pre) ; 85 (Post)
2. Length of drains (m/ha) 153 (Pre) ; 140 (Post)
3. Length of road (m/ha) 37 (Pre) ; 60 (Post)
4. Distance of the remotest plot from the field drains (m/ha) 50.80 (Pre) ; Negligible (Post)
5. Distance of the remotest plot from the field drains (m/ha) 50.60 (Pre) ; Negligible (Post)
6. Area occupied by the channels and drains (Percentage of the field area) (m/ha) 4.70 (Pre) ; 3.85 (Post)
7. Area occupied by the roads(Percentage of the field area) (m/ha) 1.00 (Pre) ; 1.55(Post)
8. Length of the field bunds embankments (m/ha) 1000 (Pre) ; 3755(Post)

Secondly, linking of canals and water courses- In the north Indian plains, about 45 % water entering the head of an unlined canal lost in transit at different stages that is 17 % from main canal and branches, 8% from distributaries and 20% from water courses[170]. Seepage from unlined canals[171] has affected a significant rise in water table in Indo Gangetic plains. Lining of canals for checking seepages loses involved heavy expenditure. It is therefore resorted to on a selective basis only and that too moistly in highly permeable soils or in high water table areas

Thirdly, Provision of Intercepting drains along canal is another anti-water logging measure to drain away the sub soil flow of water from the canal thereby checking the rise of water table. The drains both surface and sub- surface run at right angles to the direction of ground water flow. Their distance from the canal should be such that, while they intercept seepage and percolation they do not draw water directly from the canal. From drainage channels Silt, Aquatic Weeds or other vegetative growth should be removed.[172] Removal of silt is very important for the proper functioning of the canal. The silting values of the barrages waters are shown in table below. The silt content ranges from 1560ppm to 4656 ppm, which is moderately high and may cause the irrigated areas to become silted and the channels silted up.

Silt in the Ghagra, Saryu and Rapti river water at barrage sites. (Value is the mean of daily records). Silt values in parts per million.

[170] National irrigation commission 1972

[171] The lining material commonly used in the country is Brick or Tile laid in cement Mortor and also in some cases stone Masonry or cement concret. But the use of other material like Asphalt, synthetic Rubber, Plastic, Bentonite etc. is at best in experimental stage

[172] Manzoor, Alam, Shah & Aitya Habieeb Kidwai.(ed.) 1987.*Regional Imperatives in utilisation and management of resources.. India and USSR.*. Concept publishing company pp.141-162

Month	Saryu River	Rapti River	Ghagra River
July	2,160	1,568	1,560
August	2,328	2,620	2,638
September	2,723	4,656	3,809
October	3,011	3,265	3,259

Pumping from wells helps in increasing the outflow of water from the affected area. It lowers down the water table.

By using preventive measures, canal can be used in a better way. There are states where the improvement in the system has helped in the growth of the canal and has also added to the prosperity of Agriculture. For example in Tamil Nadu, improvement of the irrigation system and construction of irrigation cum drainage channels in the Tamil nadu state were undertaken by the irrigation department in the tanjavur delta under the Cauvery command , where 18000 ha or 5% of the command is waterlogged . There are now 519 major and 177 minor drains in this regions of which 34 drains were renovated by widening and deepening up to March 1988. Tamil nadu farmers have come up with alternative farming practices to use waterlogged areas. Rice nursery plants are raised elsewhere and planted before waterlogging occurs through seasonal rains. The crop is harvested in standing water. Fish cultures another creative enterprise in such areas. An aquatic plant, *Cyprus iris*, is commercially exploited as a source of fibre, and a mat weaving industry is emerging in waterlogged areas.

In Andhra Pradesh, It has established 3248 observation wells at cost of 10 million rupees to monitor groundwater in the canal commands. In order to encourage the conjunctive use of groundwater and canal water, 17.8 million rupees were earmarked in the 1987-1988 annual budget and 23.4 million rupees for 1988-1989 to provide subsidies to the farmers.

Existing drains, like Kunderu, Romeperu, Repalli, Lazzabanda (which open into the bay of Bengal) and Budamer (which flows into lake Koleru) in the badly affected southern Krishna delta, have been renovated. Some of these were excavated more than a century ago. Each of these drains had been choked by water hyacinth and ipomoea cornea, causing chronic drainage problems in thousands of hectares of rice fields. New drains were excavated in the affected areas. In the Sriramsagar project, the irrigation department is encouraging ground water use. It is estimated that in major canal commands, 0.162 million additional wells can be constructed in addition to the existing 64000 wells. Similarly in Orissa, the Delta development plan costing more than 6 billion rupees has been established through the World Bank (ministry of water resources 1991). It envisages the development of catchment areas and the improvement of drainage through surface drains at a cost of about 2 billion rupees to ameliorate 0.11 Mha of poorly drained area. The canal system is being modernized to provide control to every 8 ha block in place of the existing 40 ha. The conveyance system will be lined where the terrain is highly permeable. Tidal ingress of water will be prevented. Conjunctive use of water is proposed through tube wells.[173] Like these states there are several examples which show that with improved technique and better management, traditional and modern techniques can go on simultaneously.

Tail end Syndrome and locally organized Institution

In canal commanded area, Farmers at Tail end have several other problems. Water logging is relentlessly spreading in the lowest-lying fields close to the village site and to the river. Irrigation above raises the water table; unmanaged flows within the village lands often spill into low pockets. There is as yet no project-built drainage system. Command area development has, first, brought the tail-end problem open for policy discussions. Some

[173] Singh. N.T . 2005 *Irrigation and soil salinity in the Indian subcontinent; past and present*. Rosemont Publishing company. Pp.194-196.

remedial action has come: most notably the recognition that some tail- end reaches cannot be watered from the canals; as a preventive measure lift irrigation is being planned for such areas from the river itself. What there has not been is precise delimitation and diagnosis of the problem. This is much harder to do than it appears, for the data are maintained by the Irrigation Department engineers, and they are neither designed nor recorded to reveal problems with the running of the canals. A simple illustration: gauges are at the heads, not the tails, of each canal segment; they are read more often in early morning than in the evening. If excess water is drawn below the last gauge (e g, by illegal heading-up), if it is drawn more heavily during the day than the night, then the readings cannot record deficiencies suffered at the tail. But the problem needs to be assessed on the farms, more than in the canals. Here the data are biased by the desire to show the project functioning as designed. The most fool proof source of such data is a joint inspection report upon the area of irrigated crops signed by the village accountant together, with the canal inspector. Most of the way the ditch was choked with grass. Where the ditch tumed away from the outlet pipe, two crab boles were leaking away more than half the water. When it was inquired from the cultivator: "Whose responsibility is it to maintain this ditch?" "Mine", he said, "since I am the one needing water." "Will you do it, then?" "How can I? It is far away, and it is crossing the land of others." He quickly stopped the crab holes with hand- full of mud - they would soon be tunnelled through again - and walked back to, his dry seedbed. This non-maintenance of field channels - everywhere the legal responsibility of cultivators - prevails in Sarda, Chambal, Ghataprabha, the lower reaches of Tungabbadra, some of Pochampad. Maintenance is done by cultivators along the Kakrapara left bank canals and Sarda-Sahayak.

Command area development has achieved field channel maintenance where two requirements have been met. One is technological. Unlined ditches dug through black cotton soil, which is inherently unstable, are simply too vulnerable to erosion and bank-slippage to

be within the capability of irrigators to maintain. So are unlined ditches running at a gradient above nearby fields or nullah in crab-infested Chambal. Or Sarda's brick or Pochampad's pre-fabricated concrete lining might be considered for short head stretches of the ditches vulnerable to crabs. Note, again, how weakly the profession circulates this breakthrough in micro technology, compared to, the large scale technology, e g, of designing stilling basins for major spillways.

It was accordingly surprising to discover committees representing the irrigators under each outlet, alive and well in UP's Sarda-Sahayak project. In a visit to this area some officers told of 10 such committees in Barabanki District. They are called *kulabas samitis*, kulabas being the local term for pipe outlet. Save for one samiti whose field channels had just been completed, all had done at least one collective cleaning of the channels. They were prepared to work out and propose a roster of turns (in UP *Osrabandi*), though whether the Irrigation Department would take advantage of this initiative remains to be seen.

Farmer organisations have found a life of their own in Sarda Sahayak. The likely hypotheses are extremely diverse:

i. Curiously, though the administrative staffs' dealing with the irrigators was not, as at Pochampad's, trying to organise committees, they may have provided powerful reinforcement to them. These staff units, responsible for building field channels (Sarda command requires almost no levelling), are headed by agricultural engineers who had been doing soil conservation work in the state. It so happens that this particular profession equips its members to solve technical problems, but also motivates them toward facilitating agriculture. These staff units therefore interacted vigorously with cultivators while designing the micro- network. They employed irrigators to do about half the construction labour on the channels, and the samitis

watched over the quality of construction like hawks. The coming of the channels was thus the coming of collective concern.

ii. Phasing of the invitation to organise was in Sarda just before the preparation of the field channel plan. At other projects it has come afterward.

iii. A long history of irrigation, the canals beginning with the old Sarda project in 1928.

iv. Operation of the old Sarda canals by rotation; even though the supply was woefully inadequate, its distribution was managed.

v. Possible caste composition or other sociological factors.

vi. UP's nineteenth century irrigation rules called for Osrabandi to be framed by the Irrigation Department, giving due recognition to the roles of thokdars as representing the claims to water of their followers in a small portion of the ayacut under an outlet. The thokdars was not, as might be supposed, entirely geographic unit, but might consist of owners of holdings somewhat scattered. It was a unit of traditional leadership.

vii. Nineteenth century land revenue institutions may have had a parallel effect, to the extent that tenures in these parts of UP were Mahalwari. Whatever the sources of their energy, the UP kulabas samitis are by no means assured of a future role. As we observed, they may not be drawn upon for a proposed roster of turns. Moreover, the agricultural engineer led units with which they have close contacts will move on, once construction of the field channels is complete. No provision has been made for any continuing contacts (e g, by village extension agents). Kulaba samitis show that Indian farmers can (under conditions yet to be ascertained) take collective responsibility for the micro-system, not that they will.

Canals alignment

Alignment of the canal is a very important feature to be taken care of in canals construction. The Sarda Canal runs from north to south, the canal embankment acts as a barrier to the flow of water along the natural incline of the land from west to east, thus trapping rain water on the western side. Even prior to the construction of the canal, the road and railroad embankments had served to act as barriers to the flow of rain water, and severe water-logging occurred on either side of the metalled roads and railroads. The Sarda embankment has only made the situation worse.

One of the most important ways in which full use of natural water supplies for agriculture can be achieved is through a reduction in the amount of water lost by seepage during transportation to farmer's field and through weed control. Water losses in unlined conveyance system are usually high. While it is true that on balance the construction of all-weather metalled roads, railways and canals has raised agricultural production, and has in particular spawned the surplus producing rich peasant, these overheads have also resulted in a number of specific problems in agrarian society. In her work on North India, Elizabeth Whitcombe has shown how canals, roads' and railways led to the extension of 'usar' (uncultivable saline land), water-logging and a general increase in the incidence of malarial fever. The failure to eradicate the anopheles mosquito may well lead to a resurgence of malaria in these parts. The relative backwardness of central and eastern Uttar Pradesh in relation to western Uttar Pradesh continues to be a hotly debated issue among economists, sociologists and historians. Several factors have been considered - differential fertility, demographic pressure, - climatic conditions, caste groupings (Jats, reputed for good and careful cultivation, constitute the dominant social group in western Uttar Pradesh), tenurial patterns (bhaiyachara and Pattidars in western Uttar Pradesh, Taluqdari and Zamindari in

eastern Uttar Pradesh). Overpopulation and relative infertility made it a region of subsistence farming. Cultivators had to work hard and carefully to eke out a living. The lack of an appreciable surplus was not conducive to the entrenchment of a strong parasitic landlord class, as was the case in the more fertile regions of the eastern Gangetic plain. The cultivators here were more slovenly, for a fair crop could be raised without much effort. The raiyats of western Uttar Pradesh more independent of landlord control and more careful cultivators were able to take full advantage of new and favourable agricultural opportunities opened up during British rule - roads, railways. Eric Stokes however failed to sufficiently emphasise the greater agricultural uncertainty in eastern Uttar Pradesh which derives from its vulnerability to floods and water-logging.[174]

An example of proper alignment of any irrigation technique and also the traditional engineering technique. There are several other spheres where the traditional systems can add valuable lessons to modem engineering. None of the hundreds of old 'Anicut' have given rise to water-logging problem. But one, constructed by modern engineers, the Srivaikuntham Anicut, has water-logging problems. Intrigued by this, a water technologist of Anna University conducted a study of all eight Anicut of the Tamirabarani irrigation system. He found that all the older Anicut were built on the riverbed at an inclined angle, either 'L' shaped or in 'horseshoe' shape. It is taken for granted that that these alignments were meant to suit the rock outcrop. But Gomathinayagam noted that rock outcrops were everywhere, and provide no satisfactory explanation. Instead, consistently Anicut were made in the L shape when one channel was taking off, horseshoe shape when two channels took off. One of the reasons of these alignments is to permit diversion of water into the channels even during low flows. But there is another important reason: by increasing the length of the Anicut, the affluxes during floods are contained within the river. This type of building Anicut diagonally

[174] Sheel , Alok. 1998. *Inundation and Backwardness*. Economic and Political weekly, vol. 18, No. 1, pp. 489-490

on the riverbed are found elsewhere too, over Amravati and Bhavani rivers, built between the 8th and 13th centuries. When the British came, they built the first straight Anicut across the Tamirabarani system, at Srivaikuntham, in 1858. About a kilometre upstream, the Marudur Anicut was built by Pandya kings, which still survives with its curious shape. The length of the horseshoe-shaped Marudur Anicut is 1,207 m, while that of the straight Srivaikuntham Anicut is just 421m. The result was a disaster.

Seepage

Seepage is the side effect of all the canal irrigation found all over the world. But if care is taken than this problem can be reduced to a greater extent. For example if the canals are lined from sides, that is pucca lining is done than that will help easily in reducing seepage of water from canal to fields.

In the same way in Sarda Canal Seepage problem was expected after coming into its operation, the texture of the soil in the canal command area is sandy loam or loam. The porosity being between 40.20% to 48.25%. The nature of the soil and the physical properties indicate that the rate of seepage will be moderate. The water table records show that during the summers and winters, the water table remains low, fluctuating in depth from 3.15 m to 4.25 metres respectively. It starts rising at the onset of monsoons, when a continuous rising of water table was recorded as the rainfall progressed until the water table rose to a depth of only 0.80 metre in 1983 and 0.70metre in 1984 during the month of September. The main branches of Sarda canal are 31 metres wide and 3- 4 metres deep. The discharge of the canal will be 360 cusecs and of the pump canal will be 77 cusecs .As the canal is unlined, the discharge will cause more seepage. The rate of seepage as experimentally determined by

seepage metre is from 3.60 mm/ hr. to 6.0 mm/ hr. which is a moderate rate of seepage. But after the canals become operative this rate may increase by from 5 to 10 times.[175]

The second project - Sarda Sahayak canal project commissioned in 1974. The operation of this canal has created serious problem of seepage started right from the beginning and at present it has created a situation which may be one of its type in the history of canal irrigation .The seepage of 1984 has damaged 385 villages, 13,677 houses and 2200 cattle's. Mature natural forest containing Sal trees have been killed by canal seepage over a vast tract. The canal seepage and high water table rendered vast tract waterlogged. Due to continuous water-logging in the command area, the problems of malaria filarial skin disease and pest are very common.

Ultimately it can be said that that the above mentioned data's show that Sarda Canal operation will adversely affect the ecological balance of the state and as a consequence it will lead to the environmental changes such as management of land, water and forests for sustainable development.

Seepage from such canals can be intercepted on the slopes by planting tree belts. An experiment conducted by the Gangawati centre of the all India coordinated research project on saline water use showed that even a few rows of trees can intercept the bulk of seepage water. One of the area's most common trees, acacia nilotica was very efficient for this purpose. Maintenance of water table is very important for controlling seepage problem.

[175] Singh & Afroz. 1985. Evaluation of Environmental impacts of Saryu Canal in India. Environmental Conservation. Vol 12.Issue 04

Water table depths in metre in Sarda Canal Command Area

Month	1983	1984
January	3.95	4.05
February	4.10	4.15
March	4.18	4.20
April	4.20	4.25
May	4.24	4.28
June	3.85	3.80
July	3.38	3.25
August	2.54	2.40
September	0.80	0.70
October	1.20	1.05
November	3.15	2.85
December	3.40	3.50

The saryu canal is intended to provide irrigation for Kharif crops only. During the Kharif crop period (July to October), the daily maximum temperatures varies from 33 degree Celsius in the canal command area. With this atmospheric temperature the canal water will cause mere seepage as seepage loss increases with the temperature of the water.

Flood hazards

In the study area, the annual rainfall ranges from 1000mm to 2500mm. Due to this heavy rainfall the Ghagra, saryu and Rapti Rivers may cause destructive floods. The slope of the area is from North West to south east with the slope providing ideal natural drainage so

that there is no problem in the flow of water at present. The construction of major branches, barrages, link – channels and distributaries often across the natural slope and without adequate drainage, risk acting as obstacles to the flow of excess flood waters by blocking the natural drainage. It is obvious that the flow of water will be checked by the canals bund and increase the flood level of the command area.

Salinization

Ancient civilization flourished and then floundered when soil became saline due to poor irrigation practices and lack of drainage (example Mesopotamia civilization in the Tigris Euphrates valley). There is a rudimentary relationship between irrigation and salinity. Salinization and water-logging are the principal degradation processes on irrigated land. From various available data it is estimated that the world is losing at least three hectares of arable land every minute because of soil salinity .It is a serious problem of irrigated land. Of the 230 million hectares of irrigated land in the world 45 million hectares is salt affected land to varying degrees by human induced processes. In contrast of almost 1500 million hectare of dry land agriculture, only 32 million hectare is salt affected soil. After a report survey water-logging problem had developed in 2.46million hectare, salinity in 3.06 million hectare and alkalinity in 0.24 million hectare. Affected areas are not completely out of production. But productivity reduces in such land. Based on the climatic and meteorological conditions in various parts of India, Salinity prone soils have been identified as being of three broad types (in relation to India).

i. The western part of India is a semi-arid to arid regions with hot climate and dry winter. In this climate evaporation is always greater than precipitation. Hence the soil profile development by eluviations is greatly retarded. The soil is marked by a concentration of salts saline and alkaline.

ii. The marked seasonality of rainfall affects salt release over a large part of the country. In south India and the Gangetic valley warm rainy climate is followed by a dry winter. During the rainy season precipitation is greater than evaporation which induces leaching of soluble salts down the profile. If the water table remains high, the soluble salts will remain in the profile. In North India the salts are transported in solution by the Himalayan Rivers, which later percolates in the subsoil of the plains and accumulated in the area of inefficient surface drainage. Thereafter during the dry season these salts are drawn upwards through the capillary spaces by evaporation from the surface. In many cases salts are deposited on the soil surface showing white or black patches of efflorescence on the soil surface

iii. A large part of deltas and estuaries of rivers are affected by sea tide carrying salt laden deposits. Large parts of the seacoasts are subjected to periodic inundation by tidal water. Plants take up water from the soil solution and transpire it to the atmosphere, but they take up very little salt. Water also evaporates from the soil surface, but again no salt is lost. The net effect of transpiration and evaporation is to remove a large part of the soil water. The salt is left behind, so that the water remaining in the soil has a correspondingly high salt concentration. Subsequent irrigations bring more salt to the land which, in the absence of adequate leaching, would become progressively more saline. [176]

Scientific advances in explaining soil salt water relationships notwithstanding, we still depend upon time tested remedies to tackle problems of water-logging and soil salinity in the field. The ultimate source of these solutions lay in the ingenuity of farmers who confronted these problems. An advance in knowledge of physics and chemistry of soil salt water relationships however has improved our understanding of these problems. The book set forth

[176] Wilcox. Lloyd. 1962. *Salinity Caused by Irrigation*. Journal (American Water Works Association), Vol. 54, No. 2. pp. 217-222

the subject in historical perspective. For this reason there is a liberal use of original statements. Soil salinity is an adjunct of irrigated agriculture for good reasons; this maxim has persisted in all references to salt lands of irrigated areas. Our earliest knowledge of connection between irrigation and soil salinity relates to irrigated agriculture of the Euphrates and Tigris valleys where soil salinity brought about the decline of a highly progressive ancient civilization. By implication some scientists and historians are inclined to assume a similar reason for the decline of Indus Civilization. But direct experience of any connection between irrigation and soil salinity is hardly 150 years old. Salt lands are product of dry irrigated regions due to the interplay of factors that modulate salt accumulation. Arid and semi-arid lands of the Indian subcontinent have incipient reserves of soluble salts waiting to be redistributed. Depending upon the quality of irrigation management, soils can be either relieved of these salts or burdened with excess of them. The latter often happens because relief from excess salts does not occur until a soil is freely drained.[177]

The severely affected areas in U.P courses in the Ganga Yamuna and Ganga Gomti Doab except for in the south west, comprising most of Mathura and Agra and parts of Etah and Mainpuri districts where the problem is mainly of salinity, the bulk of the affected areas in the district of Aligarh, Etawah, Kanpur, Unnao, Pratapgarh, Hardoi, Rai -Bareilly Etc. suffer from alkalinity.[178]

The quality of water in India is of high order. Canal water originating from the river or their reservoirs representing the Parent Rivers in quality unless contaminated. Proportion of salts are safe, usually less than 500 µs cm-1. But even this small quantity of salt may play havoc if due care not taken. Minute quantities of salts are added to the soil with each

[177] Singh, N.T., *Irrigation and soil salinity in the Indian subcontinent ; past and present*, Rose mont Publishing Corp. P. 7

[178] Manzoor, Alam, Shah & Aitya Habieeb Kidwai.(ed.) 1987.*Regional Imperatives in utilisation and management of resources.. India and USSR.*. Concept publishing company pp.141-162

irrigation crops removed much of the applied water from the soil to meet their evapo-transpiration demand but leave most of the salt behind. With each successive irrigation more and more salt is added. Hence a portion of the added salt must be leached from the root zone before the concentration affects the crop yield. Leaching is done by applying sufficient water so that a portion percolates through and below the entire root zone carrying with it a portion of the accumulated salts. After much successive irrigation the salt accumulation in the soil will approach some equilibrium concentration. A successful water management program keeps the equilibrium level within a certain limit that is best for crop growth. This equilibrium level is decided by three factors, important for good salinity management:

- The salinity of applied water
- Depth of water leached below the root zone
- Depth of water applied at the surface

Rain water as a leaching agent

Waters of the northern rivers, like the Ganga and its tributaries, the Indus and the Brahmaputra are of the best quality. Yamuna water is not as good, but still of sufficiently high quality for irrigation. Waters of South Indian Rivers like that of the Tungabhadra and Cauvery, as well as those which drain into the Rann of Kutch have relatively high EC and RSC values. Canal waters originating from the rivers or their reservoirs represent the Parent Rivers in quality, unless contaminated otherwise. Proportions of salts are safe; usually less than 500 cm-l. But even this small quantity of salt may play havoc if due care is not taken. Minute quantities of salts are added to the soil with each irrigation. Crops remove much of the applied water from the soil to meet their evapo-transpiration demand but leave most of the salt behind. With each successive irrigation more and more salt is added. Hence a portion

of the added salt must be leached from the root zone before the concentration affects crop yield. Leaching is done by applying sufficient water so that a portion percolates through and below the entire root zone carrying with it a portion of the accumulated salts. After much successive irrigation, the salt accumulation in the soil will approach some equilibrium concentration. A successful water management programme keeps the equilibrium level within a certain limit that is best for crop growth. This equilibrium level is decided by three factors - the salinity of the applied water; depth of water leached below the root zone and depth of water applied at the surface. A good salinity management strategy should take care of all three factors.

Although canal water in India is of very good quality, it is still necessary to provide drainage for leaching below the root zone, and judicious use of water applied on the surface. If these conditions are met, canal water can be used for indefinitely long periods without any threat to the sustenance of stable agricultural production. The reasons for the occurrence of salinity can be traced in failures to maintain desired levels in one or more of the factors listed above. However, it is also evident from these factors that *rainwater is the best leaching agent*, even better than good canal water. Rainwater has the lowest salt content of all types of water available for irrigation. Thus the equilibrium concentration of salt accumulation in the soil attained after much successive irrigation is lower if the leaching agent is rainwater. Also, for partial leaching to attain tolerable limits for crop growth, a smaller amount of water is necessary if the leaching agent is rainwater. This, in turn, contributes to the reduction in problems of waterlogging in areas having drainage problems. Summarising, the merits of rainwater over canal water are: (1) It has a modifying effect on the number of irrigations required to meet the evaporative demand as part of it is met by rainfall and (2) It helps in leaching of accumulated salts, because it is the best quality water available for leaching. Traditional water management system was based on this principle. It survived for hundreds of

years without any noticeable land degradation. Modern extension programmes failed to grasp these principles and have done enormous damage to agricultural land.

As noted earlier, the quality of irrigation water in the Indo-Gangetic alluvial plains, both from rain and canal, are of excellent quality. But this is still one of the worst salinity affected areas. Due to the problems of drainage, soluble salts remain in the profile and increase in concentration. During drought these are drawn upwards through the capillary spaces due to evapo- ration from the surface. The problem is so acute that saline soils also occur in unirrigated regions. The process is accelerated due to canal irrigation.

The soils of the Indo-Gangetic plain are fertile and well supplied with potassium, phosphorous, calcium, iron and manganese. But under waterlogged condition the alkaline soils have zero water infiltration and diffusion rate. In consequence, the trace minerals, though rich, are not available to the plants. Thus, everywhere in this area, the threat of a rising groundwater table must be the first consideration in water management. If water influx in the substratum is greater than water expenditure then the groundwater level increases and water- logging occurs. The water influx in this area is very high because of heavy annual rainfall and an enormous amount of snow- fall carried by the Himalayan Rivers flowing through this region. The first priority, therefore, is to drain out the excess water. The traditional method facilitated drainage both by horizontal and vertical methods. The natural drainage lines were never interfered with, leave alone directing them inland through canals. Besides, the major mode of irrigation was wells, which provided vertical drainage. Fortunately, most parts of this region have sweet ground water. Around 1860, even after some extension of the canal area, about 15 per cent of the cultivated land in the province was

irrigated by wells[179]. Indeed, in recent years this method has been in conjunctive use with canal-irrigated area, which has succeeded in reducing the problems of salinity in Punjab.

Natural precipitation used to be retained[180] in water-harvesting structures like tanks and ponds (called *'jhils*' - surface depressions filled by summer rains). The jhils were reported to supply some amount of irrigation water and produced forage[181]. Indirectly too, they must have contributed significantly by enriching subsoil moisture. Recharging of groundwater was an important factor; although rainfall is high in this region it is highly variable and irrigation is essential during summer and drought. Rainwater collected in tanks also worked as a leaching agent. Canal construction techniques were not unknown but rarely used. The western Jamuna canal was constructed in the 16th century by the Delhi sultanate. But it was abandoned, probably because of experiences of salinity and water-logging. Nineteenth century construction of canals and distributaries in UP did not follow the watersheds and interfered considerably with natural drainage lines. Railways and roadways too had no consideration for the drainage systems. Very soon, severe floods, waterlogging, salinity and malaria ravaged the areas brought under canal irrigation. As the problems of salinity aggravated, investigations began

By the late 1860s, the causes were known and a couple of experimental leaching and drainage stations were established. However, the results were not encouraging. A committee (Reh Committee, 1878) was appointed, whose report reflects the unassailable contradictions faced by the government. The committee could not admit what was clearly evident from all available information - that introduction of canal irrigation itself was the basic mistake. For heavy water influx, the committee laid the blame on the farmers' practice of over-irrigation,

[179] Elizabeth whitcombe . 1972. *Agrarian Conditions in Northern India. Volume I. The United Provinces under British Rule, 1860-1900.*. University of California Press, Berkeley pg 54
[180] Ibid
[181] Stone Ian, 2004. *Canal Irrigation in British India: Perspectives on technological change in a Peasant economy* . Cambridge University presss.pg140

suggested rising of water rates to achieve greater economy of water and recommended continuation of the reclamation experiments. The traditional water management methods were already facing the adverse effects of the introduction of canals in the neighbourhood. As a consequence of the increase in water table due to the canal system, salinity increased in the command areas of the traditional systems as well. This necessitated greater application of water for leaching, which, on the one hand, increased the workload, and on the other, aggravated waterlogging. Ultimately, the farmers had no recourse but to rely on canal water. Drainage increased the problems for rainwater harvesting structures.

Large-scale implementation of drainage programme in UP began only in the 1880s, when a series of wet seasons created serious waterlogging problems and prompted an outcry against canals. By 1900, the aggregate surface drainage channels constructed were more than a third of the total length of canals and distributaries[182].

Now the problem was of water shortage. Stone describes a case in some detail, which gives an inkling of the process. The traditional system in that area was the draining of floodwater into a rivulet after flowing through two jhils. After the construction of a canal, within a few years the water levels of the jhils increased, inundating surrounding land and throwing it out of the cultivable category. Then, after the drainage channels were dug, numerous complaints were made by farmers that the drainage system was drying out the country excessively. Quite often their canals were supplied insufficient water. The jhils remained dry for about nine months a year indeed; it was so excessive that the water table of places 30 miles away fell. Some 20 years later, following serious drought, when tube well irrigation was being considered, some officers felt that the policy of surface drainage had been carried too far. The subsoil water level was lower than it was 20 years earlier and had a permanent tendency to fall. Following the destruction of rainwater harvesting structures,

[182] Ibid. Pp.133-145

canal irrigation remained the only source of recharging groundwater. Wherever canals went, well digging was often made impracticable. So the farmers had little choice but to adopt canal water.

Salinity control by Traditional System

In 40 years till 1989-90, Uttar Pradesh was able to reclaim 1,57,036 ha of land, which accounts for only 12 per. The traditional water harvesting system in this area consists of tanks both the above-surface and submergence varieties. Tanks survive over an extensive area and were around for more than a thousand years. In sharp contrast to modern canals, the commands of tanks have not suffered from the salinity problem. In general, their success owes to the fact that tanks are rainwater harvesting methods. The rain- water collected also acts as a leaching agent as it is defined above. For example the 'khadins' of Rajasthan, though they provide surface irrigation in years of good rainfall, are utilised primarily for subsoil storage properties. Khadins are found even in the heart of the Thar Desert. The temporary water table that is formed in khadins during monsoon, after collecting precipitation over the catchment area, slowly recedes into the subsoil and substrata during winter, thus continuously supplying moisture to the deep-growing roots of the crops throughout its period of growth. Depending on the rainfall in a year either gravity irrigation or bed cultivation is practised in a khadins. It is reported that khadins succeed in producing at least one crop even if the rainfall in a year is one-third the normal amount. The region where khadins are found is a particularly saline tract. The amount of run-off collected in a khadin depends on the extent of the catchment area, which is about 12 to 15 times that of the service area. The rain- water harvests of khadins contain quite some amount of salt by leaching out their wider catchments. One would expect that in course of time the salt would accumulate in the profile and turn the land unusable. Khadins however, have remained functional for several centuries. Intrigued by

this fact, the soil scientists of the Central Arid Zone Research Institute conducted on this system one of the rare studies of salinity control in traditional systems. They show that there was not much salt accumulation inside the khadin, but heavy deposits were found just outside where water from seepage passes out. Obviously, the incoming salts were continuously expelled. Their explanation is that the sediments accumulating inside the khadin gradually raise the bed level. It reaches 0.25 to 1.00 metres in old khadins. In consequence, the hydrostatic pressure of the water body of khadins pushes the salt content out, which deposits on the outer side of the embankment.

The 'bundhies' or submergence tanks were extensive in the black soil region. Bundhies were basically in situ water harvesting structures. They retained water practically throughout the rainy season. After the rainy season was over, water used to be drained out and the bed was used for cultivation. They were not used for gravity irrigation. Submergence techniques were basically conservation of moisture by contour bunding in the watershed itself. Storage of fresh rain- water for months over the whole water- sheds could affect some amount of leaching. This was the perfect answer to extremely slow water infiltration and percolation properties of the soil. At the same time the admirable water-retention capacity of the soil was used to devise a more efficient method of water utilisation than gravity irrigation. Submerging also helped in soil conservation; the area is prone to severe soil erosion. Until a couple of decades back, the submergence technique was extensive all over the haveli tract of MP. A century ago it was found all over the western region. Reference to the sailabi system of Punjab is found in old official records. It is still a recognised system of irrigation in Baluchistan where it is known as the sailaba system. Modern canals constructed in these areas face some of the worst problems of water-logging and salinity. The canal systems of Pakistan are among the most severely saline-affected systems in the world.

Canal Irrigation system is an excellent source of irrigation system but only if it is regularly maintained by the Government and by the locals itself.

Conclusion

The study on Water and The British Raj in United Provinces brings out certain interesting facts about the province, its economy, irrigation system etc. It deals with the pros and cons of irrigation system particularly of Canal irrigation in Oudh region.

India is a country of diverse topographical features. In understanding the irrigation system of a particular place it is necessary to understand the topography of that place. United province in itself has a great diversity. In describing the irrigation system of any place it is necessary to explain the indigenous techniques of irrigation because as it is already discussed that indigenous techniques are mainly the efforts of locals as it is planned according to the geography of that place.

The Indian subcontinent being in the tropical zone, receives rains the natural source of sweet water only during certain months of the year. These months receiving the monsoon rains are not more than three in most areas. Most of the water falling from the sky is carried to the oceans by numerous rivers, although a good part seeps in the earth's crust, stored there for future exploitation. It becomes necessary therefore to store rain water, to devise ways and means to prevent its being carried down to the seas, to distribute water so stored to fields and towns. Distribution entails digging or building canals, channels and aqueduct's, above as well as below the surface of the earth. Tanks and wells exploit under surface water. It has to be lifted and then distributed. Water lifting needs several devices and contrivances, manufacturing and building these and maintaining them require technological knowledge and expertise. If water cannot be mechanically lifted, arrangements have to be made for people to approach water, through flights of steps. Finally water used, especially in urban localities, has to be drained out, which again requires forethought and expertise. Construction and maintenance of these facilities entails not only technological expertise but also expertise in

administrative, financial and social fields. All these are intimately connected with water supply and water management.[183]

In order to gain such expertise of construction etc, in depth study of the place is required so as to acquire the knowledge of indigenous irrigation systems, well suiting to the geography of that place. Indigenous irrigation systems offer special opportunities for helping conserve critical eco-systems, while meeting urgent social and economic needs of local communities. The location of indigenous irrigation systems near forests and other biologically diverse areas renders the viability and improvement of indigenous irrigation systems environmentally significant. Enhanced productivity of these systems can relieve pressure on surrounding areas, and the sustainability of indigenous irrigation systems is thereby directly linked to the environmental sustainability of the watersheds of which they form a part. From a social and cultural perspective, the institutional arrangements embedded in traditional irrigation systems are important both to the political stability of the immediate region, and for "the cultural integrity of the people whose land is to be irrigated.[184]

Topography has so much of impact on the different irrigation techniques that the same irrigation technique faces varied situation at different places within the same region. For example, in the context of Sarda Canal, the average distance of water from the surface has been estimated in the reports on the Sarda canal project at twenty eight feet. But it varies greatly in different parts of the province. In the tarai or sub Himalayan tract it is rarely more than 15 and sometimes as little as 4 or 5 feet. South of the Gogra wells have to be sunk to a depth of from 25 to 60 feet before water is struck. The soil is naturally a rich alluvial deposit of light loam, stiffening in places into pure clay and here and there degenerating into barren

[183] Mate.M.S. 1998. *A History of Water Management and Hydraulic Technology in India (1500 B.C. to 1800 A.D.).* pg 2. B.R.Publishing corporations. . p 62- 87

[184] David J. Groenfeldt. 2014. *"Building on Tradition: Indigenous on Tradition and Sustainable Development in Asia*." Water, Cultural Diversity and International Solidarity, Symposium Proceedings edited by Corinne Wacker.

sand. By far the greater part of the land returned as unculturable is made up of the wide *usar* plains of the south and west, which are covered by a thick saline efflorescence known as *reh*, fatal to any growth except the hardiest grasses. It seems to be a frequent result of over cropping, and that a thicker population does more to increase than any known remedy to obviate it. Valuable minerals are not known to exist.[185]

Water policy in India has faced several stages since ancient times and its roots are in complexity. A number of studies carried out by Historians of Ancient India have shown that water management from ancient times has been in the hands of local society. Water management of innumerable water works in villages and the countryside in the form of dams, tanks, wells, reservoirs, lakes, step wells etc were managed by local people. The local control over land and water paved the way for development of the social, economic and political autonomy of villages, communities and regions that often negotiated with, and resisted the authority of, the centralizing control of state or empire. Water was managed through a system of patronage and community control through village councils in most parts of India. Prior to the arrival of British in India, water was collectively managed by communities through a system called "*Kudimaramath*" (self- repair). The advent of the corporate rule of East India Company in eighteenth century brought about a major shift in policy over collectively managing resources through public funds. Earlier peasants contributed some units of grains to public works. By 1830 peasants started paying double and out of which three-fourth went to East India Company. As a result of this increased siphoning of payments and loss of revenue in public funds, the peasants and commons were ruined. Some 300,000 water tanks built over centuries in Pre-British India were destroyed affecting agricultural productivity and earnings.

Even though public works in water and irrigation were found to be expanding these works further, Irrigation was accorded a very low priority in company policy. However due

[185] Gazette of Oudh Volume - ! A to G. pg. 3-12

to pressure by nationalists, the company in 1857 took steps to construct irrigation works. Just like railway construction in British India, the irrigation projects were to be funded with private capital. In 1857, the Court directors of the company invited a proposal for private construction of irrigation works in madras (Imperial Gazetteer of India 1908). The First private construction was the Tungabhadra project undertaken by the Madras irrigation and Canal Company. With 5% government guarantee on the capital investment, within 9 years the company faced acute financial crisis and the project was taken over by the Government in 1882 and absorbed into the public sector. During this period the company did invest some private capital in water but the failure to sustain that process led to the absorption of the company into the public sector.

The colonial state that took over India in 1858 systematically broke the backbone of local autonomy. First it drastically reduced and then discontinued the state allocation of capital for maintenance of local water works by the introduction of definite property rights in land; it then imposed a highly exploitative Land revenue system and had total control over all the natural resources of the subcontinent. The intention was to maximize revenue by the commercialization of land forests and most importantly water. With the withdrawal of state patronage, local water works that hard existed for time immemorial fell into disrepair, disuse and completely disappeared from large parts of south Asia.

The colonial rule sponsored irrigation works in the form of canals and barrages, dam in Punjab, United Provinces and the North Western Provinces. The Bihar, Bengal and Madras presidencies were designed to promote commercial crops such as Cotton, Jute, Opium, Indigo, Sugarcane, Tea, Coffee, Tobacco, Wheat etc instead of food grains. Water resources were under state control and were meant to keep India’s economy serving British interests. The colonial desires were to:

(1) Control water and other natural assets to legitimize the empire

(2) Exploit the natural treasures for profiteering and

(3) Send wealth from India to the British crown.

The public irrigation works yielded substantial profit and they were looked upon as successful projects constructed during days of the company. In this context, it would not have been in the interest of the British to allow Private enterprise to develop in India. So all infrastructure building specifically in water was British controlled and meant to serve the imperial needs of the British economy. In fact, Indian revenues were servicing British debts to the United States and Germany in the nineteenth Century, irrespective of the fact that millions were dying in absolute poverty, squalor disease and famine. Private investments in general were discouraged by the colonial state and it was especially discouraged in the augmentation; management and distribution of water in either the rural areas or towns because water was one of the principal sources of revenues for the colonial state. Privatizing water would mean the loss of these precious sources which British Government in India would never allowed happening. Thus the colonial state encouraged the private sector in Cotton, Jute, and Cash crops but retained control of infrastructure like Railroads, Telegraphs and water resources in the public sector which maximized its revenues.

During the second half of the nineteenth century there were canals constructed under public and private enterprises for irrigation purposes. The large canals were mainly built by the government but private initiative was not negligible. Under private construction were 1,000,000 acres in Punjab, 750,000 acres in United Provinces, 5,000,000 acres in Bengal and 336,000 acres in madras. However, taking estimates of the total area under private irrigation in India into account, the annual figure was about 8,000,000 acres which was about 16-18% of the total. The colonial state and the imperial mentality in the development of irrigation in

the Indus basin saw an alliance between engineering sciences and the state based. On a technocratic vision of harnessing and controlling nature to maximize revenue. Thus the private sector was never encouraged to invest in water by the British while they were in India. Private enterprises and capital was used in building canals but water management, control and distribution in both rural and urban areas was totally under state control. [186]

Sarda Canal is constructed by British in 1928. It still exists. Initially it was proposed for region between Ghagra and Ganga, and second proposal was planned between Ghagra and Gomti Doab, with second proposal British continued its construction. There was a great deal of arguments among the British officials regarding canals proposal because several officers were not in favour of its construction because they thought it might not give expected result. Some were of the opinion that as the Eastern Jumna Canal is running successfully this canal will also be fruitful. No doubt, Sarda Canal construction was helpful to the province but on the other side its impact has some adverse results also.

The above discussion does not mean that we should systematically minimise the importance of the colonial impact on natural environments. From many points of view, it represented a radically new phenomenon. First, it was an attack on the world scale, corresponding to the phase of expansion of western merchant and industrial capitalism. Second, the intruders had means of conquest at their command which were generally out of all proportion to those of the local societies. Third, the offensive was backed by a conquering modern ideology, according to which nature ceased to be the sacred order of things, or the abode of the gods (as Marx said, it was 'disenchanted'). It had become an object to be mastered, exploited, transformed, and commoditised, a means of speculation, a merchandise (and there is no need to lay the blame for this promethean and depreciating attitude to nature

[186] Asthana Vandana. 2009. *Water policy processes in India: Discourses of power and resistance*. Routledge publications. P 45-47

on the tradition of Christian anthropocentrism, as has sometimes been done).' Fourth, the colonisers carried with them techniques and tools, introduced crops and forms of animal husbandry, opened up routes for diffusion and exchange, which irreversibly altered the local socio-ecological configurations. And finally, to serve their own interests, they set up everywhere an increasingly efficient framework of governmental control, which gradually denied the local populations free access to their traditional natural resource bases, at a time when their numbers were beginning to increase. Although the ecological stresses and traumas resulting from European colonisation were not by any means the first events of their kind in the tropics, the scenarios for the first time were modern, representing the onslaught of commercial and industrial capital on the natural resources of the world at large.[187]

It is obvious of British attempt of tapping the natural resource of the colonies. Their first easy access was the Forest in India. Colonial forestry, as a rule, was mainly concerned with a few commercially valuable species, while the species commonly used by the local populations were extremely numerous. The ideal of the foresters in French Africa or Indochina, according to the principles that were taught at the school of forestry at Nancy, was Homogeneous populations, closed formations, and tall, straight tree growth. The German tradition of forestry, which spread to the Dutch and British colonies, was no less single-minded. In India as elsewhere, the foresters sought to increase the commercial profitability of the more accessible forests through the systematic plantation of a very small number of ‘species, such as conifers in the Himalaya and teak in south India, species which were of little use to the local populations, as contrasted to many other species which were eliminated.

Similarly is the case with the Water policies of Colonial Government in India. Water was also a very important natural resource of the country to be tapped by the British. And as

[187]Pouchepadass, Jacques. 1995. *Colonialism and Environment: Comparative Perspective*. Economic and Political Weekly.

it is mentioned above that the Government involved the private enterprises in it's the construction work but in its maintenance and in its operation they were not involved. It was the British government that controlled it's all other duties and implements it. Colonial government's intervention in the indigenous techniques of irrigation system of United Province has led to the loss of several wells, tanks or ponds in the region. Canal is an excellent source of irrigation. British tried to introduce this canal in this region. With the introduction of Sarda Canal in Oudh region, several wells and *jhils* have lost its existence. The application of these eco-ethnocentric concepts overseas led to the destruction or reshaping of landscapes and the displacement of indigenous populations. As always, human intervention in natural systems determined a transition from complexity to relative homogeneity.

In the context of forestry, the main trend was towards the substitution of single-species cultivation for natural diversity, the replacement of prolific generalised ecosystems by specialised ones (and especially agro- systems) was the concept of colonial forestry. Same was done by British in water policies by introducing commercialization of agriculture. Replacement of staple crops cultivation with the commercial crops was the result of colonial's intervention. This was often done on the basis of an inadequate knowledge of the environments involved, leading to spectacular failures. For instance, there was an erroneous belief; particularly in the first phases of colonisation, in the exceptional fertility of tropical soils, based on the luxuriance of spontaneous vegetation. Knowledge of the dynamics of tropical forest ecosystems was extremely scanty; a high rate of failures in these conditions was inevitable.

This phenomenon was universal, though in differing degrees, throughout the colonial world, because exploitation of the land was one of the main reasons for colonisation as such. Let us remember that the Permanent Settlement of Bengal was designed, among other

purposes, to induce the Zamindars to increase the profitability of their lands: the land revenue being fixed once for all, any increase in their rent rolls would remain exclusively theirs. This of course represented a powerful incitement to the clearance of forest and jungle on their zamindaris, and in this way the Permanent Settlement became an engine of deforestation in Eastern India.

Wherever state control over colonial natural resources expanded for the purpose of organised exploitation, it did so at the expense of local societies whose mode of subsistence was closely dependent on the natural resources in question and only marginally on the market. From the productivity point of view of modern management, the indigenous cultivator with his customary rights of usage, his manifold uses of biodiversity, his small-scale, erratic clearings, as well as the nomadic pastoralist with his destructive herds, represented a hindrance which had to be done away with somehow or other. The European coloniser had been brought up in an old food grain civilisation and was ill-prepared to understand the modes of subsistence prevalent in tropical rainforest environments. He carried with him the archetypal opposition of the Latin agronomists between ager and saltus, which was deeply ingrained in the European mind. In his view, civilised order was not a climax forest with humans living in symbiosis with it, no matter how knowledgeable and sophisticated this interaction might be, but the domestic order of cultivated fields, or a plantation of selected species, where yields are carefully monitored and the return of spontaneous vegetation efficiently prevented. The representation of space which accompanied the expansion of the colonial state was the modern conception of the administered space, where the central authority carries the same weight everywhere within fixed territorial boundaries, where rights of occupation and usage are clearly defined, where limits are clearly drawn. This vision of things cannot easily accommodate collective and unwritten customary rights, the uncontrolled complementarity between agriculture and open

forest, the migratory habits of shifting cultivators and nomadic herdsmen. Last, states cannot function with- out revenues. Accordingly, productive activities must be taxed, and the exercise of individual rights over public resources such as the forest ought to be licensed a practice which discourages wastage while producing income. Thus colonial states everywhere created from scratch vast domains of public forests by declaring all wood covered areas without a certified owner to be government property. Then the social groups who derived all or part of their living from those forests on a customary basis were brought under strict control or displaced. In such cases, of course, the recourse to legal concepts such as 'general interaction' or 'public good' was particularly convenient. Nothing typifies this attitude better than the frequent repression of shifting cultivation. This activity more than any other felt the brunt of the ethnocentric ecological prejudices of the colonisers, because it combined all the features which the modern ideology condemns. The shifting cultivators felled and burned substantial areas of forest for the sake; it seemed, of a few poor crops of low yield and nutritive value. They had no established rights in the land they cultivated. They led an unsettled and mobile mode of life and paid little or no taxes. And their activity seemed incompatible with any organised policy of forest conservation. Nomadic pastoralism was criticised along similar lines. It is usually the alleged destructiveness of nomadic herding, its low profitability and the mobility and indiscipline of the social groups practising it which were incriminated. The policy of the colonial administrations, where they were bent on suppressing shifting cultivation or restricting it, consisted in limiting the forest areas where the clearings were allowed, in reserving the activity to strictly defined social categories, in subjecting the grant of permits to the performance of labour pretentions for the forest departments, and finally in encouraging the populations concerned to adopt sedentary ways of life as settled cultivators or agricultural labourers.[188]

[188] Ibid

On the other beside so much of flaws in the colonial policies, it would be inaccurate to characterise colonial periods uniformly as the most dramatic phases of ecological devastation for the countries concerned. The first official measures for protecting nature, whatever their motives and effectiveness, arose in these countries on the initiative of colonial governments. And independence has not put a stop anywhere to the destructive processes that were under way. On the contrary, they have accelerated. But it is nevertheless true that it was colonisation which in most cases initiated the processes from which all later developments originated. The newly independent states took over from the colonial states. The economic and political pressures from the developed world persisted everywhere after independence was acquired. Legislation, policies and administrative structures relating to the exploitation and management of natural resources were for the most part maintained. The disruption of the relationship between local societies and their natural resource bases has continued in the worldwide movement towards modernisation, which goes together practically everywhere with an unprecedented increase in the industrial demand for biomass arising from much higher rates of industrial growth, and of demographic pressure on the environment due to the population explosion.

In post-independence India, the new ruling elite, supported by the business class, was committed to a resource intensive state subsidised pattern of industrialisation, the ecological cost of which was bound to be heavy. But at the time, this ecological trap in post-war growth policies went largely unnoticed. Thus the colonial phase of the history of tropical nature has to be set against the general background of the human history of nature. This is a history of continuous alterations and traumas and of continuous human responsiveness to those changing conditions. Human societies have shown and still show an almost limitless capability for situational adjustment. It would be erroneous to present the pre-colonial relationship between societies and their environment as a golden age of 'equilibrium' which

colonial conquest disturbed or destroyed. Such a view, like the now obsolete 'tradition vs. modernity' paradigm, assumes the normative operation in pre-colonial times of a system which in reality probably never existed, and which is in fact a culturist construct, an ideal type meant to provide a baseline for the assessment (and indictment) of colonial change. We cannot concur in the mythology of the unspoilt, primeval, sacred wilderness with which indigenous societies supposedly lived in perfect balance from the dawn of history until the advent of Europe. This is one of the myths which lie at the base of that green fundamentalism which is known nowadays as 'deep ecology'. What we need, on the contrary, is a radical critique, with regard to this aspect, of capitalist expansionism, of which the colonisation of nature on a world scale has been one of the major objectives, and whose essential dynamics remain in operation, in a multipolar and greatly diversified context, throughout the formerly colonised world today.

The studies made on saryu canal project indicated that under the existing conditions utility of the canal is questionable became the area has sufficient rainfall sufficient ground water resources and a high water table. The physical properties of the soil, the nature of the canal , the atmospheric temperature the slope of the area and the seepage rate of water in the soil indicated that there is a danger of acute water-logging and seepage with operation of the canal. Therefore, before undertaking any canal project the water table, rainfall and texture of the soil must be critically examined to safeguard against environmental threats. An attempt has been made to explain the answers of some of the questions mentioned above.

Several observations are made based on the analysis of irrigation before the independence of India in the beginning of this chapter, regarding ancient, medieval and colonial period. The studies of the past are very important for the critical study of future. From the analysis of irrigation research in independent India, we can make the following observations. (1) The irrigation research establishment has not given adequate importance to

the assessment of existing water resources. Though the situation has changed during the last decade, the data collection system and other aspects of hydrologic research is exclusively, if not solely, related to the medium or major river-based irrigation schemes. (2) Though the establishment has been aware of the need for proper distribution systems and management strategies for increasing the efficiency of irrigation systems, the research input into these aspects have not been adequate. The priorities have changed only marginally during the last two decades. However the need for considering these aspects at the planning stage for the selection of suitable mode of irrigation and the scale of the projects has not been widely recognised by the irrigation establishment. (3) Though the departments have been aware of the problems of water-logging, reservoir sedimentation, etc, even in the earlier part of this century, their research in this area has been limited to the search for structural solutions or those related to the refined operation of the created structures. The need for assessing the possibilities of environmental hazards at the planning stage and finding remedies through integrated management of related resources has not been widely recognised by the irrigation research establishment. (4) Most of the research conducted by the irrigation research stations is on the study of hydraulics and structural aspects, the necessary components for the construction of headwork's and canals for major surface-water based irrigation systems. One can thus conclude that the assessment of the availability and the demand of the water resources have always received low priority in research in the field of irrigation. The massive growth of irrigation projects has taken place in this century in India without adequate assessment of the supply and demand of the resources. Moreover, these aspects have not been considered in the selection of appropriate mode and scale of irrigation. The research effort suits only the requirements of the construction of head works and canals of surface-water based major or medium irrigation projects. The analysis of the research base in the field of irrigation brings to light the inherent bias of the Indian irrigation establishment towards major

irrigation projects, especially the construction of large dams and canals. The selection of these projects, without an adequate assessment of the supply and demand of the resources implies a technological prejudice in Indian irrigation establishment that the most important activity in providing irrigation is the creation of big dams and canals.[189]

An attempt on the part of the Government is not going to give any good results till the time the local people don't organize to work together for their progress. There are evidences that Collective responsibility has sprung up in UP. Collective responsibility taken up by the localities throw light on the perennial questions of rural power and leadership, of caste and non-caste solidarities, of the long feedback processes of social change in which government interventions of a century ago may be found as conditions of villagers behaviour and attitudes today, etc.

Developments very large, technologically complex, highly organised, guided by universal professional norms can in this instance only succeed if they evoke appropriate responses from individual cultivators enmeshed in habits, relationships with other men and with animals and soils that are at once localised and embedded in some village cultural matrix. The resulting pulling and pressing of the one set of processes upon the other can make discoverable the internal structure and dynamics of each. [190]

This thesis is an attempt to focus on colonial water policy. Much has been done in relation to colonial forestry; an effort has been made in it to study the colonial water policies and their impacts particularly in Oudh region.

[189] V. Santha Kumar and R. Rajagopalan. 1993. *Technological Prejudice: Case of Indian Irrigation*. Economic and Political Weekly, Vol. 28, No. 14 (Apr. 3, 1993), pp. 586-594

[190] Hart. Henry.C. 1978. *Anarchy, Paterlism and Collective Responsibility. Under the canals*? E.P.W , Vol 13 . No. 51/52

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GLOSSARY

Banger	Uplands
Bhur	Sand
Biswadars	Inferior Cultivators
Bundhs	Small dams
Chakladar	Government Officers
Chaudhary or Zamindar	Imperial officers
Dalhan Kheti	Pulses Cultivation
Deoha	Ghaghara River
Doab	Region between two rivers
Dumat	Loam
Guddasetu	Embankments
Hasil	Amount of Revenue deposited in royal treasury out of total collected revenue
Ijaredar	Contract System
Ilaqa	Region
Jagir	Grant
Jama	Total Collected Revenue
Jamabandi	Gross Revenue assessment
Jhils	Ponds
Khadar	Lowlands
Kharif	Summer Crops

Kudimaramath	self- repair
Kunds	Underground Storage Tanks
Mahal	Villages
Mahalwari System	Hybrid of Raiyatwari and Zamindari System
Matiyar	Clay
Mauzas/ Mahals /Tappas	Villages
Nazim	Nawab or Governor
Noria/ Sakiya/ Arghat	Water wheel
Odayantrikas	Water or hydraulic engineers, mechanics.
Parganas or Qasbas	Administrative Units
Podhis	Cisterns
Rabi	Winter Crops
Rahat	It is a wooden drum fixed on an axle in a wooden frame
	Similar to the one used for the pulley
Reh	Thick saline efflorescence
Sarkar	District
Suba	Province
Taluqdars	Provincial Governors
Taqqavi	Agricultural Loans
Thanas	Police post
Usar	Barren
Yatam or Shadof	Device used for lifting of water for irrigation purposes.

A Comparative view of Irrigation on Sarda Upper Ganga Lower Ganga Canal
There are only three canals in this state that irrigates more than 1 Million acres each Viz. the Upper Ganga, the Lower Ganga and the Sarda. Summary figures with regard to certain aspects of their irrigation are given below

Table 1
MAJOR CANALS OF U.P

Sr.No	***Particulars***	***Sarda***	***Upper Ganga***	***Lower Ganga***	
1	Normal Rainfall (Inches)	39.68	32.86	34.06	
2	Irrigation Channels (Miles)	7013.00	4054.00	3993.00	
3	Culturable Command (Million Acres)	7.29	3.72	4.99	
4	Irrigable Area (Million Acres)	1.89	1.73	1.30	
5	Irrigated Area (Million Acres)	1.08	1.49	1.13	
6	Irrigable Area Per Miles of Total Channels (Acres)	189.12	281.26	248.29	
7	Irrigated Area Per Miles of Total Channels (Acres)	107.92	242.48	214.31	
8	Culturable Command Areas Per Miles of Total Channels (Acres)	730.40	605.00	856.30	
9	Percentage of Irrigable to culturable command Area	25.90	46.40	26.20	
10	Percentage of Irrigated to Irrigable Area	57.06	86.21	86.31	
11	Percentage of Flow to total Irrigated Area	76.35	85.41	77.25	
12	Percentage of Lift to total Irrigated Area	23.65	14.59	22.75	
13	Percentage of Kharif to total Irrigated Area	55.63	52.57	40.80	
14	Percentage of Rabi to total Irrigated Area	44.37	47.43	59.20	
15	Acres irrigated per cubic feet per second of average water discharge utilized				
	(a) Kharif	88.0	187.0	132.0	
	(b) Rabi With Sugar-cane	182.0	441.0	217.0	
16	Acres irrigated per cubic feet per second of average water discharge at head				
	(a) Kharif	73.0	137.0	114.0	
	(b) Rabi With Sugar-cane	121.0	263.0	130.0	
17	Percentage of Cusecs utilized to discharge				
	(a) Kharif	69.70	68.10	71.30	
	(b) Rabi	58.90	75.60	66.10	
18	Total Capital Invested (Rs. In Crores)	25.83	5.23	4.73	
19	Percentage of Net Revenue to total capital invested	3.47	23.80	18.02	

Table 2

COMPARITIVE FIGURES OF THE FINANCIAL WORKING POF THE THREE MAJPOR CANALS IN U.P . EACH IRRIGATING ONE MILLION ACRES OR MORE ON AN AVERAGE

(Figures for 1955- 56)

Sr.No.	***Date of closure of construction estimate***	***Upper Ganga Canal 31st March 1891***	***Lower Ganga Canal 31st March 1891***	***Sarda Canal 31st March 1930***	
1	Area Irrigated (000 Acres)	1511	1080	953	
2	Capital Cost Per Acres (Rs.)	34	42.95	177.3	
3	Total Capital outlay including accumulated interest (Rs.)	34.15	43.14	248	
4	Grosss Revenue (Rs.)	11.19	11.89	13.96	
5	Working expenses and maintenance (excluding interest) per acres (Rs.)	4.31	4.46	6.84	
6	Net Revenue per acres (Rs.)	6.88	7.43	7.12	
7	Net surplus after adeducting interesty per acres (Rs.)	5.87	6.18	-0.08	
8	Rate of Net Revenue on Capital Cost	20.00%	17.51%	4.02%	
9	Rate of Net Revenue on Capital Outlay	19.97%	17.50%	2.87%	
10	Rate of Net Surplus on Capital cost	17.26%	14.38%	-0.05%	

Note :- Per acres caluclations are based on the irrigated area of the year. In the case of the Sarda Canla it has been assumed to be 1.0 Million Acres since the figure was exceptionally low for the year

Table 3
CROP PATTERN IN SARDA CANAL DISTRICT (Figures in acres)

			Rice			Wheat			Barley			Juar	
Period	***Total Cropped Area***		***Cropped Area***	***%age to total cropped area***		***Cropped Area***	***%age to total cropped area***		***Cropped Area***	***%age to total cropped area***		***Cropped Area***	***%age to total cropped area***
1921-1926	12267665		2290308	18.67		1,834,515	14.95		1376926	11.22		495,824	4.04
1926-1931	11798114		2304075	19.53		1,892,798	16.04		1339537	11.35		511,130	4.33
1931-1936	11809684		1941347	16.44		2,103,485	17.81		1247078	10.56		529,042	4.48
1936-1941	12214957		2281939	18.68		2,159,116	17.68		1159827	9.5		467,446	3.83
1941-1946	12430263		2132349	17.15		2,027,810	16.31		1257980	10.12		532,082	4.28
1946-1951	12725464		2624208	20.62		1,996,272	15.96		1400036	11		528,241	4.15
1951-1957	13105298		2744382	20.94		2,118,438	16.16		1380672	10.54		543,275	4.15

Table 3 (Contd.)

	Bajra		Potato		Total Food Crops		Sugar- Cane		Total Non Food Crops	
Period	***Cropped Area***	***%age to total cropped area***	***Cropped Area***	***%age to total cropped area***	***Cropped Area***	***%age to total cropped area***	***Cropped Area***	***%age to total cropped area***	***Cropped Area***	***%age to total cropped area***
1921-1926	620,646	5.06	3,333,951	0.28	11,345,235	92.55	355,105	2.89	913,430	7.45
1926-1931	513,652	4.35	48,212	0.41	10,890,915	92.31	427,515	3.62	907,199	7.69
1931-1936	601,493	5.09	51,072	0.43	10,715,340	90.73	545,690	4.62	1,094,344	9.27
1936-1941	544,542	4.46	54,215	0.44	10,920,893	89.41	619,656	5.07	1,294,064	10.59
1941-1946	650,966	5.24	57,104	0.46	11,193,298	90.05	562,315	4.52	1,236,965	9.95
1946-1951	514,132	4.04	63,377	0.57	11,425,373	89.78	586,126	4.61	1,300,091	10.22
1951-1957	557,987	4.26	70,582	0.54	12,232,945	93.34	662,154	5.05	872,353	6.66

Table 4

LAND UTILIZATION IN SARDA CANAL DISTRICT IN 1956 - 57

		Moderate Rainfall Division		*Heavy Rainfall Division*		*Combined Area of both divisions*	
Sr. No.	***Land Classification***	***Area in (acres)***	***%age***	***Area in (acres)***	***%age***	***Area in (acres)***	***%age***
1	Forest	213,208.00	1.96	698,910.00	11.34	912,118.00	5.35
2	Barren & unculturable land	574,361.00	5.28	165,244.00	2.68	739,605.00	4.34
3	Land put to non agricultural uses	985,116.00	9.05	482,618.00	7.83	1,467,734.00	8.61
4	Culturable Waste	740,917.00	6.8	363,557.00	5.9	1,104,474.00	6.48
5	Permanent Pastures and other grazing lands	11,133.00	0.1	5,187.00	0.08	16,320.00	0.09
6	Land under miscelaneous tree crops and grooves not included in area sown	590,128.00	5.42	348,714.00	5.68	938,842.00	5.51
7	Current Fallow	54,889.00	0.5	86,448.00	1.4	141,337.00	0.82
8	Other Fallow Lands	625,491.00	5.75	316,903.00	5.14	942,394.00	5.53
9	Net area sown	7,088,671.00	65.14	3,693,745.00	59.97	10,782,416.00	63.27
10	Total geographical area (by lekhpal record)	10,883,914.00	100	6,161,326.00	100	17,045,240.00	100
11	Double cropped area	1,832,263.00	25.85	895,486.00	24.24	2,727,749.00	25.29
12	Total cropped area	8,920,934.00	81.97	4,589,231.00	74.48	13,510,165.00	79.26

Source : Season and Crop Repot, U.P. Govt.

Note :- 1. Given percentage is the ration to the total geographical area given in the same row

2. % age figure against double cropped area indicate the percentage ratio of doubble cropped area to net area sown in the same division
3. % age figure against total cropped area indicate the percentage ratio of total cropped area to total geographical area in the same division

Table 5

IMPACT OF C ANAL IRRIGATION ON NET CULTIVATED, DOUBLE - CROPPED AND IRRIGATED AREA

		Net Cultivated Area			***Double Cropped Areas***	
Sr.No.	***Sarda Canal Districts***	***1925-28***	***1954-57***		***1925-28***	***1954-57***
1	Nine Districts* with substantial canal irrigation	5,916.83	6,572.59		934.85	969.89
2	Five Districts* with little canal irrigation	3,639.52	4117.24		1,372.77	1653.6
	Total	9,556.35	10689.83		2307.62	2,623.49

Total Irrigated Area		***% of Double Cropped to net cropped***			***% increase 1925-57***	
1921-26	**1955-57**	***1925-28***	***1954-57***			
				Net Cultivated	***Double Cropped***	***Irrigated***
1126.97	1,216.90	15.8	14.76	11.1	3.7	7.98
1113.64	1,091.01	37.72	40.16	13.1	20.4	-2.03
2240.61	2,307.91	4.15	24.54	11.8	13.6	3

* Bareilly, Shahanjahapur. Luckmow, Rai Bareli, Sitapur, Hardoi, Barabanki , Unnao & Pilibhit

** Pratapgarh, Allahabad, Khiri , Sultanpur, Jaunpur

Source: Season and crop reports, U.P

Table 6

AVERAGE ANNUAL AREA IRRIGATED BY VARIOUS SOURCES

			Canals		*Wells*		*Others*		*Total*	
Sr.No.	***Districts[1]***	***%of canal irrigated to total irrigation in 1956-57***	***1921-26***	***1955-57***	***1921-26***	***1955-57***	***1921-26***	***1955-57***	***1921-26***	***1955-57***
1	Bareilly (12.0)	71.65	47,330	91,306	22,785	13,254	2,383	22,873	93,945	127,433
2	Shahjanpur (7.0)	64.23	-	58,777	55,736	19,244	37,632	13,483	93,368	91,504
3	Luckmow (19.0)	64.69	-	64,739	48,866	14,893	42,397	20,443	91,263	100,075
4	Rai Bareli (20.0)	39.39	-	98,233	162,720	96,546	78,811	54,652	241,531	249,431
5	Sitapur (8.9)	57.1	-	74,125	33,629	9,661	73,698	46,009	107,327	129,765
6	Hardoi (8.5)	71.12	-	75,779	59,534	10,905	50,781	19,862	110,315	106,546
7	Bara Banki (15.0)	51.04	-	98,911	78,286	15,778	114,130	79,093	192,416	193,782
8	Unnao (22.0)	70.44	-	112,568	82,836	13,215	64,480	34,020	147,316	159,803
9	Pillibhit (11.0)	88.32	7,967	51,696	19,813	2,736	21,713	4,100	49,493	58,532
	Total	59.67	55,297	726,134	564,205	196,223	507,472	294,535	1,126,974	1,216,901
10	Pratapgarh (5.9)	16.23	-	32,404	172,355	119,828	39,765	47,313	212,974	199,545
11	Allahabad (5.0)	18.95	17,029	34,439	140,661	121,792	52,241	25,416	209,931	181,647
12	Kheri (2.8)	38.58	-	18,844	31,689	22,964	24,315	7,034	56,004	48,842
13	Sultanpur (2.4)	4.71	-	13,381	167,498	186,602	115,634	83,662	283,132	283,645
14	Jaunpur[2] (0.7)	0	-	-	307,339	355,633	45,109	21,700	352,448	377,333
	Total	9.1	17,029	99,098	819,592	806,819	277,064	185,125	1,113,635	1,091,012
	Grand Total	35.75	72,326	825,202	1,383,747	1,003,051	784,536	479,660	2,240,609	2,307,913

Note :- 1 Figure within brackets give the estimate of percentage of canal irrigated to net cultivated area in 1959-60
2 In Jaunpur canal irrigation has recently been introduced and was nil upto 1957

Table 7

INCREASE IN WELL AND CANAL IRRIGATION IN THE YEARS OF SCARCITY

	Canal Irrigation			*Well Irrigation*			*Canal and Well Combined*		
Years of Scarcity	***Total Irrigated Area based on the Average of Precedings 3 Years (Acres)***	***Total Irrigated area uring the Year (Acres)***	***Percentage Increase in the Year of Scarcity***	***Total Irrigated Area based on the Average of Precedings 3 Years (Acres)***	***Total Irrigated area uring the Year (Acres)***	***Percentage Increase in the Year of Scarcity***	***Total Irrigated Area based on the Average of Precedings 3 Years (Acres)***	***Total Irrigated area uring the Year (Acres)***	***Percentage Increase in the Year of Scarcity***
1932-33	305661	493560	61.47	409675	446360	8.95	715336	939920	31.4
1935-36	468280*	637017	36.03	357013*	439051	22.98	825293*	1076068	30.39
1941-42	533382	717181	34.45	370874	567975	53.14	904256	1285156	31.06
1951-52	549203	804723	46.53	188459	298445	58.35	737662	1103168	49.55

Note :- figure marked with asterisk are based on average for preceding two years only

Table 8

COMPARATIVE POSITION OF CANAL AND WELL IRRIGATION IN THE YEAR OF ACARCITY

	1932-33		1935-36		1941-42		1951-52	
Source of Irrigation	***Average of Preceding 3 Years (Acres)***	***Actual for the year 1932-33 (Acres)***	***Average of Preceding 2 Years (Acres)***	***Actual for the year 1935-36 (Acres)***	***Average of Preceding 3 Years (Acres)***	***Actual for the year 1941-42 (Acres)***	***Average of Preceding 3 Years (Acres)***	***Actual for the year 1951-52 (Acres)***
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Canal	3,05,661 (42.73)	4,93,560 (52.51)	4,68,280 (56.74)	5,33,382 (58.99)	5,33,382 (58.99)	7,17,181 (55.80)	5,49,203 (71.61)	8,04,723 (72.95)
Wells	4,09,675 (57.27)	4,46,360 (47.49)	4,39,051 (41.73)	3,70,874 (41.01)	3,70,874 (41.01)	5,67,975 (44.20)	1,88,459 (28.39)	2,89,445 (27.05)
Canal & Well combined	7,15,336 (100.00)	9,39,920 (100.00)	10,76,068 (100.00)	9,04,256 (100.00)	9,04,256 (100.00)	12,85,156 (100.00)	7,37,662 (100.00)	11,03.168 (100.00)

***'Jhils'* loosing its existence**

Water logging

Due to seepage, land becomes barren

Improper lining of Canal (Elephant grass are grown)

Environmental Impacts of Canal Irrigation in India

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Abstract

In today's scenario a major threat to human life is the environmental degradation and we ourselves are responsible for such degradation. Human effort since ancient times to increase agricultural production was wonderful. Various techniques of Irrigation for example tube wells, canal irrigation etc. have been introduced. It was considered a boon for the development of society, but due to human efforts to increase the agricultural production at any cost has become a curse for the society. Man always tries to over use the natural resources but in this process they forget that this over utilisation will adversely affect the society in many ways. It can even lead to serious environmental impacts on flora, fauna, human population etc.This paper deals with one such human effort to increase the agricultural production and it is the Canal Irrigation system. The construction of canals is in general beneficial for increasing the agricultural production but they are also responsible, if not properly handled, for some environmental hazards. On one hand financial input is sometimes more than the expected return and on another, if not properly handled and implemented, it causes ecological imbalances resulting in waterlogging, salinization, loss of forest area (due to extensive deforestation), grazing land, crop land etc, which leads to the displacement of human inhabitants and wildlife. Thus, overall this paper focuses on canal irrigation system of the state of Uttar Pradesh state in India.

1. Introduction

From time immemorial efforts are made to enhance the security of people by every means and one of the major among securities for the people is the agricultural development in the society either by introducing new irrigation techniques or by adding more land under cultivation. No doubt that the ancient techniques of irrigating fields were highly advanced of its period. It is always good to introduce certain new techniques to the existing one or to make certain modifications in the old ones but introducing altogether a new technique and replacing the old one is never advantageous. One has to forget that the arid and semi-arid regions covering for about 53.9% of the geographical area of country and about 40% of the total population represents a weak dependent socio-economy. Much before the British arrived in India and started the big canal system, rich culture and agriculture thrived in these dry areas. Sophisticated water management and evolved agriculture provided reasonable safety against soil water drought and ground water drought in these areas.

2. Demand of increased agricultural production

The root cause of maximum number of problems related to agriculture, soil, land, irrigation etc is the increasing population and their demand for food production. In comparing the 1941 and 1951 census of India, the increase in the population was over 40 million. Nearly 83% of the population live in rural areas and 70% depend on agriculture for livelihood. The gross land area is 729 million acres, out of this 528.3 million acres are classified (net area and the statistics have reference to it alone). The area "cultivable but not sown" includes 64 million acres of fallow and the area not cultivable includes some 54 million acres of forest. The actual area of food crops is like the sown land area, 236 million acres. This area is however constantly diminishing, in 1911 it had been 0.9 acres per head: since that date the area of cultivated land has somewhat increased but not enough to keep pace with the growth of the population. Meanwhile large areas of land are lost annually by erosion, waterlogging, salinity, and other causes. There is no evidence that yields per acres have increased. The rapid growth of population has not been accompanied by a corresponding increase in food production and in consequence the amount of cereals produced per head has fallen from nearly 15 oz. to 11 oz. daily in 1949/50, and the total calories per day from 2000 calories to 1600 calories only. This deterioration of dietary had apparently begun before the 1930s, there are number of observations and surveys suggest that in earlier days more food grains per head were available. A much more modest program was adopted in 1948 to

increase food production as much as possible by increased irrigation and by bringing into cultivation some of the land at present fallow or waste. The irrigation schemes are far by most important but these schemes have sometimes caused disaster. Like in Damodar valley region famine occurred and perished the life of million people. It is naturally a vicious river but it has been made worse by man. It was originally covered by forest but this has been badly overcut and overgrazed with the inevitable result of serious flooding and erosion. The problem of feeding India however will remain extraordinarily difficult if the population continues to increase at its present rate. Even to maintain present low standards of nutrition about 32 million acres of land would need to be added to the cultivated area in the next ten years. Government made certain effort to control the increasing population for example family planning etc which definitely helped in reducing birth rate but on the other side death rate showed still sharper fall, which led to the increase in population, thus increasing the demand of food production.

3. Irrigation

In order to cope up with this increased demand of food production, various irrigation techniques are introduced. Irrigation is an artificial application of water to the soil usually assisting in growing crops. Civilization has risen and fallen with the growth and decline of their irrigation systems. In crop production irrigation is mainly used to replace missing rainfall in periods of drought but also to protect plants against frost. Irrigation is typically applied in those arid (semi) areas where evaporation considerably exceeds rainfall, little natural leaching occurs and salts tends to accumulate. The groundwater in these zones is generally mineralised and the substrata may contain considerable geochemical salt deposits. The introduction of irrigation may leads to more deep percolation of both irrigation and rain water, recharging the ground water reservoir. As a result water table will rise until such levels at which discharge is again in equilibrium with recharge. Irrigation has two primary objectives first, to supply essential moisture for plant growth, this helps in transporting essential nutrients and secondly, to leach or dilute salts in soil.

Beside this irrigation provides number of side benefits such as cooling the soil and atmosphere to create more favourable environment for crop growth, it supplements the supply of water received from precipitation and other types of atmospheric water, flood water and ground water. Irrigation has acquired increasing importance in agriculture the world over. From just 8 million hectares in 1800 , irrigated area across the world increased fivefold to 40 million hectare in 1900 to 100 million hectare in 1950 and to just over 255 million hectare in 1995. With almost 1/5th of that area India has the highest irrigated land in the world today.

Historically civilizations have been dependent on development of irrigated agriculture to provide agrarian basis of a society to enhance the security of people. Close to 19th century canals irrigated 45%, wells 35%, tanks 15% and others 5%.

Due to Green revolution in India during 1970s there was a continuous expansion of formulated and dual cropping system on existing farmland occurred in the north west of country. This generated the need for more canal water for irrigation as rainfall in the area is not sufficient to satisfy crop water demands. Hence various irrigation techniques were introduced to meet the demand of increasing population, one such techniques that became highly prevalent was canal irrigation system. But besides being a bless canal irrigation has also brought the inherent attachments of several problems like salinity, waterlogging etc. Thus this paper is an attempt to study canal irrigation.

4. Canal Irrigation

Large scale canal irrigation, a trend introduced by British and continued in free India. It is an important means of irrigation and is more common in northern plains because Rivers are perennial, water is stored in reservoirs by building dams across rivers and then this water is distributed to the field by a method of canal. Canals can be an effective source of irrigation in areas of low level relief deep fertile soils, perennial source of water and extensive area. Therefore these are common in northern plains in the states of U.P., Punjab, Haryana, Rajasthan and Bihar which account for about half of canal irrigated areas of the country. It was during green revolution new crop varieties were introduced and it also leads to the increased use of inorganic fertiliser and pesticides and frequent irrigation.

No doubt it has its advantages that it brings down a lot of sediments from the river which makes the soil fertile, most of the canals provide perennial irrigation and supply water as and when needed, although initial cost is much higher, canal irrigation is quite cheap in the long run. But it do have its demerit also as canals are generally not deep and since they are open they may dry up. And the water soaks into the ground and leads to the problem of waterlogging, the marshy areas near the canals act as breeding grounds for mosquitoes, and the excessive flow of water brings the salt to

the surface making the soil infertile. Waterlogging and salinization are some of the major problems of Irrigation.

The intensive irrigation, need of green revolution agriculture has created a largely wasteful water requirement in the hope of increased food production in limited areas where irrigation has reached. On the other hand the ecological impact of intensive irrigation has been large scale waterlogging and development of wet deserts in fertile agricultural lands. Further this agriculture is so precariously dependent on irrigation that any delay in supply either due to actual water scarcity or due to mismanaged distribution will cause soil water droughts. On the whole this method of agriculture has increased its vulnerability to drought in many ways.

Canals account for 27.6% of the net irrigated area of the state most of which lies in the Ganga Yamuna doab, Ganga-Ghaghara doab and western part of Bundelkhand region. The total length of Canal is about 50,000Km which provides irrigation to about 70 lakh hectares of the cropped area.

5. Waterlogging

Waterlogging is one of the major drawbacks of Canal Irrigation. An agricultural land is said to be water logged when its productivity gets affected by high water table and productivity gets affected when root zone of plant gets flooded with water. More than 33% of the worlds irrigated land is affected by salinization and waterlogging. In India alone, 8.4 million hectare are affected by soil salinity and alkalinity, of which about 5.5 Million hectare are waterlogged.

Waterlogging is mainly the result of increased water table and it occurs due to excessive or intensive irrigation in poorly drained soil where water can't penetrate deeply and enters the soil faster than it drains away. It occurs even worse where there is compaction of subsoil layers, where water quickly enters the topsoil but is then blocked by water – resistant clay layer, which may occur naturally or may be induced through excessive use of agricultural machinery. There are many ways which increases the water table like water from canals may seep through beds and sides of canals reservoir etc or seepage of water from adjoining high lands into subsoil of affected land or because of inadequate drainage system soil having less permeable substratum below topsoil will not be able to drain water deep into ground causes high water table. In steep terrain water is drained quickly but in flat terrain drainage is poor which raises water table. When the water table rises it fills up the air spaces in the soil, plant roots in effect suffocate from the lack of Oxygen, limiting the plant growth in those areas. About 10% of all irrigated lands suffer from waterlogging. It occurs mostly on flat floodplain areas or gently sloping landforms with high rainfall and red duplex or heavy clay soils.

In Indo- Gangetic plain main reason for waterlogging is flood in the rivers. Rainfall in this region is very uncertain in quantity and distribution. More than 90% of the precipitation occurs in a short time span. This results in occurrence of flood. Rain water is stored in low lying areas and deteriorates soil in the long run. Waterlogging causes damage to the soil structure, suffocates plant roots, leads to the fall of productivity by about 20% in affected areas, pasture loss through drowning, fungal diseases, nitrogen deficiency, erosion in higher rainfall areas and soil structure decline, as soil is washed away. Farmers need to manage and plan their irrigation properly so that they do not over water the soil and suffer with this problem.

The problem of waterlogging started emerging on the large scale in the North West India during the last century with the growth of canal system. New areas have been affected by water logging in post-independence period when major irrigation projects were executed. Chambal in MP and Sarda Canal in UP etc are examples of this canal which leads to the problem of waterlogging and subsequent salinity through seepage as well as obstruction to the rain water run-off. The problems has been further aggravated by the process of new construction of roads railways, urban sites etc which have obstructed the natural flow of water. In other parts the problem of water logging is caused by the swelling of the rivers during monsoon which inundate large area. Areas suffering from bad surface drainage system and waterlogging in Punjab and Uttar Pradesh taken together amount to about 13.8 lakh hectares. National commission on Irrigation 1972 gives an estimate of waterlogged area of 8.10 lakh hectare for UP and 0.57 lakh hectare for MP. These figures were also accepted by national commission on agriculture, 1976.

6. Salinization

Ancient civilization flourished and then floundered when soil became saline due to poor irrigation practices and lack of drainage (example Mesopotamia civilization in the Tigris –Euphrates valley). There is a rudimentary relationship between irrigation and salinity. Salinization and waterlogging are the principal degradation processes on irrigated land. From various available data it is estimated that the world is losing at least three hectares of arable land every minute because of soil salinity .It is a serious problem of irrigated land. Of the 230 million hectares of irrigated land in the world 45 million

hectares is salt affected land to varying degrees by human induced processes. In contrast of almost 1500 million hectare of dry land agriculture, only 32 million hectare is salt affected soil. After a report survey waterlogging problem had developed in 2.46 million hectare, salinity in 3.06 million hectare and alkalinity in 0.24 million hectare. Affected areas are not completely out of production. But productivity reduces in such land .Salinity prone soils have been identified as being of three broad types (in relation to India).

i. The western part of India is a semi-arid to arid regions with hot climate and dry winter. In this climate evaporation is always greater than precipitation. Hence the soil profile development by eluviation is greatly retarded. The soil is marked by a concentration of salts saline and alkaline.
ii. The marked seasonality of rainfall affects salt release over a large part of the country. In south India and the Gangetic valley warm rainy climate is followed by a dry winter. During the rainy season precipitation is greater than evaporation which induces leaching of soluble salts down the profile. If the water table remains high, the soluble salts will remain in the profile. In North India the salts are transported in solution by the Himalayan Rivers, which later percolates in the subsoil of the plains and accumulated in the area of inefficient surface drainage. Thereafter during the dry season these salts are drawn upwards through the capillary spaces by evaporation from the surface. In many cases salts are deposited on the soil surface showing white or black patches of efflorescence on the soil surface.
iii. A large part of deltas and estuaries of rivers are affected by sea tide carrying salt laden deposits. Large parts of the seacoasts are subjected to periodic inundation by tidal water.

The quality of water in India is of high order. Canal water originating from the river or their reservoirs representing the Parent Rivers in quality unless contaminated. Proportion of salts are safe, usually less than 500 μs cm^{-1}. But even this small quantity of salt may play havoc if due care not taken. Minute quantities of salts are added to the soil with each irrigation crops removed much of the applied water from the soil to meet their evapo-transpiration demand but leave most of the salt behind. With each successive irrigation more and more salt is added. Hence a portion of the added salt must be leached from the root zone before the concentration affects the crop yield. Leaching is done by applying sufficient water so that a portion percolates through and below the entire root zone carrying with it a portion of the accumulated salts. After much successive irrigation the salt accumulation in the soil will approach some equilibrium concentration. A successful water management program keeps the equilibrium level within a certain limit that is best for crop growth. This equilibrium level is decided by three factors, important for good salinity management:

- The salinity of applied water
- Depth of water leached below the root zone
- Depth of water applied at the surface

7. Sarda canal of Uttar Pradesh

India being the second most populated country in the world face lot of problem in feeding its people. Same is the case with Uttar Pradesh (most populated state of the country). There are many reasons behind it but the one major reason which this paper is focussing is the mismanagement of canal irrigation system. Despite many failures of canal irrigation, badly managed irrigation projects are still developed for short term economic gains and political popularity. The Uttar Pradesh government in India has recently undertaken a canal project named Sarda canal at a total cost of 40 million rupees.

Sarda canal was built by British in 1928; it takes off from Sarda River at Banbasa (nainital). The length of the canal with its distributaries is 12,368 Km. It irrigates about 8 lakh hectare of land in district of Sahajahanpur, Barabanki, Pilibhit, Sitapur, Kheri, Hardoi, Lucknow, Unnao, Raebareli, Pratapgarh, Sultanpur and Allahabad district. Its main branches are Deva, Bisalpur, Nigohi, Kheri ,Sitapur, Lucknow and Hardoi. Another canal Sarda Sahayak takes off about Sarda sagar about 20 km below Sarda canal headworks near Indo-Nepal border and augments the supply in Sarda canal. It irrigates about 7.5 lakh hectare land in Jaunpur, Azamgarh, and Ballia district canal.

The construction of Sarda canal will result in the loss of 12500 ha of land, thus causing ecological imbalances, which is against the principal of soil conservation and it is a permanent loss that cannot be revived, constituted as follows:

1. Cultivated land 8000 ha
2. Forest land 1250 ha
3. Grazing land 3250 ha

The loss of the cultivated land is 8000 hectare. The average yield per hectare for all crops is supposed to be 21

quintals (2.1 tonnes) per annum. The total loss in production per annum will thus be 16800 tonnes. It is doubtful that this loss will be compensated by increased production. The total compensation paid to farmers for their land is in terms of seven million rupees. These huge investments may not yield expected returns. Besides several resources of minor irrigation have been or will have to be destroyed, because of their existence in the area or vicinity of the canal. The construction of this canal also leads to the displacement of human inhabitants and wildlife. The removal of trees during the canals construction will adversely affect the Motipur wildlife sanctuary which is rich in animal wildlife including Deer and Tiger. There is a great apprehension that the area might become devoid of Deer, which are the main animal wildlife inhabitants.

There are certain problems expected after coming into operation of its canal for example, Seepage – the texture of the soil in the canal command area is sandy loam or loam. The porosity being between 40.20% to 48.25%. The nature of the soil and the physical properties indicate that the rate of seepage will be moderate. The water table records show that during the summers and winters, the water table remains low, fluctuating in depth from 3.15 m to 4.25 metres respectively. It starts rising at the onset of monsoons, when a continuous rising of water table was recorded as the rainfall progressed until the water table rose to a depth of only 0.80 metre in 1983 and 0.70metre in 1984 during the month of September. The main branches of Sarda canal are 31 metres wide and 3- 4 metres deep. The discharge of the canal will be 360 cusecs and of the pump canal will be 77 cusecs .As the canal is unlined, the discharge will cause more seepage. The rate of seepage as experimentally determined by seepage metre is from 3.60 mm/ hr. to 6.0 mm/ hr. which is a moderate rate of seepage. But after the canals become operative this rate may increase by from 5 to 10 times.

Sarda Sahayak canal project commissioned in 1974. The operation of this canal has created serious problem of seepage started right from the beginning and at present it has created a situation which may be one of its type in the history of canal irrigation .The seepage of 1984 has damaged 385 villages, 13,677 houses and 2200 cattle's. Mature natural forest containing Sal trees have been killed by canal seepage over a vast tract. The canal seepage and high water table rendered vast tract waterlogged. Due to continuous waterlogging in the command area, the problems of malaria filarial skin disease and pest are very common.

Ultimately it can be said that that the above mentioned data's show that Sarda Canal operation will adversely affect the ecological balance of the state and as a consequence it will lead to the environmental changes such as management of land, water and forests for sustainable development.

8. Conclusion

The environmental problem such as waterlogging and salinization in the vicinity of irrigation canals are extremely widespread. It is also known that about half of the worlds irrigated area has already been damaged to some degree by waterlogging and salinization and that much of the additional land which is expected to be irrigated in the future is highly vulnerable to similar damage. This problem is not only widespread in India but in other countries like Pakistan, Iran, Iraq, USA, etc countries are also suffering with this problem.

Whenever a question arises that, "Why only canals among the indigenous techniques were adopted by modern engineers while others are not? Answer often comes out as: "Canal irrigation allows centralised management which goes well with bureaucratic control". But after reading the above details another question starts lurking in our mind that "Is it so?" Because the construction and operation of irrigation canals in India is in the hands of the state and the gap between the planners and operators on the one hand and beneficiaries on the other is even greater than in most other department of government.

But it is also important to consider that canal irrigation is successful at some places like in Italy, consorzi di bonificia involve farmers closely in the design and construction stage as well as in the operation and maintenance of irrigation canals. Thus it can be said that efficiency of canals can be substantially improved by forms of organisation which brings representation of the state into regular institutionalised connections with representatives of the affected farmer, both at the stage of construction and of operation and maintenance.

Secondly a large part of these problems are attributable to the poor drainage system. Inadequate drainage means that soil having less permeable substratum below pervious soil will not be able to drain water deep into ground causes high water table. If proper drainage is not provided then the storm water constantly percolates and level of water table rises. Providing intercepting drains along canals prevent seeping canal water from reaching the water logged areas. Improving natural drainage of area helps in reducing percolation of water so that water should not stand for longer period. To keep from salting out the soil, there must be proper drainage system. When the drainage is insufficient to counter this salt influx, the root zone becomes salinized. Thirdly lining of canals and water course reduces seepages of water.

Reducing the intensity of irrigation in area where there is possibility of water logging. Fourthly Crop rotation helps in avoiding high water table as there are certain crops which require more water and others require less water. Fifthly Optimum use of water for irrigation gives best results. Less than and more than that reduces yield. Overall it can be said that there are many ways to protect the land from such types of problems, and Canal Irrigation can be proved highly beneficial among different techniques of Irrigation.

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Human Rights in relation to Water in India

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Abstract: *Constitution of India deals with certain fundamental rights of human. There is one such right which is the basic need of human beings, but still it is not given due importance in our constitution, that is* ***'Water'****. A dispute in relation to water has existed in India since ancient time and this problem still persist and is not on the verge to be resolved even today in India.*

Supreme Court held in Chameli Singh Vs State of Uttar Pradesh that right to live guaranteed in any civilized society implies the right to food, water, decent environment, education, medical care and shelter. These are basic human right known to any civilized society. All civil, political, social and cultural right enshrined in the universal declaration on human rights and convention or under the constitution of India cannot be exercised without these basic human rights.

This paper is an attempt to focus on one of these basic rights. And it is ***THE WATER****. This is not yet explicitly mentioned in the constitution of India. Here the discussion lies on the fact that whether the provisions made so far are properly implemented or not? And what is still needed to resolve this basic problem. Water is given the fundamental status in several countries, why India is lacking in it?*

Keyword: *Constitution, Fundamental Rights, Water.*

I. Introduction

Basic human right

It has been rightly remarked by Kofi Annan (UN Secretary General) that ***"Access to safe water is a fundamental human need and therefore a basic human right".***

Rights which are essential or fundamental for the wellbeing of a person are called fundamental rights. The fundamental rights in India are enshrined in Part III of the constitution of India guaranteeing civil liberties such that all Indians can live in peace and harmony as citizens of India. Rights literally mean that freedom which is essential for personal good as well as for the community.

Under Fundamental right in the constitution of India, **Article 21** entitled 'Protection of life and personal liberty' of states, '*no person shall be deprived of his life or personal liberty except according to procedure established by law*.' This has popularly come to be known as Article on **Right to Life**. In course of time this concept has been expanded to include several other vital aspects of human life like 'pollution free water and air for full enjoyment of life.' health etc. Thus it entitles citizens to receive safe drinking water (potable water) in part of the Right to Life under article 21.Water is fundamentally different from other resources for the reasons that it is one of the four elements of the ancients (along with air, earth, and fire) essential to life, it plays an important role in hygiene and in combating epidemics.

When we talk about Water in wider perspective, there are more than 326 million trillion gallons of water on Earth but less than 3% of all this water is fresh water and of that amount, more than two-third is locked up in ice caps and glaciers. With so much water around it seems like there is enough to see us through for millions of year. But it is not so, because even water, which seems to be in abundance, is facing the problem of scarcity. Even some of the famous personalities said that the main reason for the third world war will be the dispute related to Water. Because water is necessary for the survival of all life, yet over one billion of the world's more than 6 million people do not have available sources of clean water for drinking. Over 2 million people die every year due to a lack of safe water. This shows that our future is in danger.

II. Facts Related To India

Unbelievable truth

As far as India is concerned there are certain figures which show that Water in India is in a very deplorable condition. Millions of Indians in particular women and children, are living rather than forced to live in condition of severe poverty devoid of any meaningful living conditions, they do not have adequate access to water. Despite enormous improvements over the past 15 years, hundreds of millions of men, women and children still do not have proper water for drinking and sanitation. Many remain unemployed because water resources cannot support agricultural or industrial growth. Water problems ultimately end up as 'people' problems.

According to the World Water Development Report, 2003 in terms of availability of water, India is at the 133rd position among 180 countries and as regards the quality of the water available, it is 120th among 122 countries. There are some more figures given below:

- 17% of India's population does not have access to portable water.
- 80% of children suffer from water borne diseases and a total of 44 million people have illnesses related to poor water quality
- About 226 million people lack access to safe water.
- About 70% of population (about 640 million) lack basic sanitation facility.
- The water related diseases are claiming the lives of about 1.5 million children (500,000 children due to diarrhea alone) under 5 years.
- In developing countries, of the 37 diseases identified as major causes of death, 21 are related to water and sanitation.

These are such figures which are highlighted in some or the other forums but there is still a long list of figures not known to the people, and no doubt it is uncountable. The issue of quantity and quality of water thus becomes a fundamental basis of life. In China widespread access to safe drinking water and sanitation has minimized the adverse impacts on health despite high levels of pollution of water sources. The uniqueness of water to life makes it a social asset, a common good basic to any human community.

III. Government Effort For Peoples Right To Water

Laws Framed by Government

In India, the legislations governing the water sector are not very coherent in nature. On paper they might appear to be superior pieces of legislative action and are based on objectives keeping decentralization and participation in mind. However, problems arise when it comes to actual implementation. With water resources in the country fast depleting, it might be argued that given the increasing demand for drinking water and sanitation, the funding for the same is highly inadequate. Judiciously speaking, it is also important for people in India to realize that the issue is not how to save more water, but instead how not to waste water. What further aggravates the problem is the verity of continual demographic change in India.

A quick glance at the history of India's water sector shows that it was managed on an *ad hoc* basis till 1987, when the first ever National Water Policy was formulated,31 and even that was a mere practice of codifying the manner of governmental functioning in this regard. Such a policy failed on a number of counts when it came to changing the ground realities however, because neither was it formulated with the participation of people through consultation, nor did it allocate any role to the communities involved in practicing traditional water conservation Post the dismal performance of the implementation of the National Water Policy, 1987, the government prepared a fresh draft water policy in 1998. However, instead of wider circulation among the public at large, this policy was kept a secret, though the National Water Board had already approved it. Therefore, the final document did not incorporate any concern, suggestions or ideas emerging from the public, virtually making a mockery out of the whole exercise

Indian Government has made several attempts by way of making laws to protect the people right to water.

- This can be seen in the First five year plan (1951-56) provision of safe and adequate water was recognized as a basic requirement deserving to receive the highest priority. It was admitted that though the provision of protected water supplies was started in India about the same time as in England, USA, the progress made has been little. With the rise in industrialization and urbanization the pollution of water sources by indiscriminate discharge of wastes from industrial plants and sewerage effluents from towns and cities has become a problem over the years.
- In fourth plan (1969-74) water related diseases constitute nearly 80% of the public health problems in India. United Nation water conference – Argentina in 1977- held – in which India is a signatory, resolved that all people whatever their stage of development of their social and economic condition have the rights to drinking water in quantum and of a quality equal to their basic needs.
- The decade of 1981-90 was designated as the International drinking water supply and sanitation decade .Though India has pledged its full support to the action plan under the international decade, the overall progress has been only marginal. The National water policy was announced in 1987 giving high priority to drinking water supply but in implementation it had not made much difference.
- Seventh plan (1985-90), admitted that the high rate of incidence of death and disease in urban poor settlement can be attributed largely to the poor quality of water and sanitation facilities.
- Eighthplan (1992-97), it was to extend safe drinking water facilities to the remaining urban population so as to achieve the goal of 100% coverage of population by the turn of the century.

- Several planning and funding made in relation to water in ninth and tenth (2002-07) year plan, despite all claims and concerns about the importance of providing adequate drinking water to all citizens , allocation to the urban water and sanitation sector have never crossed even 2%of the plan funds of the Government of India since independence.

During this period urban population has increased from 17.3 to 27.8% during 1951 – 2001, though water is a state subject, the low priority given by the Central government to this vital sector is reflected in the low allocation despite more than fourfold increase in urban population. The constitution of India is a remarkable document with an explicit transformatory agenda, drafted at a moment when the ideals and aspirations of human rights were compelling to the newly independent nations

IV. Right To Water In International Arena

Reflects the importance of Rights of water in the World

Ever since the Universal declaration of Human rights , the right to water has been declared explicitly or implicitly as an essential component of right to life in particular and human rights in general in a number of international declaration . The International covenants on civil and political rights which states that this right shall be protected by law. With the United Nations (*hereinafter* UN) declaring 2003 as the International Year of Freshwater, followed by the Third World Water Forum in Japan in March 2003, then a war in Iraq which tainted the country's freshwater supply and on top of that, a drought in sub-Saharan Africa that killed thousands of people on a daily basis, there has been of late, a lot of talk about water in the international community.Today, pressure on the world's freshwater resources continues to escalate and governments of different countries are struggling to find ways to improve the quality and efficiency of their water supply systems.

For the first time United Nations Economic and social and cultural rights has explicitly declared right to water as a fundamental right under right to life and placed several obligations on state parties to ensure and enable the citizens to realize the right. It is clearly stated that safe drinking water is fundamental for life and health and it is a 'precondition for the realization of all human rights'. Every citizen is entitled to **safe, sufficient, affordable and accessible drinking water.**

V. Conclusion

It must be remembered that though law can come in as a facilitator of change, for it to be truly effective and deliver on its mandate, the desire of the people must always remains the supreme consideration. Several attempts on the part of the government to protect the right of people for THE RIGHT TO WATER are not complete in itself. Right to water till today is not mentioned explicitly in our constitution, besideknowing that except air there are no other sources of life comparable to water on the earth. Thus to have access to water 'is not a matter of choice, everyone needs it.'

Despite constitutional mandates and official proclamation, India has lagged behind among others in the most important concerns for the wellbeing of people in any society. From time to time government has made many provisions but as the politics of our country is corrupt in the same way corruption is involved in this fundamental right to water because of which it is not yet explicitly mentioned in our constitution.

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