Chapter II

THE DEVELOPMENT OF AGRICULTURAL RESOURCES

The cries of triumph which heralded, in British circles, the suppression of the "Mutiny" disorders and the formal transfer in 1858 of the last vestiges of the East India Company's government to the British Crown might lead one at first to assume that these events in themselves brought a sudden and radical transformation in the British presence in India. The corrupt, lethargic, and despotic rule of the Company in its last days was now to be replaced by an administration representing the greatest and most energetic industrial power in the world. It was confidently expected that Government, having tamed the native barbarism recently manifested during the disturbances of 1857 and 1858, would, as a matter of course, lead its Indian subjects towards a civilized modernity, in whose undoubted benefits they, as well as their rulers, would ultimately participate.

There was nothing intrinsically new in this belief. It was merely the latest manifestation of a long-familiar spirit which accompanied the rise to supremacy of British industry and commerce. Public assertions by eminent promoters of Britain's trade abroad to the effect that prosperity must necessarily attend those of the hitherto backward peoples of the Orient fortunate enough to receive bounty in the form of British manufactures were already familiar:

What a satisfaction it is to every man going from the West to the East, when he clambers up Mount Lebanon to find one of the ancient Druses clothed in garments with which our industrious countrymen provided him! What a delight it is in going to the Holy City to stop with the caravan at Nazareth—to see four thousand individuals, and scarcely be able to fix upon one to whom your country has not presented some comfort or decoration! Peace and industry have been doing this and much more; for be assured that while this country is diffusing blessings, she is creating an interest, she is erecting in the minds of those she serves an affection towards her, and that commerce
is a communication of good and a dispensing of [benefits] which were never enjoyed before . . .

What the events of 1857-1858 did signify was that India was Britain's, at least for the foreseeable future. Meanwhile, old restraints on expansionist activity had now been removed. The Company, and its exclusive monopoly, had been increasingly regarded as a prime cause of India's retardment "in her agricultural and commercial pursuits."* Now it had gone, taking with it the last impediments placed by an outdated mercantilism in the path of large-scale investment of British capital in India. The establishment beyond doubt of Pax Britannica completed the picture for the eager bystanders in London and the Midlands: the opportunity for vigorous action by Government, entrepreneurs, bankers, and a technical army of engineers to achieve a degree of expansion hitherto unheard of had arisen. "India has been given to Britain, that the blessings of Christianity may overspread the land," Alderman Baynes of Blackburn announced, on behalf of the cotton interest; "and our exigencies, sooner or later, will compel us to develop its resources.""

The prospect of these resources was not uninspiring. The Bankers' Magazine, one amongst many hard-headed business journals, was moved to lyricism on account of the "unexplored mine" that India represented, "the wealth of which we have not yet even begun to enjoy."* That wealth was to be tapped by the application of European enterprise and science, "to produce results which shall place the great Asiatic peninsula as high above the rest of the world for affluence in modern as it was in ancient times."

The attractiveness of the prospects of development was enhanced by the fact that India appeared to lack very nearly everything which, according to contemporary capitalist criteria, was required in order to tap her vast wealth—or alternatively, to progress to a state of civilization. After the troubles of 1857, wrote Sir John Strachey, "ten thousand things were demanded which India had not got, but

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1From the speech of John Bowring, Manchester, at the founding of the Anti-Corn Law League; quoted in N. McCord, The Anti-Corn Law League, p. 23. For further examples of entrepreneurial fervour, see ibid., pp. 24-25. For Bowring's speech in full, see A. Somerville, Free Trade and the League.

2C. N. Cooke, Banking in India, p. 69.

3Radicalism and laissez faire demanded the East India Company, in Jenks's words, "as a propitiatory sacrifice" and were satisfied; see L. H. Jenks, Migration, p. 207.

4A. Baynes, The Cotton Trade, p. 3.

5"India," Bankers' Magazine, CLXXIX (June 1858), 430-431.

which it was felt must be provided. The country must be covered with railways and telegraphs, and roads and bridges. Irrigation canals must be made to preserve the people from starvation. Barracks must be built for a great European army... In fact the whole paraphernalia of a great civilized administration, according to the modern notions of what that means, had to be provided.’’

The means were certainly to hand—in Britain. The international finance system could now provide for the ready movement of capital abroad for large-scale construction under contract by means of the joint-stock discount houses, the British development on the lines of the credit mobilier. Engineers with considerable experience of railways and, to a lesser extent, of canals were readily available. The whole question of investment in India was given unparalleled publicity: Parliament appointed a Select Committee, outstanding entrepreneurs with a sprinkling of distinguished administrators experienced in Indian affairs, to enquire exhaustively into the practicability of the “colonization and settlement” of India. The Economist scrutinized the problems confronting the British investor and found that however formidable the obstacles dwelt upon by witnesses before the Select Committee might appear, they were largely confined—as far as experience showed—to indigo planting; the way seemed open for the investment of capital in public works. Nothing in fact looked more promising than the prospects for development in terms of mines, railways, canals, steam-boats...

The post—“Mutiny” zeal, sufficient in its belief in the universal efficacy of “Saxon energy and British capital” to reclaim not one but a number of deserts, disguised two points of considerable significance. First, whatever attempts might be made to avoid direct contact with “Agriculture,” after the unhappy experiences of indigo planters in Bengal, some such entanglement was inevitable in an environment where the land was the prime source of wealth: on this

7 J. and R. Strachey, Finances and Public Works, p. 2. For a similar exposition of India’s backwardness, from a viewpoint common to administrators and capitalists, see Cooke, Banking in India, pp. 66–67.


9 “Reports of the Select Committee on Colonization and Settlement in India.”
10 “Why is Not British Capital More Largely Invested in India?,” Economist, October 9, 1858, pp. 1121–1122.
the people depended overwhelmingly for their livelihood, the Government for its revenue, and the investors for their dividends. Second, as far as the major area for investment was concerned, that is, the public works—roads, railways, and canals—the activity after 1858 merely continued along lines laid down twenty to thirty years before. The post-“Mutiny” investors were not so much pioneers as heirs to an inheritance.

The NWP and Oudh were the provinces most intensely involved in the “Mutiny” struggles; large areas, notably the poorer parts of Jhansi and the less opulent regions of Doab districts, had suffered severely from devastation. Their geographical features—particularly as regards the Doab districts—had already rendered them liable to large-scale developments, designed to exploit the resources of the river valleys for increased production and increased distribution through trade. With the pacification of the provinces, public works activity intensified.

The Public Works and Agriculture

The great nineteenth-century developments in canal engineering were concentrated largely in the Doab.\textsuperscript{11} They began early, in the 1820s, with the building of the East Jumna Canal. This system, a radical re-development of an old Mughal canal line, was opened in 1830. It irrigated tracts in the Saharanpur, Muzaffarnagar, and Meerut districts. By 1878, its main and branch channels, together with distributaries, totalled 748 miles and irrigated 206,732 acres (as against the average of the preceding five years, 188,648). The cost of the works, excluding interest, came to £261,235. One of the most remunerative canals of British India, it paid nearly 23 percent on the capital expended on it by Government.\textsuperscript{12}

Irrigation in the grand manner began, however, with the Ganges Canal. The works were begun under Government order of May 1847, water was admitted into the canal in 1854, and irrigation commenced the following year.\textsuperscript{13} In 1861-62, the area irrigated by the canal was officially set at 372,000 acres; in 1864-65, it was set at 350,000 acres (the area under canal irrigation had contracted in comparison with

\textsuperscript{11}For the extent of the main lines and distributaries of the NWP canals, as constructed up to 1900, see endpaper map.

\textsuperscript{12}R. B. Buckley, Irrigation Works, pp. 93-95, and table, p. 92.

\textsuperscript{13}For a summary of the history of the Ganges Canal construction to 1854, see \textit{ibid.}, pp. 95-101.
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the figures for 1861-62 as a result of good seasons and adequate rainfall). By 1864-65, the canal works as completed comprised its main line (181 miles); the Fategarh Branch (82.5 miles); the Bulandshahr Branch (45 miles); the Cawnpore Branch (170 miles); and the Etawah Branch (170 miles)—a total length of 648.5 miles with 2,266 miles of distributaries. The total capital outlay thus far was £2,155,997—by 1866, capital expended on the canal stood at more than 88 percent of total expenditure of British capital in the NWP since 1858. So far, only Upper Doab districts were served by the canal. In 1868, on the proposal of General (later Sir) Richard Strachey, the construction of a Lower Ganges Canal began, together with modifications in the completed channels. By 1877-78, the area actually irrigated by the whole complex was set at 1,045,013 acres (as against the average of preceding five years: 906,036). Some 593 miles of main and branch lines had been completed by then in the Upper and Central Doab. With another 3,417 miles of distributaries, the total length of the channels constructed ran into 4,010 miles, and the cost, excluding interest, stood at £3,055,015.

In 1868, the first works—sanctioned for the purposes of famine relief—began on the Agra Canal. In March 1874, the canal was formally opened and irrigation began the following rabi season. By 1877-78, it commanded an area of 375,800 acres altogether—114,200 acres in Muttra district and a further 113,100 acres in Agra made up the proportion irrigated in the NWP. Smaller works in Bijnour, fed by a stream in Moradabad district, covered an area of 4,000 to 5,000 acres. On a capital cost of £6,996, the Bijnour Canal paid 11 to 12 percent: “it has always been a remunerative little work,” was R. B. Buckley’s comment. In Bareilly, a further group of some four channels, totalling 256 miles in length and known collectively as the Rohilkhand Canals, irrigated a belt of country along the terai where rice was grown extensively. The capital cost was £148,207.

14“Resolution Relative to the Canals of the North-Western Provinces,” P.P., 1865, 39 (343), pp. 1–2.
16On the alterations to the canal, to 1877-78, see Buckley, Irrigation Works, pp. 105–112. On the Lower Ganges Canal, see ibid., pp. 121–127.
17On the Agra Canal, see ibid., pp. 112–118. The net profit on the whole system by 1877–78 was estimated at £90,000.
18Ibid., p. 120.
on which only a small percentage had been realized by the end of 1870s. A series of small watercourses in the Dun, and south in Bundelkhand, fed by tanks and streams, completed the network of canals in the NWP: some 5,601 miles of channels and distributaries, irrigating in 1877-78 an area of 1,459,938 acres, by which time the cost of their construction, excluding the payment of interest, came to £4,338,384—all of it borrowed in England.20

Work continued on the modifications and extensions to the Ganges Canal, as projected. After 1878, further works for the protection of unirrigated tracts specially liable to drought were thenceforward to be closely scrutinized by Government, "in the light of the latest knowledge," with rigorous attention to the "financial liabilities of the execution of works." On these principles, General Richard Strachey, as President of the Famine Commission of 1878-79, recommended immediate and special enquiry into two schemes which had not yet been implemented: the Sardah Canal to be constructed in Oudh and Rohilkhand, an elaborate project first prepared by Major (later Colonel) J. G. Forbes, R. E., in 1871, and a system of canals to be supplied from the rivers Betwa and Ken in Bundelkhand.21 The Sardah scheme was shelved in the face of opposition by both the talukdars of Oudh and the Chief Commissioner. Work on the Betwa Canal however, owing to pressure to provide relief for famine distress in the conventional form of temporary employment on public works was begun early in the 1880s.22 Accurate statistics cannot be given of the overall increase in irrigated area owing to the canals. Acreages fluctuated with the seasons, the irrigated area expanding vastly in the threat of drought to contract again in seasons of adequate rainfall.23 The question of payment of water rates also affected the area under irrigation during each season. In tracts where the cultivators were dependent on the canals, times in the fasli year when measurements were taken varied from district

20Ibid., pp. 120–121.
21R. Strachey, "On the Need for Examining Certain Irrigation Projects in the NWP and Oudh," June 7, 1868, Government of India, "Famine Proceedings," June 1878, Proceeding No. 35. The projects for immediate review thus also included a navigation canal in Meerut Division to connect the (East) Jumna and Ganges canals, and a scheme to extend the Lower Ganges Canal as far as Allahabad.
23For the area irrigated by canals in NWP from 1868–69 to 1896–97, according to Canal Department statistics, see Figure 2.
to district, pargana to pargana, and even mauza to mauza, thwarting any attempt at the compilation of a comprehensive statistical record. The period over which the increases in area were to be measured also posed a problem which was insoluble given the recording procedure used. Time limits were fixed according to the dates of revenue records compiled under Regulation IX of 1833: the period within which measurements were taken varied therefore from district to district, in the order of their settlement. In many cases, no statistics of irrigated area existed prior to the revision of settlements beginning in 1860. Further, both the earlier and revised settlements made no distinction between “irrigable” and “irrigated.” In 1884, W. C. Benett noted that an enquiry by the director of Agriculture and Commerce “showed that [in several Doab districts] the settlement statistics are of no use in ascertaining the irrigated area, lands within irrigating distance of a well or tank being included in the actually irrigated area ...”

Lastly, the problem of inadequate statistics is complicated by discrepancies in the percentage of increase in irrigated and in cultivated areas given in the various official sources.

Canal development was concentrated in those areas where facilities existed for it—that is, in the western districts of the NWP. Those districts had a long-established and sophisticated pattern of farming, in which well irrigation particularly played a large part. Colonel Baird Smith estimated that in 1848-49 the number of pakka (masonry) wells in the NWP came to some 137,337 of which 72,523 were in the Doab. Devastation during the “Mutiny” brought this latter number down to close to 70,000, with each well having an irrigating capacity of approximately 4.5 acres per season. The corresponding number of the more common kachha (temporary) wells was estimated.

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23W. C. Benett, Officiating Secretary, Board of Revenue, NWP, to Government, NWP and Oudh, December 4, 1884, “Note Regarding the Proposal to Exclude from Canal Irrigation All Lands at Present Assessed as Irrigated from Wells or Other Sources” (referring to NWP Revenue Administration Report, 1880-81, p. 58), in NWP and Oudh, “Revenue Proceedings,” May 1885, File No. 380, Serial No. 10, Proceeding No. 19.

24In settlement reports, for example, figures given in (a) the main report and in (b) pargana (rent-rate) reports generally differ, a fact which is largely explained by the differing times and circumstances of their respective compilation. In an all-NWP table of irrigated area, district by district, 1860-1872, Auckland Colvin gave figures from those main (district) settlement reports available in 1872 and from yet another, incomplete (not from pargana reports) set for which the source is not given. See A. Colvin, Memorandum, Appendix III.

25See above, pp. 30-31.
at 280,000, each with an irrigating capacity of 1.5 acres per season. From this, Baird Smith concluded that some 1,470,000 acres in the Doab were irrigated by wells in 1860-61. As the number of wells and their relatively low irrigating capacity would suggest, the Doab districts were densely populated by the latter part of the nineteenth century. Table 1 gives the density of population for selected canal-irrigated districts for which figures are available from the settlement reports.

### TABLE 1

**Density of Population for Selected Canal-Irrigated Districts**

<table>
<thead>
<tr>
<th>Canal</th>
<th>District</th>
<th>Population per Square Mile $^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ganges, East Jumna</td>
<td>Muzaffarnagar (1872)$^b$</td>
<td>415.9</td>
</tr>
<tr>
<td>Ganges</td>
<td>Bulandshahr (1865)</td>
<td>719.5</td>
</tr>
<tr>
<td>Ganges</td>
<td>Aligarh (1882)</td>
<td>548.0</td>
</tr>
<tr>
<td>Ganges</td>
<td>Etah (1872)</td>
<td>465.0</td>
</tr>
<tr>
<td>Ganges</td>
<td>Mainpuri (1872)</td>
<td>452.0</td>
</tr>
<tr>
<td>Ganges</td>
<td>Etawah (1872)</td>
<td>395.0</td>
</tr>
<tr>
<td>Ganges</td>
<td>Cawnpore$^c$ (1872)</td>
<td>442.0</td>
</tr>
<tr>
<td>Ganges</td>
<td>Fatehpur (1872)</td>
<td>419.0</td>
</tr>
<tr>
<td>Ganges</td>
<td>Farukhabad (1871)</td>
<td>534.0</td>
</tr>
</tbody>
</table>

$^a$ According to the census of 1872, the average density of population for the NWP was 381.24 per square mile.

$^b$ The dates in brackets are those of the various settlement reports used.

$^c$ Excluding Cawnpore city.

For its part in supplying this dense population, the well irrigation of the Doab was not regarded by Baird Smith and other official observers trained in engineering as wholly inefficient. He himself noted, significantly, that the effects of wells were "less open to doubt than those of canal-irrigation," whilst the labour required to work the wells ensured the maximum use of water drawn; it was clear

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also that “the produce from land under well-irrigation is generally larger and better than that watered in any other way.”

The only trouble with the wells was that they did not produce enough. The land had to be induced to produce more, and to achieve that the canal system had to be expanded. Baird Smith confidently anticipated that in time canal irrigation would show results comparable to those of the wells, and that over the enormously increased area opened to irrigation by the canal system, “existing differences in relative value will disappear.”

In Meerut, the richest of the Doab districts, irrigation prior to the introduction of canals had “naturally coincided very much with the character of the soils”, E. C. Buck noted in 1874 in reviewing the settlement report. As a general conclusion from the pargana reports, it was clear that wells could be dug more easily, and lasted longer, in proportion to their distance from the great natural drainage lines: “the best well tracts were on watersheds.” It was precisely these tracts which the new canals covered most extensively—canals being “only serviceable for irrigation along the watersheds of the district.” The East Jumna Canal, opened in 1830, supplied the “rich Jat country between the Jumna and Hindun with a close network of distributary channels.” The main line of the Ganges Canal, opened in 1855, ran through the centre, level tract between the Hindun and the Kali Nadi, whilst its Anupshahr Branch, opened five years later, fed the comparatively narrow but fertile strip between the Kali Nadi and the Ganges. The division between areas with high proportions of better soils and the poorer tracts intensified: parganas Puth and Gurhmukhtesur, where widespread irrigation by wells was impracticable owing to the predominance of bhur ridges, also lay outside the range of canals and remained unreclaimed, whilst the extension of irrigation through the naturally fertile areas—for example, the central tracts of parganas Jalalabad and Baghapat—was reported by the end of the 1860s to have produced immediate and extraordinary increases in production. Where the soils were of the stiffest compo-

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Ibid., para. 85. F. Henvey, Narrative, cited Baird Smith on these points, which suggests that the situation in 1868–69 was little improved.


sition, well construction remained at least theoretically possible alongside the introduction of canals. In pargana Kotanah, to the north-west of the district, channels of the East Jumna Canal covered almost the entire area, yet good wells could still be readily constructed. This was reassuring: “In case of any accident to the canal, there could not possibly be any danger to the imperial revenue, for temporary wells could be dug in every field at trifling expense.” The supersession of wells by the canal, which immediately commanded a much greater area was said to have saved Kotanah and neighbouring parganas—the core of the opulent estate of the Begam Sumroo—from the ravages of famine in 1860-61; indeed, “the proprietors” (chiefly Jats) made enormous profits from the grain trade. To the south, pargana Dasnah benefited similarly from the Ganges Canal.31

Elsewhere, however, disadvantages and even deleterious effects of the canals were already becoming noticeable by the end of the 1860s. The growing dependence on canal irrigation brought its problems. In 1866, W. A. Forbes noted that in pargana Chaprauli, which he, like Sir Henry Elliot thirty years before, agreed to be the finest in the district, the inroad of canals had left most wells in disuse and that well-sinking was now “almost entirely abandoned. It would be fortunate,” he cautioned, “if the people would take further advantage of the natural facilities for well-irrigation, and thus guard against the uncertainties of canal-supply—a precaution some of the enterprising Jat proprietors in the neighbourhood have already begun to recognize.”32 J. S. Porter noted the advantage the canal brought to pargana Sirdhana in that it enabled “sugar and other more valuable products doubtless to be grown in greater abundance.” But against this “is to be placed the uncertainty of the water supply and the utter dependence on the canal to which the people are reduced by the ruin of their wells.” Several villages in the pargana had already sustained loss from the canal’s (or its distributaries’) interference with natural drainage: two had lost their entire kharif owing to flood water which had swamped the fields because its outlets had been obstructed by the canal; a considerable part of another mauza just beneath the canal bank was so swamped by percolation as to be unfit for cultivation.33 In other areas—parts of Baghpat, for instance—puddling

32Ibid., Chaprauli (1866), p. 8.
33Ibid., pp. 40–41. Pargana Meerut also showed similar effects of canal irrigation, viz. immense impetus to sugar cane cultivation, accompanied by a marked deleterious effect on both wells and soil; ibid. (J. S. Porter’s report), pp. 52–53. In pargana
was the inevitable consequence of the volume of water made available from the canal, far exceeding that supplied by wells and distributed by flush irrigation. Problems of soil saturation were imminent. Buck, however, noted with reassurance in 1874 that it was “entirely within the Government’s power to alleviate or entirely remove these evils.”

Wherever canal irrigation had been introduced, the same—or similar—benefits accrued, as well as the same problems. If the driving principle behind the construction of the canals was the achievement of increase, without which no real prosperity could be envisaged, this aim was certainly satisfied, even if its exact measure remains out of reach. But in which products was this increase realized?

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. These and fodder for draught beasts were generally grown on the wider areas of middle- and even poor-quality soils dependent for their moisture on periodic rainfall; irrigated land, of better- and top-quality soils, was used for the heavier and more valuable crops which required careful attention and a number of waterings in addition to rainfall for good yields. 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, sugar cane, and wheat.

In the trans-Jumna parganas of Muttra district before the building of the Agra Canal, the principal kharif crops were jowar, bajra, and cotton, and the chief rabi staples were barley, gram, and bejhar (mixed barley and gram). The canal was confidently expected to alter this, in favour of the “richer” crops. Whilst the area under cotton would be little affected, the pattern of cereal cultivation would show significant changes—“the substitution of irrigated wheat [encouraged by the relative richness of soils in these parganas], bejhar or barley for either jowar, bajra or unirrigated rabi crops.”

Kethore, swamps resulting from the inflow of canal water into the Barh Ganga River were already conspicuous by the mid-1860s; *ibid.* (Porter’s report), pp. 50–51.


35 For the total canal-irrigated area in the NWP and the specific proportions of kharif and of rabi 1868–69 to 1896–97, see Figure 2. For the proportion of total canal-irrigated area under principal crops in the kharif, 1868–69 to 1896–97, see Figure 3. For the proportion of total canal-irrigated area under principal crops in the rabi, 1875–76 to 1896–97 (statistics for rabi crops are not available before 1875–76), see Figure 4. For convenience, no separate figure is given for sugar cane, which has been included under kharif.
The next stage would be the introduction of sugar cane, indigo, and opium—all hitherto almost unknown in the area—and an increase in kachhiyana (garden produce); double-cropping would become prevalent. "There will then be not only an improvement in the quantity but also in the quality of the produce," that is, the balance of the crop pattern would turn against the coarse staple food grains.\(^{38}\) These anticipations were realized. Two or three years later, R. S. Whiteway recorded in the settlement report that sugar cane had in fact been planted extensively along the canal distributaries; the coarser kharif crops, such as jowar, had in fact been "greatly superseded by the more valuable ones," including cotton, and even indigo had been sown in some villages.\(^ {37}\) Of the canal-irrigated area of the parganas, 69.4 percent was recorded under rabi crops in the year of revenue survey as against 26.4 percent under kharif: wheat occupied 26.2 percent, barley 12.3 percent, and bejhar 21 percent, compared with kharif staples of jowar, now only 11.7 percent, and bajra 4.1 percent.\(^ {38}\) Throughout, the valuable crops of cotton, wheat, and barley alone accounted for some 39 percent of the canal-irrigated area; in the cis-Jumna parganas, untouched by the canal, these crops aggregated a mere 23 percent of the total cultivated area.\(^ {39}\) Etah district, too, showed a crop pattern generally characteristic of canal-irrigated areas, which were most extensive in the Meerut and Agra divisions of the NWP: the best districts, supplied now by an abundance of canal water, went over to producing larger quantities of the most saleable crops. In Etah's kharif harvests sugar cane, cotton, and indigo predominated, and in the rabi, it was wheat, barley, and bejhar once again. In pargana Mahrehra—the best in the district—the Cawnpore Branch of the Ganges Canal had brought an immense stimulus to indigo growing: almost every village had its factory.\(^ {40}\)

The distribution of wheat itself became one of the clearest indications of the direction in which the stimulus of canal irrigation was applied. In 1876-77, the total area under wheat throughout the NWP and Oudh was officially estimated at 5,902,770 acres, with 2,257,344 acres in the Ganges–Jumna Doab, as against 2,695,730

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in the considerably larger area between the Ganges and Gogra which was barely watered by canals. That year, the acreage under wheat for the whole of Oudh was recorded as some 1,904,798 acres; and in Meerut Division alone, one of the great canal-irrigated regions of the NWP, wheat was said to be grown on no less than 1,371,103 acres.\footnote{F. N. Wright, “Report on Wheat Cultivation in the NWP and Oudh,” June 28, 1878, paras. 6–7, Government of India, \textit{Selections from the Records of Government}, No. CLX, pp. 156–157.} It was well known that wheat was “not the food of the masses. They live either on the millets of the autumn crops or the coarse mixed grains (barley, gram, and peas) of the spring harvest. The urban population undoubtedly do consume a large proportion of wheat for their numbers; and the richer proprietors or tradesmen in the villages also use wheaten flour. But to the millions wheaten flour is a luxury, untasted perhaps from birth to death or only at high festivals and holidays.”\footnote{\textit{Ibid.}, para. 25, p. 163.}

Given these conditions, we may ask what sort of protection the canals offered in the event of drought. When the summer rains failed, it was the staple kharif grains and fodder crops which suffered; where the winter rains were insufficient, it was the poorer rabi crops. Canals were used to redress the balance only in dire emergency, and the growing of kharif food grains on canal-irrigated lands was never sustained once the immediate pressure of severe scarcity had eased. The famine years of 1868 and 1869 in the NWP exhibited a pattern which was to reappear whenever the rains failed. At the beginning of the drought, Government issued a circular encouraging the sowing of grain and fodder crops in canal-irrigated areas. This resulted, according to Frederick Henvey, in a considerable increase in areas cultivated with miscellaneous grains, “though cultivators at first were very reluctant to water food-crops at the expense of other more remunerative produce.” It was not until August 1868, when the destruction of the kharif harvest was clearly imminent, that a rush for water took place. “The fact is, as has been stated in the Irrigation Report for the year 1868–69, that farmers will only take canal-water to save, not to improve, the coarser grain-crops.”\footnote{According to Henvey, \textit{Narrative}, pp. 113–114, in 1868–69 the canal-irrigated area was estimated at 1,441,898 acres (exceeding the highest recorded figure for any single preceding year, viz. 983,390 acres). Of this area, the total acreage under food and fodder crops together was 1,189,925 acres (82 percent). Of this, the total acreage under food grains alone was 1,178,558 acres. Of this, the total acreage under wheat was 597,936, and under barley it was 257,509.}
The disastrous failure of the summer rains of 1877 in most districts of Meerut, Agra, Rohilkhand, Sitapur, and Lucknow divisions, and in parts also of Allahabad, Jhansi, and Rae Bareli districts, destroyed the kharif food and fodder crops. The enormous deficiencies in outturn could not be supplemented by canal irrigation, even where such existed, since, "at the sowing season, cultivators could not foresee the terrible drought that was to prevail, and did not avail themselves of canal-water for this class of crop, the canal-irrigated lands being principally devoted to sugar-cane, indigo, and cotton."  W. K. Burkitt saw how, in Etawah, sugar cane and indigo were gradually ousting food grains in the canal tracts and why this should give cause for alarm rather than the enthusiasm for increase so commonly expressed amongst his colleagues in the service: "During the late drought [in 1877], when I was out inspecting the condition of the country, it was to me a most melancholy sight to see acre upon acre of magnificent indigo and sugar-cane, while hardly a blade of any food-grain was to be seen. The same remarks apply, though in a very much less degree, to cotton." Crop patterns in canal-irrigated areas persisted with their preponderance of "valuable" crops, as did the consequent lack of any effective remedy for recurrent dry seasons. Again in 1880-81, an official report noted that "highly cultivated crops (sugar, wheat) suffered as might be expected least damage while the drought was felt most by peas and gram and the other pulses . . . sown on inferior localities and out of reach of water." The fact was that, except for crops sown before the onset of the monsoon proper, irrigation in the kharif was practically inconsiderable and, as was clearly stated by the highest officers of Government in the provinces, "must always be more or less so." When the rainfall failed entirely or almost entirely, canals and wells could not take its place.

Only in those few areas where canal irrigation combined with excellent soil conditions to make wheat the chief grain staple was

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45 W. R. Burkitt, Officiating Collector, Etawah, to Board of Revenue, NWP, November 16, 1877, in NWP and Oudh, "Revenue Proceedings," February 1879, Index No. 65, June 9, 1878, Proceeding No. 140.

46 NWP Revenue Administration Report, 1880-81, p. 2.

47 Lieutenant-Governor, and Senior Member, Board of Revenue, "Observations on Difficulties in the Collection of Land Revenue in the NWP and Oudh, Owing to the Failure of Crops," in Government of India, "Famine Proceedings." October 1877, Proceeding No. 13.
the threat of scarcity least felt. As previously mentioned, the Jat proprietors of pargana Kotana, Meerut district—a by-word for fertility—not only were saved by the East Jumna Canal during the drought and famine of 1860-61 but made enormous profits by supplying grain to stricken districts of the NWP famine tract.\footnote{See above, p. 70, n. 31.} Generally speaking, canal irrigation did, and could do, little to decrease the ravages of scarcity by expanding the sources of staple food supply; indeed, its effect tended to be the reverse, to contract them—a process which tended to worsen with the added stimulus of the export trade in grains, particularly wheat, beginning in the late 1870s.\footnote{For details on the grain trade and its effect on local agriculture, see below, pp. 179 ff.} In addition, the canals incited the cultivators to load the land with an unrelieved burden of crops year after year, disrupting the regular practices of following. As we have seen, Colonel William Sleeman reported double-cropping and consequent deterioration of the land through exhaustion to be conspicuous in certain Doab districts at least by 1850.\footnote{See above, pp. 34–35.} A sizeable area of dofasli, or double-cropped, land was generally taken by field officers as a sign of local prosperity. A. B. Patterson however agreed with Sleeman and drew attention to the dangers of gross deterioration from the obvious over-cropping in Fatehpur district, where, he warned, cultivation was increasing in area and intensity with a disregard for the necessary reliefs to the soil. He admitted further to hearing from “men familiar with Oudh” that there the same distressing tendency was now evident also: “the pox Britannica [as Patterson’s report obligingly states] has worked its natural effect in inducing a dense population to keep as much land as possible constantly under cultivation, and . . . the ‘Garden of India’ has already lost some of its relative superiority in fertility.”\footnote{Fatehpur Settlement Report, p. 2.}

This tendency was encouraged by the canals.\footnote{For the proportion of dofasli land to total canal-irrigated area, NWP, 1876–77 to 1896–97, see Figure 2.} Auckland Colvin noticed it as early as 1864, in pargana Thana Bhawan in the canal tract of Muzaffarnagar district:

... the chief danger in the canal area is overcropping. The land is rarely allowed to rest. For example, cotton is sown in a field in autumn, and wheat follows as the next crop; chari will be sown the following autumn, succeeded by wheat, then cotton as before and so on. The only crop for which the land
is rested is sugar cane, and not for more than one season. In ordinary villages, this system is kept within bounds, not more than 10% of the cultivated area being “do-fuslee” but on the canal, it is carried to excess. The cane is very much deteriorated.53

According to Lieutenant-Colonel A. F. Corbett, whose Climate and Resources of Upper India, published in 1874, was the first outspoken technical criticism of the Government’s zeal in promoting canal irrigation at all costs, over-cropping in itself was only a superficial explanation of the noticeable decline in productivity in certain canal tracts.54 A more fundamental cause could be found in the increase of irrigated area under the stimulus of the canals. By irrigation, as Corbett explained,

... the whole surface-soil is brought into the condition of sun-dried bricks; the more water that has been applied to the land the harder the soil becomes, and while its powers of absorption and radiation are reduced, those of reflection and retention of heat are increased: and we find also that the power of capillary attraction possessed by the land is increased, and that the soil so compacted will sooner become dried up than soil left loose and open, partly from the fact of the interstices between its particles having been reduced in size, thus increasing its capillarity, and partly from the increased heat of the surface ...55

This hardening of the upper soil by irrigation coincided with the consolidation of a “pan” in the sub-soil

by the treading of cattle in ploughing ... This causes shallower ploughing, the roots of plants have less depth of soil in which to search for food, and cannot force their way into the hardened pan; and there is the alternate soaking and drying of the land, during which the natural salts of the earth are gradually brought nearer the surface by capillary attraction.

This process may go on for some years before the land shows any excessive amount of reh (saline efflorescence) on the surface; but the soil is steadily being poisoned by its accumulation in the upper soil, which accounts, together with the increased hardness of the soil, for the diminished fertility of lands some time under irrigation.56

55Ibid., p. 19.
56Ibid., p. 67. For a corroboration of Corbett’s analysis of the origin of reh as traceable to increased capillary attraction, see J. A. Voelcker, Report, para. 74, pp. 56–58. For a summary discussion of the problems of reh and wsr (soil salinity and alkalinity) on the basis of observations made from 1858 to the 1890s, see Appendix 5.
DEVELOPMENT OF AGRICULTURAL RESOURCES

Why did this not happen with the large numbers of irrigation wells worked in the Doab districts? C. H. T. Crosthwaite explained the reason for the decline of canal—as against well-irrigated—land as follows:

... wells require a large livestock and great labour. The soil reaps two benefits therefrom: more manure saved from burning, and the tendency to overfarm checked. If a farmer has to work his well, he cannot sow more sugar and wheat than he has time to irrigate but when he is relieved from all well duty he has nothing to keep him within bounds. He sows more of these crops, and has less manure ... The extraordinary large produce of the first years of canal irrigation calls forth all the powers of the soil but if not backed up by a due supply of other food, it leaves exhaustion behind it.\(^57\)

Meanwhile the over-watered, unmanured soil was still ploughed up with bullock teams. Problems of double hardening inevitably followed, and an ominous increase in the barren and frequently reh-infected land known as usar.

Crosthwaite had reported with some alarm the spread of reh in pargana Phapphand, Etawah district—irrigated by the Ganges Canal—as early as 1871. Although reh was as yet by no means widespread, as G. H. M. Ricketts, then Officiating Commissioner of Agra Division, was at pains to point out when commenting on Crosthwaite's report, it was nonetheless an evil "demanding an immediate remedy."\(^58\)

Seven years later, and two years after Corbett's careful examination of the reh problem, the condition had become far more obvious—sufficient now to cause serious, if somewhat academic, concern on the part of Government officers. A committee was appointed to investigate the problem thoroughly, on the basis of reports—chiefly from a Mr. David Robarts, a substantial zamindar of pargana Sikandra Rao, Aligarh district—of the disastrous spread of reh in parts of Aligarh, Meerut, and throughout the Kali Nadi valley. In each case some hundreds of acres, which in these populous districts represented thousands of livelihoods, had been put out of cultivation; in each case, the damage was directly attributable to excessive irrigation by canal water. In introducing the final report of the Reh Committee in 1878, Buck, then Director of Agriculture in the provinces, warned that these and similar cases noted elsewhere, brought to light at the last


minute and even sometimes by accidental observation, were "the first and earliest outcome of the introduction of a canal system" (it was now four years since the publication of Corbett's treatise), and that the same disturbing influences might be slowly at work in many areas.\footnote{NWP and Oudh, "Revenue Proceedings," June 1879, Index No. 117, December 28, 1878, Proceeding No. 55. For an account of the reh problem in Aligarh, the focal area for official enquiry and experiment, see \textit{ibid.}, May 1880. Index Nos. 100-106, May 22, 1880, Proceedings Nos. 17-23; see also Appendix 5.}

The findings of the Reh Committee amounted, in substance, to little more than a corroboration of Corbett's assertions.\footnote{For a concise summary of the committee's findings, see Voelcker, \textit{Report}, para. 74, pp. 56-57; see also Appendix 5.} Its enquiry was far from adequate. No account, for instance, was given of the extent of usar tracts in the provinces: they were said to cover "immense areas," without details as to acreage. No agricultural chemist was appointed to the committee nor even consulted during the investigations.\footnote{Voelcker, \textit{Report}, para. 78, p. 62.} However, the committee's final report made it clear that the chief cause of the increase in usar had not gone unnoticed: they condemned the "vicious system" (in Buck's words) of swamping the fields for irrigation, which was the direct result of the accessibility of "flush water."\footnote{H. S. Reid, President, "Review of the Proceedings of the Reh Committee," para. 16, in NWP and Oudh, "Revenue Proceedings," June 1879, Index No. 112, December 28, 1878, Proceeding No. 50.} The "true remedy" was stated equally categorically: a greater economy in the distribution of water, to be achieved by the raising of rates charged by Government on flush irrigation. This was more than the Canal Department could provide. Since flush rates were already high, an increase would deter farmers altogether with disastrous results for the revenue accruing from canal charges. The committee itself realized that a remedy which it acknowledged to be inferior would have to be applied and recommended accordingly that lift irrigation should be substituted for flush irrigation as far as possible—"a waste of labour for a waste of water," sighed the president. He was encouraged solely by the realization that the waste of water was by far the more serious evil, leading as it so clearly had done to swamping, thence to deterioration of the soil and of the health of the people, thence to a diminution of their income, and ultimately, it was certain, to a reduction in the land revenue.\footnote{\textit{Ibid.}} For the rest, the committee recommended that experiments in reclaiming usar tracts
which had begun in 1874 under the supervision of the newly created Department of Agriculture should be continued. These consistently showed that usur could be brought back into cultivation only by careful watering accompanied by intensive manuring. Nothing however was done on any significant scale to increase the local supply of manure near these tracts in order to keep pace with the increase in irrigation from the canal. When Dr. J. A. Voelcker, the first agricultural chemist to be appointed by Government to report on Indian agrarian conditions, toured India in 1891, it is hardly surprising that he found “enormous tracts, especially in the plains of Northern India,” affected by reh. In the NWP alone, it was estimated to cover between 4,000 and 5,000 square miles. In the midst of this desolated usur land, patches of “valuable” crops—opium, sugar cane, wheat, castor-oil plant, and cotton—stood out “like oases in the salt-covered desert around them.”

The contrast between the benefits and drawbacks of canal irrigation was not always so clear to the eye. In Etawah, for example, the indices of prosperity in the form of extensive cultivation of “valuable” crops dominated the scene. The drought of 1868-69 had brought a stimulus to irrigation from the Ganges Canal. The falling-off in the use of the canal water after these dry months was however “chiefly confined to cotton and ordinary kharif crops which would not benefit by irrigation,” whilst the area under indigo began rapidly to increase, as did canal-irrigated sugar cane. The rest of the picture was filled in from the complaints of local farmers, recorded in this instance by Crosthwaite, when on settlement work in the district. They complained of corruption by the authorities administering the canal (standards

64On the Department of Agriculture, NWP, see pp. 101-102 below. On consultation as regards action to be taken against reh, the Irrigation Branch of the Public Works Department (Canal Department) found itself unable to meet the costs of measures recommended by the committee, viz. the appointment of a permanent agricultural chemist and regular experiments estimated at Rs. 3,000 per annum. It agreed, however, to make an allotment for the Irrigation Branch and Agricultural Department expenses incurred in collecting data in the special (i.e., Sikandra Rao and vicinity) tract; see “On the Deterioration of Land by Reh,” in NWP and Oudh, “Irrigation Proceedings,” November 1879, Proceeding No. 1. For the annual revenue and expenditure (in the form of regular charges on the revenue) of the Irrigation Branch, 1876-77 to 1899-1900, see Figure 5.

65For a summary of experiments carried out on usur tracts to 1891, see Voelcker, Report, paras. 75-76, pp. 58-61; see also Appendix 5.

66Voelcker, Report, para. 73, p. 55.

seemed to vary with the character of the successive district canal officers). They complained of uncertainty in the supply of canal water and of its inferiority as a fertilizing agent. They complained, as might be expected, of the deposits of silt and reh and the consequent deterioration of the soil. Kachhis, the skilled gardener-cultivators, and even the officers of the Government Opium Department were reported to have a marked preference for wells. But the real disadvantage of the canal was, as “universally asserted in Etawah,” that “after the first two to three years, the crops do fall off.”

Along with all this, the canal disrupted the farmer’s former pattern of work. Far from firing him with the much-heralded spirit of industriousness which increase was assumed to bring, canal irrigation required less by way of labour than his well had demanded. As Crosthwaite went on to note,

\[...\] the great relief from labour given by the canal probably goes as far as anything else with an ordinary peasant in directing his choice when it is possible for him to choose [between canal and well]. When a man has no sons or male relatives to help him, or when he has to keep more bullocks for irrigation than he wants for his plough, he may realize that he actually saves money by employing the canal. But ordinarily it strikes him the other way. The expenses of well-irrigation disbursed by degrees consists [sic] largely of the consumption of the cultivator’s own produce. The canal rate has to be paid in cash, and in a lump sum, and by a stated time, its collection attended by all the annoyance of a tax. To the average cultivator the canal appears an expensive business more costly than his well, but \[...\] he is swayed by his being saved an infinity of toil, and his ability to irrigate a much larger area of land \[...\]

It was not always a matter of choice for the farmer. He had to use canal water where the canal had put local wells out of use, especially where it had made well-digging impracticable by the rise in the water table which it had caused. Whiteway made enquiries as to the situation in Muttra in the hot weather of 1878—a difficult season—and discovered that all kachha wells in villages through which the main (Agra) canal passed and from which more than 5,000 acres had previously been irrigated were now useless, owing to the rise in spring

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68 Ibid. On the corruption of the canal administration, see pp. 88–89 below.
level.\textsuperscript{70} He concluded with caution that the canals therefore were, very possibly, a failure as an insurance against famine owing to their indirect effect on indigenous methods of cultivation. The Secretariat noted the following year that Whiteway's remarks were "deserving of attention."\textsuperscript{71}

Deleterious effects of canals on wells were by now widely noted. Saturation of the sub-soil was especially common in bhur (sandy tracts) irrigated by the canals, and this in turn caused the sides of kachha wells to fall in and made the continued construction of them to any depth out of the question. In Bulandshahr, according to R. G. Currie, a general rise of some six feet in the water level all over the canal area had resulted in the kachha wells being almost entirely superseded.\textsuperscript{72} A similar situation was reported from Mainpuri,\textsuperscript{73} and W. H. Moreland later collected further examples of this destruction of kachha wells in canal tracts from Aligarh and Agra.\textsuperscript{74} The only remedy was to construct a pakka (masonry) well. Its cost in materials and labour, however, made it inconceivable as a viable alternative for the majority of farmers.

The problems that canals caused or, more often, aggravated were not restricted to over-cropping, salination, and the destruction of wells. Percolation from main channels or rajbahas (distributaries) could create swamps. In the Budh Ganga valley area of Etah district, the entire sugar cane crop of 1878-79 was ruined by this. The Canal Department provided the sum of Rs. 4,150 in compensation, but it did not undertake to drain the swamp.\textsuperscript{75} More widespread and serious swamping arose from the canals' obstruction of natural drainage lines where an insufficient number of syphons had been built to carry the canals beneath these natural watercourses. The obstruction caused by canal embankments led to swamping, the worst consequence of which was the aggravation of malaria. During the 1870s, the incidence of the disease increased alarmingly throughout the canal-irrigated districts where the saturation from flush irrigation

\textsuperscript{70}Muttra Settlement Report, pp. 12-15.
\textsuperscript{71}Ibid., p. 3.
\textsuperscript{72}Bulandshahr Settlement Report, p. 10.
\textsuperscript{73}Mainpuri Settlement Report, p. 9.
\textsuperscript{75}NWP Revenue Administration Report, 1878-89, p. 3. For details of the swamping of the Budh Ganga valley near Soron by percolation from the Lower Ganges Canal, see NWP and Oudh, "Irrigation Proceedings," August 1879, Proceedings Nos. 1-13.
coincided with the obstruction of natural drainage lines.\textsuperscript{76} In spite of a series of minor drainage operations begun by the Irrigation Department, fever continued to be a frequent cause of death and, worse still for a larger number of cultivators, a frequent cause of debilitation, especially in districts with large irrigated areas.\textsuperscript{77} According to Alan Cadell, even the climate in Muzaffarnagar had grown worse, in terms of an increasingly unhealthy humidity, "than it was before irrigation from the canal became so general and the cultivation of rice [an export staple] so much extended."

A farmer in a low-lying area irrigated by a canal might therefore have had to face a number of setbacks with which he was hardly equipped to deal. His fields might become salinized. If they lay close to an irrigating channel, he might have had the (often doubtful) benefit of easy access to the water supply or the prospect, alternatively, of swamping from drainage obstructions. Such drainage channels as were built to take excess water off the land ran into the same problem with the natural lines; a farmer might therefore oppose their construction, with reason. The obstruction or inadequacy of drainage facilities increased the dangers from seasonal flooding. Excessive rain in the early kharif would turn his irrigated fields into a lake and drown his "valuable" crops.\textsuperscript{79} Meanwhile, his well might have fallen into disuse, leaving him no alternative but the canal for his irrigation. With the expansion of cultivation of "valuable" crops into land formerly occupied in part by staple cereals and with the increase in population, his food supply became more precarious. Not only food, but fuel and fodder were also threatened: "Since the introduction of canal-irrigation on an immense scale in this part of the country, the conditions of agriculture have been almost revolutionized," William Crooke, then manager of the Awa estate in Etah district, declared in reviewing the situation in the Central Doab towards the

\textsuperscript{76}For this condition in Saharanpur, see \textit{NWP Revenue Administration Report}, 1870–71, pp. 6–7; in Meerut, \textit{ibid.}, 1871–72, p. 8; in Meerut and Bulandshahr, \textit{ibid.}, 1873 74, p. 8; in Meerut, Bulandshahr, Aligarh, and Etawah, \textit{ibid.}, 1874–75, p. 5.

\textsuperscript{77}\textit{Ibid.}, 1875–76, p. 3. For further observations on the problem reported in 1879, see C. Planck, Sanitary Commissioner, NWP, to Government, NWP and Oudh, October 14, 1879, "The Effect of Canal Extensions on the Mortuary Rate of the Etah, Meerut and Bulundshahr Districts," in NWP and Oudh, "Irrigation Proceedings," March 1881, Proceedings Nos. 22 ·35.

\textsuperscript{78}Muzaffarnagar Settlement Report (Canal Tract), pp. 4–5, 6.

\textsuperscript{79}For an example where this inundation was reported as the "usual occurrence" when such rains occurred early in the kharif, see \textit{NWP Revenue Administration Report}, 1876–77, pp. 1–2.
end of 1881. "A great part of the culturable waste lands has been broken up, and the supply of firewood and grass seriously diminished. The consequences would have been more serious had not the use of canal-water enabled the cultivators to dispense with a large number of their plough cattle." This, however, as Crooke went on to show, was of little genuine assistance for the farmer in dealing with this sudden revolution in his environment, especially since his techniques remained unadapted to the changed circumstances. "The number of cattle now maintained is, in comparison with the area under cultivation, inadequate. This has led to a slovenly system of cultivation, and has greatly reduced the manure supply."

Early in the century, dhak jungle (butea frondosa, a fine timber tree which also provides excellent charcoal when burned) had covered much of the Doab. With the extension of agricultural settlement, the jungle had been largely stripped away, leaving bare usur patches by the time when Crooke was writing. As a result, forage and firewood for the cultivator had already become scarce and costly—a condition which was now aggravated by the contraction of "waste" areas owing to the expansion stimulated by the canals. Firewood, according to Crooke, cost a rupee for four maunds, assuming it could be bought, and dry grass for cattle was sold at from two to four maunds a rupee. The condition of cattle, especially during the thin period prior to the rains when no fresh fodder was available, was "miserable in the extreme." Cattle starvation and concomitant diseases (rinderpest, foot-and-mouth disease, fever) became regular occurrences which were aggravated by, rather than originating in, years of severe drought.

Could this be remedied? Crooke himself advocated a scheme which would combine the reclamation of usur tracts in the Central Doab with the establishment of fuel and fodder reserves. Exhaustive discussions over the next three years by the Revenue Department, however, revealed the "material difficulties" which prevented the implementation of this project and other proposals to buy up waste land and enclose it for emergency reserves: the cost was too great for Government. These same schemes went forward for discussion


81Ibid.

82This is an observation on the state of the cattle in pargana Firozabad, Kheri district, in NWP and Oudh, "Revenue Proceedings," May 1880, Index No. 77, May 15, 1880, Proceeding No. 16.

83Government, NWP and Oudh, to Board of Revenue, NWP, January 11, 1884,
by the Revenue and Agricultural Department of the Government of India, and were wrecked on the same rocks:

The expense of taking up as reserves even a small proportion of waste lands now used as pastures would be enormous. For example, a reserve of some 6% of the grazing grounds of Bareilly would cost for acquisition alone Rs. 1½ lakhs [Rs. 150,000]. The experiment of acquiring and enclosing 954 acres of usur land in Aligarh is to cost Government more than Rs. 10,000. Without multiplying illustrations, it may be briefly said that in those fully-settled districts, where pressure on the available pasturage is felt, no reserves could, by fencing, planting, and re-foresterng waste and usur land, be created which would have an appreciable effect, except at an outlay so enormous as to place the measure at present beyond the means of the Government to undertake . . .

. . . a small experiment in reclaiming and planting usur has been in progress in Cawnpore since 1882. The results so far demonstrate the necessity of great caution in undertaking any large expenditure on the formation of grass preserves in such soil . . .

Meanwhile, the contraction of fodder areas in the Doab had a direct effect on the pastoralists who supplied cattle to the agricultural communities. In pargana Lonee, Meerut district, the expansion of cultivation was rapidly converting the traditionally pastoral Gujars into settled agriculturists, a transformation described by the Settlement Officer, Forbes, as in the “spirit of industry.” The same transformation was taking place in pargana Dadri, Bulandshahr district, where the Gujars, according to the Settlement Officer, had begun to “recognize the value of property” : they “have benefited considerably,” Currie wrote, “by greatly increasing their cotton cultivation in the last two years.” But here too there were problems. Most Gujar settlements were situated in the low-lying khadir areas—the river valleys—where the constant threat of inundation meant little regular kharif cultivation could be hazarded, whilst pasture lands were


Meerut Settlement Report, pp. 31–33.

extensive, with long grass flourishing in the moist soil conditions. Gujars therefore derived their regular livelihood from grazing and from the sale of thatching grass, and their food supply from rabi grains since these were sown when there was no threat of flood. When conditions prevented cultivation, they could resort to cattle thieving. Thus, with the expansion of cultivation into the khadir, the Gujars benefited from rabi cultivation, though the kharif crops were still precarious. But with the conversion of the Gujars into agriculturists, the supply of cattle to the cultivators necessarily contracted; for this reason, cultivators had to rely on their own, often deteriorating, stock. Meanwhile, Gujars in areas outside the range of the canal developments remained obstinately unmoved by the "spirit of industry." In Muzaffarnagar, Auckland Colvin noted in 1864 how the Gujars of pargana Bedauli derived their chief support from cattle. "This," he wrote, "supplies them with a motive for maintaining large tracts of uncultivated land, and materially diminishes their necessity for cultivating land." It was assumed that this regrettable situation could be changed only by the realization of enormous gains from an increase in cultivation. "Nothing, I believe, will outweigh this motive but some agent not only bringing greater profits than cattle-stealing and cattle-breeding, but profits sufficiently great to supplant the old pleasant habits of indolence and theft by the laborious habits of toil and agriculture." Such an agent was to be found in Colvin's view in the form of canal water.\textsuperscript{87} Crosthwaite's observations on the labour-saving consequences of the canal\textsuperscript{88} lead one to doubt a priori that Colvin's vision would ever be realized.

The awe-inspiring size of the great canals obscured, to those minded to see in them a monument to engineering achievement and administrative virtue, their less direct repercussions and the faults in their construction. The Ganges Canal, for example, was in all senses a great pioneering work—"the most magnificent work of its class in the whole world," wrote W. T. Thornton from the distant vantage point of the India Office, "the value of which will be very inadequately appreciated if it fail to secure for the memory of Sir Proby Cautley, its principal designer and constructor, an Indian immortality."\textsuperscript{89} As a pioneering work, the canal had virtually no precedent. Its

\textsuperscript{87}Muzaffarnagar Settlement Report, pp. 128-129.
\textsuperscript{88}See p. 80 above.
\textsuperscript{89}W. T. Thornton, Indian Public Works, p. 109.
construction was therefore largely experimental, and errors in the
design and its implementation could not necessarily have been foreseen,
though the consequences would have been less disturbing had the canal
been built in an uninhabited wilderness. The controversies amongst
engineers which it aroused however centred less on constructional
defects than on questions of expenditure. The famous dispute between
Sir A. T. Cotton and Cautley, which threatened to rob the latter of
some of his claim to immortality, opened with an acrimonious memo-
randum on the canal compiled by Cotton for the East India Irrigation
Company, which financed the project, and published in July 1863. Init,
Cotton listed the following as the "greatest fundamental mistakes."
The head of the canal had been sited too far up the Ganges with the
result that its fall was "very great" whilst it had to be carried across
the very heavy drainage from the sub-Himalayan hills and had been
cut to carry water below surface level—all of which amounted to a vast
amount of unnecessary excavation at considerable cost. All the
masonry work was of brick instead of the (cheaper) local stone.
All the water carried in the canal was admitted at the head, and
some was therefore conveyed 350 miles to the irrigable land when
it might have been obtained at from 50 to 100 miles' distance. No
permanent dam had been built across the river at the head of the
canal to secure a constant supply of water; instead, temporary works
were thrown up after every monsoon, adding heavily to the annual
maintenance costs. The fourteen "minor mistakes" listed by Cotton
were also related chiefly to construction costs.\(^{90}\)

Cotton's estimate for the required alterations was some £2,725,000.
To achieve the maximum expansion of the canal system, by which
some 6,500,000 acres could be irrigated—a figure which was never
in fact reached prior to 1900—the total expenditure was estimated
at £5,000,000. Modifications to the existing canal channels and the
extension of the network into the Lower Doab were not begun till 1868,
by which time the budget for this alone had swelled to £3,183,390.\(^{91}\)

The prime aim with which canal irrigation was so ardently pro-
moted, to increase wealth and consequently revenue by expanding
the acreage under "valuable" crops to its greatest possible extent,
did not change. It was inevitable that a host of minor details should

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\(^{90}\) For a summary of this dispute between Cotton and Cautley, of Cotton's critique,
and of the alterations to the canal as finally sanctioned by Government, see Buckley,

be overlooked here and there in the rush to construct. The crucial problem of the local distribution of canal water was left to work itself out haphazardly. Muzaffarnagar district provided an illustration. Cadell attributed the exceptional advance of the canal tract in the twenty years prior to 1878—an advance measured largely in terms of the increased acreage of sugar cane—entirely to "this noble work," the Ganges Canal. Almost every village was said to be protected from periodic scarcity. But, he admitted, in "the anxiety to make canal water promptly available and to secure immediate revenue, distributaries had been constructed too hastily and without sufficient care . . ." Serious mistakes were almost certainly owing to the "anxiety for palpable results. It was generally acknowledged that the system of distribution adopted had for its object the prompt collection of water-rates for the largest possible area of the more valuable crops." 92 It was difficult to make more than minor adjustments to the canals. Meanwhile, the aim of increasing the revenue was achieved.93

Sound engineering principles were frustrated at the outset by the official policy on the construction of the minor channels of the canal systems. "As a rule," Whiteway remarked apropos of the Agra Canal in Muttra district, "the Government only makes the main distributaries and the zamindars must make the minor ones . . . It is easy for a rich landlord to apply to the Collector to have land taken up in the next village to make his watercourse, but practically impossible for a petty proprietor to incur the odium of an application, not only for land to be taken up from the next village, but from his neighbour's field." 94 The construction of distributaries was also used by powerful maliks as an instrument against each other and against recalcitrant cultivators.95 Equality of rights to irrigation might well exist on paper. In practice, access was controlled by the distribution of local power in the regions through which the canals ran.

Access was also subject to charges. Water rates were levied by the administration according to "the just claims of the Government to a suitable return on the capital sunk in the works on the one hand,

93 For the canal revenue of the NWP, 1876 77 to 1899 1900, see Figure 5. For details of heads of account, see pp. 134–136 below.
95 As, for example, in the (characteristic) dispute between the zamindars of Gowra and Surajpore, Bareilly district, reported in NWP, "Revenue Proceedings," January 11, 1868, Index Nos. 11–16, June 8, 1867, Proceedings Nos. 80 and 81, and November 23, 1867, Proceedings Nos. 60 and 61.
and to the known capabilities of the land on the other.” As readjusted by Government order in 1864, the rates were fixed at Rs. 5 per acre for sugar cane and Rs. 2–4 per acre for other crops. “Cultivators refusing to accept these rates,” it was firmly stated, “should not obtain any water at all.” The rates could legally be raised by the Irrigation Department according to the principles on which they were initially levied. In addition, the Canal Act of 1873 provided for the levy of an “owner’s rate” whenever the local Government should see fit to apply it. At the same time, the revenue demand was increased on irrigated lands, recorded in the Irrigation Department accounts as “indirect revenue.”

Charges for the use of canal water did not stop at the officially levied rates. To compute the acreage-based charges on each cultivator’s irrigated fields of a few bighas in extent, to record the names and numbers of cultivators liable to pay the rates, and to collect the sums due—at each season—the Irrigation Department employed a vast number of local agents: chaukidars, mohurrirs (clerks), and amins (measuring clerks). Each official of this “subordinate establishment” performed a local service, in this case assisting in the supply of canal water. Consequently, each official claimed his haq from his “clients” who used the water, over and above the Government dues. Cultivators paid their water rates, their share in the increased revenue demand, and faslana, a fee exacted per plough at each harvest by the local malik who ruled the access to the canal; they also paid a due to the chaukidar, a fee on the rajbaha (distributary) to its controller and faslana to the sub-overser or his agent, and the costs of the amin’s board and lodging when he came on his measuring round. This last item alone could amount to some Rs. 10 a season. In 1879, A. P. Webb, a zamindar of pargana Baraut, Meerut district, exposed the practices of the subordinate establishment of the East Jumna Canal in a pamphlet entitled “Irrigation Topics.” Webb also raised questions concerning the condition of crops watered by wells as against canals,

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97 Ibid., para. 13.
98 Act VIII, 1873, §§ 37–44. For a select list of statutes relating to agrarian conditions in NWP and Oudh, 1859–1900, see Appendix 6.
99 See p. 000 below. For collections of indirect revenue, 1876–77 to 1899–1900, see Figure 5.
100 A. P. Webb’s text was reprinted verbatim in NWP and Oudh, “Revenue Proceedings,” October 1879, Index No. 6, September 6, 1879, Proceedings Nos. 60–61.
and the promotion of well construction. His disclosures, documented from records in canal villages, roused the superior establishment to investigate. On the instructions of W. C. Plowden, then Commissioner of Meerut Division, the officiating collector and the superintending engineer of the First Circle of the Irrigation Works in the district enquired into Webb's "allegations . . . impugning the administration of the Government canals"—and found more than copious corroboration. These officers suggested that further enquiry might be made in Muzaffarnagar and Saharanpur, but this seemed unnecessary to the Commissioner: "I have not a doubt myself that practices similar to those detected in the Meerut district exist in other parts, but I question the advisability of going on with this enquiry." Meanwhile, Webb continued to supply the Collectorate with an abundance of details, including specimens of malbah accounts, which were summaries of cash payments on account from a "collective village community" compiled from rokras, or daily cash books. His pièce de résistance was a series of extracts in the vernacular from some bahis (account books) of the village of Suf from 1850 to 1873. These provided documentary confirmation of the oral statements of various lambardars [now in the collector's possession] . . . , that illegal canal imposts have been extorted ever since the introduction of canal-irrigation, or that they have paid the same, or known them to be paid, ever since they were lambardars [sic], and that their fathers paid before them.

In fact there is not a Canal Deputy Magistrate who did not share in the plunder of the people when ziladar [an official heading the local canal administration], and not a ziladar who is not concerned in extortions.

By the 1890s, the farmers of the provinces cultivated and irrigated a greater area than their predecessors had in 1860, and grew more of the "valuable" crops. The increase towards which all the piecemeal schemes of public works had been directed, each in its own way, had been achieved. The cost, however, was considerable. Whilst the number of farmers and their dependants had risen—at what rate it

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101 NWP and Oudh, "Revenue Proceedings," October 1879, Index No. 54, September 6, 1879, Proceeding No. 52 (summarized in turn by W. C. Plowden, ibid., Index No. 52, Proceeding No. 50).

102 Plowden, ibid.

103 Webb to Collector, Meerut, ibid., Index No. 70, October 4, 1879, Proceeding No. 37.

104 Ibid., Index No. 71, October 4, 1879, Proceeding No. 38.
is impossible to say on the basis of available statistics—their food supply had not kept pace with them; nor had they been encouraged to make it do so. The canals did not remedy the growing imbalance, and still less did it protect the people from scarcity and famine, contrary to the retrospective assertions of Sir John Strachey. As we have seen, the canals could not be used to increase the production of kharif food grains, and they were a powerful if not exclusive cause of a noticeable decline in productivity in many long-settled areas; moreover in the most extensively irrigated of the canal tracts, the health of the people as well as the condition of the soil on which they depended for their livelihood deteriorated badly under the effects of swamps. For all this, compensation was not and could not be given. The Northern India Canal and Drainage Act of 1873 provided, inter alia, that no compensation should be awarded for any damage caused by stoppage or diminution of percolation, by floods, or by deterioration of climate or soil—the principal areas of trouble created by the engineering works. In such cases where the law provided for the Irrigation Department’s liability to compensate, applications for redress had to undergo an elaborate procedure, expensive in time as well as money. In 1872, for example, zamindars and tenants in pargana Kilpuri, Bareilly district, were awarded compensation for flood damage for which the Irrigation Department admitted responsibility. A bureaucratic wrangle then ensued between the Irrigation and Revenue departments as to who should actually pay over the compensation money of Rs. 6,892.9.5. A final ruling was obtained only in 1877, when the matter reached the Financial Department of the Government of India.

Meanwhile, the expansion of cultivation brought a corresponding contraction in waste lands. This disrupted the fallowing cycles, curtailed the farmers’ supplies of fuel and fodder, and induced pastoralists in the low-lying Doab tracts to settle in on the land as cultivators, increasing its burdens. Whatever ecological revolution the canals brought or helped to bring, most farmers’ techniques were not adapted to deal with such sudden and radical changes. Nor did the canals provide them with a greater degree of control over the means by which they continued to cultivate: local power was paramount,

106 See p. 63 above.
107 Act VIII, 1873, § 8.
108 Superintendent, Tarai district, to Commissioner, Kumaon, November 6, 1879, NWP and Oudh, “Revenue Proceedings,” March 1880, Index No. 9, March 13, 1880, Proceeding No. 9.
as the double status of maliks as canal officials so clearly showed. In fact, maliks' haqps were capable of almost indefinite extension.

Government also paid increasingly for the canals, albeit in straightforward terms of account. Maintenance and improvement charges rose from Rs. 626,116 in 1876-77 to Rs. 1,391,159 in 1898-99. Establishment charges, which in 1876-77 were recorded as Rs. 848,040, had increased to Rs. 1,523,248 by 1898-99.\(^{108}\) The canals proved a costly experiment.

In addition to large-scale irrigation works to spur on production to unheard of heights of prosperity, the practically minded entrepreneurs who viewed India in the late 1850s considered its most pressing need to lie in communications. The urgency to satisfy this need was increased by the seriousness of the deficiency and by the size and diversity of profits envisaged as the fruits of such worthwhile investment. "The state of existing means of travelling in India is sufficient alone to prevent the country and its resources from becoming known to capitalists," Major-General C. W. Tremenheere, R. E., declared in 1857 to the Select Committee on Colonization and Settlement. "The ordinary mode of travelling is either by marching in stages from twelve to fourteen miles a day, or travelling by dawk in a palanquin. Capitalists will not submit to this tardy mode of progress.\(^{109}\) Carriage was similarly ill-developed. The rath, or two-wheeled cart, drawn by a pair of bullocks "whose jog-trot keeps the ruth in a perpetual oscillation," was the commonest form of transport, and had been for centuries. "Rocks have altered, worlds have changed, and nations have worn away," wrote Bholanauth Chunder in 1869 on a journey from Muttra to Brindaban, "but no improvement has taken place in the vehicular architecture of the Hindoo.\(^{110}\) Throughout the later nineteenth century, carts remained the predominant and indispensable mode of transport serving a widening network of railways and feeder roads.

As in the case of the canals, the construction of roads and railways after 1858 followed well-established precedents.\(^ {111}\) The pioneer

\(^{108}\) *NWP Irrigation Revenue Reports*, 1876-77, 1898-99. See also Figure 5.


\(^{111}\) For developments prior to 1857-58, see D. Thorner, *Investment in Empire*. On the role of the railway contractor, as exemplified by the ubiquitous Mr. Thomas
achievement of all public works in British India, the Grand Trunk Road, metalled throughout, already ran up from Calcutta to Benares, then to Allahabad and Cawnpore, and on through the Doab to Delhi. The commercial linkage of the great marts of the Ganges-Jumna region and the political linkage of the capital centres of administration were accomplished by the East Indian Railway, which bound Delhi, Agra, Cawnpore, and Benares to each other and to Calcutta. Subsequent developments were to extend lines out over all but the least productive districts, where expenditure on communications would hardly be repaid by the amount of traffic which could use them. Branches of the East Indian Railway spanned out through the Doab while the central and eastern regions were tapped by the Oudh and Rohilkhand Railway. District road-building seems to have depended largely on the relevance of each district to the overall scheme and pattern of traffic: areas farthest from the great arterial routes or the feeder lines—eastern parganas of Fyzabad, for example, and most of Bahraich—were poorly supplied with roads.

Whatever intentions of universal expansion supported the promotion of the rail- and road-building schemes, they were thwarted at the outset by the means used to carry out the actual construction. The rapidity of railway-building in British India up to 1875 was, as L. H. Jenks has remarked, greater even than in Great Britain and France, but was not accompanied by a comparably intensive development of subsidiary roads or by a growth in local trade binding markets to metropolitan centres. The capital for the railways was imported from Britain. No industry grew up to provide the materials for their construction; instead, iron and timber were imported—into a country rich in these natural resources. The skilled staffs of the railway were English, paid wages and salaries at English rates. The remittance of two-thirds the railway capital to India in bullion may have contributed to the inflationary effects of the increasing amounts of specie sent in payment for India's increasing exports, with the result that prices rose steeply, especially those of grain in the urban marketing

Brassey, see A.HELPs, Life and Labours, especially as regards Indian railways, at pp. 270-277.


113 See endpaper map. For sections of lines, with dates of construction, see Appendix 7.

centres. The inevitable consequence was a "highly precarious" prosperity, disruptive of traditional arrangements and benefiting only those in a position to manipulate the new machinery of commerce.\textsuperscript{116}

The construction of the railways also brought its measure of physical disturbances; as in the case of the canals, there was trouble over the natural drainage lines. In the Ramganga valley area of Bareilly, for example, landowners complained of damage done to crops and lands owing to the obstruction by the embankment of the Oudh and Rohilkhand Railway of the natural drainage of floods during the period 1870-1873. The company was finally called upon (in 1875-76) to pay the Government assessed compensation of Rs. 5,242 and to provide a remedy. Landowners in the Ganges khadir of Unao district (north of Cawnpore) complained of similar floods in 1870, 1871, 1872, and 1874, with the last of such severity that an enquiry was held into the extent of the losses. Ten years later, floods occurred in Budaon; a great part of the damage was reported as owing to the same cause—the Oudh and Rohilkhand Railway line.\textsuperscript{116}

The new lines of communication cut across old lines of local supply. Compensation for land taken up for works did not allow for this. In Cawnpore, an investigation into the case of the insolvent Raja Dhiraj Singh of Gangaganj revealed the extent to which arrears of revenue accumulating on the lands under his charge was owing to heavy assessments combined with an inability to recoup losses attributed to deteriorations from public works. One village commanding a total area of 2,191 acres was assessed at Rs. 3.10.0 on each of its 965 cultivated acres, a rate admitted to be high even in "this highly assessed part of Cawnpore," and it was all the more so since the soils were light and of under- rather than above-average quality. By 1873, this village had been "much cut up" by roads and canals. The compensation for land taken up by the works themselves was said to have been given at a fair rate as far as the land itself was concerned because it was founded on the revenue rate;\textsuperscript{117} "but the village has suffered much damage in consequence of the interference with its communi-

\textsuperscript{116} Jenks, Migration, pp. 227-230. On local manipulation of the new machinery of commerce in the NWP and Oudh, see pp. 188 ff. below.

\textsuperscript{117} Administration of the Guaranteed Railways, Report on the Oudh and Rohilkhand Railway, 1874-75, p. 14. For further details on the Bareilly floods, see NWP Revenue Administration Report, 1872-73, pp. 6-7. On the Budaon floods, see ibid., 1880-81, p. 6.

\textsuperscript{117} For the rules regulating the calculation of compensation payments (based on an estimate of "customary rent" at fair rates) for land acquired by Government for "public purposes" (that is, public works development), see NWP, "Revenue Proceedings," June 29, 1867, Index No. 32, May 25, 1867, Proceeding No. 28.
cations, and of course no compensation has been given for this. For instance, one large tract of valuable land was highly manured before the [East Indian] railway was constructed. Since its construction the railway embankment has completely precluded the transfer of manure from the village site to this tract, and the value of it has fallen quite 50%.” Added to this came the swamping of some acres through the interference of the canal’s watercourses with natural drainage lines. Elsewhere on the estate, a kachha road had “eaten out the heart of a plot of land devoted to market gardening.” Lastly, the shade of trees planted to hold the East Indian Railway’s embankment and the side of the Kalpi road was proving very injurious to adjacent cultivation.118

Perhaps the most disturbing consequence of the railways—most disturbing because least capable of remedy—was the widespread use of local timber as fuel for the locomotives. Tremenheere had noted the relative scarcity, even in 1857, of wood fuel in the Gangetic valley, and he cited this as an additional reason for the necessity of constructing branch lines into the sub-Himalayan plains and other hilly districts of Central India where wood was to be found in “inexhaustible abundance.” Tremenheere suggested that the railways might even make this wood available, at a moderate transport charge, to supply abundant and cheap fuel to the inhabitants of the long exhausted plains.119

In practice, the railway companies drew their fuel supply directly—and cheaply—from local timber until the 1880s. As early as 1865, a Government of India Resolution noted the “very considerable deforestation already occurring in the Doab” owing to the railways’ requirements, as well as the “absence of any reliable expectation of an early cessation of the demand which gave rise to it.” Remedial measures were clearly already required to provide for “the reproduction of trees where the country was most affected by the extraordinary

118E. C. Buck, Settlement Officer, Cawnpore, April 19, 1873, “Report on the Case of Dhiraj Singh,” an example of one of the many heavily assessed estates in the district disturbed by the public works, in NWP, “Revenue Proceedings,” December 1873, Index Nos. 4–5, July 5, 1873, Proceedings Nos. 75–76. The outcome was that Dhiraj Singh received a Government loan to clear his debts (and to provide for a dowry as befitted his station in the event of his marriage, with the express intention that this might serve as a safeguard against further insolvency). The revenue demand on the estate remained unaltered. For examples of legal provisions introduced to restore financially failing zamindaris to solvency, see pp. 203, 231–233 below.

Demand for wood-fuel. Remedial measures however lay beyond the means of the Government: its answer was to suggest that the proprietors of land be induced to plant trees. But groves were assessed to revenue, and those who controlled them had every incentive to sell the wood for railway fuel and thus pay the revenue with ease. This situation was illustrated clearly in the case of mahwah groves in the western half of Partabgarh district. The fruit of the mahwah was a valuable source of food for the local peasants, who also used its seed for fuel-oil. W. E. Forbes, the Settlement Officer, noted, however, that it was on the mahwah—as he had already observed two years earlier—that the axe falls heaviest, and in respect of which the planting does not keep pace with the destruction. A considerable amount of timber has found its way across the Ganges. From one estate alone, a short time since, thousands of trees were purchased by the Manikpur Firm of Moula Dad Khan and Khuda Dad Khan who, I have heard, concluded a most profitable bargain with the East Indian Railway Company. The straight trees were sawn up into planks, while the crooked and gnarled stems were converted into charcoal. Mahwah charcoal is highly esteemed as fuel, and always commands a good price. No doubt the proximity of the Railway has caused a more wholesale destruction of this tree than would otherwise have been the case.

Reforestation of the mahwah was a difficult matter. For one thing, the mahwah, in comparison with the mango, is—as Forbes noted—a slow-growing tree, "and in these days, zamindars cannot afford to wait long years while the land yields no return." For another, the peri or mahwah tax, "a universally recognized impost throughout the district, is a deterrent to the cultivator who would plant a 'Mahwah' grove, for he well knows that by and by it will but too surely form the pretext for systematically depriving him of the usufruct."

Deforestation seems to have appeared a regrettable necessity to the railway companies. The Oudh and Rohilkhand Railway Company drew its fuel supply from the country adjoining the line. By the end of the financial year 1872-73, the company already ran a second regular service daily between Lucknow and Cawnpore, and with the rapid extension of its lines over the next years, its demand for local fuel increased accordingly. The company's report of 1872-73

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180 Government of India (Home Department), Resolution No. 3565, April 17, 1865, in NWP, "Revenue Proceedings," May 27, 1865, Index No. 26, Proceeding No. 4. The matter was reported to have been constantly under consideration by the local Government "for the last two years"; ibid., Index No. 27, Proceeding No. 5.

Development of Agricultural Resources

referred to attempts which had already been made to substitute coal, but, as the report of the following year noted concerning similar discussions, the company was "averse to doing this as long as it is dearer than wood." The stumbling block was the charge levied by the East Indian Railway Company on the freight of coal from the nearest source, Bengal: from Giridi to Benares, the rate was Rs. 33 per 100 maunds. The Oudh and Rohilkhand Railway Company could afford to use coal only if the rate were brought down to Rs. 22 per 100 maunds, which would allow a safe margin of return on capital expended over running costs. In 1874-75, the East Indian Railway agreed to give a rebate on all freight charges for coal carried to Benares paid by the Oudh and Rohilkhand Company, on quantities of not less than 6,000 tons freighted per six months. But the coal freight was still subject to a heavy charge owing to the four-mile gap between the stations of the two companies at Benares. The Oudh and Rohilkhand Railway was still being supplied with local timber in the 1880s.

The Public Works Department also competed with the rural population for fuel; their source was even cheaper than that of the railways: dung. In 1879, A. O. Hume drew attention to the contrast between the relatively meagre amount of dung used by the "natives," chiefly for cooking, and its "vast consumption in brick-making. . . . The Public Works Department are great sinners. The increase of brick-making, and with it, the consumption of dung as fuel (it being, in most places, cheaper than wood) has been enormous of late years." With the contraction of other fuel supplies from the dwindling waste lands, pressure to use dung increased, which in turn diminished the amount of manure available to nourish the soil.

The overwhelming proportion of "Saxon energy and British capital" introduced into India in the form of public works was concentrated on immediately productive areas. Schemes for the reclamation of wilderness and barren waste were less attractive to contemporary expansionist zeal. Such attempts as were made to bring waste lands in northern Oudh under some sort of cultivation had been frustrated through unfavourable conditions—unhealthiness, scarcity of labour, and the lack of a nearby market for timber and firewood which were

183 Ibid., 1873-74, pp. 17-18.
184 Ibid., 1874-75, p. 13.
185 A. O. Hume, Agricultural Reform, footnote to p. 30.
expected to produce the first profits. Out of thirty-three lessees of the Kathna forest grants (an area of some 94,432 acres), the eleven lasting beyond the first round had discontinued their efforts, either because the strain on their capital was too great, or prudence forbade them to expend without hope of an early return.\textsuperscript{186} C. W. McMinn cast doubts on the practicality of any scheme for reclamation of the terai "by English gentlemen, allured by the exquisite beauty of the Oudh wilderness." The whole area, from the Ganges at Hardwar to the Koriali at Gola-ghat, some 250 miles by 20 miles in extent and at one time under cultivation, had been turned by Firoz Shah into a hunting ground. Within a few years, the abandoned fields had become dense jungle, and the jungle, catching the rainfall and retarding its flow, became a swamp: "it is doubtful if all the power and wealth of England could now bring back into cultivation the wilderness which Firoz Shah created by a word. A civilized Government cannot send hundreds of thousands of its subjects into a pestilential swamp for each man to cut down a few trees and then dying, hand his axe to another fated for brief toil."\textsuperscript{187} Hard-headed enterprise had better avenues for the employment of its resources than to dream of such picturesque impracticalities.

\textit{Small-Scale Improvements}

As a systematic series of propositions, "economic development" existed only in theories constructed by political economists chiefly of the classical school.\textsuperscript{188} In practice, certainly as far as British India was concerned, such "development" as took place was the work of a variety of promoters of "Progress and Civilization"—members of joint-stock companies and the ubiquitous engineers to Government itself, all of whom candidly pursued their aims of increasing wealth. They proceeded with vigour, and achieved much within a surprisingly


short space of time: "Backward and partially-developed tracts are rare in the NWP," the secretary to the local Government wrote in 1871 to the Board of Revenue. There was, however, little concern as to how the various schemes might match up, one with another. The example of the gap between railway stations at Benares is but one of many such instances of the lack of co-ordination. There was even less interest in catering specifically to the needs of those on whose environment the promoters' capital was bestowed. Beneath the weight of public works embellishment, the basic techniques and requirements of the great mass of cultivators in the provinces persisted unchanged.

Robert Knight, who was constantly and publicly at war with the Government of India over its persistent and seemingly foolish obstructions of entrepreneurial ambitions, cried aloud at the neglect of agriculture. In July 1876, his paper, the Indian Agriculturist, came out with a review of Corbett's treatise, which stated the case for agricultural modernization in no uncertain terms:

There is great truth in his [Corbett's] assertion that an irrigation cry and a drainage cry, have induced the Government to embark in projects purely engineering and not agricultural, to trust the agricultural education of India solely to engineers and to district officers; the former of whom look upon agricultural projects from a purely engineering point of view, while the latter have little interest in agricultural matters beyond the narrow one of collecting the revenue. In a country which is so largely dependent as India, not only for the subsistence of its vast population but for its political maintenance, upon the productiveness of the earth, the science of agriculture should doubtless be made of the first importance and should have been called in to aid all projects of agricultural improvement...

The views of district officers on the efficiency of peasant techniques varied according to the relative intimacy of their experience with Indian agriculture. S. M. Moens in Bareilly and J. R. Reid in Azamgarh, to name but two settlement officers who made themselves experts on the peasants' activities in their respective districts, showed

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189 June 28, 1871, in NWP, "Revenue Proceedings," March 1874, Index No. 27, March 7, 1874, Proceeding No. 73.
180 Knight also voiced his expansionist zeal in the columns of other journals he edited, viz. Indian Economist and the daily newspaper The Statesman.
181 See pp. 76-77 above.
182 Indian Agriculturist, July 1, 1876, p. 194.
183 On contemporary European criteria for Indian agricultural efficiency, see pp. 31-32 above.
clearly in their reports how skilful the cultivators were in the main extracting a varied livelihood from the soil in the face of obstacles posed by their frequently hostile environment. W. A. Forbes and his predecessors, in assessing the best of the Meerut parganas, showed how the much-admired prosperity of the Jat cultivators derived from their own modes of exploiting the excellent natural facilities of the region. Others, deceived by the simplicity of cultivating equipment and the distressing condition of so many of the cultivators, committed the error of a simple attribution of the latter to the former. McMinn, for example, whose juristic turn of mind was better adapted to detecting the subtleties of tenure and the errors of Government policy, was emphatic in his denunciation of the peasants' practices: "Indian modes of agriculture, far from being the ripe result of Indian experience represent the dregs of an old world barbarism, all the main features of which are common to both East and West."\textsuperscript{184}

The opinion that modern Europe, evolving from an origin common to that of ancient Indian society, was in agriculture as in all else superior and that owing to this unquestioned superiority the fruits of its enlightenment could be rapidly and successfully transplanted in alien soil, was widespread. District officers, who noted with approval the simple fact of vast acres coming under cultivation owing to the stimulus of the canal, subscribed to it. So did officials in the higher reaches of the Secretariat, where peace and public works were believed a priori to bring the only tangible and therefore secure prosperity.

This opinion, which some might call a prejudice, was not backed by any comprehensive scheme for remedying the lamentable defects in indigenous techniques. Plans for "vertically integrated" agricultural improvement were not—and could not be—developed in the context in which the provinces' administrators found themselves. They had to balance the powerful expediencies of revenue and commerce at every turn; they were buffeted by gusts of disapproval from the Supreme Government in Calcutta or in London; and they were haunted by the nightmare of political upheaval should they disturb unawares the agrarian society whose loyalty was so precariously secured. Hence it is understandable that problems of ecological imbalance were discussed in engineering terms, with no more than piecemeal consideration for

\textsuperscript{184}McMinn, \textit{Introduction}, p. 192. His attitudes did not change but reappeared in full vehemence in his \textit{Famine Truths}, published thirty years later (1902) and containing, \textit{inter alia}, a spirited denunciation of the assertions of R. C. Dutt to the effect that British rule was a major cause, in its land revenue policy, of India's poverty.
the social issues involved. The question of narrowing the gaps between better and worse cultivation, where attempts at solutions would have involved direct interference by Government in the affairs of the rural population, was seldom raised in administrative circles.

In 1870, after much insistence by the Viceroy, Lord Mayo, a Department of Agriculture was finally set up as part of the central administration of the Government of India at Calcutta. This might at first be taken as clear evidence that Government has serious intentions of coming to grips with the problems of agricultural improvement. Lord Mayo himself, alone of the viceroys of India, boasted of years of practical experience in agricultural affairs: "many the day have I stood the livelong day in the market selling my beasts." Before his appointment, he had indeed been a farmer—of an extensive estate appropriate to the means and the station of a prosperous Irish gentleman. Previous to Lord Mayo's time, "the attention of the Government had been chiefly directed to collecting the revenue, and little had been done to develop agricultural resources; more energy had been applied to shearing the sheep than to feeding him. Lord Mayo, as an expert, understood the fatal consequences of such a policy . . . ." and he had ideas, certainly, as to what might be done by an agricultural department. As Sir John Strachey noted later with pride:

The objects which Lord Mayo had in view were distinctly sketched in the Despatch of 6th April, 1870. The new department [its title is significant: Revenue, Agriculture and Commerce] "was to take cognizance of all matters affecting the practical improvement and development of the agricultural resources of the country," but its operations were not to be confined solely to this object. The administration of the land revenue and cognate matters, the development of mineral resources, of manufacturing industries, and generally of commerce and trade of the country, were to come within its scope, while among its most important functions was to be the collection of agricultural and commercial statistics . . . The programme was accepted with little modification by the Secretary of State.\footnote{For the career of the Earl of Mayo, see W. W. Hunter, \textit{A Life of the Earl of Mayo}. On Mayo in the context of classical economics and administrative policy, see Black, "Economic Policy," \textit{Economic History Review}, 2nd ser., xxi, 2 (August 1968), pp. 321–336.}

\footnote{W. Wedderburn, \textit{Hume}, p. 27. The creation of the Department of Agriculture could not bring about a reversal of this policy.}

\footnote{J. Strachey, "Minute on the Measures Necessary for Carrying out in the NWP the Objects with Which the Department of Revenue, Agriculture and Commerce Was Organized," para. 1, in NWP, "Revenue Proceedings," December 1874, Index No. 42, December 5, 1874, Proceeding No. 58. For the full text of the "Minute," see \textit{Indian Agriculturist}, June 1, 1877, pp. 164–166.}
What Strachey did not make clear was that substantial modifications had in fact already been agreed to by Mayo, under duress. His original plan had been for a "real working Agricultural Bureau; he was forced to content himself with the miscellaneous department of the Secretariat which was all the India Office would give him." The department was doomed to ineffectiveness from the start, sandwiched between the two massive pillars of Revenue and Commerce. It collapsed finally in 1879 under the combined weight of interminable restrictions on its activity "in the field," insufficiency of funds and lack of staff, and the unremitting pressures applied by the India Office. Its nine-year history of frustrations was chronicled by its first Director, A. O. Hume, in *Agricultural Reform in India*, which was published on his 'retirement' from Government service in 1879.

In 1874, a subsidiary department was set up in the NWP with the same objects in view. Its programme was ambitious:

the collection and organization of agricultural and commercial statistics ...; to direct experiments for agricultural improvements in model farms and elsewhere; to watch and report on the progress of trade, and to suggest in what directions it may be developed, or hindrance to its prosperity removed; to investigate facts connected with the condition of the agricultural classes, and generally to be the executive agency by which the local Government may carry into effect, in these provinces, the intentions of the Government of India, when the department was founded.

The provision for staff for the newly created department—a director and his assistant (both European officers), and a number of "native" clerks—could hardly inspire confidence in its capacity to perform the monumental tasks Sir John Strachey's minute envisaged, nor could the size and itemization of the department's annual budgets. In 1887, for example, when the department had been in operation for thirteen years, the total "agricultural expenditure" for the NWP for that year was accounted at Rs. 101,400. Of this, the cost in salaries and wages for the director and his subordinate staff came to Rs. 62,000; experimental farms took a further Rs. 12,400; well-sinking—through-

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139For details of the career of A. O. Hume, Bengal Civil Service, advocate of the introduction of capitalist farming in India and founder of the Indian National Congress, see Wedderburn, *Hume*.

140Strachey, "Minute" (cited above, n. 137), para. 3.

141Compare the relatively grandiose revenue establishments for each district—and the burden of work assigned to them; see pp. 235 ff. below.
out the provinces—took some Rs. 7,000; and reh experiments, chiefly in Aligarh, took Rs. 20,000.\textsuperscript{142} That year, 1886-87, the land revenue receipts stood at Rs. 42,587,917—99.4 percent of the demand.\textsuperscript{143}

With such authority and resources as Government allowed it, the department could do little other than follow meekly in the steps of precedent as far as agricultural improvements were concerned. But precedent was obviously deficient, as Knight’s \textit{Indian Agriculturist} announced with its usual candour:

Where or when has any systematic attempt been earnestly made under British rule to insure good husbandry; or indeed improvements of any kind in the way of obtaining supplies of food? It is true that some measures have been taken with reference to cotton-growing; but these seemed framed more for benefitting the foreigner than the native; or in other words, more for furthering the growth of the article of commerce in preference to that of the food needed for the support of the actual cultivator and producer of it.\textsuperscript{144}

Such experiments with agricultural staples—for export—as had been made prior to the department’s coming into being had not been conspicuously successful. The distribution of New Orleans cotton seed amongst zamindars in Banda district in 1861 to coax them into bigger and better production was an unqualified failure.\textsuperscript{145} All experiments with foreign cottons tended to meet more or less the same fate.\textsuperscript{146} The cultivation of indigenous strains also ran up against difficulties which prevented the vast increase in cotton production from developing as officials and entrepreneurs had once hoped. Apart from the vulnerability of the plant to disorders whichhardier crops might survive, the chief restrictions on the spread of cultivation on a par with, say, sugar cane was the extreme fluctuation in demand—both in India and abroad. The enormous impetus to cotton-growing created in 1860-61 by the American Civil War ceased as abruptly as it had developed.\textsuperscript{147}

\textsuperscript{142}Finance Department, \textit{Report of the Finance Commissioner}, 1887, pp. 581-583.

\textsuperscript{143}\textit{NWP Revenue Administration Report}, 1886-87, pp. 5-6. For the land revenue, demand, collections, and balances, NWP and Oudh, 1864-65 to 1884-85, and 1885-86 to 1899-1900, see Figures 7, 8, and 9.

\textsuperscript{144}\textit{Indian Agriculturist}, April 1, 1876, pp. 100-101, at p. 100.

\textsuperscript{145}\textit{NWP, “Revenue Proceedings,”} August 10, 1861, Index No. 56, Proceeding No. 37.


\textsuperscript{147}For a concise account of the Indian cotton boom, see Landes, \textit{Bankers and Pashas}, pp. 69-74. For further details on the cotton boom and NWP agriculture, see pp. 178-179 below.
Meanwhile, the complications arising from the distribution of Manchester yarn and piece goods created a norm of instability on the home market.\textsuperscript{148}

Experiments with imported varieties of food grains—again for export—fared little better. For example, in 1869 Carolina rice seed was distributed to zamindars in certain districts of the NWP selected on grounds of prosperity and influence (Rohilkhand and Jhansi divisions alone were not represented); this, the most extensive experiment of its kind yet tried in the provinces, was a total failure.\textsuperscript{149} Nonetheless, Government persisted, and in 1872-73 the same experiment was repeated, with nothing more than poor results obtained in any area and failure in the majority of samples.\textsuperscript{150} The same was the case with wheat experiments. Rs. 100 worth of the “best white” wheat from Jubbulpore—some 122 maunds—was imported by the department in 1876. The experiments ran into difficulties because the seeds had not been thoroughly cleaned (part of the wheat had been grown mixed with peas and barley in Jubbulpore) and because the rabi season was unusually damp. The seed proved, in addition, to be ill-adapted to canal-irrigated land. The result, in sum, was failure once again.\textsuperscript{151} The next year’s experiments in improving the quality of wheat failed likewise.\textsuperscript{152}

The failures were not confined to those samples distributed to zamindars. Attempts at the improvement of agricultural staples of this kind were also made on model farms established for this purpose in the districts of Allahabad, Cawnpore, and Bulandshahr.\textsuperscript{153} They met with a similar fate. Even Sir John Strachey was compelled to express a measure of disappointment: “There can ... be no doubt that the farms have hitherto [up to 1874] failed to effect much good, in consequence of the absence of any responsible controlling authority.”\textsuperscript{154} The chronicle of the model farms is for the most part a gloomy

\textsuperscript{148}For an outline history of Manchester cotton interests in India, see A. W. Silver, \textit{Manchester Men}.

\textsuperscript{149}NWP, “Revenue Proceedings,” April 2, 1870, Index No. 3, Proceeding No. 19.

\textsuperscript{150}\textit{Ibid.}, September 1873, Index No. 20, September 13, 1873, Proceeding No. 3.


\textsuperscript{152}\textit{Ibid.}, pp. 190–193.

\textsuperscript{153}For a discussion on the advisability of the establishment of model farms to promote agricultural improvements, see Government of India, “Famine Proceedings,” December 1873, Appendix A, pp. 1–17.

\textsuperscript{154}Strachey, “Minute” (cited above, n. 137), para. 7.
record of wasted and irrelevant expenditure. The current working expenses of the Cawnpore farm for 1873, for example, came to Rs. 5,982. This did not include the superintendent’s pay nor make any allowances for interest, or wear and tear of machinery (which totalled an additional Rs. 820 on Rs. 8,286 worth of fixed capital). Receipts from the sale of the farm’s produce came to Rs. 2,384. Ricketts, then Commissioner of Allahabad Division, demolished the pretention that the farm was a useful institution and pressed for its abolition. The area on which this expenditure was concentrated was seventeen acres of garden, not farm land. Moreover, the farm represented a departure from other forms of rural expenditure by the administration in that the procedures practised there lay beyond the reach even of the prosperous:

No native farmer, however well off he may be, or however enterprising, can hope in his own land to attain anything like the success that has been attained occasionally in experiments conducted under this farm. He sees at a glance that the conditions of the farm and his own fields are so different, that the results attained in the farm are beyond his reach. He sees there ... an unlimited supply of water, manure, costly implements, machinery, labour and supervision, and capital—that, in fact, field produce is treated as garden produce and he knows that this cannot be done on a large scale; he sees through the experiments at once, and resolves not to imitate what he has seen.  

Peasant conservatism. Government’s orders were, however, that the farm was to be maintained, but not on a large or expensive scale; the larger part of the land was to be devoted to the cultivation of shrubs and flowers, and a good native gardener was to be employed.

By 1886-87, as we have seen, some Rs. 12,000 was budgeted for expenditure on experimental farms thus modified and, by this time, largely confined to Cawnpore; the farm in Bulandshahr had been abolished in the mid-1870s, and experiments at Allahabad were even more restricted than those at Cawnpore owing to the absence of irrigation.

A wider area for judicious experiment lay, theoretically, in the

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184 G.H.M. Ricketts to Government, NWP, September 30, 1873, in NWP, “Revenue Proceedings,” November 1873, Index No. 38, November 15, 1873, Proceeding No. 24. For the report on the Cawnpore experimental farm by the Collector (C. J. Daniell), see ibid., Index No. 39, November 15, 1873, Proceeding No. 25.

185 Government Order, NWP, ibid., Index No. 37, September 27, 1873, Proceeding No. 85

186 Report on the Administration of the Department of Agriculture and Commerce,
estates of insolvent proprietary families which came under the hard-bargaining management of the Court of Wards. The prospect for developments within the estates was not exactly unlimited. The management’s priorities were to work the estate back into revenue-paying health and at the same time to keep relations between the proprietor (and his “agent”—the Government manager) and cultivators as near to the status quo as possible during the period of temporary caretakership, which ensured that any improvements introduced would be of the peripheral variety. Nonetheless, the temporarily captive Court-of-Wards estates presented Government with its clearest opportunity to state the official view on “the role of the State as regards agriculture”:

We cannot, it is true, force civilization, or any of her handmaids, on any people; but it is possible, by patience and tact, if we do ourselves possess the knowledge, so to put before all we deal with, good and evil in any matter, that many shall inevitably choose the good: and this is all that our supposed State intervention in agriculture has ever aimed at. We advocate no system of State agriculture, we do not propose to cultivate the people’s land for them, but only by careful study of local conditions, and by the application, with suitable modifications, of methods thoroughly approved elsewhere, to evolve improvements in the indigenous practice; and so put these before all interested in such questions that they may realize their full scope and verify them for themselves...

If this be not an appropriate and legitimate undertaking for the more enlightened rulers of a less enlightened nation, we must abandon all scientific conceptions of the functions of a Government thus situated.

What better area for the application of enlightenment could be found than the Awa estate? Although in size it was but “a scarcely perceptible speck on our vast empire . . ., it is none the less fairly typical as regards soil, climate, population and agricultural condition, generally, of more than half of the NWP (to say nothing of other parts of the country). Tentative measures now (and hereafter, as experience is gained, to be) proposed for Awa, will be equally applicable to enormous tracts yielding a land revenue of several millions sterling . . .”


168 Strachey, “Minute” (cited above, n. 137), para. 8.
160 Ibid., para, 10.
Awa had an additional feature to recommend it as an area for experiment. It was situated in part of an enormous reh-infested tract, not far from pargana Sikandra Rao in the neighbouring district of Aligarh where the Agricultural Department’s reh statistics were to be collected under Government instructions. The director’s proposals for using this wealth of opportunity were approved by the Board of Revenue and the Lieutenant-Governor of the provinces as showing due practicality and foresight with the required amount of caution. Expenditure was budgeted in two parts. The estate administration would cope with charges amounting to approximately Rs. 14,000 for arboriculture, survey, drainage operations, wells, and the purchase of cattle. Expenditure by the Agricultural Department was to be of the order of Rs. 5,000. This was to include the cost of improved implements (ploughs and sugar mills) and cattle, the collection of village statistics, and, most important, the improvement of staple produce. But which staples? The director’s listing may be summarized as follows:

Wheat? Doubtful if it will live in competition with the American trade in ordinary years; may be rejected as one of the principal crops for experiment.
Indigo? Has received almost all the improvement possible by indigo planters.
Linseed? For flax? Cultivation too empirical as yet to attempt to try it except at the Government’s experimental farm.
Safflower? Trade declining; not worth attention.
Rice? Can never form a large NWP export.

“We are therefore almost confined,” Buck concluded, “to cotton and sugar.”

Small wonder that the Court-of-Wards estates proved only marginally superior as experimental grounds to the model farms. Year after year, the estates’ managers reported on their improvements: the installation and repair of tanks and indigo vats; experiments with staples—chiefly cotton and wheat; cattle-breeding; experiments of almost academic interest with costly implements and installations such as elaborate masonry wells. The question of the applicability

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162Ibid., para. 43.
163Ibid., Appendix A, paras. 2–3, Index No. 3, Proceeding No. 23.
of the experiments to their environment was asked afterwards more often than before. All the while the managers were enjoined to bear in mind the necessity of caution in introducing new staples or novel methods, "recognizing the suspicious nature of the people." Small wonder that in 1880, Sir George Couper reiterated familiar statements of the pioneering 1860s: "Barely on the threshold, as we still are, of the great work of improving native agriculture, it would be idle to suppose that we can as yet fully appreciate all that is required, or that our designs—however carefully conceived—will always be successful. The most that is possible is to feel our way cautiously, collecting and classifying facts, and making modest attempts to advance whenever openings appear to present themselves."

Even in the (relatively rare) cases where Government-sponsored experiments in improved agriculture were successful, problems arose as regards their diffusion amongst the rural population. Cultivators were indeed persuaded by a variety of incentives to produce "valuable" crops, and lamentable though this might be when viewing the declining production of coarse food grains, it was certainly desirable that the better methods of production of "valuable" crops should be encouraged. How could this be done, practically speaking, over so vast an area with such limited resources for encouragement? There were even obstructions by other aspects of Government, aside from its caution in promoting improvements wholesale. Chief among these was the fiscal system itself. Once more the Indian Agriculturist lost no time in clarifying this issue:

The Indian Government, by placing the three most valuable and powerful mineral manures so largely extant in this great empire under the lock and key of the excise (namely, salt, nitrate of potash and nitrate of soda) has virtually rendered improvements in agriculture, and the production of large crops of grain of the best quality, an impossibility. Hence as nitrate of potash, or saltpetre or nitrate of soda may not be freely manufactured from saline soils, for fear of illicit culinary salt being made on the sly, we have to look to England, Europe and Egypt to supply our wants . . .

Transport costs alone on such bulky imports made a regular supply of mineral manures out of the question.

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184 For accounts of the experiments on the estates, see *NWP Court of Wards Reports*, annually, from 1879–80, Appendix C or D (Improvements).
186 *Indian Agriculturist*, March 1, 1876, pp. 61–63, at p. 62.
The lack of adequate means for widespread improvement was paralleled by the lack of any agency for instruction. Who could inform the peasants of the provinces of newly developed techniques? The overworked revenue officers did not act as agricultural advisers. The Department of Agriculture itself could do little beyond collating data at its Allahabad office from such sources as the revenue administration made available. In 1886, D. M. Smeaton, then the Director, formed an Agricultural Association of eighty-six selected influential zamindars, who were appointed his honorary assistants. As with the extension of irrigation by minor distributaries, the encouragement to re-plant tracts stripped of trees, and the dispensation of special experimental seeds, now the “diffusion of agricultural science” was entrusted to the detectably powerful among the zamindars of the provinces.\textsuperscript{167}

This at least was in accordance with the improvements themselves, which were to remain firmly in the luxury class. Hume had already noted the apparent poverty of indigenous technology and the disproportionately grandiose nature of European-imported machinery that was suggested as the corrective.

Improvements \ldots are urgently called for, but they have yet to be created, and this not by the bodily importation of the results achieved by science in Europe, but by the application of the principles on which those results are based to the widely different conditions and requirements of this country. Of these, the people who pester the Government to purchase grand combined steam ploughing, reaping and threshing machines for the ryots here, seem to have about as accurate a conception as a certain Maharajah, who was with difficulty dissuaded from sending home an elephant to an old pensioner at Bayswater (who complained of being no longer able to get about on foot and being too poor to keep a conveyance) had of those of our London suburbs.\textsuperscript{168}

Experiment with complex machinery, however, proved irresistible. Yearly, from 1882-83, the Government of India published a list of agricultural implements tested, and found useful, on the experimental farms. Most items were of labour-saving design and high initial capital cost; many were for use on large farms; a few were of some direct practicality—such as light-weight ironshare ploughs—but the problems of distributing them among the peasants put a prior restriction on the number produced. Some were frankly absurd, such as the Kewani

\textsuperscript{167}On the formation of the Agricultural Association, NWP, in 1886, and its first meeting, at Cawnpoore, on April 15, see NWP and Oudh, “Revenue Proceedings,” May 1886, File No. 941, Proceeding No. 3, Serial No. 4.

\textsuperscript{168}Hume, Agricultural Reform, pp. 52–53.
windmill, which was procurable in the U.S.A. at a cost of Rs. 299.4.3. Its special advantages were said to be its continuous action without requiring attention and its dependence on the wind for motor power. The report went on to state, however, that its action was in fact known to be irregular; it might perhaps be worked from a reservoir, but it could not apparently stand the rush of a dust storm and "may not be working when water is most required." Most notable of all was the Banda steam plough "affair" of 1882. The spread of kans grass, a seasonal phenomenon that was aggravated by long periods of drought, could not be dealt with by indigenous implements; the cultivators were accustomed to abandoning kans land, to return after a few seasons as the kans withered. The regular revenue demand under the revised settlement put an end to this sporadic mode of cultivation; if the land was made liable to pay according to each season's fixed assessment, it had to be cultivated each season. The appearance of kans, however, made cultivation literally impossible—and therefore necessitated remissions of the revenue demand. The loss to Government account, and the intractability of the kans grass (its roots were sometimes all of forty feet in length and were supplied with a complex water-storage system enabling the plant to grow undetected in the subsoil over long periods) seemed to call for a mechanized remedy—the subject of a long and detailed correspondence in the "Revenue Proceedings." A steam plough, the latest development in English agricultural machinery, was imported for the purpose of getting rid of the kans. Its capital cost, to the Government, was Rs. 42,304.12.3. To this was added the cost of maintenance, amounting by the end of 1881 to Rs. 9,220.11.6. The cost of further maintenance would, it was estimated, come to another Rs. 6,000 if wood were used for fuel, or Rs. 9,000 if coal were used. There were additional problems: where the plough was located, wood was very scarce; and there was proved to be no superiority in a steam as against a bullock-drawn, "native" plough for newly broken-up land, which deprived the new machine a priori of any subsequent use. Access to fuel was difficult, and the bill disturbing. Meanwhile, when the plough reached Banda, the kans had disappeared. Government had no alternative but to order the machinery, the cost of which had already amounted to approximately Rs. 51,500 (equal to nearly

189 See Revenue and Agriculture Department, List of Agricultural Implements, 1882-83. No catalogue seems to exist of machines tested and judged inefficient.
one-half of the annual budget for the Agricultural Department),
to be broken up for sale as spare parts.\textsuperscript{170}

Nowhere was the irrelevance of improvements on which Government
chose to spend with such comparative lavishness more clearly
demonstrated than in the case of the Agricultural Shows. These were
held from time to time (chiefly at Bulandshahr and Allahabad)
in the best traditions of English capitalist farming. Ricketts, Collector
of Allahabad in 1865, described how the shows were promoted by
Government "to induce the Natives to attempt to improve their
ancient methods of cultivation and to breed superior stock." In the
same note, he also described the reaction of "an intelligent and
observing Native" to the Government's efforts:

What does he see? English machinery of most costly kinds; steam-ploughs
and threshing-machines, which will be of no use here until the plough-
bullock rises in price to £40, or the cooly's wages rise to 14s. a week, and corn
at English prices—English ploughs which his cattle cannot draw, and which
break when used (as at Lucknow) in this hard soil, and which he cannot
mend—and weeding machines which he can never want, for he has cheap and
abundant weeding power in the women and children of his village; and in
cattle he sees the pampered favourites of some amateur or Native Chief, which
have cost ten times their value to feed, and which he sees at once are no use
to a poor man, for he cannot feed them—and he retires to his village and
says, these English do not understand his great want; he will dispense with
all their machinery if they will simply give him help to make wells, and
place the water within his reach . . .\textsuperscript{171}

In Ricketts' view, such assistance was now needed more urgently
than before: deforestation of the Lower Doab plains, he asserted,
was contributing to a conspicuous increase in the occurrence of
droughts and unfavourable seasons. But by what means could "these
English" (that is, Government) help the cultivator to keep the soil
supplied with the requisite moisture? Ricketts pressed for takavi loans
(advances from public funds) to cope with the problem—he was,
in his own words, "advocating what, though in reality is an old

\textsuperscript{170}For the correspondence relating to the Banda steam plough, see NWP and
Oudh, "Revenue Proceedings," April 1882, Index Nos. 10–20, pp. 41–57. For a
description of such a steam plough, a prize-winning machine manufactured by John
Fowler—Fowler's Patent Steam-Ploughing Apparatus—see M. Partridge, \textit{Early

\textsuperscript{171}G. H. M. Ricketts to Commissioner, Allahabad, January 9, 1865, in NWP,
"Revenue Proceedings," May 6, 1865, Index No. 8, February 18, 1865, Proceeding
No. 23.
system, is new to most of those in Government employ in these Pro-
vincial, where it seems to have grown obsolete." Only one of Ricketts'
staff had any practical acquaintance with the takavi system, and his
knowledge was very limited.\textsuperscript{172}

Takavi loans were indeed an "old system," dating back to pre-
Mughal times. Revenue officials’ advances of cash from the treasury
or their own resources to cultivators for the purchase of seed and
plough cattle and the digging of wells were first recorded in the
fourteenth century. By Mughal times (the sixteenth and seventeenth
centuries), takavi had become commonplace.\textsuperscript{173} It constituted a
regular means of supply for cultivators and a regular means by which
the lenders could increase their claim to the produce of each harvest
(official dues plus repayment charges) and their control over the
producers. Takavi was in fact an integral part of revenue administra-
tion.\textsuperscript{174} We have already seen how the Begam Sumroo utilized it
over a twenty-year period, greatly to her advantage.\textsuperscript{175}

The early years of British rule in the NWP saw the principle of
takavi officially recognized in revenue regulations of 1793, 1795,
1803, and 1805.\textsuperscript{176} Rules for the administration of the loans were
later drawn up and included in the official manual, \textit{Directions for
Collectors of Land Revenue}.\textsuperscript{177} There is evidence that in at least one
district in the first three decades of the century, takavi loans were
in fact made extensively: Moradabad was said to have been pro-
pering rapidly as early as the 1820s, and much of its sudden rise
(its state at the time of the British conquest was one of abject poverty)
was attributed to lavish amounts of takavi.\textsuperscript{178} "Advances seem to
have been made with a liberality which is unknown now," E. B.
Alexander noted wistfully fifty years later, at the time of settlement
revision, "large sums, amounting in some cases to as much as a lakh

\textsuperscript{172}Ibid.

\textsuperscript{173}I. Habib, "Usury in Medieval India," \textit{Comparative Studies in Society and History},
VI (1963), 396-397. See also Habib, \textit{Agrarian System}, pp. 253-255.

\textsuperscript{174}For a late nineteenth-century summary account of this "State action in India in ... assisting the supply of agricultural capital," see A. H. Harington, "Economic

\textsuperscript{175}See pp. 48-49 above.

\textsuperscript{176}Bengal Regulation XXXIII 1793, extended to Benares Province by Regulation
XLVI, 1795, to the Ceded Provinces by Regulation XXIV, 1803, and to the Con-
quered Provinces by Regulation VIII, 1805.

\textsuperscript{177}\textit{Directions for Collectors of Land Revenue}, paras. 46-47; Appendix V, paras. 245-249.

\textsuperscript{178}Moradabad Settlement Report, p. 16.
[Rs. 100,000] being spent in encouraging sugar-cane or in purchasing seed and cattle for distressed cultivators."

Such liberality vanished with the growing concern of officialdom for security and the consequent increase in elaborate procedure to protect it in its dealings with the rural populace. As early as 1861, it was clearly recognized that advances were restricted to the construction and repair of "works of permanent utility," such as the more expensive types of well, and to renovations to tank bunds (embankments). A period of three, four, or five years maximum was stipulated for repayment; if the work for which the advance was specifically made were not completed by the date officially stipulated, the whole advance with 12 percent interest was to be recovered forthwith. Even in its truncated form, takavi remained the only official source from which agriculturists might seek assistance for improvements. Efforts were persistently made by district officers to widen the range of takavi grants—witness the strenuous pleadings of Ricketts—but these were frustrated with equal persistence by procedural obstacles. The shortcomings of Government policy as regards takavi were most conspicuous in poorly endowed districts. From Jhansi, E. G. Jenkinson urged Government to increase takavi loans for the repair of old and the construction of new works to develop local irrigation by wells and tanks—targets within the limited range of official sanction for the loans. Some Rs. 17,492 had been distributed among eighty-one villages between 1864 and 1866, but "Much more might be done and many old bunds which zamindars are most anxious to repair might be repaired," Jenkinson wrote, "if Government would consent to relax the rule regarding the term of years within which takavi advances are repayable." In the NWP, no provision for takavi advances was made in the Budget. It was therefore thought inadvisable to grant advances which are repayable by instalments extending over a longer period than five years. Yet, by the same token, it was surely unwise to allow a "mere question of procedure to retard the improvement of a district and prevent the construction of so many useful works": the term for repayment should be extended—but it remained unchanged.

179Ibid., p. 15.
181Jhansi Settlement Report, p. 72.
182Ibid., p. 73.
Advances for the purchase of seed were restricted to times of scarcity, and district officials were instructed to disburse them with great caution. In July 1868, a confidential circular was issued to magistrates and collectors, drawing attention to cases of "hardship and distress demanding Government interposition": where fields had been extensively sown but the seed had failed to germinate owing to the drought, high prices for seed corn were making it difficult for cultivators to find a second supply. "To supply seed under such circumstances," the circular warned, "is a duty in the first instance devolving on the landlord; and ordinarily it may be safely left in his hands." Government might intervene only where the zamindars were poor and, more especially, where the cultivators of an estate were the "proprietary community" of zamindars themselves. Even in these cases, the matter was hedged about with procedural restrictions. The magistrate and collector of the district was required to submit an application for the exact amount of takavi estimated necessary to the Board of Revenue in Allahabad. Where distress was reported to be general, he could apply further to the board for a lump sum based on an approximate estimate. Only where it had become clear that the harvest could be saved by immediate action could the magistrate and collector bypass the board's office for the time being and make the necessary advance, "in anticipation of sanction."  

Such advances as were made went to those in a position and with the time and money to apply for them: powerful local maliks, or Government acting on their behalf in the case of Court-of-Wards estates. In 1870, the officiating collector of Allahabad announced proudly that large takavi advances had been made in his district: some Rs. 28,044.8.0. All of it went to "principal landholders, that aid might be afforded to the poorer classes on their estates" through the construction of irrigation works: Rs. 19,845 to the Raja of Manda's estates under Court-of-Wards management by the collector; Rs. 3,150 to the Raja of Dhya; Rs. 1,000 to the talukdar of Burokhur ...  

Reviewing the takavi situation in 1870, the Governor-General—Lord Mayo himself—made it plain that for some time past he had been "satisfied that measures might be taken with great advantage, in many parts of India, for extending and improving the system of giving

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183Circular 8 A (Confidential), July 14, 1868, in NWP, "Revenue Proceedings," August 8, 1868, Index No. 13, July 18, 1868, Proceeding No. 62.

assistance to proprietors of land for the construction of permanent works of agricultural improvement . . . The Government has always, if not by extensive practice, at least by its legislation, recognized the duty which, in this country, devolves upon it of giving advances of public money for the promotion of agricultural improvements . . .”

This duty appealed to the Governor-General. Security was watertight since the land on which the improvement was to be made was declared by law to be liable for the repayment of advances ("they may be recovered by the same processes as are applicable to the recovery of land revenue arrears"). What was more, the takavi system was in principle "identical with that which has been carried out in the United Kingdom, with admirable results, by means of the Land Improvement Acts." What was needed for India's agriculture, therefore, was to consolidate and amend the law on takavi, to bring the system into line with present-day circumstances:

No sounder or more useful principle could be acted upon by a Government which desires to make the resources of the State available for the promotion of wealth or improvement of the people. There is perhaps no country in the world in which the State has so immediate and direct a need in such questions. The Government of India is not only a Government, but the chief landlord. The land revenue, which yields 20 millions of our annual income, is derived from that portion of the rent which belongs to the State and not to individual proprietors. There can be no doubt that throughout the greater part of India, every measure which can be taken for the improvement of the land, and for increasing its productive powers, immediately enhances the value of property of the State and adds ultimately to the public resources without the imposition of any fresh burden on any class of the community . . .

The following year, a bill embodying these principles was made law: the Land Improvement Act, XXVI of 1871, "to consolidate and amend the law relating to advances of money by the Government for agricultural improvements." But the gap between principle and practice was not closed, as became clear with the re-appearance of the scarcity spectre. In 1874, an alarm of famine went up in Jaunpur on the failure of the chief staple food grain, rice. Failure of the crop was matched by near-failure of the takavi machinery to provide assistance. "The Board permitted small takavi advances to be given,”

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168 Government of India (Home Department), to Government, NWP, June 2, 1870, in NWP, “Revenue Proceedings,” December 3, 1870, Index No. 1, June 18, 1870, Proceeding No. 56.

169 Ibid.
Ricketts commented, "but the grant was, on the whole, quite homeopathic, and it was homeopathically administered, for some advances were as low as four annas." The codification of takavi regulations had perpetuated rather than relaxed restrictions on their use. In 1873, the official rules for the administration of loans under the Land Improvement Act had been published by the lieutenant-governor of the provinces, with the previous sanction of the governor-general. Government was well-protected from any danger of over-hasty expenditure. Applications for takavi were to be made by landlords, or by tenants with the consent of the landlord. They were to be written, and on stamped paper. They were to be presented in open court by the applicant in person, or another authorized by him. Each application was to include, besides the applicant's name, profession, parentage, tribe or caste, and residence, the exact amount applied for and whether it was to supplement any private capital and, if so, to what extent; a description of the proposed work and an estimate of its cost were to be attached, together with details of the position, character, and area of the land and the village and revenue subdivision in which it was situated. Applicants were required to state the advantages expected to result from the work and its anticipated effect on adjacent or other lands. The nature of the applicant's rights or interests in the land or in any other land offered as security for repayment had to be made plain. The amount and number of instalments for repayment, and the security offered, were also to be stipulated. Where the advance exceeded Rs. 500, a rough plan and estimate were to be submitted with the application; where the advance exceeded Rs. 5,000, an accurate plan, with specifications and estimates, was required. This was merely the beginning. A local enquiry was to be held into every application, conducted by the revenue officials on their tours and, in the case of applications for more than Rs. 500, by the chief revenue officer of the district. Officers were required to publish notice of the proposed work and the proposed date of the

187 NWP Revenue Administration Report, 1873–74, p. 6. Though rumours of a widespread "famine" proved unfounded, the loss of the rice crop remained an established fact.


189 "Notification" (cited above, n. 188), § iv.

190 Ibid., § v.
enquiry; the notice had to be read by the principal inhabitants of the village, and a copy was to be signed by the village headman, an accountant, a policeman, "or other local officials or respectable inhabitants." The remaining rules (there were thirty in all) stipulated the procedure for investigation and for certification of such works as the local enquiry proved bona fide and allowed to proceed. A seven-year period was fixed for repayment, unless special sanction of Government were obtained, for advances not exceeding Rs. 500. The period for advances above this sum was twelve years (the larger the work, the farther it was removed from the needs of cultivators but the more generous were the terms of assistance). In case of any proposed period for repayment exceeding twenty years, the Government of India's sanction had to be obtained. Lastly, the interest charged on advances was 6.25 percent, to be altered as Government saw fit.

Subsequent notifications made no fundamental alterations in these rules, with the result that the procedural obstacles to widespread use of takavi remained in full force. In the course of an official enquiry into the working of the Land Improvement Act made during 1875, R. M. Lind, then Commissioner of Meerut Division, pointed out that the act had done nothing to solve the basic problem: the need for assistance remained undeniably greater amongst those classes of the peasantry designated as "tenants" than amongst their masters, the landlords, but tenants were in no position to ask Government for advances for the construction of such works as the act contemplated. Their wants were seed and plough bullocks: where could assistance be found to provide these under the provisions of the act, which could serve the interests only of the landlords? Statistical statements compiled for the enquiry proved this to be the case. Of Rs. 26,322.12.0, the total sum advanced under the act to date, Rs. 24,293.8.0 went to landlords. The remaining Rs. 2,029.4.0 was distributed to some fifty-two tenant applicants throughout the provinces.

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181 Ibid., § ix.
182 Ibid., §§ xxiv, xxx.
183 For details of tenancy categories in the later nineteenth century, see pp. 152 ff. below and Appendix 8.
conclusions on the evidence of the enquiry, the Board of Revenue could not but agree that “the class who have most availed themselves of the Act are the landlords”—a conclusion to which they were themselves resigned: “This is only what was to be expected.”

The takavi situation changed little throughout the last quarter of the century. Later enactments—the Northern India Takavi Act, X of 1879, repealed by the Agriculturalists’ Loans Act, XII of 1884—did extend the scope for Government loans, but the old rules remained in force, effectively barring access to the majority of cultivators. For “smallholders,” the qualification for assistance was still “distress.” Advances for seed and cattle were made only during scarcity years; all were of course recoverable with interest. In 1891, Voelcker noted the wisdom of Government proposals to make loans available locally for well-digging:

The plan is an excellent one; but its success depends entirely upon how it is worked, and how nearly it is brought home to the people, and is adapted to their means. What is still requisite is, to make it clear to the cultivators that the system is one that will benefit them, one that will enable them to benefit themselves. If this idea could be once thoroughly grasped, the advantages not alone to the people, but to the Government, in the form of an increased revenue from the land, would be very great.

This was precisely the situation as Mayo had seen it, twenty years before.

It is hardly surprising, therefore, that throughout the period takavi loans should have borne the small proportion to the collections of land revenue year by year which the official statistics indicate. “If what has been done be compared with what might be done [by way of takavi], the discrepancy is startling,” commented the anonymous contributor of the series of papers “Oudh and Optimism” to Knight’s Indian Economist in 1874. Oudh figures were typical for the provinces as a whole. In 1868-69, Rs. 115,667 had been advanced under the pressure of the severe drought of that year for “improvements.”

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196 Ibid., board’s review of commissioners’ reports.
197 See, for example, “Report on the Scarcity and Relief Operations, NWP and Oudh, 1877-78, 1879,” p. 12, in NWP and Oudh, “Revenue Proceedings,” December 1880, Index Nos. 2–3, November 6, 1880, Proceeding No. 11; ibid., December 4, Proceeding No. 2. See also Government of India, “Famine Proceedings,” September 1880, Proceeding No. 1; ibid., October 1880, Proceeding No. 2. Loans to small holders were approved in principle, provided “adequate security” was offered.
198 Voelcker, Report, para. 107, p. 85.
199 “Oudh and Optimism,” Indian Economist, October 31, 1874, pp. 61–64.
which represented barely $\frac{1}{111}$ of the land revenue of the year. It fell steadily during the succeeding years until it reached the "contemptible sum" in 1872-73 of Rs. 16,523. In 1874, whilst the land-revenue demand had risen by the equivalent in rupees of £200,000, a little more than $\frac{1}{900}$ of the total collection was returned as takavi advances.  

In all, who could benefit from this piecemeal "development" of the provinces? In densely populated districts where the canal and railway companies had been most active, the land itself had paid a heavy price for the expansion in cultivation and communications which the public works had stimulated. Cultivators in canal-irrigated areas paid charges for the new facilities twice each season: water rates to Government and illegal dues to the subordinate canal establishment appointed by Government to record and collect its rates; zamindars paid, in addition to their owner’s rates (from 1873), indirect charges in the form of an increased revenue demand. Where railways cut through arable land, cultivators and zamindars had to face *inter alia* the consequences of increasing deforestation. Remedial action by Government was consistently frustrated by its unwillingness to expend on projects promising little or nothing by way of immediate returns. Government’s attempts at technical improvements on a small scale, in line with the best of contemporary farming practice in Britain, were too far removed from the millions of small cultivators and their needs to be in any sense efficacious. Meanwhile, the small cultivators’ notorious lack of resources persisted. Their own means and methods proved consistently inadequate to increase the productivity of their holdings to the extent desired by Government. Charges levied by their social superiors and the increasing cost even of necessities such as fuel and fodder deprived them of opportunities to lay up reserves over the seasons. Lastly, they could find little assistance from the only source remaining beyond the malik or the money-lender: Government. The history of takavi outlined above exhibits in itself the insoluble problems which confronted Government from the introduction of improvement schemes which, although with the means to hand, could not be adequately adapted to the physical, let alone the

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200 *Ibid.*, at p. 63. For the amount of takavi advanced annually in the NWP and Oudh, 1871–72 to 1899–1900, see Figure 6 (statistics before 1871–72 are not available). Compare the revenue demand, collections, and balances, 1864–65 to 1884–85 (by divisions), Figures 7 and 8, and 1885–86 to 1899–1900 (provincial aggregates), Figure 9.
social, environment of the provinces. Only that minority of the rural population already in a position of prosperity and sufficient power to maintain some independence of action had access to the benefits of innovation.