INTRODUCTION

This study is about the British government's attempts to control the rivers in North Bihar (Bihar north of the Ganges) for the purpose of irrigation and flood control, and the resultant impact on the agro-ecology of the region.

Modern irrigation engineering that evolved in India was very much a product of the European colonial technological project. The term 'Colonising the Rivers' is used in a certain context, which will become clear in the subsequent pages. But briefly, it is used to describe the Colonial State's attempt to curtail the freedom, and disturb the ideal natural conditions of the rivers. This was done by constructing permanent concrete weirs (a low dam built across a river to control or direct the flow of water) across the rivers and diverting a portion of the water supply into artificially created waterways called canals or, by confining their flow within certain limits with the help of embankments. This kind of intervention affected both the agro-ecological setting as well as a large section of the population dependent on agriculture.

The term 'Colonising the Rivers' is also used in a more conventional sense of the term. Although rivers were used as trade routes even in pre-colonial times, the commercial exploitation of river water for the purpose of agriculture was started in a big way in the colonial period. River water was valued in terms of money or the revenue it could generate (e.g., through water rates in irrigation canals, embankment cess, etc.). As I will discuss later in this work, the motive of the colonial state in meddling with the rivers was, to increase quantitatively the agricultural production of India and, alter qualitatively its commodity composition so that Indian agriculture could be transformed to suit
colonial requirements. Rivers and other watercourses, which became the property of the State, were now to be used to meet this end.

Survey of the Existing Literature

Till recently the study of irrigation in general, was a neglected subject. Works on this area were rare and invariably undertaken mainly with a view to assisting the current policy formulation. D.R. Gadgil's book\(^1\) was, for instance, basically a technical cost-benefit analysis primarily oriented towards policy formation and refining of project appraisal techniques.

The nationalist historian R.C. Dutt's\(^2\) concerns on irrigation were limited to a critique of the diversion of enormous investment to the railways rather than to the construction of irrigation canals. He believed that while canals would contribute to stability of agriculture, the railways, transporting imported British goods to the remotest corners of India cheaply and quickly, would hasten the ruin of the surviving Indian industries. He also showed how the economic returns on investment in irrigation were much higher than those in the railways. For all his brilliant arguments, it seems that Dutt had an inherent faith in the modern irrigation engineering as a precondition for Indian agricultural development.

Similarly, Bipan Chandra is critical of the 'uniformly low' expenditure on irrigation compared to that on railways.\(^3\) Irrigation by no means rivalled the railways in terms of resources expended by the state. In fact, the proportion of total government

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outlays upon 'creative investment' (public buildings, irrigation, agriculture, transport and communications) taken up by railways was up to four times greater than that devoted to irrigation during the 1900s.⁴

Despite the relatively small scale of construction of irrigation projects in India - one acre in six was irrigated from government schemes by the late 1930s. There is an almost total absence of modern historical studies into their impact. The real break in the study of this subject came in the 1970s with Elizabeth Whitcombe's book.⁵ Discussions on irrigation in the United Provinces constitute a section of the book where Whitcombe questioned the role of artificial irrigation in the security of agriculture which had long been regarded almost as a truism. She argued that the way canals had been constructed often adversely affected the local peasant economy through, for example, shift to the production of cash crops, decline in food availability, marginalisation of wells, over exploitation of lands, decrease in pasturage and consequently decrease in cattle population, etc.

Whitcombe also shows the ecological problems related to canal irrigation, such as, seasonal flooding and increase in reh (salt efflorescence) infested lands and the creation of swamps which resulted in recurrence of malarial outbreak. Moreover, the irregular and insufficient supply of water was made available to the cultivator "at double the cost: the cultivator had to pay government its fixed acreage water rate- and pay the canal official

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his illegal, but by no means irregular, charges." The conclusion that she reached was that 'the canals proved a costly experiment'.

A.K. Bagchi, taking a Marxist approach, highlights the exploitative character of canal irrigation in class terms. He asserts that the canals helped in the creation of structures within the agrarian community, which were exploitative in character. According to him the emphasis on cash crops and increase in irrigated area proved profitable to the landowners. It also helped the exploitation of the landless strata of the poor peasants more intensively by the big landowners. Although his findings are more or less based on Whitcombe's findings in the United Provinces he certainly provides a new angle to the study of big irrigation projects in India.

Ian Stone, in a more exhaustive study, on the other hand, builds up a productivity efficiency model and placed the peasant in it. His study is also on the United Provinces. He does not accept the verdict on the canals given by Bagchi and Whitcombe and argues that the problems created by irrigation were incidental to the larger designs of improved productivity, market regulated demands and a peasantry tuned to increase its gains. He further believes that the impact was not confined to the crops, which took water from the canals but "were felt across the whole range of peasant production and society." He also argues that the peasant response to canal irrigation was a positive one. They shifted to this new method not out of any compulsion, as argued by Whitcombe, but because they

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6 Ibid., p.10.
7 Ibid., p.91.
10 Ibid., p.105.
11 Whitcombe argues that the peasant took to the canal either because he had no choice (his wells fell in) or because he saw the prospect of relatively effortless (but possibly short-term) commercial gain.
revenue base, mobilisation of political support and recruitment in the army, etc., and links it with the colonial interest of Britain in India. But these were only secondary objectives. Ali fails to differentiate between the primary objectives of the colonial state and secondary objectives. The primary objective of the colonial state was to convert India into a satellite of the British economy. Further, he shows little concern to the new pattern of relationship that was emerging between India and Britain in the second half of the 19th century which had a definite bearing on British irrigation policy towards India.

Ali's major concern in this book was to analyse the social, demographic and economic engineering done through the colonisation scheme. A very important issue of the impact of canal irrigation on the agro-ecology of Western Punjab was totally neglected.

M. Mufakharul Islam's study, also on the undivided Punjab, traces the origin of canal irrigation in India in the changing dynamics of the colonial situation. During the regime of the East India Company, India was considered important as a source of mercantile profit and tributes. But during the ascendancy of the industrial bourgeoisie India was expected to play the role of an economic satellite, a supplier of raw materials for, and purchaser of the product of, the metropolitan industries. These two roles were interrelated as both these objectives could be fulfilled through the development of India's productive power in the agricultural sector. "For while the development of agriculture was necessary for the increased supply of raw materials and wage goods, such exports could enable India to pay for her imports from Britain." The emphasis on the development of irrigation facilities was thus a part of the larger design. He writes, "the primary

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found the new device labour saving as well as capable of irrigating much larger areas than was possible with wells.\textsuperscript{12} The present study would, however, reveal that the canal administration, at least in the initial years, used all the methods in its command to destroy and discourage the competition to canals from the indigenous irrigation systems prevalent in North Bihar.

It must be noted that a great deal of Stone's most detailed research has focussed upon the particularly buoyant districts of Meerut and Muzaffarnagar, whereas coverage of the more stagnant districts of the central and lower doab is limited. Despite Stone's intended preference for canals in comparison to well irrigation from a productivity efficiency model and his acceptance of a colonial design in it, he fails to recognize the hegemonising aspect of canal irrigation. As this study would reveal, canal irrigation, due to its enormity, was beyond the control of the agrarian community in direct contrast to the indigenous system of irrigation that was practiced in North Bihar.

Imran Ali's\textsuperscript{13} concerns about canal irrigation were very different. His main argument was that although agriculture in canal colonies in West Punjab (now in Pakistan) showed an impressive process of growth if measured with such indices as cultivated area, output marketed and trade, it failed to convert to capitalist agriculture. This was because of the colonial policy, which re-imposed the traditional social structure, which was dominated by rentier and absentee landlords.

His study covers the area of undivided Punjab, which had received the lion's share of the government's investment in canal building activities from 1880 onwards. Ali identifies a wide range of objectives in planning canal irrigation in Punjab: promotion of agricultural development, prevention of famines, expansion and stabilisation of the

\textsuperscript{12} Stone, \textit{op. cit.}, pp. 93-95.

\textsuperscript{13} Imran Ali, \textit{Punjab Under Imperialism, 1885-1947}, Delhi, 1988
justification for the Pax Britannica lay in the need for converting India into a satellite of the British economy."\textsuperscript{16}

The most important contribution of Islam's study on the impact of canal irrigation lies in his analysis of the functioning of agrarian community in the regions irrigated by canals. He shows how, despite the colonial state's desire to make Punjab a domain of owner peasants, a stratified peasant society emerged, "with resourceful peasant grantees largely depending on sharecroppers for organising the cultivation."\textsuperscript{17}

However, Islam's study is silent on the issue of management, control and distribution of canal water to the fields. On this issue, Ian Stone writes\textsuperscript{18}:

...little time and resources existed for the details of distribution, only gradually did the attention of the engineers move beyond the prestigious main work to the more mundane activity of establishing an effective distributary system. The construction, operation and management of the actual water distribution system were by default, placed in the hands of the irrigating community (farmers using canal water).

Nirmal Sengupta echoes the same opinion when he writes, "the jurisdiction of the canal authority did not go beyond the main lines constructed by the government engineers. Thereafter, the grantees were required to make arrangements for leading this water to irrigable fields, maintain those channels and allocate water to others in whatever manner they desired."\textsuperscript{19}

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\textsuperscript{16} Ibid., P.15.  \\
\textsuperscript{17} Ibid., p.86.  \\
\textsuperscript{18} Stone, \textit{op. cit.}, p.196.  \\
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One basic and important aspect of irrigation which most of the above-mentioned studies missed was a proper and sympathetic description of the traditional irrigation system and techniques of management. The reason for this might be the euro-centric orientation of modern engineering and the colonial notion of superiority of western civilization acted as a stumbling factor even for a proper understanding of traditional technologies and sciences.

Nirmal Sengupta\textsuperscript{20} provides us with a close examination of traditional irrigation practices and its management in South Bihar. Sengupta gives a proper description of the \textit{ahar-pyne}\textsuperscript{21} system of irrigation, which made it possible to draw the best out of very unfavourable natural conditions of that region. Sengupta also examines the social organisation and the system of produce rent which were, according to him, linked with a proper working of the irrigation system.

Most of the above mentioned studies, apart from that of Nirmal Sengupta, are based on the northern and north-western river systems with a focus on the canal irrigation. The colonial intervention in irrigation and flood control in eastern India has only recently become a subject of detailed study.\textsuperscript{22}

The eastern region, with its unstable river regime and a completely different agro-ecological setting, did not attract much investment in canal construction. While over 59 per cent of the government's total main canal lines were located in the northern and western region (United provinces, Punjab and Sind) followed by 25 per cent in the

\textsuperscript{21} \textit{Ahars} in South Bihar were artificial water retention structures, while \textit{pynes} were canals made to transport the water from the \textit{ahars} to the fields.
southern province of Madras, the eastern zone (Bengal, Bihar and Orissa) accounted for barely 5.8 per cent. But even the limited attempts of the colonial government to control the unstable rivers of this region destroyed the 'inundation irrigation' system of the region, and also altered the agro-ecological setting.

Objectives of the Study

The aim of this study is to look into the traditional methods of irrigation and agriculture, the colonial intervention in irrigation and flood control, and the consequent changes in the ecology of that region. The proposed area of study is North Bihar, i.e., Bihar north of the Ganges (see Map 1).

Also the study attempts to deepen our understanding of how man has been affected by his natural environment through time, and conversely, and perhaps more importantly, how he has affected that environment and with what results. Further, the attempt is to fill a gap in the existing literature, as there has been no work on floods or flood management and irrigation in North Bihar for the colonial period.

The period of study extends from 1850 to 1950, although an attempt has been made to study the subject from the beginning of the colonial encounter. The chronological limits of this study are somewhat hazy. The beginning is taken as around 1850 because the end of the Company rule and the beginning of direct British rule brought about a gradual tightening of the administrative frame in the countryside and an increase in the volume and diversity of archival material. It is around this date that the colonial

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24 "In the region under the Permanent Settlement, the colonial state dealt only with the zamindars and not with the peasants who tilled the soil. Thus, it had no reason to maintain under its direct control an administrative infrastructure in charge of the statistical coverage of the village economy. But in the second half of the nineteenth century it belatedly attempted to improve its knowledge of local life and its means of action at the village level, but only with partial success. It was the need for prevention of famines, regulation of economic life according to market principles, expansion of the rule of law and maintenance of public order that prompted the colonial state towards this." See Anand Yang, The Limited Raj: Agrarian Relations in Colonial India, Saran District, 1793-1920, Delhi, 1989.
government, in the face of increasing frequency of famines, started planning the development of infrastructure like canals and railways. The colonial government from the beginning of the 19th century adopted flood control measures (e.g. the Gandak embankment), but it was from the middle of the century that the large scale, haphazard growth of embankment construction actually began and the government tried to make legal provisions.

By the end of the 1930s embankments as a technology option for flood control had lost its appeal and multi-purpose dams were being touted as the answer for both flood control and irrigation. The post-1945 period witnessed the planning and investigation of, what would have been one of the biggest dams in the world to control the river Kosi. After this project was shelved, the alternate project for the control of the Kosi included embankments, which only few years back were termed as the biggest cause of the deteriorating flood situation. Another interesting development seen in the late 1940s is the beginning of a process for planning a much bigger Gandak canal project even though the experience of the canal authorities on the Tribeni canal was not very satisfying.

Chapter 1 of this thesis consists of first, a detailed geographical study of North Bihar. A detailed survey of the (a) river system of the region, (b) water table, (c) rainfall, (d) climate, (e) gradient of the region, and (f) types of soils has been made to understand the traditional agricultural practices as also to critically examine the British intervention in irrigation and flood control. Second, a survey of floods and the peasant response to such floods is analysed. It investigates whether the peasants considered floods as a menace or had adjusted their lives and agricultural practices to it.

Third, an attempt is made to find out the traditional irrigation practices through chaurs, pynes and "overflow irrigation" from rivers. A description of traditional
agricultural practices and techniques, agricultural cycles, varieties of crops grown etc., in short the 'science' behind traditional agriculture in different regions of North Bihar, is attempted.

The general theme of this study is to show the impact of colonial intervention on the 'agro-ecology' of North Bihar. The term 'undisturbed' has been used to describe the pre-colonial 'agro-ecology' of North Bihar. It does not mean that there was no human intervention in pre-colonial times. But, as will be shown in subsequent chapters, the quality of intervention was different - whereas in the pre-colonial times the emphasis was more on adjusting one's life and agricultural practice to suit the natural conditions, in the colonial period the attempt was directed towards changing the natural setting itself. It is also to be noted that the changes made in the natural setting of North Bihar during the colonial period occurred at a very fast pace, and were irreversible.

The second and third chapters of this study consist of a discussion of the various aspects of the British intervention in canal construction. First, is discussed the planning and construction of these canals and the various engineering problems associated with them. Second, an attempt is made to analyse the motives behind the construction of these canals. A brief discussion on famines in Champaran district, which was the centre of great canal construction, is included. It is also shown how the introduction of canals was intended to help in the extension of cultivation. Third, an attempt is made to show the destruction of the traditional means of irrigation and, in some areas, their rehabilitation in a different form. A comparison of the working of these two systems of irrigation is also undertaken.
The fourth and fifth chapters of this study examine the various aspects of colonial intervention in flood control. To begin with, there is a discussion on how the natural actions of the rivers to conserve themselves in the deltaic region were tampered with by the construction of embankments.

There is also a discussion on the role of embankments in increasing the flood level, changing the nature of floods, and cutting off of the fertilizing silt brought by the rivers. It has been shown that embankments, even as a temporary solution to control floods, proved unsuccessful. The discussion centres on the role of embankments in tampering and subsequently destroying the drainage network of North Bihar. An analysis of the role of the railways and roads in obstructing the drainage of the region and in worsening the already grim flood situation is also given.

Finally, an attempt is made to analyse the politics behind the construction of embankments. It is also attempted to find out the peasant response to and outlook on embankments. An attempt is also made to show how the competitive construction of embankments by zamindars and rich peasants led to further deterioration of the flood problem in the region. But the most interesting fact to be noted is the inability of the colonial government to stop this development despite being armed with various laws.

It needs to be noted that nowhere has it been suggested that the colonial intervention disturbed an ideal, static agro-ecological setting of the region. Infact, as would be discussed in the first chapter, North Bihar was characterised by an ever changing natural setting because of the shifting of the rivers. The British intervention was aimed at bringing about some permanence to the landscape of the region by trying to 'tame' the rivers by various means.
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