CONCLUSION

I have in this work, at the very outset, shown that rivers in North Bihar spilled during the monsoon to 'conserve' themselves in a deltaic region. Although North Bihar was a flat country, water drained off through an intricate network of rivers, drainage channels and chaurs. Also, the floods in North Bihar, instead of being seen as a 'menace', were an important input for agricultural production; it helped in irrigation, enriched the soil, provided an abundant harvest of fish which helped in combating malaria, and most importantly, helped in building up the low lying tracts in the region. The nature of floods was such that inundation was not for long durations or of great depth, at least in years of normal rainfall and water drained off from the lands quickly to low lying areas. The water bodies, like chaurs, jheels, tals, etc., were nothing but a sort of 'retaining basins', which were left untouched. All these water bodies were interconnected and drained into one another. The rivers, although flowing in ridges elevated above the general level of the country, finally became the receptacles of the drainage of the whole area.

Apart from 'overflow' irrigation from rivers, irrigation was also practiced by means of putting temporary bandhs across the rivers in the northern parts of North Bihar, and by means of wells in some other parts. There was a certain degree of ad hocism involved in these irrigation technologies as the earthen bunds had to be built every year. But these technologies were culturally so entrenched in the agrarian life and their management practices fine tuned through the ages to the needs of agriculture that there seemed to be no problems associated with their working, at least till the beginning of British rule.

Changes brought about by the colonial government in the Bengal Presidency were responsible for the disappearance of these small irrigation works. The change from the produce rent to cash rent, and the practice of farming out of villages to tenure holders, meant
that *zamindars*, who were the pivots in the efficient working of the *bandh* and *pyne* irrigation, avoided their responsibility. They lost the interest because they did not foresee any incentive in investing in agricultural development. However, in some pockets of North Bihar some entrepreneurial European planters, government engineers (in the case of Masan *pynes*), Managers of *zamindaries*, and intermediary tenure holders helped in the revival of *bandh* and *pyne* irrigation in the early years of the 20th Century.

Some of the general features of flood-based agriculture practiced in pre-colonial North Bihar have also been discussed in chapter 1. These go on to strengthen the contention that the peasants through the ages had adjusted, and developed, the agriculture of the region in such a manner as to obtain the maximum benefit from floods, which were inevitable. When the rivers shifted their course and flooded some areas, the peasants shifted to new areas left open for reclamation by the receding of the rivers. Given the ever-changing nature of the agro-ecology of the region, primarily because of the shifting rivers, the peasants too were on the move.

Within North Bihar there existed variations in the agricultural pattern, which again was a function of the necessary adjustment to floods. The ‘cones’ and the ‘Ganga meander belt’, which were prone to the spilling of the rivers in July and August, grew *bhadai* and *rabi* crops. On the other hand, the ‘inter cones’, which were receptacles of river spill, grew more of *aghani* rice. This variation in the agricultural pattern was evolved through ages and no attempts were made in a big way to alter these variations by changing the natural conditions.

In Chapters 2 and 3, certain important findings on canal irrigation are presented. The colonial government was reluctant to invest on public works in the permanently settled areas as it believed that it was primarily the responsibility of the *zamindars* to invest in
agricultural improvement. It believed that while it had fixed its share of the revenue, the zamindars would benefit from the profits earned by agricultural improvement. This was the most important reason for the low level of investment by the colonial government in public works in the Bengal Presidency.

But after the first famine of the 19th Century (in 1866-67), the need for construction of irrigation projects was felt. From 1867 onwards various schemes were formulated from almost all the major rivers, such as the Gandak canal project, the Bagmati canal project, the Kamala and the Kosi canal project. But none of these schemes were implemented, mainly due to doubts raised about their financial viability and the expected demand for canal water in most of the years.

In the beginning smaller irrigation schemes, such as, the Teur canal, Dhaka canal and Saran canals, were constructed to observe the peasants response to canal water. None of these schemes turned out to be successful projects, both financially and in terms of achieving the target of area irrigated. During the famine of 1896-97 the distress was so widespread and acute in the aghani rice growing tracts, especially in the northern thanas of Champaran that the clamour for irrigation grew. Tribeni canal, a smaller version of the earlier Gandak project was started.

The construction and planning of the canal projects were often extremely ill conceived, to say the least. For example, the alignment of the Tribeni canal was right across the drainage line of the region, and thus proved to be a constant source of danger to the safety of the canal works. The faulty alignment of, and the inadequate and insufficient waterways provided on the Tribeni canals gave rise to abnormal and unprecedented floods in the nearby lands turning them uncultivable. Floods also damaged canal works, which required huge expenditure on upkeep.
These costly mistakes could have been avoided if proper surveys of the region through which the canals crossed, had been conducted. Also, the behaviour of rivers was not properly studied. This became evident in 1907 when the river Gandak deserted the site of the head regulator of the canal, which was approaching completion. In later years sufficient water could not be obtained for supplying to the canal. Even the canal and drainage crossings were designed in way which could not carry enough water. In the case of the Saran canals also the lack of a proper study of behaviour of rivers led to problems in its working.

The colonial state, through the passing of various Irrigation Acts, became the sole authority to control and provide the means of irrigation. It was also seen that in northern Champaran the state not only built canals, but also in the process destroyed all other means of irrigation, existing since ages, which could have competed with the British made canal.

While introducing irrigation works, it was not the interest of the peasants which was kept in mind. The colonial state had other more important reasons. First, only those projects were sanctioned which could be financially remunerative. This aspect of the colonial policy is evident in the case of the Saran canals, which was closed because it could not prove financially viable. Second, the canals by providing direct protection to an area prevented the loss of revenue paid to the government, saved the outlay incurred in the costly measure of famine relief and prevented the temporary disruption of the international trade in foodgrains. Third, apart from giving certainty to all agricultural operations, canals could help in increasing the outturn per acre of crops, and enabling more commercially valuable crops to be grown. Fourth, canals were introduced in areas where there was a great scope for extension of cultivation, e.g., the northern thanas of Champaran. All these were tuned to give financial security to the colonial state and increase the food grain export from India which was critical to the colonial state for various reasons.
The northern part of the Champaran district had a great potential for development of agriculture, compared to the rest of North Bihar, as in this district population was sparse while agricultural land was in plenty. The construction of the Tribeni canal and the extension of railways to the area were intended to give a fillip to agricultural development, such as extension of cultivation, increased production of food grain, and higher volume of exports from this region. So, the colonial state may not have directly benefited from its investments (as it had fixed its share of land revenue at the time of Permanent Settlement), but the increased exports of food grains benefited it indirectly.

The northern part of Champaran was also prone to famine, especially in the second half of the 19th century. Apart from the reasons cited in British records, such as, failure of rainfall, the absence of artificial irrigation in the region, the social composition of the region (more than 50 per cent of the population was dependent for their living on their labour), and the over-dependence on a single crop (aghani rice), it was the peculiar kind of commercialization of agriculture which was directly responsible for the occurrence of famines. The benefit of commercialization was shared by the colonial state, zamindars, tenure holders, while the profits earned were not invested back in agriculture. The peasants, while exposed to an increased burden, could not reap the benefits of the commercialization.

Some aspects of the working of the system of pynes during the colonial period have been shown in Chapter 3. A number of the older system of pynes which were restored and worked satisfactorily irrigated large tract of land. This shows that there was ample supply of water in the rivers across which the bandhs were erected. The temporary nature of these small and simple structures was not a limiting factor in the satisfactory working of pyne irrigation. Also, the breaking up of the traditional social and economic ties under
colonialism and the various measures of the canal administration to discourage the construction of *bandhs* were responsible for the decline of the *bandh* and *pyne* irrigation.

There was no doubt about the need for means of artificial irrigation in northern *thanas* of Champaran. But in the geographical and ecological context of the region small and temporary structures, like the earthen *bandhs* erected by the peasants, were better suited. The Tribeni canal not only proved to be costly, both in construction and maintenance, but also interfered with, and destroyed, the drainage of the region. That the results shown by the Tribeni canal was not very promising was admitted by the government engineers themselves when they refused to give their consent to an extension scheme of the canal. It was also admitted by the same engineers that the region in which the proposal to extend the Tribeni canal was made had not suffered the vagaries of famine because of the widespread practice of irrigating lands by means of *bandhs* and *pynes*. But this wisdom was gained after a considerable damage had already been done and a huge amount of money spent on canal projects. Moreover, the damage done to the drainage network of the region, and the changes made in the agro-ecology of the region, was permanent and irreversible.

It has been shown in chapter 4 that the colonial attempt to control floods also proved disastrous. The construction of embankments along the rivers to check the spill of the rivers led to the complete destruction of the drainage network of the region. The ideal natural conditions under which the rivers conserved themselves, by spreading its silt load in the surrounding countryside, was also disturbed by the embankments.

In the initial years, the government intervened only in renovating some of the old embankments, but at the cost of the ‘benefited’ *zamindars*. During the first half of the 19th century, the government stepped in only when petitioned by the *zamindars* to help in the maintenance and repair of the embankments. In the early period the government was more
concerned with the question of whose responsibility it was to maintain and build embankments. At the same time the government was also trying to force the zamindars to build embankments, which it thought the latter was not doing.

In the last quarter of the 19th century there was a shift in the concerns of the government; from an earlier concern that the zamindars were not paying enough attention to, and investing in embankments, now the concern was on how to control the haphazard and 'unscientific' construction of embankments by individuals. The negative effects of the embankments constructed in the previous years started to manifest themselves after more than fifty years.

It is because of the embankments that North Bihar witnessed an increase in the flood level every year because the silt brought by the rivers, instead of being spread over the adjoining areas, was deposited in the riverbed itself, raising the level of the riverbed. This involved heavy expenditure on the upkeep of the embankments, as they had to be strengthened and raised regularly. But raising the level of the embankments or other repairs were a means of postponing the inevitable disaster to a future date. With the higher riverbeds and yet higher embankments when breaches occurred the damage caused by floods was even greater. Even as a temporary solution, embankments proved to be a failure as it was impossible to predict and avoid breaches in them caused by higher floods. The floods caused by the concentrated discharge of river water caused greater damage to the life and property of the people.

The other immediate damage caused by embankments was the shutting out of the silt brought by the rivers, which earlier fertilized the lands. It also destroyed the 'overflow irrigation' from rivers, which was earlier practiced by the peasants of North Bihar. There was a constant demand to construct sluice gates in the embankments to irrigate the lands.
from the river water. The annual overflow of the rivers towards the countryside increased the moisture content of the soil and recharged the ground water. It also recharged the various water bodies, which were used to irrigate valuable *rabi* crops. Also, the land building activity of the rivers was prevented by the embankments, and the natural reclamation of the low lands by the deposition of silt was consequently stopped.

Embankments were also responsible for damaging the drainage network of the region. Drainage channels silted up and turned into stagnant pools of water. Large areas, including the *chaurs*, remained waterlogged even till the month of January, thus delaying, and in some cases denying, the sowing of the *rabi* crops. It also caused deterioration in the health and sanitation of this region.

The Railways and Roads were the worst offenders in obstructing the drainage of the region. Their alignment, in most cases, was right across the drainage of the country, thus obstructing the free flow of the river spill along the natural drainage line. Also, the inadequate and insufficient waterways provided in the embankments further aggravated the flood situation of North Bihar. This impounding of water not only caused serious damage to health, agriculture and property, but also disturbed the natural process of the rivers to build up the land. This study adds on the existing knowledge about Railways; it was not just a means to exploit the Indian markets and raw materials, but also adversely impacted the agro-ecology of North Bihar.

The tampering with the rivers meant that the nature of floods changed; floods now came in a sudden rush, there was an increase in the level and duration of floods, and longer time was taken for the water to be drained. Moreover, the floods were now caused by the rain water which could not find its way into the rivers. Unlike the silt laden waters of the rivers, rain water did not fertilize the lands or helped in combating malaria.
The attempt of the colonial government to control floods was not made in a very planned or co-ordinated manner. The various agencies of the government (Railways, District Boards, Irrigation Department, etc.) and different districts acted locally and without consulting each other. The haphazard and unplanned manner in which embankments were constructed by the zamindars further worsened the situation. The worst victims were, of course, the peasants whose interests were invariably bypassed over the interests of the various agencies of the colonial state, the European planters and some influential zamindars. The colonial government armed with various legal provisions to control and co-ordinate the embankments, could do nothing to stop this reckless drive of competitive embankment construction.

Apart from protecting the property of the colonial government, the planters and the zamindars from floods, it was the revenue considerations of the colonial government, which motivated it to control floods. The certainty of agricultural production which could ease revenue collection, appear to be a major motivating factor for the government to control floods. For the zamindar, the main consideration which seems to have motivated the construction of embankments was to give protection from floods to areas (the cones) which traditionally did not grow aghani rice, the most valuable crops of the region. Land hitherto left untouched as the floods directly affected them were also sought to be reclaimed by the construction of embankments.

It must be reiterated that the colonial state made interventions, both in irrigation and flood control, chiefly to suit colonial interests, without conducting any scientific studies, thus causing incalculable long term damage to the regions.

In fact, by the beginning of the 20th century a broad consensus had developed within the irrigation and civil bureaucracy about the inefficacy of their actions both in the field of
irrigation and floods and exercised restraint in moving further on these lines. However, this wisdom came a bit too late. Paradoxically, the nationalists saw this as colonial reluctance to make development expenditure, and continued to argue for 'development' in the paradigm initiated by the colonial state. Also, the colonial state even when it wanted to, it could not control the forces it had unleashed in the countryside. The zamindars, various agencies of the government, like the Railways, District Boards, etc., had their own interests to serve. All of them continued to take such actions which helped in the worsening of the floods. The damage done to the agro-ecology of north Bihar by the colonial intervention in the name of 'modernization' could not be reversed.

The agro-ecology of North Bihar had changed significantly and irreversibly due to the tampering of the rivers and drainage network. The measures adopted by the colonial government to control the rivers and the forces that it had unleashed in the countryside created a situation which the democratic government in post-independent India could not ignore. The embankments erected by the colonial government and the zamindars had created strong vested interests. New townships and villages had come, and agriculture was extended, in areas which were prone to floods, but the presence of embankments had given a false sense of security. In a democratic set-up it was impossible for the government to ignore these vested interests and demolish the embankments to restore the ecological balance. Instead, the government was forced to strengthen and raise the height of the embankments from time to time to avoid the danger of floods caused by breaches in the embankments. On the other hand, the demand for irrigation schemes also increased. Moreover, the 'modernization bug' (or the mindset to control or tame nature rather than evolving ways of working with it) had bitten the new peoples' representatives too. So we witness a newfound zeal and enthusiasm in the post-independent phase to carry out flood control, drainage and
irrigation schemes in North Bihar. The results have been disastrous: there has been a three-fold increase in the area affected by floods from 1947 till the present. Destruction of life and property has increased manifold. Increase in the area suffering from water-logging and drainage congestion leading to adverse impact on health of the people, disruption in the agricultural cycle, stagnation in agricultural production, large scale displacement, and consequently migration of labour to north Indian labour markets are some of the other consequences of this type of 'modernization'.

In a nutshell, this work provides a sympathetic description of the indigenous technology in agriculture, irrigation and flood control, tries to locate the technological interventions in the agro-ecology of the region, and studies the long term environmental impacts of such colonial intervention in irrigation and flood control. Also, this study makes a break with the earlier works by studying the environmental implication of the various measures adopted by the colonial government in rural Bihar, such as the Permanent Settlement and the various Irrigation and Embankment Acts.