

EAST INDIA: (PROGRESS AND CONDITION).

STATEMENT

EXISTING.

MORAL AND MATERIAL PROGRESS AND CONDITION

INDIA,

DURING THE YEAR 1871-72.

(PRINTED PURSUANT TO ACT OF PARLIAMENT.)

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## P R E F A C E.

In the Act of Parliament constituting the Secretary of State and Council of India, it is provided that an account of the state of Indian finances shall be presented to Parliament within 14 days, during which Parliament may be sitting, next after the 1st May; and that "such account shall be accompanied by a statement prepared from detailed reports from each Presidency and District in India, in such form as shall exhibit the moral and material progress and condition of India in each such Presidency."

From 1858 to 1865 the voluminous administration reports, prepared by the several Governments since 1854, were presented to Parliament, in the form in which they arrived from India, without arrangement or condensation. It was found that this way of complying with the requirements of the Act failed to secure the objects contemplated by the framers of the clause, which were, that a report on the progress of India should be annually furnished in a convenient and manageable form, supplying all necessary information, and adapted for future reference. It was, therefore, determined that, in future, statements should be prepared at the India Office, based on the administration reports and other information received from India, but in a conveniently condensed form.

The first statement of this kind was for the year 1864-65. The subject was treated under the different departmental heads of revenue, finance, public works, legislation, judicature and police, education, emigration, agriculture, sanitary measures, municipalities, ecclesiastical establishments, native states, army, marine, and miscellaneous. The same arrangement was followed in the statements for 1865-66 and 1866-67, though the subjects were not treated exactly in the same order, and some additional headings were introduced. But in 1867-68 a different arrangement was adopted, and continued in the statements for 1868-69; 1869-70 and 1870-71. Instead of treating the subject under the several departmental heads, a general account was given of the proceedings of each local government, and various miscellaneous matters and events were recorded in an introductory section. In two out of the three last statements, outline maps have been given, showing the political divisions and boundaries of each local government to face the eight different headings.

The present statement has been arranged on a different plan. It has been thought that the most useful form that such a document can take, is one by which an inquirer may obtain, by the perusal of one section, a general but correct knowledge of what has taken place during the year under review, in connection with any subject in which he may be interested. A knowledge is required, not so much of the general proceedings of the different local governments, as of the progress that has been made throughout British India in improving the condition of the people, and in providing for their moral and material wants. In commencing a new series, it has been found necessary, in treating of subjects such as land revenue, irrigation, and some others, to give a concise account of the previous history of administrative measures connected with them, so that, during the perusal of future statements similarly arranged, there may be ready means of reference to a fuller account of any measure or undertaking, the yearly progress of which may be recorded. The present plan provides a place for every subject or section of a subject, and so long as it is closely adhered to in future statements, the progress under any given head may be traced through the different years without any trouble.

The whole subject of the moral and material progress and condition of India is arranged in 15 sections, each treating of a department of administration which is complete in itself, and under one or other of these heads every measure and every event will naturally find its place. The full details of the arrangement will be seen from the accompanying Analytical Table of Contents, which has been inserted for facility of reference.

The statement itself is, to a certain degree, based on the Administration Reports issued by the different provinces. In the case of financial statistics, the figures given in the Parliamentary Paper entitled Finance and Revenue Accounts of the Government of India for the year 1871-72, have been strictly adhered to; and in trade statistics the figures shown in the annual statements of trade and navigation, compiled in the different presidencies, have been adopted.

The same orthography of proper names has been adopted as is now sanctioned by the Government of India. Those who advocate different systems of spelling will never agree, but no one can doubt the serious inconvenience of many different ways of spelling the same word. Dr. Hunter's system of orthography is based upon that of Sir William Jones. It has been adopted by the Supreme Government, in legislation, in maps by the Superintendent of the Great Trigonometrical Survey, in the Post Office Guides, in the Telegraph Department, in the almanacs, and by several newspapers, as well as by the Punjab and Bombay Governments. It is thus making its way into general use. It has always been the system in use by the Asiatic and other learned Societies. Its adoption for the new Gazetteers has received the sanction of the Secretary of State in Council. It is, therefore, adhered to as closely as possible in the present statement.\*

An attempt has been made to illustrate some of the subjects by the use of a map of India of convenient size repeated as often as may be required, according to the subject to be illustrated. A forest map shows the reserved and unreserved forests and the plantations, as well as the localities where the principal timber trees grow. One map, to illustrate the irrigation section, is tinted so as to show the amount of rainfall over the various zones, and the irrigation works themselves are shown on three maps on a larger scale. The map showing communications gives the lines of railway and electric telegraph, the different harbours and the lighthouses. Another map gives the political boundaries of native and border states, and another shows the distribution of troops. Plans showing Karáchi Harbour, the Pamban Passage, and Calcutta and Bombay Harbour defences, are also given. The Trigonometrical and the Geological Surveys of India are also illustrated.

CLEMENTS R. MARKHAM,

\*Dr. Hunter's rules are as follows:—

Short *a* (as in the second syllable of *tartan*) to be expressed by *a*.

” *u* (as in *but*) also to be expressed by *a*.

Long *a* (as in the first syllable of *tartan*) to be expressed by *á*.

” *á* (as in *say*) to be expressed by *e*.

*u* or *oo* (as in *food*) to be expressed by *ú*.

*i* (as in *fit*) to be expressed by *í*.

*i* or *ee* (as in *police* or *meet*) to be expressed by *í*.

*i* (as in *ride*) to be expressed by *ai*.

*ow* or *ou* (as in *crowd* or *cloud*) to be expressed by *au*.

All names which have acquired an absolute fixity of spelling, from historical or popular usage, such as Calcutta, or Bombay, are to be left untouched; except that when such names end in *nagor*, *nagore*, or *nuggur*, the termination *nagar* is to be uniformly used, and *pur* is always to be adhered to in place of *para* or *poor*.

The rule of the Great Trigonometrical Survey is as follows:—

“Rules for pronouncing Indian proper names: *a* has a variable sound, as in *woman*, *rural*, *paltry*; *á* as in *tartan*; *í* as in *clique*; *í* as in *ravine*; *u* as in *bull*; *ú* as in *rural*; *o* as in *note*; *e* as *a* in *say*; *au* as *ou* in *cloud*; *ai* as *i* in *ride*; *g* as in *gong*; *abud* as *ábád*; *basar* as *bázár*. Exceptions to spelling by rule are indicated thus \*Calcutta, \*Calicut, &c.”

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## S T A T E M E N T

EXHIBITING THE

## MORAL AND MATERIAL PROGRESS AND CONDITION OF INDIA

DURING THE YEAR 1871-72.

## I.—ADMINISTRATION AND LEGISLATION.

THE year 1871-72 was the last in the administrations of the late Governor General, and of the Governors of both the minor Presidencies. A record of its events, therefore, forms the concluding chapter of Lord Mayo's administration, while it is an introduction to that of Lord Northbrook. Year 1871-72.

In the autumn of 1871, Lord Mayo had made a tour through part of the Punjab, and in January 1872 he proceeded on his fatal voyage to Rangún and the Andaman Islands. The assassination of this able and popular Viceroy was a great calamity; and the social grief and feeling of public loss, in Calcutta and throughout India, were overwhelming. His murderer was a mountaineer, of a bloody race, from the Khaibar country, who was actuated merely by his own savage passion for revenge on those who had punished him for his crimes. There is no trace whatever of his having received any communication from India, or of his having been in any degree a political tool; and his act was probably unprompted by religious feeling. Thus, Lord Mayo fell while in the performance of a dangerous duty, as a general might fall in battle under a chance shot. The crime was devoid of all political significance. Death of Lord Mayo.

Lord Napier, the Governor of Madras, proceeded to Calcutta to assume the office of Governor General on the 19th of February 1872; and Lord Northbrook arrived at Calcutta on the 3rd of May. Lord Mayo presided over the affairs of India during the whole of the year under review, except the last two months; Lord Napier was Governor of Madras during the same period, and Sir Seymour Fitzgerald was Governor of Bombay. Lord Hobart assumed the governorship of Madras on 15th May, and Sir Philip Wodehouse that of Bombay on 7th May 1872. Thus, the new rulers of all three Presidencies commenced their periods of office in the same month of the same year, a coincidence that has never before occurred in the history of British India. Arrival of Lord Northbrook, Lord Hobart, and Sir P. Wodehouse.

On the other hand, 1871-72 is the first year of the administration of Mr. (now Sir George) Campbell, the Lieutenant Governor of Bengal, who succeeded Sir William Grey on 1st March 1871; and of Mr. R. H. Davies, the Lieutenant Governor of the Punjab, the melancholy accident which caused the death of Sir Henry Durand having taken place on the 31st December 1870. Sir William Muir became Lieutenant Governor of the North West Provinces on the 7th March 1868. Colonel Keatinge was Acting Commissioner of the Central Provinces during 1871-72; and Sir George Couper, Sir W. Merewether, and Mr. Eden, of Oudh, Sind, and British Burma. Lieutenant Governors and Commissioners.

The Legislative Council of the Governor General passed 21 Acts, the most important of which were the Act to amend the law regulating advances of money. Legislation.

ADMINISTRATION  
AND  
LEGISLATION.

money by Government for agricultural improvements, and the Indian Evidence Act. Four Acts were also passed with special reference to the administration of the Punjab. By a Resolution of the Government, dated 14th December 1870, which will be more fully referred to in another section, the independent administration of certain branches of expenditure was left to the local governments, and Acts XVIII. and XX. of 1871 enable the Lieutenant Governors of the North West Provinces and the Punjab to levy rates on land, not exceeding five per cent. in the former territory, and about three per cent. in the latter, on the annual value of an estate, the funds so raised to be spent in the districts which provide them, under the direction of local committees. Act XXX. of 1871 was passed for the regulation of drainage, irrigation, and navigation in the Punjab. One of its main features was a clause authorising, under certain conditions, the imposition of a water rate on lands near canals, which were irrigable but not irrigated. This clause was, however, disallowed by the Secretary of State. Act XXXIII. of 1871 consolidates and defines the law relating to the settlement and collection of land revenue in the Punjab; and Act IV. of 1872 removes a mass of regulations and orders which are no longer necessary, or which have been superseded by later Acts. Act XXIV. of 1871 prohibits municipalities from borrowing, except with the sanction of the Government, but enables them to apply to local governments for a loan, by pledging the proceeds of any rate or tax they may be entitled to levy, as security for payment. Act XXVII., for the registration of criminal tribes, will be noticed in the section on police.

**Bengal legislation.** The Legislative Council of the Bengal Government has been very active, and the Lieutenant Governor bears testimony to its success and usefulness. It is composed partly of official and partly of non-official members; but there is no one upon it who directly represents the feelings and interests of the lower classes. Besides numerous enactments for the improvement of Calcutta, it passed an Act for taking the census, a district road cess Act, and an Act to protect the Jagannath pilgrims, and to appoint a health officer at Puri, whose duty it will be to enforce sanitary regulations when great masses of pilgrims are assembled.

Madras legis-  
lation.

The Madras Legislative Council passed two Acts, one to enable Government to levy an excise duty on salt, and another for the protection of the Madras pier. A Bill was also introduced for the better regulation of the police.

Bombay legis-  
lation.

Five Acts were passed by the Bombay Legislative Council, having reference to the affairs of the city municipality.

Department of  
revenue, agri-  
culture, and  
commerce.

The most useful administrative measure introduced by Lord Mayo during the year 1871-72 was the creation of a new department in the Government of India to deal with all subjects connected with revenue, agriculture, and commerce. The want of such a department had been the direct cause of much loss and waste, and of numerous mistakes in times past, in consequence of the special subjects belonging to it being scattered in various departments, and not being considered as any one's business. Yet these very subjects are the most important with which the Government has to deal. On the wise and judicious treatment of them absolutely depends the material welfare of the people, and the fruitfulness of the various branches of the revenue. Lord Mayo and the majority of his Council felt that more systematic measures should be taken for securing the improvement and development of the agriculture, commerce, and industrial arts of India; and that closer attention should be given to the great products which constitute the staples of agricultural and manufacturing industry and of export trade. Agriculture, in India, is susceptible of almost indefinite improvement; while the future development of Indian commerce depends on the quantity and quality of existing staples, and on the introduction of new products. Scientific knowledge of agriculture has, at present, no existence in India. The cultivation of the quinine-yielding chinchona plant, of cotton, coffee, tea, indigo, rhea, and jute fibres, and other products, needs the intelligent and watchful care of a central department; as do all measures for improving the breeds of horses and cattle, for introducing new products, for regulating fisheries, and for promoting agricultural instruction. Lord Mayo's Government, therefore, came to the conclusion that a separate department should be formed for the care of these great interests, and to take cognizance of all matters affecting the practical improvement and development of the agricultural

agricultural resources of the country, and the administration of the land revenue, the forests, commerce, mines, surveys, and industrial arts.

Lord Mayo's proposal was favourably received by the Home Government. The Secretary of State considered that the Finance Minister should be a minister of control only, separated from the actual administration of any branch of the revenue. He thought that the work of the new department would increase as the natural result of special attention being devoted to many branches of administration which had hitherto been more or less neglected. It was anticipated that the local governments would, as a rule, originate improvements and reforms, and that the new department would make the valuable experience, locally gained, subservient to the interests and welfare of the whole empire. Formerly great attention was paid to audit, to trifling retrenchment, and to clipping; now the far wider and more important duty of watching the sources and development of the revenue, and of ascertaining how it may be increased, and how best the welfare of the people may be promoted, will also receive its due share of attention.

L  
ADMINISTRATION  
AND  
LEGISLATION.

Department  
sanctioned by the  
Secretary of State.

The Department of Revenue, Agriculture, and Commerce was constituted by a Resolution of the Government of India, dated 6th June 1871, and Mr. A. O. Hume, C.B., was appointed its first secretary. It has charge of all questions relating to land revenue and settlements, to Government advances for works of agricultural improvement, to agriculture and horticulture, to studs and cattle breeding, to silks and fibres, to forests, to commerce and trade, to customs, salt, opium, excise, and stamps, and to industrial arts. The department also has under its charge the census, the gazetteers and collection of statistics, and the surveys, including geology and meteorology. Its establishment has only entailed an additional expenditure of under 2,000*l.* a year, and its usefulness has already become apparent. Subjects of vital importance to the people of India that were formerly neglected, or treated in separate departments, which was almost worse, will now receive constant and careful attention and supervision. Lord Mayo hoped and expected that in due time the local governments would form similar departments for the same purposes, and that this wise and statesmanlike measure would thus bear fruit. On the 29th of December 1871 Mr. H. Rivett Carnac, who had previously been Cotton Commissioner in the Central Provinces, was attached to the new department of revenue, agriculture, and commerce, as "Commissioner of Cotton and Commerce with the Government of India." It was considered desirable that the duty of collecting and arranging on a systematic plan the statistics of the trade of British India, and of reporting thereon, should be entrusted to a single officer; he will be supplied by the railway officials and the local governments with all the traffic and trade returns that can be made available.

Constitution of  
new department.

Commissioner of  
Cotton and  
Commerce.

In close connection with the new department is the Statistical Survey of India, of which Dr. W. W. Hunter was appointed Director General in October 1871. The object of Dr. Hunter's appointment is to introduce systematic arrangements for collecting accurate statistical material, to act as a central guiding authority to the local collectors of information, to take steps to ensure uniformity in their operations, and hereafter to consolidate provincial reports in a general gazetteer of India.

Statistical survey.

Dr. Hunter's work on Orissa forms the first fruit of the statistical survey, which is the largest of the kind that any single government has ever yet attempted. It deals with a population exceeding 240,000,000, split up into 50 different races, speaking a great variety of languages, and representing very diverse stages of human society. But Dr. Hunter succeeds to a vast accumulation of materials collected during the last 100 years. The Court of Directors encouraged researches into their territories, and between 1807 and 1813 they expended 30,000*l.* on a statistical examination of part of Bengal alone. But there has hitherto been no central organization for bringing such local researches to a common focus. Materials are buried in different offices, unavailable either to the public or to the Government. The survey of Bengal, just alluded to, was stored away in the India House in 50 folio volumes of maps and manuscripts without being touched. Dr. Hunter's first duty has been to collate and utilize already existing materials, and to supplement their deficiencies. His plan is to distribute the work as much as possible, and at the same time to secure uniformity and punctuality in the results by means of a central editor.

Dr. Hunter.

## ADMINISTRATIVE REFORMS IN BENGAL.

### I. ADMINISTRATION AND LEGISLATION.

A set of leading questions has been issued by the Director General showing exactly what is required, and reducing the work of the local officers to the minimum. The returns will gather together all the essential characteristics of the empire, district by district, exhibiting them in a skeleton form; but nevertheless in a form which under skilful treatment may be clothed with life and human interest.

#### Final work of statistical survey.

The final operation of the statistical survey will be to work up the whole, and to compile a connected account of each district from the returns. These provincial accounts will be condensed by the Director General into an Imperial Statistical Account of India.

#### Results of sta- tistical survey.

This survey forms an epoch in the history of statistical enterprises, and its practical results will be most important. Until the Government knows more about the real facts of the country, and the actual condition and requirements of its inhabitants, it will never obtain more than a half success in its efforts to render the people happier and more prosperous.

#### Orthography of Native Names.

The Government of India, with the approval of the Secretary of State, has adopted a uniform system of orthography for the purposes of the statistical survey, and for official use generally. The system is based on that of Sir William Jones, but a certain freedom is allowed in spelling names which have become familiar to the public, and Dr. Hunter has himself prepared a guide to the orthography of Indian proper names, as an illustration of the principles sanctioned. An official list of towns, geographical divisions, and natural features such as rivers, mountains, &c., is in course of preparation.

#### Two administra- tive measures of Lord Mayo.

Thus the two great administrative measures of the last year of Lord Mayo's Government were the formation of a department of revenue, agriculture, and commerce under Mr. Hume, and of a statistical survey of India under Dr. Hunter.

#### Administrative reform in Bengal.

The Lieutenant Governor of Bengal has also been very active in re-organizing the administrative machinery of his provinces. He found no reliable, or even approximately reliable, information available regarding the area of land under cultivation, the prevailing rent rates, the area sown with different crops, which districts produce more grain than they consume, which hoard grain, which export it. He felt that, in case of famine, he could not tell whence the deficiencies of the famine tract could be best supplied. He saw the necessity for governing more actively, for a change from a less seeking of information to a greater seeking of information; and he maintained that it was the duty of an administrator to obtain and classify detailed information, and not merely to set up courts of justice, keep the peace, and dispose of matters which force themselves on the attention of Government.

#### Bengal Board of Revenue.

His first changes were in the procedure of the Board of Revenue. Formerly the Board disposed of land revenue and other questions. Sir George Campbell ordered that they should all be submitted to him for final sanction. Instead of the two members sitting as a Board as heretofore, he placed one in separate charge of land revenue, and the other of salt, opium, customs, excise, income tax, and stamps; and he considers that the efficiency of the executive administration has been much improved by the arrangement. Another great reform has been the reduction of the enormous quantity of reports and returns which used to be sent in by heads of departments. Each head is now ordered to analyze and digest the returns into one, and in that form to submit them to the Government.

#### Bengal magistrate- collectors.

Sir George Campbell has also made a change in the districts, by concentrating more power in the hands of the magistrate-collectors. He has been anxious to give them a stronger controlling power over all the departments in their districts, for he holds that departments are excellent servants but bad masters. The collector will thus be the real executive chief and administrator, over every one and everything except the proceedings of courts of justice. Thus the police have been made more entirely subordinate to the magistrates, the gaols have been placed under their general control, as well as the public works. In most parts of India, except Bengal, there is a native executive establishment which is extremely useful in many ways, under an officer called a tahsildar in the Upper Provinces, and a mamlutdar in Bombay. These officers see to the assessment and expenditure of local rates, look after the excise, manage sequestered estates, arrange for the passage of troops, carry out local works and repairs, and obtain statistics.



statistics. Sir George Campbell is desirous of giving some such executive establishment to the district officers in Bengal. He would institute a native civil service on a wider basis, and thus supply a want which, in his opinion, impairs the efficiency of administration in the Lower Provinces.

Municipal institutions, in India, were, in their present form, the creation of our Government, and are quite distinct from the old village communities. Municipalities were first formed for the three presidency towns. In Calcutta the municipality consists of the justices and a chairman named by Government. Its expenditure amounts to 250,000 *l.*, and the taxation is levied in the form of lighting, police, water, and general rates on all owners and occupiers, besides license fees for carriages, horses, and carts, and license tax on trades and professions. The Calcutta municipality already has a debt of 1,400,000 *l.*, and a sinking fund for paying off the loans. Great improvements have been effected, especially as regards drainage and water supply. In Madras the receipts of the municipality are 57,134 *l.*, and there is a debt of 101,957 *l.*, being money borrowed for completing the water supply project. The municipal funds are applied to education, hospitals, vaccination, and other objects of public utility, and on experiments to utilize sewage for agricultural purposes, which have been very successful. In the town of Bombay there was to be a general revision of the assessment in 1872, which has not been made since 1866. The expenditure was 379,760 *l.* for 1871, being an excess over the receipts, and the means of meeting it, and of restoring what was due to the sinking fund for repayment of loans, were supplied by a loan of 150,000 *l.* The survey of the town of Bombay has been completed.

Municipalities.

Calcutta.

Madras.

Bombay.

Except in the presidency towns, municipal institutions only date from 1850. It is true that an Act was passed in 1842 empowering inhabitants of towns to form municipalities, but it proved ineffectual for the purpose, and the existing municipal institutions are based on Acts XXVI. of 1850, XX. of 1856, and VI. of 1868.

Municipal  
institutions.

If the people of a town expressed a desire to that effect, the Government was empowered to order Act XXVI. of 1850 to be put in force. A certain number of inhabitants were then appointed as Commissioners for defining the taxes to be raised for the purposes of the Act, for applying them in payment of officers and servants, for the execution of works for the improvement of the town, and for other expenses. This Act is now in force in very few places. Act XX. of 1856 was passed for the maintenance of police chaukidars, and may have effect in every town to which the local government may extend it by notification. The magistrate is then to determine the number of police to be maintained, and the sum to be annually raised, which is to be either an assessment according to the property of the persons liable, or a rate on houses and grounds not exceeding five per cent. of their annual value. In each town brought under the provisions of the Act, the magistrate is to appoint a punchayat or committee, consisting of three or five inhabitants, whose duties are to apportion the rate; but the police are appointed by the magistrate. The surplus, after paying the wages of the police, may be devoted to the purposes of cleaning or lighting the town, or to other improvements. Act VI. of 1868 may be extended, by Government notification, to any town, when the provisions of Act XXVI. of 1850, and XX. of 1856 are to cease to have effect. The police rate is fixed at *Rs.* 1. 8. a year for each house; and the municipal tax is limited to *Rs.* 2. 4. for each house. The proceeds are to constitute a town fund, under the control of the magistrate. This fund is to be applied to the support of the police, construction and maintenance of roads, the general improvement of the town, vaccination, and dispensaries. A town committee is to be formed of not less than five inhabitants, and, if necessary, subordinate ward committees. These committees are to be nominated by the magistrate unless orders are given for their appointment in some other way, and one-third are to be officials; they are empowered to elect their own chairman, and a third of the members are to retire each year. Their duties are to consult and advise with the magistrate on the assessment and expenditure of the town funds. If the Government appoints the magistrate to be the chairman of a town committee it becomes a corporation, and the committee itself receives magisterial powers. In the Punjab, Act XXVI. of 1850 has ceased to be operative, and all municipalities are under Act XV. of 1867, re-

Act XXVI. of  
1850.

Act XX. of 1856.

Act VI. of 1868.

Act XV. of 1867.

renewed

I.  
ADMINISTRATION  
AND  
LEGISLATION.

newed by Act II. of 1872. By it, the towns where it is in force are administered by a committee which must consist of five members, but which is invariably much larger. These committees are divided into three classes, with graduated powers of expenditure; those of the first class expending the town funds on objects authorised by the Act, without a control beyond a Government audit of accounts; those of the second class only expending sums without sanction, up to 200 £, while all proceedings of those of the third class are subject to confirmation.

Application of  
Municipal Acts.

These Acts, it will be seen, render municipal institutions compulsory, when the Government sees fit to introduce them into any town. The Act VI. of 1868 applies to large cities, the older Act, XXVI. of 1850, to smaller towns, and Act XX. of 1856, called the Chaukidari Act, to groups of villages and very small towns.

Municipalities in  
Bengal.

Excluding Calcutta, the municipal taxation in Bengal amounts to 110,000 £. The complaint chiefly is that power is too much monopolised by the magistrate, and that municipalities have not sufficient real self-government and vitality. The Lieutenant Governor considered that the existing municipal Acts differ in their scope from each other; and in the Municipal Bill which was passed by the Bengal Council in 1871-72, an attempt has been made to weld these Acts together, and to regulate the whole subject of municipal administration and taxation. But the Bill failed to receive the sanction of the Viceroy. In Bengal there are 25 large towns with municipal institutions under a local Act (III. of 1864), 91 smaller towns under another local Act (VI. of 1868), and 65 under the Chaukidari Act. The Act XXVI. of 1850 is only in force at Jamalpur, in Monghir.

Municipalities in  
the North West  
Provinces.

In the North West Provinces there are 67 municipalities under Act VI. of 1868; and, in many cases, the two-thirds of the committees, which are not official, are elected by popular suffrage. A few have magisterial powers under the Act. Their income, in 1871-72, was 180,402 £, raised by the *octroi* impost, the tax on houses, one on professions and trades, and a tax on carriages and horses. The *octroi* duty forms by far the largest item of the municipal funds in the North West Provinces, the Punjab, and Oudh. It is levied on food, fuel, building materials, piece goods, and metals entering the town (Government property, salt, opium, and articles liable to customs duty, except piece goods and metals, and exciseable liquors being exempt); and so long as it does not become a transit duty, there is no taxation less unpleasantly felt or more profitable. There are also 275 towns under the Chaukidari Act, where the assessments are made under the orders of the magistrates, but the details are worked out by a punchayat, or committee of the inhabitants. The collections, under this Act, amounted to 33,261 £, most of which was absorbed by the pay of the police, but the surplus was applied to local improvements.

*Octroi* duties.

Punjab municipi-  
palities.

In the Punjab, the municipal committees, as has just been explained, are divided into three classes. There are seven of the first class, Delhi, Murri, Lahor, Amritsar, and the three hill sanatoria; 19 of the second, and 103 of the third class. There are also 195 small towns administered by a magistrate in conjunction with a punchayat, which are practically in the third class. The municipal income was 175,839 £, five-sixths of which was derived from the *octroi* duty. Election is confined to two or three of the municipalities of the most important towns. In Oudh there are 17 towns under municipal control; but the committees are all nominated by Government officials.

Oudh Muni-  
cipalities.

Madras and  
Mysor.  
Madras Municipal  
Act.

In the Madras Presidency there are 46 municipal towns, and in Mysor 10. By the Madras Municipal Act (III. of 1871), not less than three inhabitants are appointed by the Governor in Council, as Commissioners, in any town brought under its operation, to carry out its purposes, to continue in office three years; and the collector is *ex officio* Commissioner in every municipal town in his district. It is provided that the Government, if thought advisable, may arrange for the election of a certain number of the Commissioners by the ratepayers. The funds are to be expended on the repair and maintenance of streets and bridges, diffusion of education, and on hospitals, dispensaries, choultries, markets, tanks, and wells. The Commissioners may levy a rate on the annual value of houses and lands, a tax on arts, professions, trades, and callings, on carriages and horses, and tolls.

There

There are 168 municipalities\* in the Bombay Presidency, besides 54 in Sind. They are constituted under the provisions of an Act to enable improvements to be made in towns (XXVI. of 1850), but it is generally admitted that the time has come for its amendment; a Bill for that purpose is now under consideration. Many towns systematically evade the burden of municipal government, while it has been introduced into others which are so small as to render its working impracticable. The most important municipalities are Súrat, with a revenue of nearly 50,000*l.*; Pána, Ahmadabad, each with an income of 10,000*l.*; Pandharpur, Sholápur, Nariád, Bulsur, Násik, Ahmadnagar, Belgaum, Hubli, and Sátára, with incomes from 9,000*l.* to 2,000*l.*; and Karachi, with an income of 22,000*l.*; Haidarabad, Shikárpur, Sakkhar, and Lárhána, in Sind. The members of the municipal boards in Sind, except those who have seats *ex officio*, are elective. The principal municipal revenues are from *octroi* duties, which are said to be more popular than any other form of taxation.

In Burma municipal action is much needed, and funds are required at Rangún. That town has grown with extraordinary rapidity. When first occupied by the English it was in a low swamp under water at every rise of tide. Lands were sold, and the proceeds were directed to the purpose of raising the land, and laying out streets. The Lands Sale Fund is now exhausted. Meanwhile the town is spreading in every direction, and people are settling in swamps in the unreclaimed part. The population of Rangún is now 100,000, and 400,000 tons of shipping visit its port, yet the only water supply is from unwholesome wells; there is not a single drain except on the surface, and there are no public lamps.

The general habit of self-government is thus being gradually diffused throughout India. In some parts its development is more rapid and complete than in others; but everywhere it is beginning to have an effect upon the people. The privilege of electing their own managers of their local affairs from among their neighbours has been extended, in several instances, to the inhabitants of large towns in the North West Provinces, and in Sind. There is a provision in the Madras Act with the same object, but it does not appear to what extent it has been put into operation. In the Punjab the privilege of election has been very sparingly applied. But where there is no election there is local government through *puncháyats*, or boards composed of the inhabitants, so that throughout India the habit of self-government engendered by municipal institutions may be expected in course of time to have a marked effect on the inhabitants of towns, and through them on the mass of the people. The levy of rates for local purposes is quite in accordance with ancient usage. These town dues were called *chunghi* or "handful," implying that everything that passed had to pay a small contribution.

The year 1871-72 has thus been one of considerable activity as regards the introduction of improvements into the system of administration, especially on the part of the Supreme Government and that of Bengal, while much legislative work has also been done. The uses of the new department and of the statistical survey will be developed during ensuing years, but their labours already begin to yield good fruit.

\* According to the list in the Appendix to the Administration Report of 1871-72; but in the Report of 1870-71, the number is given at 201.

II.  
FINANCE.

II.—FINANCE.

Income.

THE income for 1871-72 amounted to 50,110,215*l.*; of which over 20,000,000*l.* was derived from land revenue, 9,000,000*l.* from sales of opium, nearly 6,000,000*l.* from the salt tax, over 7,000,000*l.* from customs, excise, and stamps, and the other 8,000,000*l.* from smaller items. The ordinary expenditure amounted to 46,996,038*l.* Tables showing the revenues and charges, and receipts and disbursements, and the items of revenue and expenditure, during the year 1871-72, will be found in the Appendix.

Expenditure.

Salt tax.

The main source of revenue is derived from the demand on land; but this is a branch of administration of such importance as to require treatment in a separate section. Next in importance comes the salt tax, a burden on the people, which, as long as it is moderate, simply acts as a capitation tax. The consumption of salt in India is greater, in proportion to other articles, than in any other part of the world. It is an absolute necessary of life, both for human beings and for cattle.

Bengal salt agencies.

The salt tax has always been raised on various systems, by the different local Governments. Until 1863 the districts on the sea board of the Bay of Bengal were divided into salt agencies. Advances were made to these agencies, and they agreed to manufacture and sell to the Government a certain quantity of salt at a certain rate. This salt was stored in Government warehouses until it was sold. The merchants paid the fixed price, including the duty, and received an order for the quantity required, upon a particular agency. The cost of each particular kind of salt was fixed each year by the Board of Revenue. The importation of foreign salt was also allowed, and it commenced in 1818, but there was no large importation until 1835. The custom dues were to maintain the average prices of Government sales. This Government monopoly was an artificial system of the worst kind, for the districts where the salt agencies were established were ill-adapted for the production of salt. The sea-water becomes diluted at the mouths of the Ganges and Brahmaputra; the salt cannot be evaporated by the sun's rays, and an expensive boiling process was necessary. In 1863 the Government resolved to abandon the system of manufacture altogether and to rely upon an excise, and upon the duty on imported salt. The consequence was that the production in Bengal ceased at once, and entirely. There was no excise on salt at all in the first year, after the abolition of the agencies, for there was no one who had sufficient capital to manufacture under the excise system. The price of salt fell 50 per cent. It was imported at 5 rupees per 100 maunds, having been manufactured at 100 rupees per 100 maunds. The chief importation is from England; but salt also comes from France, Madras, Bombay, Sind, and the Persian Gulf. In 1871-72 the quantity of salt imported into Bengal was 5,765,177 cwt. The Bengal duty is *Rs.* 3. 4 *s.* per maund, or about 1 *d.* per pound, and the amount raised, in 1871-72, was 2,578,134*l.* The average consumption of salt in Bengal, per head, is calculated by Mr. Campbell at 9½ lbs., or 50 lbs. a year for each household, the cost of which is about 6 *s.* 6 *d.* A ryot thus pays, for his salt, about 5 per cent. of his annual income. The native higher classes constantly point to an increase of the salt tax as a means of improving the revenue; but the Lieutenant Governor of Bengal recently declared that he would rather cut off his right hand than be a party to increasing the tax on a first necessary of the poor, which is already enormously high.

Abolition of the salt agencies.

Importation of salt into Bengal.

Bengal salt duty.

Consumption of salt in Bengal.

Salt supply in the North West Provinces.

Salt Customs line.

In the North West Provinces the salt supply is mainly derived from salt lakes in Rájputána. They overflow every rainy season, and on drying leave the salt in a thick incrustation. Formerly the duty was collected at various stations, scattered over the country. Afterwards the approach from the lakes was cut off by a long customs line which, before 1842, ran up the right bank of the Jamna until it joined the Himalayas, so as also to cut off the Lahore salt. Since that date the line has been turned from Delhi, across by Hissár to the Satlej, and since the annexation of the Punjab, down that river to its junction with the Indus. This exterior customs line was established in 1834. It is now 2,508 miles long; 10,800 officers and men are employed upon it, and the cost of its maintenance is 88,562*l.* It consists of a hedge, partly green, partly dry, and there are 242 miles of the barrier which is not supplied with a sufficient

cient hedge. The revenue from the salt line is 803,258*l.*; of which 414,501*l.* was collected in the North West Provinces, and 388,757*l.* in the Punjab. The duty on salt in the North West Provinces is three rupees per maund. Bengal imported salt very seldom comes up higher than Allahabad.

North West Provinces salt duty.

The Punjab salt supply is derived from the salt mines; and a customs line is also maintained down the Indus, to keep out the red salt of Pesháwar, 982 miles long. The income from salt in 1871-72 was 800,236*l.*, including that from the salt line, and the cost 78,490*l.* The duty is 3 rupees per maund.

Punjab salt mines and duty.

In Madras the salt revenue, since 1805, has been collected through a monopoly, the sale and manufacture being in the hands of the Government. Contracts are made with manufacturers at the different salt works for the quantity required for the year, which is then brought into store on the Government platforms and sold by measure. A sum of 40,000*l.* a year is paid to the French Government not to manufacture salt at Pondicherry, but to receive supplies from the British officials, and not to sell below the Government price. The price has been periodically raised, and it is now two rupees per maund. Without the duty the price would be two annas per maund, so that the duty is *Rs.* 1. 14. The net income from salt in 1871-72 was 1,153,425*l.*; the revenue having been increased by raising the price, but the increase of profit was considerably less than the degree in which the tax was augmented, and the sales have actually diminished. Lord Hobart is of opinion that the salt-tax has reached a point beyond which it ought not to be carried, and that further taxation would contract the consumption. It is proposed also to substitute an excise for the present monopoly, and an Act conferring powers to do so was passed in 1871. The consumption per head of the population in the Madras Presidency was calculated by Mr. Plowden at 15 lbs. a year. It has since been given at 12 lbs. a year.

Madras salt monopoly.

Madras salt duty.

Consumption of salt in Madras.

In the Bombay Presidency the excise system for salt was introduced in 1837. Previously the duty had been imposed partly as transit duty, partly as a monopoly price at the salt works, and partly as excise; but in 1837 a uniform plan was adopted. The Gujrát works, however, are Government property and a fixed price is paid to the makers. Elsewhere there is an excise on the manufacture, the makers taking out licenses to open works. Salt is exported to the Malabar coast and to Calcutta. A good deal is smuggled, and large quantities are made by solar evaporation in the Runn of Kach. In 1869 the Bombay duty was raised to *Rs.* 1. 14. The superintendence of the Bombay Salt Revenue has been removed from the Commissioner of Customs to a new officer styled Collector of Salt Revenue. In 1871-72 the excise duty on salt removed from the pans amounted to 591,321*l.*, and the duty on salt imported by sea only 26,325*l.* The other sources of salt income are, duty on salt imported by land 22,181*l.*, proprietary right in Government salt pans, ground rent from salt pans, and sale of smuggled salt, giving a total of 657,289*l.* for 1871-72.

Bombay salt excise.

Bombay salt duty.

In British Burma there is a duty on imported foreign salt, and an excise on that manufactured in the country. In 1871-72 the amount of European salt imported was 16,934 tons, and the net revenue 11,477*l.*

It will be seen that the salt tax varies in amount in the different provinces; that in Bengal it is *Rs.* 3. 4., in the North West Provinces and the Punjab 3 rupees, and in Madras and Bombay *Rs.* 1. 14. per maund.

Variations in salt duty.

The possibility of equalizing the duties has long been discussed. Lord Hobart is in favour of reducing the duties in Northern India to the level of Madras. Sir G. Campbell thinks that the tax is too high in the North West Provinces and those countries which are far from the sources of supply; he would equalize the rate all over India, except in the lower valley of the Ganges, where the land revenue is permanently settled, making it two rupees for the lower and three rupees for the higher duty. The subject, which is one of vast importance to millions of people in India, is likely to receive very careful consideration from Lord Northbrook's Government.

Proposed equalization of salt duties.

The net opium revenue for 1871-72 amounted to 7,657,213*l.*, the gross receipts being higher than in any previous year since 1855. This was due to the high price and to the small payments made to the cultivators owing to shortness of the crops. The opium is gathered in the early spring, manufactured and stored

Opium.

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- Opium sales in Bengal. in summer, and sold in the following year. In 1871-72 the number of chests sold was 49,695 at 139 l. per chest, which is 26 l. higher than the average price of the preceding year. The net profit on each chest was 90 l. The short opium crop of 1871 was caused by a peculiar blight, which was nearly absent in the crop of 1872, although drying winds and other causes again caused a short crop.
- Area under opium cultivation. The area under cultivation is increasing, and in 1871-72 was 560,000 acres in Bengal, and 608 in Bombay. It is a high class of cultivation, the land being specially attended to and manured; and a competent expert is employed by Government to watch the plant as grown by the cultivators, and to study the causes of and remedies for blight or other deterioration. There are two opium agencies; one at Patna for Bahar, and the other at Ghazipur for the North West Provinces and Oudh, and the agents enter into contracts with the cultivators and make advances for the supply of opium at a rate fixed to meet the market, precaution being taken that all the produce is sold to the Government.
- Opium agencies.
- Málwa opium. But opium is also grown in Málwa, in the Province of Central India, between Agra and Bombay. It can be grown more cheaply in Bahar, but the Málwa country is within the territory of native states, so that their free grown competes with our highly taxed opium. An administrative problem thus arose, which is analogous to that with reference to the unequal amount of the salt tax. It was necessary to put Málwa opium on an equality with that of Bahar and Benares, and to deprive it of the advantage it derived from being grown free of the monopoly in native states. This has been effected by levying a heavy duty on Málwa opium at Bombay, its sole legal port of export. (Up to 1842 the duty was only 125 rupees per chest, and the quantity of Málwa opium exported was equal to that from Bengal.) The object has since been to equalise the duty in two ways; first, by increasing the quantity and lowering the price of Bengal opium, and secondly, by raising the duty on Málwa opium; it is now 600 rupees per chest. The amount realised, on opium exported at Bombay, was 2,355,159 l. in 1871-72, levied on 39,225 chests, of which 37,979 came from Indor and 1,246 from Ahmadabad. The subject of abolishing the monopoly in Bengal, and of substituting a customs duty as at Bombay, has often been under the consideration of the Government of India, but is surrounded with enormous difficulties.
- Customs duties. After land revenue, salt, and opium, the next item of revenue is the custom duties, which yield nearly two millions and a half nett, exclusive of the importation of salt. In Bengal alone the land and sea customs net revenue in 1871-72 was 1,009,464 l., of which one quarter was for exports and three quarters for imports. Besides Calcutta, the ports are Chittagong, and ports in the Balasor, Cattack, and Puri districts. The largest item of import duty was on cotton manufactures, amounting to more than half a million; next come liquors, and then metals. Of the Bengal exports, more than half consists of rice; then follow oil seeds, indigo, and lac. The exportation of jute, cotton, silk, tea, saltpetre, and sugar is free. In Madras the net customs receipts amounted to 298,206 l., but the good harvests of the two previous years reduced the demand for rice and grain. Coconut oil was largely exported from Malabar, and much grain was dispatched from the same province to Arabia. The net customs receipts of Bombay reached to 602,729 l., being a decrease of over 50,000 l., said to have been caused by the effects of the war in Europe, and by the large export of spirits from bond, free of duty, to the Portuguese settlement of Damman, for importation to Súrat, in order to benefit by what is known as the Firmauni privilege. This privilege was granted to the Portuguese factory at Súrat by the Great Mogul in 1714, and has always been recognised by our Government. By it goods belonging to Portuguese subjects, and carried in Portuguese vessels, are subject only to 2½ per cent. duty on importation at Súrat, while the tariff rate is three rupees per gallon. A wide margin is thus left for profitable speculation. There has been a great increase in the export of grain from Sind.
- Bengal customs.
- Madras customs.
- Bombay customs.
- Burma customs. In British Burma the customs receipts have largely increased, and amounted in 1871-72 to 289,770 l. nett.
- Excise. The abkári, or excise duty on spirits, and the duty on stamps, are the items which come next to customs in importance. In Bengal the excise duties include spirits, intoxicating drugs and the proceeds of the retail sale of opium.

In 1871-72 the Bengal excise net revenue amounted to 723,949 *l.*, of which about 120,000 *l.* was from hemp, and 310,000 *l.* from opium, chiefly consumed in Assam. The hemp is produced in a limited area in the districts of Rájsháhí and Bogra, where it is cultivated in a skilful and scientific way. The duty on it has been so raised as that the consumption has become a third less than it was 15 years ago; and the revenue has been doubled. In certain districts of Bengal an experimental trial has been made of a plan for first fixing the number of spirit shops, and then leasing the retail licenses by auction. The object of this trial is, distinctly, to reduce the sale of intoxicating drinks, by raising the price and restricting the number of places of sale. Some steps have been taken for extending the cultivation of opium to the Punjab, by levying a tax of two rupees on each acre cultivated; but the attempt has not been very successful, 13,229 acres having been under cultivation in 1870-71, and only 6,225 in 1871-72. The Punjab licenses for the sale of spirits and drugs, as well as the sale proceeds of excise opium, in 1871-72, yielded a net sum of 83,649 *l.*; Madras, 553,791 *l.*; Oudh, 78,106 *l.*; and in Mysor and other provinces the abkári is a steadily increasing item. In the North West Provinces the excise takes three forms; a duty on the manufacture of country spirits, sale of opium, and farm of the right to retail drugs. The net excise revenue was 216,868 *l.*, being a considerable increase on the receipts of the preceding year.

The income tax has gradually lost more and more of its objectionable character by being levied more exclusively on high incomes. In 1870-71 the minimum of taxable income was 50 *l.*; in 1871-72 it was 75 *l.*; in 1872-73 it was raised to 100 *l.*: and now the tax is to be abolished altogether. It is doubtful whether an income tax could ever be properly assessed, unless it was continued and carefully worked out during a long series of years, and even then Sir George Campbell expresses a doubt whether it would ever serve as an effectual means of drawing a sufficient revenue from the untaxed upper classes. In Bengal there has been little complaint about the tax; and half the taxpayers of 1870-71 were exempted in 1871-72, in consequence of the minimum of taxable incomes having been raised. The taxable income of Bengal was calculated at 21 millions, of which 8 millions were derived from trades, 7 from land. In 1870-71 as many as 32,000 ryots and petty landholders were assessed; but in 1871-72, owing to the minimum being raised to incomes of 75 *l.*, there were none. This shows that no Bengal ryot has an income reaching to 75 *l.* a year. In the North West Provinces the demand on income tax was 79,174 *l.*; the total of incomes assessed being 8,229,510 *l.* There was much less objection to the tax in 1871-72 than in the previous year, only 16 per cent., instead of 65 per cent. The great objection to the tax, in the opinion of Sir William Muir, is that it destroys the influence and popularity of the district officers, and fosters suspicion and concealment on the part of the moneyed classes. In the Punjab the income tax receipts fell from 161,896 *l.* to 52,265 *l.*, the largest source being the salaries of Government servants. The Madras Government consider the income tax to be entirely unsuited to the circumstances of the country, and that it is retained at a cost to the community very disproportionate to its financial importance. In Bombay, 9,915 persons in trade were assessed as having incomes over 75 *l.* a year. The raising of the minimum taxable amount released 7,795 persons from the burden; and the yield fell from 37,600 in 1870-71 to 36,304 *l.* in 1871-72, from merchants, traders, house-owners, and landed proprietors. The number of public companies paying income tax was 53, yielding 13,004 *l.* In the whole Bombay Presidency 13,343 persons were assessed, in the following proportions. Of the European population, 39 per cent. was taxed; of the Parsees, 4 per cent.; while of the Hindus and Muhammadans, only a little over 1 per cent. The abolition of the income tax altogether, which has now been announced, will give universal satisfaction, although the raising of the minimum taxable income to 100 *l.* has removed all objections to it, on the score of its pressing hard upon the poorer classes.

A very important financial measure was adopted by Lord Mayo's government, which came into operation in 1871-72. Formerly, expenditure was completely centralised in the Supreme Government, by whom grants were made to the local governments, on detailed estimates showing the needs of each department. The local governments asked as much, and the central government gave as little, as possible. By a Resolution, dated 14th December 1870,

Transfer of certain heads of expenditure to the control of the local governments.

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certain heads of expenditure were transferred to the control of the local governments, with fixed annual grants to meet it. This grant amounts to the net assignments of the previous year for each head; a proportion of about 7 per cent. being deducted as a relief to the Imperial finances, and as representing a share of the burden to be charged upon local resources. The remainder was made over as a fixed annual income, the excess being defrayed at the cost of the province.

The heads, thus transferred, are jails, police, education, registration, medical services, printing, roads, civil buildings, and miscellaneous public improvements. This will undoubtedly prove to be a very beneficial measure. It will give the local governments a special interest in controlling expenditure on these heads, as well as in their efficient administration. The arrangement came into operation for the first time, during the year under review; but it appears that Bengal is the only province which has been able to make the assignment meet the expenditure on the heads placed under local control. Sir George Campbell has not found it necessary to impose fresh burdens on the people by local taxation. The assignment to the North West Provinces was 628,400 *l.* This has been found sufficient, except in the case of public works, where the expenditure exceeded the Imperial grant by 60,000 *l.* In the Punjab the arrangement came into operation on 1st April 1871; but the assignment was found to be insufficient, and in June of the same year, the Lieutenant Governor was empowered (Act XX. of 1871) to levy additional rates on the land not exceeding six pies per rupee on the annual value, to be expended under the control of local district committees. In the Central Provinces also, the assignment fell considerably short of the sum required for the support of the various departments transferred to local control.

Local taxation.

The question of local taxation has consequently required very careful consideration, and has received much attention from the local governments. It is beginning to press upon the people in various ways; through the municipal institutions, through the necessity for meeting the expenditure on heads transferred to the local governments, and through the general movement in the direction of improved administration. But the pressure is very unequal in the different provinces. Bengal, with a population of 64 millions, only raises 25 lakhs from local taxation; while the Punjab, with a population of 9½ millions, raises 29½ lakhs. Bombay, with a population of 13½ millions, raises 36½ lakhs; Madras, with a population of 30 millions, raises 47 lakhs; and the North West Provinces raises 53 lakhs, also with a population of 30 millions.

Bengal.

Punjab.

Thus the local taxation of Bengal, outside the presidency town, is extremely light as compared with that of the other provinces. There is a road cess and a small postal cess on Zemindars, in addition to municipal taxation. But in the Punjab the additional rate on land, already alluded to, has been imposed. It is called the new local rates cess, and has given rise to many complaints. It is represented, however, that the money is urgently needed for district works of importance, and that it is to be expended exclusively within the contributing districts.

Oudh.

Burma.

North West  
Provinces.

In Oudh also this local rates cess has caused much discontent; and its imposition is reported to be looked upon as a breach of faith in the villages, the Government demand on which had previously been fixed for 30 years. In British Burma there is a capitation tax adopted from the old native Government, which is peculiar to that province, and is in accordance with long established custom. For the North West Provinces a special Act has been passed (XVIII. of 1871), making every estate liable to such assessment as the local government thinks fit, not exceeding 5 per cent. of its annual value; the term "annual value," being defined as double the amount of land revenue assessed on each estate. But there has been no new local cess in the North West Provinces, except in the permanently settled districts; this Act only legalizing existing cesses in the rest of the provinces. In the permanently settled districts of Benares, a rate of two annas may be imposed on each acre under cultivation, half of which the landlord may recover from his tenant. Local committees are to be appointed to supervise the expenditure of the sum assigned. Thus "the deficit, together with the increased expenditure which the yearly "growing demands of administrative efficiency may require, is to be made up by

"provincial



"provincial taxation." In the Central Provinces, local demands are met by the *pandhri*, an old Mahratta tax on the non-agricultural classes, which was in existence when Nagpur was annexed, and though re-adjusted, it has always been continued. In 1867 it became a pure income tax on persons whose incomes were derived from any other source than agriculture, the lowest limit being 7 *l* 10 *s*.; and persons assessable to income tax were exempted from the *pandhri*. In 1869-70, its proceeds were made over to the local government, and by this means an adjustment of local income and expenditure was effected. The lowest range of the *pandhri* has been raised from 7 *l*. 10 *s*. to 10 *l*. per annum, which has reduced the number of payers one-half, the loss of income being 22 per cent. Tolls were also introduced on two important lines of road in the Central Provinces, but with an unsatisfactory result. There are also education, postal, and road cesses; besides the octroi levied by municipalities.

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Central Provinces.

In Madras the local cesses are many and various. But what the people most feel and dread are the frequent changes. "A ryot either has to pay, or is in imminent danger of having to pay, about a dozen different kinds of taxes and fees. There are the land, water, house, and income taxes; the road, irrigation, and village service cesses; the education rate, the toll on roads, the octroi, the stamp duties, and registration fees. It is beginning to be felt, in this presidency, that some pledge ought to be given that there will be no further taxation for 30 years, except in case of war." In Bombay the deficiency as regards the transferred branches of administration has been met by making the municipalities liable for the maintenance of the police, and by claiming an amount not exceeding one-fifth out of the gross revenues of certain towns. A cess was also made leviable on the non-agricultural classes in districts which, it was considered, did not contribute their fair share towards the expenses of the state. This tax was extremely unpopular, and caused much discontent, and it has since been abolished.

Madras.

Bombay.

A brief general recapitulation of the local taxation will make its scope more clear. A 5 per cent. cess on the rental, in excess of the land revenue, which was arranged for at the time of the current settlement, and can give rise to no complaint, is levied in the North West Provinces, the Punjab, the Central Provinces, and Burma. It is applied to expenses connected with the police, education, the local post, and roads. In addition to this cess which forms a part of the settlement, a "local rate cess" has been imposed in the North West Provinces, the Punjab, and in Oudh. In Bengal and Madras there are tolls upon ferries, roads, and canals; and in Madras and Bombay there are water rates, road and education cesses. In the Central Provinces there is the *pandhri*, or tax on incomes of 10 *l*. a year and upwards. The octroi duties are levied by municipalities throughout India except in Bengal, and in Burma there are also bazar collections. In Madras there is a tax on trades and professions, and in the Punjab a municipal horse and wheel tax.

Recapitulation of  
local taxation.

The introduction of a paper currency into India dates from 1861, and, after having been in circulation for 10 years, the results in 1871-72 are reported to be very satisfactory. Before 1861 there was a limited circulation of notes issued by the chartered banks of Bengal, Madras, and Bombay, and with a circulation confined almost exclusively to the presidency towns. India had been steadily draining Europe of silver bullion at the rate of 10,000,000 *l*. a year; the circulating medium was silver, and there was an incessant transmission of large remittances to and fro over the length and breadth of the land. The great expense and inconvenience of carrying about heavy packages of silver rendered the introduction of a paper currency a measure of no small consequence to the welfare of the people of India. Mr. Wilson originally proposed the adoption of this measure in a Minute dated 25th December 1860. But his scheme received some modification in the Act to provide for a Government Paper Currency (XIX. of 1861), which was passed when Mr. Laing was Financial Member of Council. A Department of Issue was established for the issue of promissory notes, payable on demand, for sums not less than 10 rupees. Mr. Wilson intended to have issued notes as low as 5 rupees. The head commissioner of the Department of Issue is the master of the mint at Calcutta, and the masters of the Madras and Bombay mints are also commissioners. Circles of issue are established, each

Paper currency.

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FINANCE.

with a chief town as a centre or place of issue of notes, with subordinate agencies of issue within the circle. The head commissioner provides the promissory notes, which are issued at the different centres in exchange for silver, or for other notes; and the whole amount of the bullion or coin so received for notes must be retained as a reserve, with the exception of such an amount, not exceeding four crores of rupees, as the Government may from time to time fix, the amount so fixed being invested in Government securities. The notes are deemed to have been issued on the security of silver received for them, of the money invested, and of the general credit of the Government. The promissory notes are legal tender within their respective circles. A short Act (I. of 1866) was subsequently passed, altering the conditions on which persons tendering bullion or foreign coin were to receive promissory notes in exchange. In the first Act it was provided that such persons might be required to pay the expense of melting and assaying such bullion or foreign coin. The new Act entitled them to receive a certificate acknowledging the receipt, and the value, after deducting the expense of melting and assaying, and also stating the interval on the expiration of which the holder shall be entitled to receiving notes in exchange. In March 1862 an agreement was made with the chartered banks, to continue in force for five years, which provided for the issue and payment of the currency notes, through their agency, and for the establishment of branch banks with the same object. The notes are of 10, 20, 50, 100, 500, and 1,000 rupees; and up to 1867 ten circles had been established at Calcutta, Allahabad, Lahor, Nágpur, Madras, Calicut, Trichinapalli, Vizagapatam, Bombay, and Karáchi. The amount of notes to be issued is not to exceed 4,000,000 *l.* In 1866 the circulation of these notes had reached to over 10,000,000 *l.* Since that time the demand for notes has steadily increased. In Bengal the issue of notes in 1871-72 amounted to 2,073,572 *l.*, as compared with 869,486 *l.* in 1870-71; and the local officers report that the increased paper circulation has been a great convenience to the trading classes, and that notes are now beginning to pass from hand to hand at par in the neighbourhood of the treasuries. In the North West Provinces 1,221,060 *l.* worth of notes were issued, the number of notes being 94,712. The demand for small notes was very large, which is a sign that they are not only used as a medium of exchange in remittances, but are, to some extent, coming into use instead of silver in the ordinary transactions of daily life and commerce. In the Punjab the average circulation of paper notes, in 1871-72, was 841,836 *l.*, showing an increase of nearly 86 per cent. over last year's average; and in Madras it was 1,260,477 *l.* In Bombay, 1,968,877 notes were received and issued, to a value of 21,841,335 *l.*; and the circulation of notes averaged 4,820,603 *l.*, being a rise of 21 per cent. above last year's average. In the Madras Presidency the establishment of paper currency agencies was sanctioned, in January 1872, in eight new places, including Utakamund, Tutikorin, Cocanada, and Mánantawádi (the chief place in Wynaad), for the convenience of the coffee planters. The currency notes are acquiring the ready confidence of the public; and this measure, which was first worked out by Lord Halifax, has, in a very great degree, promoted the convenience and commercial welfare of the people of India.

## III.—LAND REVENUE.

THE land revenue of India is a branch of the administration which is so closely connected with the every-day life of the people, and so important in its political as well as in its merely fiscal bearings, that it can never be treated like salt or customs, as a mere item in a financial account. The welfare and contentment of the people depend upon the wise adjustment of the demand on the produce of the land; and the difficult questions relating to land revenue have always required the most close and careful attention from Indian Statesmen. At present this subject is under consideration in most parts of India. The new settlements throughout the North West Provinces have not yet been sanctioned. Settlements are in course of adjustment in the Punjab. The old settlements are falling in throughout the Bombay Presidency; the Madras survey is in progress, and the Lieutenant Governor of Bengal is doing all that is still possible to improve the state of affairs in that province. So that, although a few districts have been actually settled during the year under review, the present is a fitting occasion for briefly reviewing the state of the land revenue arrangements in British India.

Bengal and Bahar being under the permanent settlement of 1793, can receive only very partial benefit from the efforts of modern rulers. Their hands are tied; the land was assessed for ever to the Zemindars, who held it 90 years ago, on payment to the Government of ten-elevenths of the rental; but on failure of payment a defaulting estate was immediately to be sold. The Government, however, required that the rent to be paid to the Zemindars by the cultivators should be specified, and reserved the right of interference on behalf of the inferior holders. A judgment creditor has the power of selling the landed rights of a debtor, and sales for debt have always been frequent, as well as for failure to meet the revenue demand. Before our rule the land was practically not transferable by sale, and the seizure and sale of land for private debts scarcely ever occurred, because there was no absolute property in land, recognised by the State. Thus the permanent settlement has deprived the State of all participation in the increased value of land, while it has endangered the position of tenant cultivators. These consequences are inherent in the system, and cannot be greatly modified. The land revenue of Bengal, Behar, and Orissa, was a little over 3,000,000 *l.* in 1793, and it is nearly the same now, yet the rental of permanently settled estates is now 10, 15, 60, and even 100 times the amount of the Government demand, instead of eleven-tenths of it, as in 1793.

There are, however, evils which have grown up with the permanent settlement, but which are not necessarily part and parcel of it, and the present Lieutenant Governor has turned his attention to their remedy. At the time of the introduction of the Government settlement no survey was made. There was a mere register of rent-paying estates, with the names of the proprietors, but no means of identifying the lands. The Cáoongoes, or district accountants, whose duty it would have been to register all holdings and transfers, were abolished; and the Patwaris, or village accountants, who should have kept a record of the rights of the ryots, fell into disuse, or became mere servants of the Zemindars.

Sir George Campbell has taken steps to restore the ancient institutions of the country, which the permanent settlement has done so much to impair. The whole of Orissa (which, however, is not under permanent settlement) is now parcelled out into Cáoongoe jurisdictions; and Patwaris are being regularly registered and recognised throughout the Lower Provinces. The Lieutenant Governor is anxious to foster and improve indigenous agency, and to secure the rights of the cultivators. With this view, the sales of estates which come into the hands of the Government from default of payment of the demand, are suspended pending a full inquiry into the minor tenures, and until all rights have been recorded. Many great landed estates also come under Government management from being owned by owners disqualified on account of sex, age, or mental incapacity; and it is intended that they shall be models of what well managed estates ought to be. The survey of Bengal, except

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the district of Midnapur, is now completed. It consists of three branches; firstly, the demarcation, and, secondly, what was called the "scientific" survey. The demarcation officer defines the boundaries of villages and estates on a scale of 16 inches to the mile, and settles disputes. The scientific surveyor then fixes the village boundaries, and delineates all topographical features. A third important branch of the survey is that which takes cognizance of the alluvium and diluvium on the banks of rivers; processes which are constantly in progress, and which increase and decrease the area of estates. The alluvium and diluvium survey was commenced in Patna in 1863, and finished in Rájsháhi in 1871.

Government  
estates.

Several thousand estates come under settlement by the Board of Revenue every year, which have either been bought in by the Government at auction, thrown up by the rivers, or reclaimed from jungle. On these Government estates the settlement is made with the village headman or the ryots themselves, and the rights of the ryots to hold their lands, subject to the payment of fair rents, are to be recorded. The question of the sale of Government estates by auction has been under consideration, and, in the meanwhile, their sale has been stopped since May 1871.

Districts not under  
permanent  
settlement.

There are, however, several districts within the Government of the Lower Provinces, which are not included in the permanent settlement; such as Orissa, Cachar, some lands in Chittagong, the Palamau pergunnahs in Chota Nágpur, the Bhutan Dhoors, Kuch Behar, and Asam. In the latter extensive district the demand was at first paid by means of a poll tax and personal service. In 1832 a land and plough tax was introduced, collected by the village headmen, and in 1867 a settlement was made direct with the ryots, when the revenue was nearly doubled. It rose from 128,850 *l.* in 1868 to 207,754 *l.* in 1869.

Recapitulation of  
Sir George Camp-  
bell's measures.

Thus, as regards the administration of the land revenue in Bengal, active measures have been adopted to ascertain and register the rights of the cultivators, to execute revenue surveys, to make the Government estates and those of wards models for imitation throughout the country, and to restore the ancient village offices and institutions. The net land revenue of the Lower Provinces for 1871-72 was 3,651,556 *l.*

NORTH WEST  
PROVINCES

The settlement of the land revenue of the North West Provinces was made between 1834 and 1844, generally for 30 years, so as to terminate between 1864 and 1874. A renewed settlement has now been in progress for several years; but the revision of the settlement has not yet been finally sanctioned in any district. The sanction of Government for the new settlement in the different districts, will be given during the next and following years, so that the present is a convenient time for giving a short general sketch of the principles upon which these settlements are based.

Emperor Akbar.

The first regular settlement of what are now called the North West Provinces, was commenced by Shir Khan, and completed by the Emperor Akbar. Correct accounts of the boundaries of each village were drawn up, the cultivated and uncultivated areas were measured, the land was divided into classes with reference to the descriptions of soils, and each field was assigned to one class or other. The average produce of each class, and the average price of grain was then ascertained for 10 years, and one-third of the average gross produce was taken as the rent. But the leading principle of Akbar's settlement was that the Government held the village community, and not each individual cultivator, responsible for the payment of the rent.

Regulation VII. of  
1822.

Akbar's principle was adopted by the English in Regulation VII. of 1822, by which the lands were to be measured and classified, and the rents to be ascertained and registered for the thorough protection of the cultivators; and still following the example of the great Emperor, the settlements were to be made with the proprietors, whether individuals or communities, and not directly with the cultivators.

Difference between  
Akbar's system  
and ours.

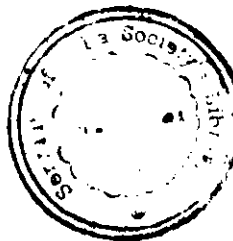
There is, however, one important difference between the system of Akbar and that of the English, which it is necessary to bear constantly in mind. Akbar was the landlord and received the rent from the cultivating communities. The English have admitted the existence of proprietors, who receive the rent, while the Government only takes a portion of this rent as a land tax.

For 10 years the scheme contained in Regulation VII. of 1822, remained ineffective, owing to the want of the requisite machinery for its execution; but this

this was provided for by Lord William Bentinck in Regulation IX. of 1833, and the settlement was commenced. A great administrator, Mr. R. M. Bird, carried it through during the next nine years, and by 1842 it had been completed in all the districts.

Mr. Bird.

Mr. Bird was at first only interested in the improvement of the judicial machinery, and the various arrangements of the settlement were not originally intended as machinery for the accurate ascertainment of the resources of the land. Their first object was the framing of a record of the several interests of those who held their lands in common, and of the rights of cultivators; and Mr. Bird was induced to enter upon the investigation by the conviction that the judicial tribunals were unequal to the ascertaining of those rights, and to the protection of those who possessed them. He undertook the duties of a revenue officer only with the view of perfecting these plans for the good of the people, and because he was convinced that practical operation might be given to the rules contained in Regulation VII. of 1822. His principle was that the assessment of a fair and moderate revenue on the land might be so combined, with an ascertainment of private rights of the village communities, that such records might be framed, such principles fixed, as would correct the evils which, at that time, interfered with agricultural prosperity. Thus the founder of the settlement of the North West Provinces was not an officer whose chief idea was the collection of revenue, but a great administrator, whose first thought and moving principle was to secure the people in their rights and to promote their prosperity.



The principle of the settlement was to take two-thirds of the rental as Government revenue, leaving the remaining third, and all future increase during the term of settlement, to the proprietors. It will be remembered that Akbar took the whole rental, and recognised no proprietor but the State. In this lies the main difference between his system and ours. The proprietors recognised by the settlement were not always the village communities, but in many, if not in most cases, they were intermediate persons who succeeded in establishing claims to the rent. The tenure by village communities or brotherhoods, is called Bhyacharah; but this tenure exists in the smaller proportion of the whole number of villages in the North West Provinces. The most common tenure is that where a village belongs to a family, the cultivators being tenants of all the family as a body. The Government settlement is made with the proprietors for each village or township.

Tenures.

The first operation is the demarcation of the village boundaries, and the ascertainment of its total area, and the next is the interior measurement of fields by rod and chain, called the khusruh. Each field is registered with the name of the cultivator and proprietor, its dimensions and area, the nature of the soil, and the rent. A list of cultivators is made out, showing what each holds, and what rent each pays, and another list is made out of the proprietors. An administration paper of each village is then drawn up, showing how the revenue is to be distributed and collected, what are the relations between proprietors and tenants, and the remuneration of village officials. Cáoongoes, or district accountants, are then appointed by the Government, and patwaris, or village accountants, by the laudholders.

Operations of the settlement.

The first settlement, for 30 years, was completed in 1842. It included 80,883 townships, and an area of 71,985 miles; and the revenue demand was fixed at 4,052,992*l.*, including the permanently settled province of Benares. The rate per acre on cultivation was 3 *s.* 6 *d.* The population affected by the settlement was 23,199,668.

Results of the settlement.

Mr. Thomason, one of Mr. Bird's most able assistants, administered the system for 10 years (1843 to 1853) as Lieutenant Governor of the North West Provinces. The collectors of each district have, under them, an efficient native executive staff, consisting of tehsildars, eight or ten to a district, who superintend sub-divisions, and enable the collectors to exercise a minute control over the affairs of the district.

Administration of the settlement.

The 30 years of the first settlement were interrupted by the drought and Famine of 1837-38, the Mutiny of 1857, and the Famine of 1860-61. The latter visitation gave rise to a long discussion on the advisability of introducing the Bengal permanent settlement into the North West Provinces. The Famine of 1837 was more severe than that of 1861, although there was heavier pres-

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sure from drought in the latter year, and the reason of the power of the people in the latter year to pass through the ordeal with far less suffering was believed to be the creation of a vast mass of readily convertible and easily transferable agricultural property. This state of things was the direct result of the limitation of the Government demand on land for the long term of 30 years, and the careful record of individual rights. The settlement had introduced moderate assessment, minutely recorded and easily understood titles, long leases, and the guarantee of enjoyment of all profits during the currency of such leases. Land thus obtained an increasing marketable value, which as a security was largely made use of in mitigating the pressure of the famine. Such being the result of the fixity of the public demand for 30 years, it was urged that the inference was irresistible that, to perpetuate these results, the public demand on land should be fixed for ever. These arguments were urged by Colonel Baird Smith in his Report on the Famine of 1860-61, and by Mr. Patterson Saunders in his account of the cotton districts of the Doab; and a strong feeling arose in favour of a permanent settlement. A long official discussion on the subject was carried on between 1861 and 1868, but the Government never appear to have intended to introduce a permanent settlement over a wide extent of country, but to limit it to particular estates under certain conditions. The proposal was to calculate the proportion between cultivated and fallow land on an estate, and where the cultivated area exceeded a fixed ratio, to grant a permanent settlement, withholding it from estates where that test failed, until the required proportion was reached. This method was resolved upon as a precaution against "undue sacrifice" of the Government revenue; and Sir Charles Wood, in a Despatch dated 24th March 1865, ordered that no estates of which the actual cultivation amounted to less than 80 per cent. of the cultivable area was to be admissible to a settlement in perpetuity. This decision was repeated in a Despatch from Sir Stafford Northcote, dated 23rd March 1868; and another provision was added, namely, that no permanent settlement should be concluded for any estate to which canal irrigation was likely to be extended within the next 20 years. The terms on which a permanent settlement was to be granted were thus at length formulated, and officers were ordered to ascertain what estates were ripe for settlement in perpetuity.

Objections to a permanent settlement.

But Sir William Muir, when he became Governor of the North West Provinces in 1868, found it necessary to re-open the question. He represented that the two conditions enjoined by the Secretary of State were not sufficient, and that a third ought to be added, namely, evidence that the standard of rent prevalent is adequate, and not below the level of rent throughout the country at large. To this condition the Government of India added another which virtually put an end to the proposed measure altogether. It really amounted to a postponement of a permanent settlement so long as the country continued to improve by any cause independent of the action of the occupant of the land.

Permanent settlement abandoned.

Thus the matter rests, after a discussion extending over 12 years. First, a general permanent settlement at existing rates was proposed; then it was declared that settlement in perpetuity could only be granted to such estates as had 80 per cent. of their cultivable land under cultivation; then another condition was added with reference to the extension of canal irrigation; then a third condition was proposed; and, finally, the Government have declared that, pending further discussion of the whole question, the existing orders on the subject are to be held in abeyance. The elaborate minutes and despatches which have been written since 1861, have led to no result; but in the meanwhile the settlement officers and the people have been kept in a state of great uncertainty. The late Sir Donald M'Leod, Lieut-Governor of the Punjab, before he left India in 1870, recorded his opinion against the introduction of a permanent settlement. He considered that it would be a mistake to declare permanent the money assessment of any land whatever, because money is an unreliable standard of value. Fifty years hence, if the demand assessed upon land represents but half the real value it did when first fixed, it will be a matter of the utmost difficulty to find other sources from whence the enormous deficit can be supplied, and the effort to realise it will be attended with exceeding danger. But Sir Donald added that if, instead of using a cash standard, we were to employ some other standard supplying a correct measure of the increase of value, such as the value of labour

labour and the price of corn, he would be entirely in favour of permanency of settlement, wherever the cultivation had attained to the required proportions.

The Famine of 1861 led to the long discussion of the permanent settlement question. Another very important event during the currency of the first settlement of the North West Provinces was the passing of Act X. of 1859, to amend the law relating to the recovery of rent. By this Act every cultivator is entitled to a potha, or legal document, containing the amount of annual rent to be paid to the proprietor; but the proprietor is empowered to raise the rent at the expiration of the period stated on the potha, by serving a written notice. The grounds on which the different classes of cultivators are liable to enhanced rent, are stated in the Act, and the proprietor is empowered to enforce his claim in a court of law.

Rent Act of 1859.

The new settlement of the North West Provinces necessitated a repetition of all the elaborate processes which were introduced by Mr. Bird in 1832: measurement, inspection, assessment, preparation of records, and decision of claims. Almost all the records were destroyed during the mutinies. During the 30 years of the old settlement, the proprietors effected considerable changes in the rent rates, while the Government demand of two-thirds of the rent remained the same. In the new settlement, the Government demand has been reduced to one-half the rent; but the settlement officer has to discover the extent to which the rent rates have been modified by competition and increased prices, and by the rent law (Act X.) of 1859.

New settlement.

By 1871, the settlement of eight districts had been completed, but not yet sanctioned by the Government, namely, Dehra Dun, Saháranpur, Gorakhpur, Busti, Jhansi, Lalatpur, Bulandshahr, and Garhwal. In the case of Muzaffarnagar, a doubt was raised as to the sufficiency of the rates fixed, and a revision was ordered. The measurements were completed in 13 districts, and the work of inspection was brought to a close in six. The actual net increase of revenue up to March 1872 is 282,631 l., or 13 per cent. on the land revenue assessed. The revision of settlement has been going on for 17 years; and there are now only four districts, Murádadab, Agra, Humirpur, and Banda, in which the former settlement had not expired on 1st April 1872. In Etáwah and Mattra it came to an end in July 1871.

Progress of new settlement.

An important change has been made in the manner of conducting the village surveys, which are the foundations of the settlement operations. Instead of the old method by means of measurements of fields by native amins, checked by an accurate survey of village boundaries, there is in future to be a cadastral survey on rigorous principles, in every detail, such as exists in Madras. The settlement maps were sufficient for the purposes for which they were primarily intended; but they could not be used in compiling a district map, nor could they pretend to the same scientific accuracy as is obtained by the adoption of correct principles of surveying. The Government of India, therefore, resolved to have the field surveys, as well as the village boundaries, executed by the Surveyor General's Department, and thus to place the whole operation under one head, and to introduce a cadastral survey such as is executed in the countries of Europe and in Madras. In 1871-72, the cadastral survey of Mattra and Murádadab was accordingly made over to two parties of the regular survey. By this measure there is a saving of labour, for work was formerly done twice over to some extent; but this saving is said to be outweighed by the higher cost of the supervising establishment. In that case the excess should not be charged as part of the cost of the settlement, but debited to the general purposes, for which a correct survey will be useful. At the same time really accurate measurements, made on rigorous principles, may be the means of very materially enhancing the land revenue, as will presently be shown, in glancing at the operations of the Madras Revenue Survey, and its results.

Cadastral survey.

The Government demand is now fixed at 50 per cent. of the assumed rental, and an additional 5 per cent. is taken in the form of a cess for local purposes of education, roads, police, and other objects of general improvement. But, by a recent despatch from the Secretary of State, a change has been made with regard to the settlement of the cesses, for, while the amount of the land revenue is fixed absolutely for the period of the settlement, the amount of cesses is declared to be open to revision, from time to time, at the discretion of the

Government demand.

Additional cesses.

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local Government. Judging from the districts already settled, it is calculated that the rent rolls of the province have increased by 52 per cent. since the first settlement, by reason of extension of cultivation, enhanced prices, and competition.

Rent-charges.

A very important fact in connection with the agricultural prosperity of the provinces has been brought out by the new settlement. As much as 74 per cent. of the assessable area of the districts hitherto surveyed is actually under cultivation. Mr. Bird has left on record his opinion that one-fifth of the cultivable land should always be left untaxed, to allow for raising artificial grasses or other fodder for cattle, and for fallows. This margin has long been encroached upon in many districts, so that very little increase of revenue can be expected to arise from further extension of cultivation. Hence, if the Government raises its demand on the land, the proprietor can only meet the enhanced demand by raising his demand for rent. Here, then, will the great difference between the system of the Emperor Akbar and that of the English, be made practically apparent. Akbar recognised no proprietors, and the rent was the Government demand. We have created a body of proprietors with powers, which none but the Government ever claimed before, over the original occupants of the land. Thus the process of raising rents, aided by our law courts, may give rise to much strife and discontent; yet the revenue cannot be raised further than the rents have as yet risen, without the danger being faced of a general rise of rents. To remedy this evil, it is proposed to pass an Act enabling the settlement officer, when he raises the revenue, to raise the rent also. It is said that the powers given by Act X. of 1859 are not now largely used by the proprietors to raise rents, but they have the power and may, at any time, begin to use it. During the year 1870-71 there were 60,405 suits instituted under Acts X. of 1859 and XIV. of 1863; of which 34,516 were for arrears of rent, 4,812 to eject cultivators, 3,025 to recover occupancy, and 2,468 complaints of excessive demand of rent. The evil will be remedied by an Act, to be passed this year, enabling the settlement officers, when they raise the revenue, to raise the rent also.

The net land revenue of the North West Provinces for 1871-72 was 3,682,588*l.*

ODDH.  
Oudh Land Revenue,  
Settlement of  
1856-57.  
Confiscation of  
talukdari estates.

After the annexation of Oudh in 1856 a settlement was made, village by village. The object was to deal with actual occupants of the soil, called village zemindars, or with proprietary co-partners, and not to suffer the interposition of middlemen. The claims of the talukdars, or great landed nobility, were to be considered at some other time. But it was a mistake to assume that the talukdars were only middlemen employed to collect revenue. They formed, to a great extent at least, an old landed aristocracy possessing undoubted rights of property in the soil; and two-thirds of Oudh (23,500 villages) were in their possession at the time of the annexation. Yet the assumption that they were interlopers, with no rights of property, was acted upon in the extremest manner. The Maharaja Main Sing, one of the most powerful talukdars, possessed 577 villages, paying 20,000 *l.* to Government as land revenue. The settlement of 1857 dispossessed him of all but six villages paying 290 *l.* It is doubtful what his private income may have been, but it was probably 20,000 *l.* a year, which was suddenly reduced to 300 *l.* This is one instance out of many. In another ancient estate out of 378 villages, 266 were taken away; in another 155 villages were confiscated out of 204. The sweeping injustice of the settlement of 1856-57 in Oudh can hardly be overstated. It amounted to the confiscation of property worth several millions sterling. The consequence was, that in Oudh alone, the mutiny of the Army led to a general rebellion of the more influential classes of the people. Lucknow was recaptured in March 1858, and Lord Canning issued a proclamation confiscating the proprietary right in the whole soil of Oudh, with the object of making all titles depend upon grants from the British Government.

General rebellion  
of the people.

Engagements and  
agreements with  
the talukdars.

Sir Robert Montgomery, the First Commissioner of Oudh after the Mutiny, resolved to abandon the policy of 1856-57, and to restore the talukdars to all they had formerly possessed. They were invited to come to Lucknow with safe conducts; two-thirds of them did so, and political engagements were entered into with them, for the settlement of the land revenue of Oudh. It was, as

General



General Barrow, one of the divisional Commissioners, expressed it, "A revenue settlement made upon the battle field," and as such possesses the character of a political treaty.

The present settlement of Oudh is, therefore, a *tálukdári* settlement, so framed as to secure village occupants from extortion, and exacting certain duties and responsibilities from the *tálukdárs*. The *tálukdárs* were confirmed in possession of everything they held at the time of the annexation, in February 1856, and the rights of subordinate proprietors were confirmed as regards all they had held at the same period. The Government demand was fixed at half the gross rental, the under proprietors only retaining that share of profits which they formerly enjoyed. In 1859 sanads or titles were issued to the *tálukdárs*, giving them permanent hereditary and transferable rights, including the perpetual privilege of engaging with the Government for the revenue of their *tálukdárs*; these rights, however, being subject to any measure the Government might take to protect the village zemindars and other occupants from extortion, and to uphold their rights in the soil, in subordination to the *tálukdárs*. These sanads were granted, and issued by Sir Charles Wingfield on the 19th of October 1859. The *tálukdárs* hold their property by virtue of these sanads, on conditions unknown to Hindu or Muhammadan law. They have full powers of alienation by will, and in case of intestacy their estates descend to the nearest male heir, according to the law of primogeniture. But subsequent legislation has introduced some modifications. Every *tálukdár* now has power to revert to Hindu or Muhammadan law, or to the ancient customs of the family as regards the rule of succession to estates; and by the "Oudh Estate Act" (I. of 1869) a list of Oudh *tálukdárs* is to be placed on record with the law of succession applicable to each estate, but the right to transfer or bequeath is still retained.

*Tálukdári* settlement.

Sanads granted to the *tálukdárs*.

Succession to *tálukdári* estates.

The *tálukdárs*, as a rule, have shown themselves willing to make concessions with regard to the smaller proprietors who hold land under them, and whose rights have now been well secured. The great landowners have agreed that a class, including one-fifth of the whole number of cultivators, shall receive rights of occupancy, and important protection has been extended to other classes of tenants. By Act XXVI. of 1866, called the "Oudh Sub-Settlement Act," the rules were declared to have the force of law, which the Chief Commissioner had previously made, for determining the conditions under which those who possessed subordinate rights under the *tálukdárs* should obtain the sub-settlement of lands or villages, which they held before the annexation in February 1856. The payments made by the under-proprietors to the *tálukdárs*, before the annexation, form the standard by which the present payments are regulated; but they are never to exceed the gross rental of the village, less 10 per cent., in what are called *seer* or *naukar* lands, that is, lands set apart for the subsistence of the tenant or home farms.

Rights of small proprietors.

The revenue and field survey of Oudh was completed in 1871; 466 square miles, assessed at 14,673 *l.* a year, were settled in perpetuity; 20,617 for 30 years and upwards; 71 for terms under 30 years; and 1,731 were in progress of assessment. The number of acres held under the law of primogeniture is 5,497,976. There are 410 *tálukdárs*, of whom two-thirds hold their estates under that law. The number of under proprietary holdings in the province is 31,280, and the average rent paid on them about 1 *s.* 6 *d.* per acre. The net land revenue of Oudh in 1871-72 amounted to 1,207,902 *l.*, the largest that has been collected in the province since the commencement of British rule. No estate was sold for arrears.

Present Settlement and Land revenue.

The system of the North West Provinces was introduced into the Punjab on its annexation, but there is one great difference between the two provinces. In the North West Provinces the village communities have only been partially preserved; but in the Punjab, including the Delhi district, all the old village communities are very often perfect, each with a cultivating body and a complete internal system of management. Each man has land to correspond to his share in his own separate management, and the grazing ground is common to the cattle of all. Certain sums were always set apart from the revenue, for the remuneration of village officials. The Punjab settlement is based on the same system as that of the North West Provinces, with the essential difference that in the Punjab the bulk of the proprietors are actual cultivators, and that there are much fewer

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non-cultivating proprietors. Each Punjab village undertakes the payment, through its representative council of elders, of the revenue assessed upon it; and the payment is distributed among individual members of the community in proportion to the land held by them. The revenue is very punctually paid, and sales of land are unknown. Another great blessing enjoyed by the proprietors of land in the Punjab has been that, up to this time, they have been exempted from the interference of the civil law courts administering technical law. The settlement officers are invested with judicial powers, and landed property is not liable to summary sale in satisfaction of simple debt, without the special sanction of higher authorities.

Settlement  
operations.

As in the North West Provinces, the village boundaries are surveyed scientifically, and the fields are measured by means of native agency, the village field map and index being annually revised by the village accountant or pátwari. Every acre belongs to some one, and can change hands by sale, mortgage, will, or legal transfer, but the settlement is made with the proprietors as a whole. The assessment is fixed on each village for a term of years, and is calculated to leave an ample surplus profit. This demand does not exceed one-half of the net rent to the proprietor, after deducting all expenses of cultivation. In addition, one per cent. of the net assets is deducted for a road fund, one per cent. for an education fund for village schools, and there is a charge for a district post, besides a cess for police and conservancy. There has been a very great increase of cultivation during the last 15 years, under the settlements made for limited periods.

Progress of  
settlements.

During 1871-72 revenue settlements were at work in six districts, and in six others the revised settlement, completed between 1865 and 1869, were confirmed; two will expire in 1874, one in 1876, and the others between 1880 and 1888. As many as 11,991 suits for rights in land and rent suits were disposed of, in the settlement courts, during the year 1871-72, besides a large number of miscellaneous revenue cases. Four revenue survey parties were at work in Delhi, the Derájat, and Bháwalpur, an independent State, under the Punjab Government.

The net land revenue of the Punjab, for 1871-72, was 1,763,587 l.

CENTRAL  
PROVINCES.

In the Central Provinces the settlements throughout the greater part of the districts have been sanctioned, and have been working for several years. There was a question whether the village headmen should be considered proprietors, or merely managers, and the Government has decided not to part with its proprietary right in the soil for the future. But as regards the district of Sambalpur, where a summary settlement has been arranged for 12 years, a promise had been made after 1857, to the gaotikas, or headmen, that they should receive proprietary rights in their villages. The settlement was made with the gaotikas of each village. The gaotikas is allowed to hold a home farm rent fee, and in perpetuity, to the extent of one-quarter of the whole assessment of the village. The remainder is held by cultivators, whose tenures are made secure, and who can only be ejected for not paying the Government demand.

Evils of land sales.

A great evil is arising in the Central Provinces, as in the Punjab and North West Provinces, owing to old families being dispossessed in considerable numbers to make room for money-lenders. Colonel Keatinge, the Commissioner, looks upon "the sale of ancestral land in execution of a money decree as a grave and serious political evil, by which the Government, in pursuance of a theoretical system of justice, at once opposed to the wishes and habits of the people of the country, is needlessly sacrificing popularity, which it can ill spare. Sale of land is a modern innovation, and one which is injurious in every way, in the present condition of the country."

The land revenue of the Central Provinces amounts to over half a million. Out of an area of 36,046,250 acres, a little less than a third is cultivated, and about another third is cultivable. The rate of assessment on cultivation is about 1 s. an acre.

MADRAS.

The system of land revenue in the Madras Presidency is entirely different from that which prevails in the north of India, the settlement being made with each ryot or cultivator, instead of with the proprietor or village community. The revenue unit is the actual field, and not the township or estate. Every ryot is secured in possession so long as he pays the revenue; and waste lands are avail-

Ryotwar system.

able

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able for the first comer who chooses to take them up on the prescribed terms. Sir Thomas Munro, who was Governor of Madras from 1818 to 1827, was chiefly instrumental in introducing this ryotwar system, and he looked upon its great advantage as being the strength and security it gives to the Government, by bringing it into direct communication with the great body of the cultivators. In the Northern Sarkhars, consisting of Ganjám, Vizagapatam, and Rájmahendri, the perpetual settlement was introduced; and there are a great number of Inams, or rent-free estates, throughout the Presidency of Madras, some of them held for upwards of 700 years. Throughout Malabar, too, there is proprietary right, the landlords receiving from 20 to 40 per cent. of the rent, and paying the rest to Government. The Malabar rule is to deduct 20 per cent. of the gross produce of the rice fields for reaping, the remainder being the available gross rent. From this, one-third is taken as expense of cultivation; and one-third as the cultivator's share. The remaining third is rent, to be divided between the proprietor and the Government.

Districts permanently settled.

Inams.

Malabar.

But throughout the greater part of the Madras Presidency, the system is ryotwar, and a maximum rent is fixed on each field, to be paid for good crops. If the crops fail, the rent is reduced; and there is an annual settlement on cultivated land, according as it is irrigated, or not irrigated. In 1837, it was ordered that there should be no increase of demand, on account of the growth of more valuable produce; and in 1852, another order was promulgated, to the effect that no ryot was to pay an additional tax on account of improvements, causing an increase of value, which were made by himself. During the government of Lord Harris, in 1854, very considerable reductions were made in the demand on land in most of the Madras districts, amounting to a total sacrifice of revenue to the amount of 259,000 *l.* This has led to a very considerable increase in the area of cultivation, a proof that the people were previously too heavily assessed.

Ryotwar system.

The original Madras surveys were exceedingly incorrect, and in many districts the land revenue demand was based merely on the unchecked statements of the village accountants. But in 1857 a new revenue survey was commenced in Madras, under the able management of Colonel Priestley, with the object of correcting the measurements of superficial areas, and of ensuring a fair and just assessment on each description of land, by a classification of the different fields in each village. The survey is conducted on the accurate English method, and is the only Indian revenue survey which is based on vigorous principles in every detail. The area to be surveyed was assumed at 60,000 square miles, or 38 millions acres. The village maps, on a scale of five chains to an inch, show all topographical details and the limits of every field, with a record of the nature of tenure, cultivation, present assessment, name of ryot, and source of water supply, if irrigated. Up to 1872, the survey of eight districts was completed, and eight were in progress. The completed area amounts to 32,122 square miles, besides 7,862 in the districts still under survey. The excess of assessable area brought to light by the survey ranges from 2 to 23 per cent., and in the completed districts the survey gives 24,000 square miles, which have hitherto only been counted as 21,500 for assessment purposes. The average assessment is 3 *s.* 9 *d.* per acre, and the addition of these 2,500 square miles to the taxable area represents an annual gain to the State of 300,000 *l.* The average size of fields is about two acres, and the approximate number measured and plotted in the eight completed districts is 7,000,000. The number of village maps that has been drawn is 15,546, and the average error per mile, shown by the test of comparing the work with that of the Great Trigonometrical Survey, is 7.61 feet.

Revenue survey.

The net land revenue of the Madras Presidency, for 1871-72, was 4,016,555 *l.*, on 16,877,509 acres; of which 13,858,661 were under dry cultivation, and 3,018,848 irrigated.

The Bombay Presidency did not comprise large territory subject to a demand on the land until a comparatively late period. As Akbar made the first regular settlement in the north of India, so Malik Ambar, the Abyssinian, was the great native administrator for the western side of the peninsula. He revived and confirmed the tenures of village communities (Mirasi tenures), and made village settlements for money payments. But this system was not adopted by the English; and in 1847 the present ryotwar system was introduced, under the

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able superintendence of Sir George Wingate. It is a field settlement, but it differs from the Madras system, from the circumstance that in Bombay, instead of an annual settlement, the rent is fixed for each field for a period of 30 years. Each ryot may each year cultivate what fields he pleases, and give up what he pleases; the fields which are not taken up for cultivation being let annually by auction as grazing grounds. All joint tenures and common responsibilities are entirely abolished.

Bombay revenue survey.

The unit or basis of the Bombay Survey, an artificial field, or area, called "number," the size of which is fixed at what one pair of bullocks could plough up to double that size. This varies to from four to eight acres for rice cultivation, and from 20 to 40 acres for dry crops. The village boundaries are marked by stone pillars, and a series of detached earthen mounds are raised to demarcate the limits of fields or "numbers." The survey is a very rough measurement, and is useless for general purposes, or for the construction of correct maps; but the classing is a complicated and elaborate system, by which the value of each "number" is carefully ascertained. Numerous considerations are brought into account, which are classed under three heads, namely, distance from the village site, natural productive capability, and the nature of the water supply. When the classing is completed, the amount of the assessment is fixed, which is calculated with a view to leaving such a surplus to the cultivator as will render him capable of improving his circumstances, and extending his cultivation. The settlement was generally for 30 years. A new era of prosperity and progress was inaugurated in the Bombay Presidency by this settlement, the faults of which are on the right side, namely, assessments, which are said to be too low. The cost of collection is also said to be unduly heavy.

Classing.

Results shown by re-settlements.

As the Bombay 30 years' settlement was commenced more than 30 years ago, the revision of several districts has been completed, and several reports on the re-settlement of various talukas have been received during the year under review. These reports enable an opinion to be formed on the results of the settlement, and on the effect it has had on the prosperity of the people. As examples, the three talukas of Bhímturi, Chándúr, and Indapur, may be taken, the one in the Púna, the second in the Nasik Collectorate. The two first were settled in 1841, and re-settled in 1871. Bhímturi is a long narrow belt of country lying along the banks of the Bhíma, to the south of Púna, and almost destitute of trees, except where thickets of babúls grow near the river banks. In 1841 the people were in an abject state of poverty and wretchedness. In 1871 the population had increased 39½ per cent.; the number of carts from 273 to 1,011, owing to the opening of new roads; the number of ploughs, 22½ per cent., and of bullocks, 19 per cent. In 1840 there were 527 wells in working order, now there are 727. The whole cultivable area is now taken up. The Chándúr taluka is situated between the Chándúr hills and the river Godávári. Since 1840 the population has increased 100 per cent.; the number of carts from 903 to 2,747; of bullocks, from 8,602 to 13,998; of wells, from 712 to 1,076. In 1840 the number of acres under cultivation was 95,867; it is now 110,223; and the new settlement increases the land revenue by 52 per cent. Both talukas, which may be taken as samples of many others, have now got all the cultivable land under cultivation. Indapur is notoriously one of the most unfavourable districts in the Deccan, owing to the poorness of the soil, and the small and uncertain rainfall. Yet, during the 30 years of the settlement, the population has increased 31 per cent., bullocks and farming stock, 20 per cent., plough, 28 per cent., and carts, 300 per cent. These instances may be taken as good evidence of the success of the system, and of the increasing prosperity of the people.

The net land revenue of Bombay, including Sind, amounted, in 1870-71, to 2,911,062 *l.*, and in 1871-72, to 2,744,060 *l.*

In North Canara the people consider that, as in Malabar, they have special tenures, that Government has no right to raise the demand on their land, and that it cannot be sold for arrears. Accordingly, the introduction of revised rates of assessment in the Karwar Taluk was the occasion of a general combination to resist payment and to test the validity of the Government claim by an appeal to the law courts. This interesting suit has not yet been finally decided.

BURMA.

In British Burma there is a vast excess of culturable but uncultivated land, and the rates of assessment, though varying with reference to quality of soil and means

means of transport, generally range low. The light land tax is, however, supplemented by the capitation tax peculiar to this province, while the rice duty falls wholly upon the producer, and is reported to be equivalent to a further enhancement of the land tax. The holders of the land in Burma are the actual cultivators, the extent of whose holdings averages about five acres.

The net land revenue of British Burma during the year 1871-72 was 551,531 £.

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#### IV.—AGRICULTURE.

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THE season of 1871-72 was one of abundance and general prosperity in Bengal. The rains were extraordinarily abundant, and there was so much rain in the early months as almost to have obliterated the distinction between the hot and rainy seasons. At Calcutta there was the greatest rainfall on record. In 1871, though the rain unfavourably affected the crops in dry situations, they were generally abundant, and the jute crop was an extraordinary one. The indigo was much injured by the heavy rains in Bengal, but there was a good crop in Bahar. In 1872 there were very early dry crops. In Bahar the indigo cultivation has continued to increase, planters holding very extensive leases of villages, partly from the native landowners, and partly from the Court of Wards. But in Eastern Bengal, indigo has a good deal given place to the spread of jute cultivation. The question between indigo planters and ryots has entirely subsided. The rains gave rise to great floods in Central Bengal during 1871. The embankments on the left bank of the Bhágirathi, in Murshidabad, gave way, and the waters swept over Naddea and part of Jessor, causing serious loss, especially in cattle.

CROPS.  
Weather in Bengal.

Crops.

Indigo.

Floods.

In the North West Provinces, the spring harvest of 1871 was an unusually good one, but the rainy season was most abnormal. It began early, continued late, and the fall was extraordinarily great. In 1868 it was 19 inches over the whole region on an average, in 1869 it was 37, in 1870 it was 45, and in 1871 as much as 54 inches. This caused very general injury to the autumn crops. Indigo was a complete failure, and the grain harvests were bad.

Crops in the N. W.  
Provinces.

In the Punjab there was a falling off in the area under cultivation, which is ascribed to the insufficiency or unseasonableness of the rainfall. In the spring crop the decrease was not in wheat, the cultivation of which slightly increased, but principally in grain; but the decrease in the acreage of the autumnal crop was more general than in the spring crop. From Oudh the returns are not at all reliable. In the Central Provinces the monsoon set in early, and abundance of rain fell; but in August there was a long break, and the autumn crops were poor everywhere. Generally the rainfall is the lightest nearest the western extremity of the Sápura Hills, and increases as it passes eastward, being heaviest over the Wainganga watershed. This year the peculiarities of the rainfall were intensified. At the extreme west there was much less rain than usual, while the country to the east suffered from too much rain. But the poor harvest did not cause any great rise in prices. Improved means of communication between distant parts of the provinces have had a most material effect in mitigating local dearth, and has much reduced the inequalities of prices in different districts. In Chanda, thanks to importations from Chattisgarh, prices were lower than in 1870-71; and in the Narbada Valley, where the wheat crop suffered most severely, the price of wheat, the staple food of the country, was but slightly higher than in the preceding year. In the Haidarabad Assigned Districts (Berár) the rainfall was also unusually scanty, which led to much hardship.

Crops in the  
Punjab.

Oudh.

Central Provinces.

In the Madras Presidency the season of 1871-72 was unfavourable for agriculture, except in Karnúl, Chengalpat, Salem, Coimbatore, the Nilgiris, and Malabar. The failure of the north-east monsoon on the coast was followed by a drought, which, but for prompt importations of grain from

Crops in Madras.

Cattack,

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Cattack, might have resulted in overwhelming distress. The rainfall was also very scanty in Madura and Tinneveli. But the effect of good harvests for two previous years was felt, and the prices of grain declined.

## Crops in Bombay.

In Bombay there was a scanty rainfall in 1871-72, and a generally unfavourable season. There was great distress in some districts, and in Khandesh it was necessary to grant very considerable remissions, as well as in Súrat, Broach, Sholápur, and Ratnagiri. In Sind the season was on the whole a satisfactory one.

## Importance of meteorology.

Indian administrators are beginning to be impressed with the great importance of meteorological observations to agriculture; and a general system of inter-comparable registration is being introduced. Mr. H. F. Blanford was appointed Meteorological Reporter to the Government of Bengal, and a number of first-class stations have been established which have now furnished registers for five years. He also receives complete returns of the rainfall from 144 third-class stations. Dr. Townshend, who is in sanitary charge of the Central Provinces, and Dr. Murray Thompson, the Meteorological Reporter in the North West Provinces, have made their registers strictly comparable with those of Bengal, and the extension of knowledge thus gained is most important. The Punjab barometric registers are still unavailable for comparison. A series is taken at Lacknow by Dr. Bonavia. In Madras a number of first-class stations have also been formed under the supervision of Mr. Pogson the astronomer, and in Bombay, Mr. Chambers is in charge of the meteorological work. The question of placing the whole system of meteorological registration under one head, and, by introducing uniformity throughout India, of utilizing the combined work, is still under the consideration of the Government.

## Connection between meteorology and agriculture.

The Lieutenant Governor of Bengal is impressed with the connection between meteorological registration and agriculture, and considers that there is much scope for inquiry as to the effect of peculiar climatic conditions on health and on the crops. Little is known of the course of the monsoons, of the circumstances under which the summer rainfall is thrown sometimes on the east, sometimes on the west of the Bay of Bengal; is sometimes abundant in Bengal and scanty in the North West Provinces, and at others, as in 1872, almost deserts Bengal, and falls in great quantities in Northern India. The questions whether the rainfall of Northern India is more connected with rainbearing winds coming from the Bengal, and deflected by the Himalayas, or with those coming up from Western India, and whether the S. E. winds in Bengal, towards the end of the rainy season, and in October, have any connection with currents which cause the N. E. monsoon falling on the S. W. coast of the Bay of Bengal, will be solved by the efforts of meteorologists, with data carefully registered over a series of years. Mr. Blanford is already able to give a tolerably complete notion of the general barometric pressure over Northern India, throughout the year, as well as of the distribution of the mean temperature, deduced from observations extending over four years. The annual changes in temperature appear to correspond in general with the distribution and changes of mean pressure; the areas of low temperature coinciding with those of high pressure. As these interesting investigations advance, light will also be thrown on the normal law of the monsoons and of their anomalies, with reference to the distribution of rainfall, and its variation in different years; and eventually a very much more complete knowledge will be acquired of laws, which, in their influence on the crops, have a direct bearing on the well-being of the people.

## Agricultural societies.

Efforts have been made during many years, both by the various local Governments, and by societies and individuals, to introduce improved methods of agriculture. The societies have effected much substantial good by conducting experiments, introducing new plants, and recording information on agricultural subjects, but they have never had funds to introduce practical operations on a large scale. They have, however, had the merit of acting as pioneers, and their labours have been fairly useful. As regards horticulture, they have done much; among other things, their introduction of potatoes, cauliflowers, and peas, has led to those vegetables being largely cultivated by the natives. The most valuable work of the Lahor Society has been the experimental cultivation of better kinds of flax and rhea fibre, the production of silk, and the introduction of the olive plant.

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The Agricultural and Horticultural Society of India was established by Dr. Carey in 1820. It imported fruit trees, offered prizes for essays on the cultivation of indigo and sugar, and on the acclimatisation of foreign plants. At one time it had a farm of 160 acres near Calcutta, which was, however, given up. It now has an income of 3,000*l.* a year, including a Government donation of 500*l.*

Agricultural and Horticultural Society of India.

The Agri-Horticultural Society of Madras was founded in 1835. It has devoted itself to the encouragement of the cultivation of European vegetables, to the improvement of the cultivation of indigenous fruit trees, and to the introduction of new species. It largely imports and distributes vegetable and flower seeds and trees from other parts of India, superintends cotton experiments, and gives prizes for sheep and poultry.

Agri-Horticultural Society of Madras.

The Agri-Horticultural Society of Bombay was founded in 1830, and in the following year an annual grant of 300*l.* a year was given by the Government. In 1835 the society bought a piece of land at Suri, and laid it out as a garden, and in 1853 they established an experimental garden at Kirki, where, down to 1861, experiments were carried on at a loss of expenditure over receipts of 1,126*l.* But the only experiments of which a record exists are those conducted by Dr. Birdwood with cotton and the sorghum or great millet (*imphee*). In his Report, dated May 1861, Dr. Birdwood makes the following remarks with reference to the *imphee* experiments :—

Agri-Horticultural Society of Bombay.

Dr. Birdwood's experiments.

“ I deeply regret the poor results of these experiments with *imphee* at Kirki, for I anticipated their success with pleasure. The rapid decay of the manufactures of India invests with the highest importance every attempt to increase the number of its exchangeable raw products. The most trifling articles of native workmanship are being replaced in the bazaars by similar wares from Europe ; are being driven from the home markets by the sheer force of Saxon productiveness. Our best efforts, therefore, must be directed to counterbalance the decline in manufactures by a proportionate development of the agricultural wealth of the country ; new raw exchangeable products must supply the place of each manufacture as it in succession fails, if the prosperity of India is to be sustained under the circumstances of her dependent and intimate intercourse with western civilisation.”

As regards the society's experiments in cotton, Dr. Birdwood recorded the following very important remarks :—

“ Had twice as much been expended in India in cotton experiments as has actually been, I would still persevere with them. Such experiments are made out of a nation's superfluities, and should be undertaken under the sense that the most of them may fail, certain as it must be that at least one will succeed, or some collateral advantage be gained that shall a thousandfold repay all the accumulated outlay. It is on this ground that agricultural and horticultural societies have been, and economic museums are being, established over the world. It is anticipated that these institutions may for years carry on their operations in vain, but they are, nevertheless, supported (quite independently of their educational service) under the unfailing conviction that, in the end, some economic plant will be naturalised, and some staple brought to the manufacturer's notice through their agency, which shall so add to the wealth of the nation that all previous expenditure will be but as dust in the balance. We must regulate such expenditure, then, not so much by its immediate results as by our means. Attention should be turned to hybridization, as the most likely mode of establishing a larger staple of cotton in the parts of India beyond the influence of the sea and the two monsoons.”

Cotton experiments.

The Bombay Society was resuscitated, through the exertions of Dr. Birdwood, in 1859. When he became its honorary secretary it had only 29 members, and an income from all sources of 500*l.* a year. When he left, in 1868, the members numbered 153, with a fixed income of 1,235*l.*, besides special subscriptions. Dr. Birdwood's great work was the establishment of the Victoria Gardens and Museum at Bombay, including a complete botanical garden. The botanical garden was composed of exotic plants first introduced by Dr. Birdwood ; of naturalised exotics, such as the cocoa-nut, jowari, tobacco, and many other plants, and of indigenous plants. A sum amounting to 36,000*l.* was raised by public subscription, entirely through Dr. Birdwood's exertions, for the laying out

Dr. Birdwood's labours.

Victoria Gardens at Bombay.

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out and decoration of the Victoria Gardens. It is much to be regretted that, after Dr. Birdwood left India, the botanical garden should have been destroyed, and that the Society should not have published a single report. Dr. Birdwood had arranged, before his departure, that the municipality should pay all the garden expenses, the Society merely undertaking the management, so that the Society now has ample means to devote to agricultural experiments. The Government grant of 300*l.* should certainly be continued, but Government should insist upon getting something in return. This would be secured by the appointment of an efficient secretary.

## Agri-Horticultural Society at Lahor.

The Agri-Horticultural Society of Lahor was founded in 1851, for the collection of information respecting agricultural operations, to institute experiments, and to supply members with seed and plants. It has promoted the cultivation of flax, experiments in the cultivation of silk, and the distribution of seeds and plants. Among other plants, it has introduced the olive, the Chinese tallow tree, the Australian gum tree; and it has established a school for gardeners. A fifth agri-horticultural society and stock farm was started at Cawnpur in March 1865, by Mr. Halsey, the magistrate. He has raised a crop of cotton from New Orleans seed from Dharwar, and has crossed the country sheep with half-bred Leicesters, and distributed 100 male lambs.

## Stock farm at Cawnpur.

## Government gardens.

The Government Gardens at Calcutta, Saharanpur, Madras, Utakamund, Lucknow, and Bangalor, have also done most valuable service in the introduction and distribution of new plants and seeds.

## Improvement of native agriculture.

The local Governments have themselves, from time to time, adopted measures to improve the system of native agriculture, and efforts are still being made in that direction. Agricultural processes in India are rude and simple, but they are the result of most careful empirical experiments, carried on for several thousand years. Shallow ploughing for light soils, in a climate where heavy rains alternate with strong solar heat, is the native principle, and is the correct one. The natives by no means think that they do not know their own business. The weakest point in native agriculture is the deficient use of manure.

## Model farms in Bengal.

The plan of the Lieutenant Governor of Bengal, with a view to introducing improved methods of husbandry, is to make the Government estates, one or two in each district, models of revenue and agricultural management; the farms only to be of a few acres, so as to be within the ryot's competence to imitate. The Commissioner of Orissa has recommended the formation of a model farm, of 8 to 10 acres, on each canal, and there are to be others on the Midnapur and Son Canals. The actual cultivators are to be engaged to farm under supervision, leaving him in possession of his holding, with water and land rent-free. There is to be a model farm of 100 acres on the canal in Midnapur, with attached ryots' farms under supervision, and model villages are to be formed on Khás (Government) and Wards' estates. These plans are all calculated to be useful in the course of time, though results must not be expected immediately.

## Saidápet farm at Madras.

In the Madras Presidency, Sir William Denison started a model farm at Saidápet, near the presidency town, which has been very successful and useful, under the able management of Mr. Robertson. The farm now consists of 250 acres in a ring fence. One great point established by Mr. Robertson is, that green crops for fodder can be raised at all seasons of the year. Lucerne, under irrigation, produces a large quantity of valuable fodder; horse grain can be raised under dry cultivation as a green fodder plant, and it improves rather than impoverishes the soil. Yellow cholom (*Sorghum vulgare*) has also been found to be an excellent fodder, more nutritious than turnips, and pays well for high cultivation. Mr. Robertson has also shown that it is only necessary to steep the grain for horses, which has hitherto been boiled, a most important discovery. It is difficult to overrate the value of these experiments which seem likely to make the green crops under dry cultivation in Madras, what root crops are in England, and thus to be the means of furnishing the Madras ryot with far better means of maintaining his cattle than he now possesses. General F. Cotton recommends that the model farm should be removed to a better side than is afforded at Saidápet, where it may become a place of instruction



instruction for agricultural teachers of every class. Both he and Mr. W. Robinson of the Board of Revenue, strongly urge that agriculture should not only be taught on the Government farms, but that it should be recognised as a science worthy of a professorship at the Madras University. Another plan is to start district farms under Mr. Robertson, at Coimbatore, Belary, Tinneveli, and Ganjám, subject to the supervision of the Board of Revenue. This is a question of the very first importance, which is likely to receive a large share of attention in the immediate future.

In the Bombay Presidency, attention has chiefly been turned to the improvement of cotton cultivation, and, in the Dharwar district at least, the introduction of American cotton has been a complete success. The number of acres under cotton cultivation in the whole Presidency in 1871-72 was 2,963,874, being a decrease of 772,397 since 1870-71; but it is thought that the yield per acre has been greatly understated in the returns, for the export has actually increased. Superintendents of cotton experiments are employed in Dharwar, Gujrat, Khandesh, and Sind. Selection of seeds has been carefully attended to, and a considerable quantity of first-class seed has been distributed. Hybridization has also been persevered with, and in Sind there is every prospect of a valuable crop between the American and Dharwar native. During 1871-72 there were 153 licensed steam presses, and 287 hand-presses.)

Bombay cotton experiments.

Khandesh is at present the only district where there is a model farm; it is not a financial success; but the Cotton Commissioner has urged the advantages which would result from the establishment of permanent Government farms, by affording reliable information regarding the out-turn and money value of the various crops. One is under contemplation in Ahmadabad. Immense sums, in former years, were spent on cotton experiments, especially in the introduction of exotic seeds. But in order to increase the yield per acre, and to improve the quality of Indian cotton it is necessary to continue such experiments patiently for long periods, and to convince the growers of their value. They must be fully impressed, by continual experience, that a good market is ensured to them, on condition that clean and carefully picked cotton is produced; they must be induced to seek for and use good seeds, so that the staple may be improved, and so strive to produce a larger quantity per acre, through more careful and scientific cultivation.

In 1866 the Government made provision for the performance of some of these duties, in the Central Provinces and the Berárs, by appointing Mr. H. Rivett Carnac as Cotton Commissioner. In the following year (1867), 552,520 acres were under cotton cultivation in the Central Provinces, and 1,254,552 in the Berárs, out of 8,500,000 throughout India. The exports from all India amounted to 1,500,000 bales, out of which 250,000 bales were from the Central Provinces and the Berárs. The great sheet of trap-rock of the Deccan provides the black soil which is so favourable to cotton cultivation, while the railways which traverse the Berárs to Nagpur offer facilities for export. Thus, in the valley of the Púna forming North Berár, 32 per cent. of the cultivated area is under cotton. But the exportation is checked to some extent, because there is a large and steady demand for home consumption. The native manufacturers of finer fabrics have been little affected by the introduction of piece goods from England, and the annual consumption in the Provinces is not less than 60,000 out of 120,000 bales. (In the Berárs in 1867 the out-turn was 250,000 bales of 400 lbs. each, of which 207,000 were sent to Bombay for export.)

Mr. Rivett Carnac, Cotton Commissioner.

Mr. Rivett Carnac's duties were to promote the introduction of foreign staples, and the improvement of the indigenous plant. Some of the landholders in Wurdah, were induced to raise cotton for seed on carefully selected garden lands. Fine "bolls" of cotton were then selected and supplied to seed gardens, and cultivators were impressed with the importance of selecting their seeds. By careful selection and careful cultivation of selected seeds, much can no doubt be done to improve the character of indigenous seed. The seed of the Hinganghát district in the Central Provinces is considered to be the best. Mr. Ashburne successfully improved the inferior cotton of Khandesh by introducing Hinganghát seed, and the cultivators of Nemar and

Seed farms in Central Provinces and Berár.

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The Berárs have also obtained supplies of it. Experiments for introducing exotic cotton have not been attended with any great success. In 1868 three cotton seed farms were established, one of 52 acres in the Wurda Valley near Hinganghát, a second of 98 acres near Amraoti in East Berár, and a third of 113 acres near the railway station of Shegaon in West Berár. The object of these farms was to test the effect on indigenous cotton of deep ploughing, of manure and irrigation, to watch the effect of hybridizing various species on the plan of Major Trevor Clarke, and to instruct the natives. But it seems to be necessary first, to convince them that they require instruction. When the Commissioners visited one of the model farms, he got the old head of a village on one side and said, "Now, Patelljee, tell me really what you think of all this." The Patell replied that the English gardener was an intelligent young man, that he worked hard and was not quarrelsome, and that considering that he knew nothing about it when he came, his cotton was not much worse than theirs. The sons of several respectable landholders were, however, being trained at the experimental farms, and it was hoped that they might hereafter disseminate the knowledge they acquired.

Cotton transport  
by railway.

Mr. Rivett Carnac also took great pains to improve the system of getting the cotton down to the coast. Daily supplies arrived at the railway stations much in excess of the quantity that it was possible to send off by train each day. The yards became full to overflowing. The Cotton Commissioner established cotton yards at 12 railway stations, acres upon acres were covered with cotton bales, divided into squares and streets, every compartment with its watchman and fire engine, every bale entered in a register, and waiting its turn for loading. Order was thus established where there had been chaos. (At Khámgaon, in Berár, there are two large factories for cleaning cotton, and three for full pressing bales with steam power.) Throughout the Central Provinces and Berár, there are 21 full and 98 half presses. The half pressing system is chiefly in use, which takes up less space than the dokra or old native bale, but requires re-packing for export.

Cotton, Central  
Provinces and  
Berárs.

✓ In 1871-72, the area under cultivation in the Central Provinces was 13,365,902 acres, of which 667,226 acres was under cotton. The number of bales exported was 43,297, of which 24,432 were full pressed, and 39,754 half pressed and dokras. In the Berárs, 1,478,648 acres were under cotton, and in one part of Akola the natives were taking to the cultivation of New Orleans. The two experimental farms continued to be worked, but with little success. One of them has been converted into a model farm for the cultivation of all kinds of produce likely to do well in the Berárs. In June 1871 a cotton farm was established near Bulandshahr, in the North West Provinces, consisting of 93 acres, which were sown with Hinganghát, Burni, and Juri (Berár) country cotton, and New Orleans. It is in charge of a Scotch gardener.

Cotton farm at  
Bulandshahr.

Jute fibre.

Rhea fibre.

Growth of rhea  
fibre.

The jute fibre, in Bengal, is very largely grown, and its export to Europe and America has been developed, of late years, into a trade of important dimensions; while the rhea fibre, which is known to be vastly superior to jute, has failed to become a profitable object of cultivation. The reason of this is well known and an effort is being made by Government to overcome the obstacle. The rhea fibre of India is the same as the China grass (*Boehmeria nivea*), a stingless nettle with a perennial root whence rise 9 or 10 straight slender stems to about six feet, from the exterior of which the fibre is extracted. It is a native of Asam, and of Rangpur, in Bengal, where it is cultivated by the fishermen, near their huts, for making nets. Fresh sets of stems will yield them four or five harvests a year, but the manual extraction of the fibre is too laborious to make the cultivation, on a large scale, remunerative. For this object machinery is essential. Rhea is experimentally grown in the Kangra Valley, in the Dehra Dun, in Sahárunpur, in Bháulpur by Mr. Sandys, a planter, and elsewhere. This rhea plant produces, when properly manipulated, one of the strongest known vegetable fibres, three times as strong as the best Russian hemp. There is practically an unlimited demand for it in English and American markets at prices from 30 l. to 80 l. a ton. It is a plant which requires much moisture and a rich soil; but it will grow in many parts of India, and is susceptible of rapid propagation from cuttings; yet, and although the merits of the plant have been known

Value of rhea fibre.

known for the last 60 years, it is not successfully cultivated. Volumes have been written upon it, the Government and the Agri-Horticultural Societies have striven to encourage its growth and to develop a trade in its fibre, but all attempts have hitherto failed. The failure is entirely owing to the absence of suitable mechanical appliances for the separation of the fibre and bark from the stem, and of the fibre from the bark, and to the heavy cost of effecting such separation by manual labour. Thus the only real obstacle to the development of an extensive trade in this article is the want of suitable separating machinery. Existing flax and hemp-preparing machinery has failed where the rhea fibre is concerned. On the one hand there is an unlimited supply, on the other an unlimited demand, with only a single link wanting to connect one with the other. At last, in 1869, the Government of India resolved to offer prizes, sufficiently large to attract the attention of the first European machinists, for the best inventions for securing the manufacture of such rhea fibre, at 15 *l.* a ton, as would fetch a price averaging 50 *l.* a ton in the English market. The prizes offered were 5,000 *l.* and 2,000 *l.* for the best and the second best inventions. The trials were to have taken place at Saháranpur in 1872; but, owing to the cost and risk of sending expensive machinery to India, only one mechanist, Mr. Greig, appeared in the field. His machine did not altogether fulfil the conditions, but he was given a *douceur* of 1,500 *l.* It is now proposed to have the trials in England. There was some difficulty in taking this course, owing to the necessity for using the stems in a green state, such as they would be in on a plantation. It has been found, however, that China grass is grown on an estate near Marseilles, and the proprietor will undertake to supply a sufficient quantity for the trials, in a green state. This obstacle has thus been overcome, and there is every reason to hope that the ablest mechanists will take the matter up, and that the great object will at last be gained.

Sericulture has received some attention during the last year; and a most interesting account of silk in India has been written by Mr. Geoghegan, in consequence of representations made by the Silk Supply Association. The advantage of a further development of silk industry in provinces in India where it already exists, and of its extension to other provinces, was obvious; and the first thing needful was to collect information on the subject, so as to make a general review of all industries connected with silk in India. The East India Company took great pains to foster the production of silk. The planting of mulberries was urged on the Zemindars in Bengal, and in 1769 a staff of reelers was sent out from Italy to set on foot, in the Bengal filatures, the system pursued at Novi. The first silk prepared in the Italian method reached England in 1772, and Bengal silk soon became an important article of export to England. When the trading operations of the East India Company came to an end in 1833, its connection with silk culture ceased. At that time 956,453 lbs. were exported. There were then 11 head factories in Bengal, each with a commercial resident, with filatures throughout the district to which the cocoons were brought. An attempt was also made to foster the production of silk in Madras by Government aid in 1793, but it was abandoned in 1798. The Company effected great improvements in the reeling and drying, but none in the culture of the mulberry, or in breeding and rearing the worms; and since the trade has passed into private hands no active measures have been taken for the promotion of this industry. The quantity exported from Bengal has not varied in the last 30 years, being about 1,500,000 lbs.; but the price has nearly doubled. The cultivation in Bengal is mainly carried on in the districts of Rájsháhi, Birbhúm, Meldah, Murshidabad, and in Asam. In Rájsháhi there are 34 filatures owned by Europeans, and 63 by Natives, having 5,760 basins, and employing 10,000 hands. The yield of raw silk is 5,000 maunds, and 150 square miles are under mulberry cultivation. In Birbhúm the silk industry, of an annual value of 160,000 *l.*, supports 15,000 persons. In Asam the mulberry is grown in small patches; two kinds of worms are reared, and a fine white silk is produced. A very considerable quantity of tasar silk is raised in the Chattisgarh country, in the Central Provinces, the worms being fed on the *sál* tree. The only other province where sericulture is practised to any extent, is Mysor, where the

IV.  
AGRICULTURE.Machinery needed  
for rhea fibre.Reward for the  
best machine.Trial at Sahá-  
ranpur.Trials of machinery  
for rhea fibre to  
be made in Eng-  
land.

Sericulture.

Silk cultivation  
fostered by the  
East India Com-  
pany.  
Silk trade in  
Bengal.Silk experiments  
in Madras.E. I. Company's  
improvements in  
reeling silk.

Silk exports.

Present state of  
sericulture in  
Bengal.

In Asam.

In Mysor.

## IV.

## AGRICULTURE.

mulberry gardens occupy 18,443 acres, or 31 per cent. of the cultivated area. Here it is a profitable culture, the value of the silk annually produced being 55,000 l.; the cultivation is said to have been introduced by Tippoo.

## Silk experiments.

In other parts of India sericulture may be said to have been confined to experiments which have hitherto been more or less abortive. In 1854-56, Mr. Bashford, the Superintendent of the Sarda filature in Bengal, made some experiments in crossing; and Mr. Fox, in 1867, began an experiment in Sháhabad, but the trial came to an end after three years. Signor Lottei, in 1859, drew attention to the munga worm of Asam, as being capable of yielding silk, with care and better reeling, to compete with that of China; but his application for a grant of rent-free land to improve the munga worm was refused. In Bombay, Mr. Baker introduced worms from Mysor into Dharwar, 50 years ago, and the cultivation took root for a time, but cotton has since driven silk out of the field. The exertions of Signor Mutti at Pána, between 1838 to 1846, though under Government auspices, ended in failure, and there was a similar result in Khandesh. More recently a small experimental farm was established by Messrs. Dymes at Ussur, in Madras, in 1868; and Signor de Vecchi erected a filature near Bangaloh, purchased cocoons largely, took much trouble to improve the native worm, and endeavoured to acclimatize the Japanese species; but he has since left the country, discouraged at the results of his efforts. In the Punjab, several experiments have been tried by Mr. Cope and others, and the late Sir Donald McLeod took a deep interest in them. The Maharajah of Kashmir has also taken steps to encourage sericulture in his dominions. But it is only in Asam, Bengal, and Mysor that silk is produced to any extent.

## Silk experiments in Bengal.

## In Bombay.

## In Madras.

## In Mysor.

## In Punjab.

## Wild silk.

## Dr. Birdwood on wild silk.

## Captain Hutton on wild silk.

## Tasar silk.

There is, however, another branch of the industry connected with the wild spinning insects of the jungle, called tasar and eria. In 1858, Dr. Birdwood proposed the utilization of the wild worms found in the Bombay Presidency; and, in 1856, Captain Hutton, of Masúri, represented the existence of certain wild silk worms in the Dehra Dun; but no useful result attended his experiments. He, however, maintains that Masúri is a capital place for rearing the ordinary silk-producing moths; and in 1871 he prepared a most valuable monograph for the Government, on the known Bombycidae of India. The tasar insect is found all along the Sub-Himalayan range, and in forest-covered hills to the south of the Ganges, and it has, for centuries, been an article of trade. It feeds on the sál, the jujub, a *Terminalia*, and other forest trees; and the seed is purchased from the jungle people by the rearers, who raise the worms on trees, and keep guard on them with pellet bows. The tasar silk is much used in native fabrics, but the yield is diminishing as cultivation extends.

## Prospects of sericulture.

The numerous unsuccessful experiments are certainly discouraging to some extent; but it is certain that several parts of India are well adapted for sericulture; and judicious steps should be taken to promote it. With this object the Madras Board of Revenue (February 1872) would limit cultivation to localities where it is still carried on with some success, and would distribute mulberry seed to the best growers gratis. They would go so far as to establish nurseries in carefully selected centres, to hatch and improve the breed by selection and distribution gratis, but would not extend Government operations to reeling silk.

## Date palm.

Attention has been given by Dr. Bonavia, the Superintendent of Science in Oudh, to the cultivation of the date palm in that province, where it has been found to grow well. The paper by Mr. Edwards, on the cultivation and preparation of the date, has been translated into Urdu, for distribution among the natives to whom seeds are given; and an arrangement has been made with the Political Resident in the Persian Gulf for a yearly supply of seeds and cuttings of the date palm for planting in Oudh. In October 1872, a favourable report was made on the progress of this cultivation.

## Products of the mountains.

While cotton, sugar-cane, indigo, jute, opium, and cereals are grown on the plains of India, the mountainous parts yield valuable crops of coffee, tea, and chinchona. Many hundreds of acres have already been cleared in these hill districts, where rows of coffee and tea plants have taken the place of tall forest

forest trees and tangled undergrowth. The means of acquiring waste lands were rendered easy by the rules published in August 1862. By them no greater quantity can be sold in one lot than 3,000 acres, and no lot is to be sold unless it has been previously surveyed and marked out. The upset price is not to be less than Rs. 2. 8., nor more than 10 rupees per acre of waste land.

The extension of coffee cultivation in the hill districts of Southern India has been very remarkable. It was commenced experimentally in the Wynaad in 1840, and in 1862 there were 11,386 acres under cultivation in that district alone. In 1865 Wynaad coffee cultivation had increased to 200 estates, covering 14,613 acres. The export in 1860-61 was 19,119,209 lbs., worth 337,436 l.; and coffee cultivation has thus become a very important and increasing source of wealth. In 1871-2 the value of the coffee exported had risen to 1,383,416 l., and the quantity to 56,889,888 lbs. In Mysor there were 112,840, and in Curg 76,275 acres under coffee cultivation in 1871-72, and the quantity exported was 3,747 tons. Coffee.

Tea cultivation is carried on in Kángra, Garhwal, and Kamaun; and in Asam, Cachar, Silhet, Chittagong, Darjiling, and Chota Nágpur. In Dehra Dun there are 11 tea gardens; in Kángra 21; in Kamaun 38; and there are no less than 47 tea companies. In Darjiling there were 62 gardens in 1871-72, covering 12,305 acres; and the out-turn of tea was 2,665,821 lbs. With a fair chance, Darjiling tea could drive Chinese tea out of the markets of high Asia. Its growth in Sikkim employs 43 Europeans and 9,493 natives. In Asam 31,303 acres are under cultivation, yielding 6,257,643 lbs. of tea; in Cachar 23,081 acres, with an out-turn in 1872 of 5,406,400 lbs. In Silhet 21,408 acres, giving 4,641,659 lbs. Tea.

Chinchona cultivation, which was introduced into the hill districts of India from South America in 1860, has now passed through all the great difficulties and perils of its experimental stage; and has assumed its place among the important permanent measures of the Government. Unlike tea and coffee, the Chinchona plant had never before been cultivated. It was brought direct from the wild forests where, in an incessant struggle for existence with other trees, it grew under many disadvantages. Everything, with regard to its cultivation, had to be discovered by actual experiment. The total expenditure has been 61,719 l. The return represents a value which is simply incalculable and without price; but the mere interest on the outlay will soon be highly remunerative. Setting aside the use made of the bark in India itself, the value of which is already very considerable, upwards of 2,500 l. will be annually realised from sales in the London market of the Nilgiri bark alone, to which the Darjiling and other sales must be added. Mr. Money, and other planters, are also beginning to export bark on a large scale. There are now 2,639,285 plants in the Government plantations on the Nilgiri hills, without counting those of private planters. The largest trees are 30½ feet high, and over 3 feet in girth round the trunk. The area covered by the plantations amounts to 950 acres; and the bark under cultivation is much richer in quinine, and the other febrifuge alkaloids, than the wild bark of South America. During last year, 7,295 lbs. of excellent bark were sold in the London market, realising prices from 2s. 3d. to 2s. 10d. the pound; and 65,688 lbs. were supplied to the local manufactory, making a total value of 6,500 l. This year 20,000 lbs. will be sent home for sale. There are 591,600 growing trees of red bark on the plantations, and if an eighth of these be cut down every year bark will be annually available, yielding 10,323 lbs. of febrifuge alkaloids. The alkaloid is manufactured on the spot by Mr. Broughton, the quinologist, in an exceedingly cheap form, and is supplied to the medical stores. Hundreds of fever patients are thus annually cured. The grand object of this beneficent measure will thus be obtained by the provision of an abundant supply of the febrifuge, at so cheap a rate as to be within the means of the population at large. Chinchona.

At Lingmulla, on the Mahábaleswar Hills, in the Bombay Presidency, a Chinchona plantation was formed in February 1864. In April 1872 there were 7,460 plants, but have been injured by want of sufficient water and heavy gales of wind. There are also 20,000 plants in the nursery ready for planting out.

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The results of analysis of the bark by Mr. Broughton are on the whole encouraging.

## Darjiling Chinchona.

At Rungbi, near Darjiling, 2,000 acres are under Chinchona cultivation; the bark has been sold in the London market at prices ranging to 1s. 3d. per lb.; and enormous quantities of bark have been stored for local manufacture. A chemist has been appointed to reside at the plantations, with a view to an efficient febrifuge being manufactured at so cheap a rate as to be within the means of the natives of Bengal, who will thus participate in the benefits which their brethren in Madras are already enjoying. In the Sittang division of British Burma Chinchona plantations have been formed by Captain St-ton, the conservator of forests, at two places, about 3,700 feet above the sea, one to the north and the other to the south of the Thoukyeghat river, east of Tounghu. The main plantation now contains 354 plants fairly established. Chinchona plantations have also been formed in Curg, and in the Bababaden hills in Mysor; and the tree is grown with success in Wynaad, on the Palnai hills, in Tinnivelli, and in Travancor.

## Cardamoms.

Cardamoms grow wild in the forests of the western ghauts, and the yield, in the forests of Mysor alone, was 26 tons in 1870-71, valued at 17,000*l.* Instructions were given in 1871-72 for the demarcation of such tracts of jungle as were favourable for the growth of this spice, and coffee planters are beginning to turn their attention to its cultivation. Several other useful products have been introduced into India during recent years. The ipecacuanha plants, several cases of which have arrived in good condition at Calcutta during 1871 and 1872, will be cultivated in the Sikkim Terai. Carolina rice has been introduced into Bengal, Mysor, Bombay, and Madras, and at the Saidapet model farm its cultivation has been very successful. The Cochineal insects have been imported into Mysor from Teneriffe. They have taken kindly to the acclimatised cactus; the climate is suitable, and the experiment promises well.

## Ipecacuanha.

## Carolina rice.

## Cochineal.

## Fisheries.

In 1869, Lord Mayo's Government came to the conclusion that the time having come when the great importance of obtaining exact information as to the natural capabilities of the land and water of the vast empire of India is beginning to be fully and clearly appreciated, an effort should be made to utilise to the utmost the fishes of the rivers and coasts as sources of food to the population. Dr. Day, who was already well known as the author of an important work on the fishes of Malabar, was therefore appointed to make inquiries respecting the fisheries throughout India on a comprehensive system, and to submit reports on any matters relating to the utilisation of the natural resources of the rivers and seas, which seemed to him to deserve the attention of the Government. Dr. Day commenced his investigations in Orissa, and went thence to Burma. He has also reported upon the Punjab, North West Provinces, Sind, and Madras. He treats of the fresh water fisheries of India under five heads: namely, wasteful destruction, the fishermen, the fisheries, the fish, fish in an economic point of view, and the effects of a fish diet. There seems to be a concurrence of opinion from all parts of India that there is, at present, a wasteful destruction of fresh water fish, either by poisoning; or by the use of meshes so small as to catch all the small fry. The invariable rule, among fishermen of every caste and creed, is to get everything they can, irrespective of the season, entirely oblivious of next year's supply. The consequence is that the waters are insufficiently stocked. Dr. Day has no doubt that, if the fishes were allowed fair play, an increased supply would be the result. He recommends the prohibition of trapping and snaring the breeding-fish during the monsoon months, by regulating the size of the meshes of nets, or the interspace between pieces of rattan or reed. This would permit the breeding fish to deposit their ova, and return to the rivers from which they ascended for that purpose. He would also forbid poisoning and other wholesale methods of destruction; and would provide fish ladders at the weirs or anicuts.

## Dr. Day and his reports.

## Dr. Day on fresh water fisheries.

## Fish as a source of food supply.

The large fish-eating population gives great importance to these questions. The whole of the indigenous population of Burma eat fish. In Canara, Mr. Thomas, in his interesting and exhaustive report, mentions that 760,160 out of a population of 839,688 are fish eaters. In Orissa fish is almost universally eaten, and very largely in Bengal, the North West Provinces, and the Punjab.

A series

A series of questions, drawn up by Dr. Day, has been circulated, in order to elicit opinions and to obtain materials for a more comprehensive report. Meanwhile, the Secretary of State has drawn attention to the conclusions of the Sea Fisheries Commissioners in England, who recommended unrestricted freedom of sea fishing, while, even in estuaries, they reported that the natural increase of fish is so rapid and great as to be little affected by man's destructiveness. It has also been enjoined that, in framing regulations for the fisheries, care must be taken that they are of such a nature as to interfere as little as possible with the habits and welfare of the very poor class of people engaged in earning a livelihood from fishing.

A general review of the whole of the results of Dr. Day's inquiries will hereafter be made by the Government of India, and a decision will then be formed on his recommendations, and on the most advisable measures for the maintenance of supplies of fish.

The breeding of stock has received much attention in all parts of India. Great pains have been taken, especially in Madras, to improve the native sheep, and sheep have been introduced into the Punjab and the North West Provinces, from England; while shows and prizes have stimulated the breeding of cattle. As regards horses, the Madras and Bombay armies depend on the open market for their supply, but in Bengal Government studs have long been established to supply the army in that Presidency with horses. In 1794 a very unsuitable locality was selected in Tirhut for the purpose of breeding stock, and in 1808 Mr. Moorcroft, an experienced veterinary surgeon, was sent out as Superintendent of Studs. He organised the department, sent officers to Persia and Arabia to buy stallions and mares, and in 1819 he himself penetrated across the Hindu Kush to purchase Turcoman horses, and, as is well known, this intrepid explorer died of fever near Balkh. From time to time commanding officers expressed general dissatisfaction at the remounts supplied by the stud, and a Committee, appointed in 1851, exhibited very unfavourable results; but in 1860 Lord Canning recommended the continuance of the system, to which Sir Charles Wood agreed, but at the same time adduced arguments in favour of making India self-reliant in respect of the supply of horses.

The studs are in two divisions, the central at Pusa, Baxar, Ghazipur, and Kurunthedi; and the North Western at Hapur, Saharunpur, and Karnal. In the Central Division the mares purchased or bred by the Stud Department are lent to farmers, and covered by Government stallions; and the farmers are bound to sell the foals to the Department at eight months old. The foals so purchased are sent into various depôts, until they are old enough to be presented as remounts. In the North West Provinces the mares belong to the farmers themselves, are registered by Government, and are served by Government stallions. There are about 18,000 mares on the register, and 328 stallions belonging to the stud. There is also a home system under which both stallions and mares belong to Government. There was a home stud at Hissar which was discontinued in 1842, and in 1865 it was re-established at Karnal, where there are English mares sent out in 1866 and 1867, some of the stallions sent out by the Secretary of State, and several mares from New South Wales. Twenty stallions were sent out to India, by the Secretary of State, every year from 1861 to 1865, 13 in 1866, 19 in 1867, 10 in 1868, 2 in 1870, and 6 in 1872. The Government of the Punjab also gives much encouragement to the breeding of horses, providing stallions in the best breeding districts, and offering prizes for the best animals exhibited at the different agricultural meetings.

An annual supply of 750 to 800 horses is required for the Bengal army, but the Stud Department is not able to supply more than 500. In 1868 there were almost unanimous reports as to the badness of the remounts, and Lord Mayo appointed a second Committee to inquire into the general management of the Government studs. It was found that the Department cannot supply the number of horses required, that the prices of its horses are exorbitant, that it has extinguished private enterprise, and has failed to improve the indigenous breed of horses. In consequence of the report of the Committee, the Government of India resolved to abolish the asami system and to establish a new breeding stud in the Punjab on the home system.

Views of the Home Government on Dr. Day's fishery reports.

General review of the question of fisheries to be made hereafter

Breeding of live stock.

Supply of horses for remounts.

Government studs.

Mr. Moorcroft.

Stud Committee of 1851.

Stations of Government studs.

Asami system.

Zemindari system.

Home system.

Punjab system.

Insufficient supply of horses.

Stud Committee of 1868.

Unfavourable report.

Resolution of Government of India.

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Views of the Home  
Government.

The Home Government, however, have come to the conclusion that the proper direction in which the efforts of Government should tend is towards the encouragement of private enterprise. Various excellent breeds of horses have existed in India, in Katiwár, in the Bhima Valley, and in the Punjab; and, with proper assistance and encouragement, the breeding of horses for the market would probably again revive as a profitable enterprise. India also receives foreign supplies from the Persian Gulf, Central Asia by Kabul, Australia, the Cape, and England. Instead of Government studs, it is proposed that stallions be furnished in the best breeding districts, that prizes be offered for promising brood mares and young stock, and that liberal prices be given for suitable three or four year old colts. With such judicious encouragement it is anticipated that the ancient and successful practice of private horse breeding in India will revive.

## Horse shows.

In the Bombay Presidency a good deal is already being done in this direction. In Ahmadabad there are now nine Government stallions, and their employment is stated to have produced most favourable results; in Ahmadnagar there are two, in Belgaum two, in Dharwar three, in Khandesh eight, in Sátára four, and in Sind seven. In Ahmadabad there are also three Government bulls, the services of which are much appreciated by the breeders; and Mr. Borradaile, the Collector, zealously promotes horse and cattle breeding in his district. In all the districts the Government stallions are much sought after, and their services are fully appreciated by stock breeders. Annual horse shows have been held at Ahmadabad since 1869 with great and increasing success. At Sírúr, also, near Púna, there is an annual horse show in January, when prizes are awarded for the best young stock, the produce of Government stallions, and for mares in foal. Country breeders readily attend the show, and it promises to become, year by year, more attractive. Another annual horse show takes place at Dehwari, in Sátára, at which prizes are awarded. In the Punjab, where there are 57 Government stallions, the Lieutenant Governor has determined to make Ráwalpindi a centre of operations connected with horse breeding; and another will be formed on the Derajat frontier, where there are many first-class mares of the Baluch and Sagar breeds. A horse fair is held at Ráwalpindi, where every inducement is offered, by means of prizes, to breeders of the best animals, and at the last fair in March 1872, besides numerous remounts for the native cavalry, 21 gun horses were purchased for the artillery. It is expected that, in a few years, the Ráwalpindi horse fair will produce a good supply of artillery horses. There are cattle fairs at Hissár and Sarsa, the centres of the grazing districts in the Delhi region, at which upwards of 25,000 people assemble, some of them coming from distances of 200 miles. The most successful cattle show in South India is that which was periodically held, for a succession of years, at Nellor, through the influence of which the breed of cattle was certainly improved. It was begun by Mr. Dykes, the Collector, who took a deep interest in it.

## Cattle fairs.



## V.—IRRIGATION.

IRRIGATION is a necessity for a large section of British India, is of incalculable importance to the cultivators over a still larger area, and is unnecessary only in two limited bands of territory, where the rainfall is excessive. The map, showing the amounts of rainfall by tints of colour, exhibits this very clearly. In the north-west corner of India there is an arid region, including all Sind and half the Punjab, where the normal annual rainfall is less than 15 inches. Here irrigation is essential to the existence of the people. Next, there are two zones of dry country, with an annual rainfall between 15 and 30 inches. One surrounds the arid region on the north and east, in a belt from 100 to 200 miles wide, and has been named by Dr. Brandis the Northern Dry Zone; it includes Delhi and Agra. The Southern Dry Zone is in the peninsula, extending from Nasik to Cape Comorin, at a distance from the two seas. These dry zones also stand in absolute need of irrigation. The next region has a rainfall between 30 and 60 inches, and includes the upper part of the valley of the Ganges, Central India, and the eastern coast of the Madras Presidency. Here irrigation is also much needed, and great distress has been caused by the want of it. The fifth region has a rainfall between 60 and 75 inches, and comprises the deltas of the Mahánadi and Ganges, and the lower part of the Ganges valley. In this more favoured belt, irrigation may be looked upon as a luxury, often useful, but not absolutely necessary, except in extraordinary years. Finally, there are two belts of excessive rainfall, where irrigation is unnecessary, the one extending from the mouth of the Irawadi, along the east coast of the Bay of Bengal, up the valley of the Brahmaputra, and along the skirts of the Himalaya; the other along the west coast of the peninsula, from the seashore to the summits of the gháuts.

Necessity for irrigation in India.

Zones of rainfall with reference to need of irrigation. Arid zone.

Two dry zones.

Zone of from 30 to 60 inches.

Zone of from 60 to 75 inches.

Zones of excessive rain.

The Governments of India have always, and especially of late years, given much attention to the supply of water for the irrigation of those parts of the country which most need it. Gigantic works have been undertaken, and many have been completed in the arid region, in the dry belts, in the less dry tracts, and even in the belt where artificial supplies are more or less a luxury. Still very much remains to be done, and the progress of our efforts to supply the various regions with water for irrigation, and so to secure the inhabitants from famine, will be best considered by dividing the subject according to the principal river basins. First in order will come the basin of the Indus, the abode of the first civilised race in India, and consequently the region where irrigation was first practised: it includes an area of 372,700 square miles. Then the Ganges River basin, covering 391,100 square miles, and that of the Mahánadi. Next the basins of the Tapti and Nerbada; and, finally, those of the rivers emptying themselves into the Bay of Bengal, on the eastern coast of the peninsula.

Irrigation works undertaken by Government.

Irrigation considered with reference to river basins.

The Indus basin divides itself into two parts, the first comprising the Punjab, where the six rivers spread out like a fan; and the second and lower being the valley of Sind.

THE INDUS BASIN

The relative requirements and needs of the Punjab, as regards irrigation, are very clearly exhibited by the rainfall map. When the six rivers issue from the Himalaya, they come upon a narrow belt at their feet, where the supply of rain is plentiful. The rivers then enter the northern dry zone, where they spread wealth and fruitfulness along the banks; but at the same time, in the course of ages, they have cut deep down through the soil, and left high land on either side, the valley being from 10 to 50 feet below the central plateau. The fertility is consequently confined to the low valleys, four to ten miles wide, over which the rivers meander from side to side in the course of ages, and are only checked by the steep scarps which they have themselves gradually formed. The low land by the rivers is called *khádar*, and the high and sterile tracts on either side *bángar*. The *bángar* lands form the doabs between the rivers. Though the soil is fertile, cultivation must depend upon the scanty rain, unless it be supported by artificial irrigation. Large portions of the *bángar* are covered

Requirements of the Punjab.

Moist and dry zones.

Physical conformation.

Khádar land.

Bángar land.

covered

<p>V. IRRIGATION.</p> <p>Arid zone.</p>	<p>covered with grass or brushwood, or are entirely waste. The general surface of the Punjab slopes southward from the Himalayas at a considerable gradient, and as the rivers converge, the depth of the river beds below the plain is reduced and eventually the <i>bángar</i> is lost sight of, and low <i>khádar</i> extends right across between the rivers. But here the rivers enter the arid region, where there is scarcely any rain, and which would be a scorched and uninhabitable waste if the water from the Himalayas was not led over it to convert it into a garden.</p>
<p>Kinds of irrigation.</p> <p>Wells.</p>	<p>The different kinds of irrigation required by such a country suggest themselves. Near the foot of the Himalayas, and in the upper valleys and <i>khádar</i> land, where water is under 25 feet from the surface, irrigation is supplied from wells. In the low tracts, where the rainfall is less than 15 inches, water must be led from the rivers during the season of inundations. The perennial canals,</p>
<p>Inundation canals.</p>	<p>which can only be constructed at vast expense, and when great engineering skill can be obtained, are necessary for the high and rainless tracts of the four doabs, where wells are too costly, and to which the inundation waters could not be brought. These doabs have excellent soil, and only require water to become fertile.</p>
<p>Permanent canals.</p>	<p>During the period of native rule, well irrigation and that from inundation canals were alone available. By these canals the district of Multan, between the Sutlej and the Chenab, where rain hardly ever falls, is converted into a succession of beautiful gardens shaded by date palms. There is a burning sun above and canals flowing below. During the winter the water of the rivers is not sufficiently high to enter the canals, some of which are artificially excavated, while others are merely channels abandoned by the rivers; but as the rivers rise in the spring, from the melting of Himalayan snows, the water gradually enters the channels, which obtain their maximum volume in summer; so that, when water is most needed, when the sky is brass and the earth iron, the inundation canals from April to October produce luxuriant crops. The corn, before yielding its grain, is twice mown down as fodder for cattle, and then ears, and produces abundant harvests. The mangoes are only second to those of Mazagon, and oranges and pomegranates grow in profusion.</p>
<p>Native irrigation.</p> <p>Multan inundation canals.</p>	<p>In Multan the main canals were considered the property of the Government, but the annual repairs and clearances were done by the people. The <i>kárdar</i> of the district demanded as many labourers as he considered necessary, according to the extent of the clearance required. The landholders then formed <i>puncháyats</i> or committees, and fixed the portion of the general burden to be borne by each village, with a scale of fines for defaulters. The system was worked by <i>cher</i> or statute labour. The plan of distributing the water varied. On some canals the number of hours <i>per diem</i> was fixed, during which Persian wheels were to be worked, or the side channels to remain open. On others, bunds were allowed to be thrown across for a certain time, at fixed points.</p>
<p>System of clearing Multan Canals.</p>	<p>One great trouble was that the waters of the rivers were apt to recede, leaving large sand banks at the canal mouths, which had to be cut through, or a new head made; then the channels were irregular, without any provision for the escape of surplus water, and the excavated earth was generally heaped up irregularly on the banks, which were never made with any slope, yet on them the safety of the country from inundation often depended. The Afghan rulers, left by Aurungzebe, did much to establish this system of irrigation, and Saween Mull, who was governor from 1821 to 1844, so enriched himself from the plenteous harvests of Multan that he left a private fortune of 900,000<i>l</i>.</p>
<p>Defects in canals.</p>	<p>But the inundation canals were not confined to one district. Taking advantage of natural ravines, some rude canals existed in Gugaira, and other districts of the Bari Doab, above Multan. There was a more complete system in the rich country of Muzaffargarh, between the Chenab and the Indus, the land under the influence of which was one sheet of cultivation. There the proprietary right was vested in <i>zemindárs</i>, who were hereditary landowners, while under them were the owners of wells and Persian wheels, called <i>chukdars</i>* and <i>sillundars</i>,† who brought the land under cultivation. These paid a portion of the</p>
<p>Gugaira inundation canals.</p>	
<p>Muzaffargarh inundation canals.</p>	

\* From *chuk*, a wooden frame sunk as the foundation of a well.

† From *sillun*, bricks.

the produce, called *lichh*, to the zemindárs, and also a settled rate to the Government. A man was said to own, not so much land, but so many watercourses or Persian wheels. The actual cultivators rent from the owners of wheels or wells, and the canals were kept clear of silt by statute labour.

In the Shahpur district there were and are several inundation canals, drawing their supply from the Jhilam.

Sháhpur and Derájat inundation canals.

In the Derájat, on the right bank of the Indus, the canals run parallel with the river, and fill during the periods of inundation. There were 12 of these canals, with an aggregate length of 291 miles. The landowners arranged the distribution of water among themselves for the khurreef crops, which are all grown on canal lands. The native State of Bhawalpur, on the south side of the Satlej, is also dependent on inundation canals, its *khádar* land, bordering the river, being 10 to 12 miles wide. In a former age such inundation canals were conducted from all the five rivers of the Punjab, and traces of them are perceptible, with ruins of cities and villages on their banks.

Bhawalpur inundation canals.

Our duty has been to maintain and improve these native works, and Lieutenant (afterwards Colonel) Anderson was appointed to superintend them in 1850. For purposes of administration they are divided into the Upper Satlej, the Lower Satlej and Chenab, and the Indus Canals.

Colonel Anderson

The Upper Satlej Canals are in the central part of the Bári Doab, above the Multan district. Here the face of the country is covered with traces of former life and prosperity; the cause of decay being due to the loss of water supply, for the River Bias once had an independent course to the Chenab, fertilizing the land on either bank; but in 1790 it was diverted into the Satlej, and its old bed became a dry ravine, with a complicated network of deserted watercourses. Colonel Anderson's attention was early given to this waste. Inundation canals have been brought into it from the Sutlej. The Khanwah Canal leaves that river at a point 20 miles below Ferozpur, by a mouth 90 feet wide, narrowing to 20 feet at the end of its length of 55 miles. A great deal of water used to force its way out of the canal at weak points, and flowed back to the Satlej, inundating the country. The head of the canal also gave much trouble. It was thoroughly cleared out in 1850, and a jetty was built to turn in the water, but in 1852 a waste of sand, a mile wide, intervened between it and the Satlej. A new channel had to be opened, and it has since been much improved. The Khanwah is of the utmost value to the agriculture of the Gúgaira district, irrigating 157 villages, and much labour and money have been devoted to its improvement. By 1858 these improvements had been completed, and during the following years several *rájbuhas*, or supply channels, were constructed in connection with it, with masonry outlets, which were paid for by the cultivators.

Upper Satlej canals.

Old bed of the Bias.

Khanwah Canal.

The Sohág Canal leaves the Satlej a little below the mouth of the Khanwah, to irrigate the country between that canal and the river. It is 73½ miles long, and has been very much improved of late years; the channel straightened, and masonry outlets constructed. The Kutora is a nulla to the north of the Khanwah canal, and Colonel Anderson proposed that the Sutlej water should be conveyed to it from opposite Ferozpur, and so into the old bed of the Bias. Another natural ravine, or watercourse, is the Para, which is a continuation of the Sohág. It is connected with the old Bias by a channel called Nawabbin, a name derived from a Nawab of Multan, in the last century, who carried the supply of the Para into the Bias, and thence into the Multan district, for the purpose of providing a navigable passage for his wife, who was travelling down country in a boat. The aggregate length of the Upper Satlej canals is 213 miles.

Sohág Canal.

Kutora nulla.

Para nulla.

Colonel Anderson's scheme, with reference to the Upper Satlej system of canals, was to establish a control over the river by the construction of a masonry dam at Ferozpur, so as to prevent silting up at the canal heads, and he would have provided one main head for the old Bias, the Khanwah, Sohág, and Para. A great scheme, based on that of Colonel Anderson, for the complete irrigation of the central part of the Bári Doab, by inundation canals, was submitted to the Government of India in January 1872. The area of the country affected by this project is 11,000 square miles, of which 3,200 are on the left bank of the Satlej, and partly in the Bhawalpur State. The aggregate length of the channels

Comprehensive scheme for improving inundation canals.

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channels is 1,143 miles on the Bári Doab side, and 80 on the left bank. The estimated outlay is 3,560,786*l.*, of which 633,056*l.* is the cost of a dam across the Satlej at Ferozpur, with headworks, such as was originally proposed by Colonel Anderson.

- Multan canals.** The Lower Satlej and Chenab Division comprises the canals which fertilise the Multan district. Since the annexation they have been cleared by statute labour every year, the slopes and headworks have been improved, and the distribution carefully supervised. There are now 39 canals, with an aggregate length of 632 miles, of which only 11 miles have been added since the commencement of our rule. They irrigate 120,000 acres, belonging to 410 villages.
- Indus canals.** The Indus canals include those of Muzaffargarh and the Derájat. There are 66 in the former district, drawing their supplies from the Indus and Chenab. The canals have hitherto been kept in repair and cleared by statute labour.
- Derájat canals.** The canals of the Derájat aggregate a length of 592 miles, 108 of which have been constructed since the commencement of our rule. The annual clearances are almost entirely effected by free labour. During 1871-72 much trouble was given by the high flood of the Indus, and some of the embankments were breached, causing extensive inundation and damage to crops. A scheme is now under consideration for the improvement and extension of the irrigation in the Dera Gházi Khan district, and another for the irrigation of part of the Sind Sagar Doab, by taking off a supply of water from the Indus where it runs through a rocky channel near Kalábágh.
- Dera Gházi Khan canals.**
- Sind Sagar project.**
- Swat River project.** Yet another project for the irrigation of the Yusafsái part of the Pesháwar valley received the sanction of Lord Mayo's Government at the instance of Sir Richard Pollock, then the Division Commissioner. The Pesháwar valley is encircled by mountains with the exception of a small opening towards the Indus, and comprises 2,400 square miles, divided in two by the River Kabul, which enters the plain at Michni. It is joined midway by the Swat river, flowing from the north-west, and entering the plain at Abazai, and the Bara from the south-west, entering the plain at Shaikhan. The distribution of water from these three rivers is a constant source of feud among the villagers. Four or five villages have a joint right in one irrigation cut, and are together responsible for its maintenance, the cut being supplied by feeders from the rivers. Yusafsái is the portion watered by the Swat river to the north-west. The Swat on entering the plain divides into many channels, widening through rich meadows, fringed with willows and poplars, which all unite again before joining the Kabul. But the supply is often insufficient and irregular, and the remedial scheme is to throw a bund across the Swat at Abozai, in the gorge. A main channel will be led from above the bund, 18 miles long, with 121 miles of distributing channel. The cost of this "Swat River Scheme" is estimated at 52,700*l.*
- Pesháwar irrigation.**
- Swat irrigation.**
- Swat Canal.**
- Bhávalpur irrigation.** But the most instructive system of inundation canals is that within the native State of Bhávalpur, which has been created by the Political Agents, Major Minchin and Captain Grey, and their able engineer, Mr. Barus, during their administration of the country for the young Nawab, who is a minor.
- Description of Bhávalpur.** Bhávalpur extends for 300 miles along the left banks of the Satlej, Chenab, and Indus. It consists of the *khádar* land along the river banks, averaging a width of 10 miles; the *bángar*, a strip of land running along the whole length of the State, parallel to the *khádar*; and the desert to the south. A large part of the *bángar* is now covered with sand drift from the desert. The desert tract dates its origin from the drying up of the Ghaggar, the ancient Saraswati, which once flowed through the heart of the country from the Sawálikh mountains to the Indus, between Rori and Uch, parallel with the Satlej.
- Ancient channels.** The waste dry channel, traversing the Bhávalpur *bángar*, has ruins of old towns dotted along its banks. It is the old bed of the Ghaggar, (the waters of which now hardly ever reach beyond Bhutner after the heaviest rainfall), and is locally called the *Hakra* and *Sankra*. For the first 80 miles of the Bhávalpur State there is a vast branch of the Hakra, parallel with the River Satlej, called the *Trewanna*, pursuing a tortuous course between the Hakra bed and the Satlej. Once it fertilised a vast tract, but for centuries it has received no water from its parent stream. It had, however, been supplied with water at the rise of the Satlej by numerous excavated channels from the river to elbows of the Trewanna, where, in its windings, it approached
- The Trewanna.**

approached nearest. By these means lengths of the Trewanna were just able to keep alive some of the land it once fed plentifully. But, owing to long neglect, the feeding channels and the Trewanna itself silted year by year, and more and more land fell out of cultivation. The people took to rapine for a living, and at last the whole north-east district of Bháwalpur became a mere population of cattle lifters.

This was the state of affairs when Major Minchin, the Political Agent, assumed charge of Bháwalpur in 1867, during the minority of the Nawab. He borrowed 15,000 £. at 12 per cent. interest for 10 years, and dug a canal called the *Ford-wah*, which issues from the Satlej, and extends parallel to it, and about 20 miles from it, for 105 miles. Irrigation channels are led from the canal, and it does good work, though of course it is unable to replace the vast irrigation of the Trewanna. It was then resolved to restore the Trewanna, as far as possible, by clearance and by leading feeders into it from the Satlej. These works are now in course of construction with the best results. Below the tails of the Trewanna and Ford-wah, in the Khairpur district, commence six small canals, which extend to the district of Bháwalpur. Their complete re-modelling is a projected work for next winter.

Below Khairpur, which is one of the districts of the Bháwalpur State, and 20 miles north-east of the city of Bháwalpur, there was a large natural dry channel, called the *Vahind*, a feeder of the Sankra. It was proposed to restore water to this channel by feeding it from the Satlej when in flood, and this was partially done in 1871-72 with great success. A new canal, 20 miles long, has also been cut to feed a ruined channel called the *Khanwah*, and the old portion of which has been re-modelled and extended. From the city of Bháwalpur to the junction of the Satlej and Chenab, a distance of 30 miles, there are numerous small native inundation canals, and one large channel, the *Nowrunga*, which has been completely re-modelled, and fed at a high level by a head 20 miles long. The *Kutuhwah*, *Sultanwah*, and *Mobarikwah* are perennial canals with their heads below the winter zero of the river, leading to Ahmadpur, the former capital of the State.

The principal canals from the Chenab are the *Minchin-wah*, *Barnswah*, and *Sadikwah*, large channels 100 feet to 200 feet wide, irrigating a vast area by an endless network of branches. Below the junction of the Satlej and Chenab, and parallel to the latter river, there is a great dry channel winding down the remaining length of the Bháwalpur State, called *Hurriari* or "the fertiliser." All the branches from the Chenab system of canals are tailed into the *Hurriari*, but their volume is inadequate to afford a useful supply to that great channel. In 1871, however, a spill from the Chenab into the *Hurriari*, at high flood, was carefully utilised, and it is now proposed to make a permanent cut along the line which the spill took, and so give water to the *Hurriari*. From the Indus there are nine canals, seven of them old native works, and two constructed by the English. The Indus alone, of these rivers, pours its flood over the face of the country in July and August, the waters uniting to run into the eastern Narra, a great channel belonging to the Sind system.

The system of yearly clearances has been placed on a thoroughly sound basis in Bháwalpur. The exact quantity due from each farmer is accurately calculated on correct principles, and he is then made responsible for the clearance along the extent of the canal which rightfully falls to his share. All this useful work has been done within the last four years; and the English Political Agency has thus raised a revenue which they found at 12 lakhs paid in grain, to 19 lakhs (or 190,000 £.) paid in cash. This is a measure of the blessings conferred upon the country by Major Minchin and his coadjutors.

The important system of inundation canals from the Punjab rivers, upon which the very existence of the inhabitants of a vast area in the rainless region depends, was administered by the people themselves, under Government supervision. The whole of this class of canals within British territory, has now been placed under the regular management of the Irrigation Department. Until recently there was no direct canal income, the returns appearing in land revenue.

The region for state canals presented far greater difficulties. This region, in the Punjab, comprises the Bári Doab between the Bias and Rávi rivers, the Rechna Doab between the Rávi and Chenab, the Chuch Doab between the

The Ford-wah.

Khairpur small canals.

The Vahind.

The Khanwah.

The Nowrunga. Ahmadpur canals.

Bháwalpur Chenab canals.

The Hurriari.

The Indus canals.

Bháwalpur system of clearances.

Results of English work in Bháwalpur.

System of inundation canals.

Doab permanent canals.

V. IRRIGATION.	Chenab and Jhilara, and the Sind Sagor Doab between the Jhilara and the Indus.
Bári Doab canal.	The Bári Doab was considered the most important, as containing Amritsar, and being the cradle of the Sikh nation; and a great canal was projected for its irrigation immediately after the annexation of the Punjab. One small permanent canal already existed in the Bári Doab. It was called the Husli Canal, and was constructed in about 1633, by order of Shah Jehan, not for irrigation, but to supply fountains at the royal gardens of Lahor. When the Sikhs acquired the sovereignty, they led a branch to Amritsar, to supply the sacred tank. The canal followed the natural line of drainage by a tortuous course of 110 miles, and passed through low land which least required irrigation.
Husli canal.	
Details of Bári Doab canal scheme.	The great English project was to bring a central canal down the high land of the Bári Doab for 247 miles, receiving its water from the Rávi, where that river debouches from the lowest of the Himalayan ranges, at Madhopúr. Here there is a deep cutting through the high bank of the Rávi. The canal then crosses two mountain torrents, and gains the table land, striking into its wild wastes, to vivify and regenerate the ruined cities and villages, and rejoin the Rávi, 56 miles above Multan. At the thirtieth mile a branch diverges, to fertilise the most arid part of the Doab, and reaches the ancient city of Kassur (84 miles), and from this branch a smaller channel is diverted eastward to near the Satlej, opposite Sobráon (61 miles). At the fifty-fifth mile another branch is taken off, to spread fertility down to Lahor (74 miles). The original plan was that the canal should be navigable throughout, the slope being counteracted near the head by boulder rapids, and afterwards by masonry falls. The total length, including branches, was to have been 466 miles. The main channel, at its head, was to be 120 feet broad, and 5½ feet deep. The total cost was originally estimated at 530,000 £., and the work was entrusted to the late Colonel Dyas, with Lieutenant Crofton as his assistant. They commenced work on the first 30 miles in 1850.
Head works.	
Mountain torrents.	
Kussoor branch.	
Sobráon branch.	
Lahore branch.	
Dimensions of canal.	
Cost of Bári Doab canal.	In 1856, it was found that the cost of the canal would not be under 1,350,000 £.; and efforts were concentrated on the completion of the main line, down to where the Lahor branch breaks off. Water was first admitted into the Bári Doab Canal on the 11th of April 1859, and it soon became evident that the declivity of the bed, in the upper parts, was too great, the consequence being extensive channelings out in the sandy tracts, and deep holes below the falls. It was also found that the discharge from the Rávi had been overrated, and that the permanent supply was less than the works were designed to carry. It became evident that to utilise the channels a supply must be drawn from other sources. The minimum supply of water from the Rávi had, in 1848, been calculated by Sir Robert Napier at 2,753 cubic feet per second. It turned out to be only 1,414, and the maximum 2,529. The sources from which the full quantity can be obtained are the river Bias, or the Rávi further down. Estimates for remodelling the canal were ordered to be framed in 1868.
Water first admitted.	
Defection in Bári Doab canal.	
Re-modelling of Bári Doab canal.	The re-modelling was commenced, and in 1870 it was resolved to complete the Kassur and Sobráon branches, but without navigation. The total cost of the project had, by that time, risen to 1,260,250 £., and when completed, with the branches, to 2,000,000 £. Important mechanical workshops were established at the head works at Madhopur, and in 1867 the formation of a water course was sanctioned, to supply motive power for the machinery.
Works pur.	Mad ho
Present state of Bári Doab canal.	During 1871-72, the re-modelling of the central line, and the excavation of the branches, made good progress. The aggregate length of the main canal is now 212 miles, with 692 miles of <i>rájbuhās</i> , or distributing channels. The net receipts for water were 39,606 £., or 3 per cent. on the outlay; but there is also an indirect income estimated at 26,142 £. An important question arose with regard to the rates to be charged for water. Originally these rates were uniform for all crops, being <i>Rs.</i> 2. 6. 8. per acre for water given in flow, and <i>Rs.</i> 1. 3. 4. for water lifted. After much consideration, it was resolved that the rates should vary for different crops, and be divided into four classes; the scale being for sugar cane, 6 rupees; for rice and gardens, <i>Rs.</i> 4. 12.; for wheat, barley, cotton, and indigo, <i>Rs.</i> 2. 8.; and for other cereals and pulses, <i>Rs.</i> 1. 8. per acre. In 1870 there were 279,210, and there may now be 300,000 acres receiving water from the canal; and it is estimated that the value of the crops is eleven times the price charged for water.
Receipts.	
Water rates.	

Irrigation has not yet been provided for the other Punjab Doabs. In 1862, Mr. Bourne, the managing director of the Oriental Steam Company, proposed a scheme for a joint stock company to construct a canal from the Chenab, and his plan was warmly supported by the Lieutenant Governor; but in 1864, the Supreme Government informed Mr. Bourne that they were not prepared to give him any definite encouragement. Colonel Crofton, however, pointed out places whence a permanent supply of water could be obtained from the Chenab. In 1860, Mr. Purdon had a project for a canal down the Sind Sagar Doab, from near Mari on the Indus, to the same river about 70 miles above Mithankot, a distance of 220 miles. The reason for the cessation of necessary investigations with reference to these projects, which were commenced in 1864, is stated to be the difficulty of obtaining qualified engineers for the service. A rough reconnaissance was, however, made of the river Chenab last year, near Chiniot, in the Jhang district, with the view of ascertaining the feasibility of drawing off water there, for the irrigation of the lower part of the Rechna Doab. As a ridge of rocks here crosses the river, it is thought that a channel might be taken off at small cost, yielding a perennial supply of water. There are 7,000,000 of acres in the unirrigated Doabs waiting for water, and to swell the revenues of the State; while, in the district of Gurgaira, lying in an unfortunate position in the Bári Doab, below the point to which the English canal reaches, and barely within reach of the inundation canals, only 66,000 acres are watered out of 500,000. Certainly much remains to be done.

Chenab scheme.

Sind Sagar scheme.

Rechna Doab scheme.

Needs of part of the Bári Doab.

One great work has, however, been recently commenced in connection with Punjab rivers. The Satlej or Sirhind canal project was submitted by Colonel Crofton in 1862. At the point where the water parting separates the Jamna from the Satlej, there is an interval where the classic Saraswati once watered the land of Kiva, on its way to the Indus, but where now the streams have ceased to be perennial, while the desert fast encroaches on the once rich kingdom of Thanesar.

Sirhind canal project.

In 1840 Sir William Baker ran a line of levels across this region, from Karnal to Ludhiána, finding the greatest elevation above the Jamna and Satlej to be 68 feet, and he afterwards carefully examined the courses of its river beds. In 1841 the same officer reported that the introduction of a stream from the Satlej into an immense cultivable tract, now desert, was physically practicable. The immediate commencement of this work could not be authorised, but Mr. Thomason, then Lieutenant Governor of the North Western Provinces, declared that Captain (now Sir William) Baker had been the successful pioneer in this little known tract, and that he had suggested plans which should not be lost sight of, and which hereafter might mature into works of great national value. Twenty years afterwards Colonels Dyas and Crofton again brought the project to notice. The water parting between the Jamna and the Satlej runs close to the former valley, and no streams between those two rivers derive their waters from the snows of the Himalayas. They are all, therefore, devoid of a perennial supply, hence the necessity for drawing one from the Satlej. The site for the head works was fixed by Colonel Crofton, on an eastern branch of the Satlej, just below the mouth of the Lohind Torrent, the main stream being diverted into the eastern branch by a bund at Thannah Ghat. There will be great difficulties in taking the canal across the Sursa Torrent, which will be overcome by a dam with sluices for the passage of floods, and piers sufficiently high to retain the canal supply. The canal, with its branches, will then be taken into a hitherto neglected tract, where it will water 783,000 acres, of which more than half are in the native states of Patiala, Jind, and Nabha. The total length of channels was to be 554 miles, of which 100 was for navigation only, and the project included a navigable communication, 205 miles long, from the Satlej at Ferozpur to the Western Jamna Canal above Karnal. The estimates were completed and submitted for the orders of Government in February 1872, the total cost being calculated at 2,980,427*l.*, of which sum 1,062,216*l.* were to be paid by the three native states whose territory will be irrigated from the canal, the British Government having agreed to divide the available water supply of the Satlej rateably among the irrigable lands within reach of the canal, irrespective of the states within which they were situated, a proportional share of the cost being borne by each state. The first 37 miles

Sir William Baker's surveys.

Colonel Crofton's scheme.

Head works for Sirhind canal.

Sursa torrent.

Sirhind canal. Length.

Cost.

Work commenced.

V.  
IRRIGATION.

have already been commenced; materials have been collected and prepared for masonry works, and upwards of 322,000,000 of cubic feet of excavation were executed in the main and diversion canals, during the year 1871-72.

SIND.  
Arid zone.

Indus.

After the rivers of the Punjab unite at Mithankot the Indus flows for 450 miles to the sea, through the arid rainless country of Sind. Here irrigation is absolutely essential to cultivation. What the monsoons are to other parts of India, the inundation of the Indus, and the canals which distribute its waters, are to Sind. This country is an alluvial plain, almost every portion of which has been swept by the Indus or its branches, at some time or other. Traces of ancient channels are to be met with in almost every direction. The land is highest at the river banks, and slopes away from them on either side. The reason of this is that the river brings down a greater quantity of silt than its stream, moderated in velocity on the nearly level plain, can carry forward. The silt is deposited, and the result is that the bed and banks of the Indus are continually rising. The process is sure, but very slow. Dr. Lord calculated that the Indus annually brings down silt sufficient to form an island 42 miles long by 27, and 40 feet high. When the bed attains a certain height the water falls over, and the river, at intervals of several centuries, changes its course. It has slowly worked its way from east to west. In 710 A.D., the invading Moslems found a Hindu dynasty at Alor, and the ruin of Alor was caused by the Indus moving to the west. Then the seat of Government was moved to the City of Brahmanabad, the ruins of which are now 45 miles from the river.

Difficulties of Sind  
irrigation.

It is this movement which causes one of the difficulties in Sind irrigation. The river is continually carrying away the banks in one direction, and forming new land in another. This process never ceases; and the falling masses of earth make a noise in the distance, resembling volleys of musketry. From Sakkhar to the sea the distance is 300 miles, and the banks are permanent only at three places, Sakkhar, Jharrak, and Kotri. At Sakkhar the river rushes through a narrow gorge in the limestone hills, forming a perfect rapid during the inundation, with a descent of above four feet. At Jharrak the river is not contracted, but there is rock on either side. At Kotri hills approach on both sides, and the clay soil is deep and tenacious. The rise of the Indus commences in May, and subsides at the end of August.

Sind canals.

The canals are excavations carried away from the river in an oblique direction, so as to secure as great a fall as possible. They vary from 10 to 100 feet in width, and from 4 to 10 feet in depth. None, in former times, had their heads at the three places where the river bed is permanent, and none are deep enough to draw off water from the river, except during inundations. They resemble natural watercourses more than canals. From the position of the canal heads they are liable to two evils; either the river encroaches and tears away the banks, or it recedes and forms a great sandbank across the head.

The canals cut through the high margin of the river banks, and conduct the water to lower levels, down an inclined plane, where, under favourable circumstances, it flows out on the surface. Thus the cultivation may be divided into three classes: first, the land which can only be irrigated by using Persian wheels to raise the water; secondly, land irrigated by machinery when the canal is low, but over which the water will flow naturally when the canal rises; thirdly, land watered altogether without the aid of machinery. Some of the largest canals were at first natural channels, others were dug by various rulers of Sind. They are rude and simple expedients which attain their object, though less perfectly and at greater cost than if they had been constructed on sound principles. The care of the canals consists in clearing out the silt deposited by the inundations, or washed away from the sides. This was done by statute or forced labour.

Sir W. Baker in  
Sind.

Captain (now Sir William) Baker was appointed to the superintendence of canals and forests in Sind, in 1843, and he surveyed the canals and made several valuable reports, especially on the Eastern Narra Canal, on the left bank of the Indus.

General Walter  
Scott.  
Abolition of Canal  
Department.

In 1844 he made over charge to Captain (now General) Walter Scott, who was the first engineer to take charge of the canal clearances; but in 1849 the Canal Department was abolished, and the Collectors were left without assistance; the records were locked up, and much previous labour was wasted. The canals deteriorated,



rated, becoming less wide and less deep. Canal mismanagement culminated in 1853. In 1851 Captain Blois Turner reported on their condition, and in 1856 a separate officer was appointed as Superintendent of Canals. Since that time Colonel Fife has been the most prominent irrigation officer. In 1860 the Canal Department in Sind was again abolished, and in 1870 it was once more re-organised under Colonel Merriman.

V.  
IRRIGATION.  
M management.  
Captain Blois  
Turner.  
Colonel Fife.

Sind Canals may be divided into three classes: first, those of great extent and importance, running 70 or 80 miles; second, those of smaller extent, and branches; third, the distribution channels.

Classification of  
Sind canals.

On the western bank, commencing from the north of Sind, near Sakkhar, the chief canals are the Sind, Ghar or Larkhana, Bigari, and Western Narra. All but the Bigari are probably, judging from their tortuous courses, natural channels kept open artificially.

Canals west of  
Indus.

The Sind canal opens from the main stream of the Indus, on the right bank, 21 miles below Sakkhar. Its total length is 66½ miles, and at its tail it divides into three branches, the Mutti, Kadu, and Mihshuda, the former connecting the Sind with the Larkhana canal. The course of the Sind is very tortuous, and the fall deficient.

Sind canal.

The Ghar or Larkhana leaves the Indus 23 miles below Sakkhar, and has three heads or channels of supply. It is very tortuous, and the fall is thus much reduced. Several smaller canals branch from it, until it divides into two branches, the Núr-wah and Nowrung, and loses its name. The Nowrung again divides into two, the Andra-wah and Muldussi, and these are again divided into several smaller channels.

Ghar canal.

The Western Nara leaves the Indus 27 miles below Sakkhar, and at 40 miles from the head it is 200 to 300 feet wide. This canal is less winding than the Ghar, and the fall is consequently greater. The country is well cultivated on either side of it, and the villages are numerous. It returns to the Indus at Sehwan.

W. Nara canal.

The improvement of these canals, especially of the Ghar, was commenced in 1856 under Captain Ford. A channel of supply was cut from the Western Nara to the Ghar called the Ford-wah, which augmented its supply and raised its level. The head of the Ghar was also improved. The Ford-wah is considered to have been one of the most successful works in Sind. It raised the level of the Ghar three feet, and increased its volume enormously, thus converting a large area from wheel to natural flow irrigation. The lower part of the Western Nara was of course somewhat injured, but not in proportion to the gain of the area dependent on the Ghar.

Ford-wah.

The Bigari canal, also on the right bank of the Indus, is the most interesting in Sind.

Bigari canal.

In 1844 it was described by Lieutenant Maclagan as having a total length of 48 miles, with a fall of 35 feet. The head was on a side channel, at a distance of nearly seven miles from the Indus. For the first 23 miles it passed through a country covered with jungle, but presenting frequent traces of former cultivation. It then entered a district where much water was taken by means of Persian wheels, and towards the end of the 48th mile it became a mere ditch. In 1851, General Jacob, Political Superintendent of the Upper Sind Frontier, represented to the Commissioner (Sir Bartle Frere), the great advantage of enlarging the Bigari. It was then becoming yearly smaller, from the defective system of clearing. At the head it was 24 feet wide, with a depth of nine feet. It was proposed to enlarge to 40 feet, with a depth of 11, and to slope the banks to a proper gradient. The Núrwah was the chief offshoot of the Bigari, and had been carried far into the desert north of Khangarh. General Jacob, in 1852, proposed that the Núrwah should also be cleared and enlarged. He entrusted the work to a native contractor, who had to remove enormous heaps of earth, 25 to 30 feet high on the banks, to cut away jungle, and to clear dams out of the bed. The contractor did his work well, though only a common Sindhi Maistri, and completed it in 1854. The capacity of the Bigari was about doubled by the new excavations, and much wheel irrigation was converted into natural flow with a saving, each season, of 130 rupees for every wheel. Villages sprung up along the Núrwah, where a few years before people scarcely ventured to take their flocks, from fear of Balúch plunderers. Jacobabad was

General Jacob.

Enlargement of  
Bigari.

Bigari canal.

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founded in the midst of a barren treeless waste. The water of the Bigari canal was brought to Jacobabad, and the tail was extended thence to the Kelat boundary near Keragari (Khyra Ghuri). Now the former desert is a dense forest of babúl and other trees, upwards of 60 feet high, sheltering the houses and gardens of the inhabitants. Within a few miles there is the desert again which skirts the Baluchistan hills, a level plain of splendid, fertile, alluvial soil, but hard, naked, and barren like a threshing floor, without shrub, herb, or grass, except in the vicinity of canals. There the desert is converted into a garden, woods took the place of sand, and the Bigari canal revenue, which amounted to 4,796 *l.* in 1852, was 13,594 *l.* in 1857, and 17,339 *l.* in 1862. The improvements of General Jacob only cost 16,200 *l.* In 1860 it was resolved to increase the width of the first 40 miles; and in 1867-68 this important canal was again enlarged and improved.

Canals east of the  
Indus.  
E. Nara canal.

On the eastern side of the Indus, between that river and the desert, there is an ancient channel, called the Eastern Nara, which had ceased to flow as part of the Indus since that river, deserting the passage through the rocks at Alor, took to its present channel between Rori and Sakkhar. The Eastern Nara had no direct communication with the Indus, when Sir William Baker came to Sind in 1842, but received a precarious supply of water from a remarkable depression which runs parallel with the Indus from above Bhawalpúr, and, being lower than its flood height, receives some water from canals, and a more considerable volume by direct overflow. The channel of the Eastern Nara being also lower than that of the Indus, can easily be filled from the great river on a higher level, and Sir William Baker pointed out the rock at Rori as offering a site for the head works. Hitherto the overflow of the Indus, in floods, had formed the Nara supply. In 1826 Sir A. Burnes mentions that the Nara, which in its lower course is called the Púraun, was filled by a flood which cut through the Allah-bund, and reached Lakpat. In 1843 Sir W. Baker saw marks of a flood that rose 18 feet, and in 1843 there were only four feet in the same place. The Nara passes through the wild Thurr, a country covered with enormous sandhills, with occasional tracts of alluvial soil between them, along a channel on which are formed a series of bottoms locally called *dunds*. There are 400 of these *dunds*, or lakes, supplied from the Nara. The people in the Nara valley gain a livelihood by rearing cattle, feeding flocks, fishing in the *dunds*, and carrying on a grain trade with states beyond the Thurr. They eagerly raise crops, whenever the Nara supplies water.

Dunds.

Rori cut.

The cut from the Indus at Rori to the Nara is 11 miles long, and the Nara is 20 feet below the river. Sir Bartle Frere strongly recommended its being made, and work was commenced in 1853, together with bunds across the channel at intervals, to lead off the water for irrigation. In 1854 the cut was in full progress, beginning just above Rori; 16 feet deep, 206 wide, with a berm 15 feet wide on each side, and the excavated earth distributed in two terraces on either bank, forming admirable garden ground. The Rori cut or supply channel was completed and opened on 9th May 1859. Bunds were also constructed across the Nara channel to prevent the escape of water into the large *dunds* among the sandhills.

Mitrow canal.

Two canals, branching from the Eastern Nara, have also been constructed. The Mitrow Canal was commenced in March 1859. It was to be filled by a branch from the Nara, and in 1866 there were 190 miles open, which irrigated 156,803 acres.

Thur canal.

The Thur Canal is another branch from the Nara, intended to water lands at the edge of the desert. It was commenced in 1864, and is now completed, irrigating about 38,000 acres; 50 masonry heads for minor channels were constructed during 1871-72.

Fullali canal.

The Fullali Canal is the main feeder of irrigation channels from Haidarabad southward and eastward. Originally it was a natural branch of the Indus, joining it again 16 miles below Haidarabad. This was prevented by a dam, in the time of the Amirs, and the water was sent to feed the Gaja, Gúni, and other canals to the south. The chief portion thus fell into the Gúni, after a course of 40 miles, the average width being 350 feet. The improvement of the Fullali was commenced in 1856. Two channels of supply were cut from the

he Indus, and the effect on the water supply was very satisfactory. One of the most interesting services, on which Sir William Baker was employed in Sind, was a survey and levels along the Gúni to its junction with the Púraun (the continuation of the Eastern Nara), and thence to the Allah-bund, which he surveyed and levelled. The Amirs of Sind, after an unsuccessful invasion of Kach, cut off the supply from the Fullali and Gúni, which had fertilised one of its provinces. After our occupation of Sind, the Government of Kach requested Sir Charles Napier to cut the bunds and let the water flow again. Sir Charles sent Baker to do this, who took precaution to take levels first, and found that, owing to certain depressions and elevations caused by subsequent earthquakes, the cutting of the bunds would not restore the water to Kach, but, on the contrary, would let salt water flow back into Sind.

Gúni canal.

The great administrative question with reference to the Sind canals has always been the system by which they were annually cleared of silt, an operation which is absolutely necessary. The old custom was for the Government to pay for the clearance of the large canals, and for the people to keep up the minor channels. In 1864 the cost of clearances was 41,041*l*. As in the case of the Punjab inundation canals, the Sind canal clearances were effected by *cher*, or statute labour. Every cultivator was forced to furnish a quota of labourers in proportion to the extent of his cultivation. The silt is sometimes removed in baskets, and sometimes by a board drawn by oxen, like a gigantic hoe, trailed along the ground. But usually the only implement is a hoe, with a long blade and short handle. The labourer fills the blade by striking it into the soft soil, and by a jerk throws a shovelful upwards and behind. One man stands behind another, and the soil is thus passed on. The canal digging lasts from December to April. But in 1856 statute labour was abolished, and the annual work of clearances became very expensive, while insufficient funds were allowed for it. The canals are deteriorating, solely owing to the sum annually allotted being less than is adequate for the purpose.

Canal clearances.

There is a special tax, called *huccaba*, of three annas per biga, levied from lands watered by canals cleared by Government, to aid the cost of clearance. Sir William Merewether has represented that the *huccaba* is credited to revenue, and that only a portion, arbitrarily fixed without regard to real requirements, is allotted to canal clearances. He has remonstrated against this, and has represented that the canals will each year deteriorate, in proportion to deficient clearance. The sum required in 1870 was 41,168*l*., and the grant was only 37,540*l*.; yet the *huccaba* amounted to 47,708*l*., every farthing of which, he urges, ought to have been expended on the object for which it was intended. Sir William Merewether thinks that the *huccaba* should be made an entirely separate fund, for canal clearances. This question was taken into consideration, and the Government of India declared that the *huccaba*, being part of the land revenue, could not be dealt with separately; but that whatever sum was needed for canal clearance should certainly be given.

Huccaba tax for canals.

Since 1855 Colonel Fife has advocated the construction of perennial canals in Sind, issuing from permanent heads. Sites for such heads can be found at only three points on the Indus, at Sakkhar, at Jharrak, 250 miles lower down, and at Kotri. He considers these to be the proper points for canal heads. From Rori he would take one down Eastern Sind, crossing 150 canals to Fullali, which would become the trunk line for 80 miles. From Sakkhar, opposite to Rori, another would be led down the western side, parallel with the river, crossing the Sind and Ghar, and entering the Western Nara to rejoin the Indus at Sihwán. The present canals would be used as distributing channels. From Jharrak two more canals would be taken, one on each side, towards the sea. This scheme would revolutionise the ancient system of Sind irrigation, its advantage being that such canals are permanent, and their supply perennial.

Perennial canals.

Permanent canals.

One perennial canal has been undertaken, from the rocky banks of the Indus above Sakkhar to Shadadpúr, a distance of 63 miles. The line crosses the old Sind canal, where there is a regulating bridge of seven arches each, 10 feet span, and the water is regulated by horizontal sleepers. The scheme for this canal was approved in the end of 1861, and commenced; and in 1868 the work had reached the 24th mile. It is the first attempt at a perennial canal in Sind, and is to irrigate 140,000 bigas of land, yielding a revenue of 209,999*l*. It was opened in June 1870.

Canal from Sakkhar to Shadadpúr.

## V.

## IRRIGATION.

General Strachey  
on Sind irrigation.

General Strachey, in 1867, recorded an opinion that the remedy for inconveniences caused to cultivators by uncertain water supply, never under control, was the substitution of perennial for intermittent inundation canals. The area under canal cultivation in Sind is about 1,200,000 acres, and the land-tax and water charge about Rs. 2. 4. per acre. He thinks, if all the water was supplied by flow and none by Persian wheels, this charge might be raised to Rs. 3. 4., and that the cultivated area would be doubled. He thus concurs in the views of Colonel Fyfe, and would take two perennial canals from the Indus at Sakkhar and Rori to Sihwán on the west, and the Fulaili on the east side, crossing all the present canals, and using them as distributing channels.

THE GANGES  
BASIN.  
North Western  
Provinces.  
Rainfall in Ganges  
basin.

The basin of the Ganges is nowhere within the rainless zone; but nearly the whole of the course of the Jamna is in the dry region, with a rainfall less than 30 inches, while that of the Ganges flows through a country which receives very little more rain, until the two rivers unite at Allahabad. But here begins the great distinction between the Ganges and the Indus. While the Indus, in its lower course, receives no affluents, and passes into an arid belt which is absolutely dependent upon its water for every blade of grass, the Ganges is joined by numerous tributaries, and passes into the well-watered plains of Bengal; the rainfall being 46 inches at Benares, and 66 at Calcutta. It is the portion of the Ganges basin above Allahabad, therefore, that most requires irrigation. Colonel Greathed divides this upper region, which comprises the North West Provinces, into three zones. First, the tract along the foot of the Himalayas, which is well watered by rainfall and by numerous rivulets from the mountains, most of which dry up after the rainy season. But along the length of this sub-Himalayan tract there is a deposit of sand and boulders forming a continuous belt 15 miles wide, which creates a vast filter-bed, and, being bordered on the down-hill side by a band of clay, it becomes a covered reservoir. The natural pressure augmented by the rapid slope, across which the filter-bed lies, forces water under the clay, and produces a line of springs on the other side of the clay band, which feed numerous streams, and refresh the country. The local name of the belt of boulder is *bahbur*, and of the tract which it waters by filtration, *terai*. The second zone comprises the great plain through which flow the Ganges and Jamna; and the third is the province of Bandakband, sloping northwards from the high plateau of Central India towards the Jamna.

Physical configu-  
ration.

Climate.

The climate of the North West Provinces is very dry, from April to June, when westerly winds prevail, the vegetation of unirrigated plants is almost suspended. In June the winds bring the rain-clouds up the valley of the Ganges from the Bay of Bengal, and the season of agriculture commences; but the rainfall diminishes as the distance from the sea increases.

Well-irrigation.

From the earliest times the people have practised well-irrigation, the depth at which the water is found on the plains being from 10 to 50 feet; but the method is expensive, for it employs six men and three pair of bullocks every day, to keep five acres watered. Colonel Baird Smith, in 1860, reported that there were 70,000 masonry and 280,000 temporary wells in the Doab between the Jamna and Ganges, irrigating 1,470,000 acres. But it is from the water of rivers that the main supply must be drawn by means of State canals, which are far beyond the means of private enterprise in India; and hence the water which, if raised to the proper level, would have fertilised the whole land, has for centuries rolled useless to the sea. Yet the native rulers did not wholly neglect this great source of supply. The Emperor Feroz Shah, between 1351 and 1388, drew a canal from the Jamna to water his favourite hunting ground at Hissár; but there are no marks of irrigation works along the line of his canal, which fell into disuse on his death. For a hundred years no water had flowed to Hissár, when, in 1568, the Emperor Akbar issued a decree, ordering the canal of Firuz to be restored. It is singular that the Ayin Akbari makes no mention of this work of Akbar, and we are indebted to Colonel Yule for our knowledge of the original *sanad*, which places the fact beyond doubt.\* In 1626, the Emperor Shah Jehan projected a branch from the canal of Feroz, to convey water to the city of Delhi, and Ali Murdan Khan was his engineer. The Delhi canal crossed the low land by a masonry aqueduct, traversed the Arávali hills by a channel cut through the solid

Native works.  
Feroz Shah.

Akbar.

Shah Jehan.

solid rock, 60 feet deep at the crest, and flowed through the city in a masonry bed, throwing off innumerable minor streams. Throughout the great halls and courts of the palace a plentiful supply was carried in numerous channels, filling the graceful fountains and marble baths, and watering the gardens. For 150 years it continued to be efficient, but in 1753 this Delhi branch ceased to flow. Ali Murdan also made a canal in the Doab, but it was abandoned almost as soon as it was made, probably owing to the difficulty of maintaining a passage across the mountain torrents at the head.

Thus, when the English came into possession of the country, all these works of former rulers had fallen into ruin. "We found the country desolate, the cities burnt, when the sons of strangers came to build up the walls, and the rulers to minister." English works.

The North West Provinces comprise a region which seems designed by Nature as a great field for artificial irrigation. The rivers, after leaving the last gorge of the Himalayas, enter upon plains with a rapidly-decreasing slope; and, flowing parallel to each other, they divide the country into sections, which, both as regards soil and declivity of surface, offer every requisite for irrigation. The steep slopes, at the mouths of the mountain gorges, in many cases enable the engineer, by a proper adaptation of levels in his artificial channels, to obtain a command of water which places the whole country under his command. The chief difficulties under such conditions are in the neighbourhood of the steep slopes, and in the management of the mountain torrents. Occasionally, however, it becomes necessary to adopt other expedients for bringing the water from the river beds to the level of the land to be irrigated, and very heavy excavations are frequently necessary, besides weirs and other works, to regulate the distribution and velocity of the water. North West  
Provinces as a  
region for irriga-  
tion.

The first undertaking of the English was the restoration of the Feroz and Delhi canals, which was commenced in 1823; and the Western Jamna Canal system was fully developed by Colonel Colvin and Captain (now Sir William) Baker, between that date and 1843. The supply is derived from the Jamna, at the point of its debouche from the Sawalakh hills, where the stream is rapid, the fall great, and the bed consists of shingle and boulders. In the cold weather the stream is generally confined to one or two only of the numerous channels into which the bed is subdivided, which are all filled by the high floods of the rainy season. One of these branches was appropriated to the Western Jamna, which leaves the river at a point called *Hathni Kund* (the Elephants pool), nearly opposite the old palace of Badshah Muhal, returning to the main stream, after a course of 25 miles. The supply is increased by deepening the channel, and throwing out a spur into the main stream, which was extended right across in seasons of drought. Additional supplies are thrown into this western branch by two feeders, one called "Colvin's Cut," the other natural. The materials used for the dams were boulder stones and gravel, filled into large gabions of coarse basket work. The canal, continuing along the *khadar*, or low land, near the river, first follows a branch of the Jamna; then a channel excavated to the Putralla river, and then occupies the bed of the Putralla to its confluence with the Somb. Here was the main difficulty, in restraining and regulating these torrents, and forcing them to allow the fertilising flood to pass on its way in peace. The Dadupur dam was built across the united Somb and Putralla, here occupied by the canal, just above their junction with the Jamna. Originally it was carried across this channel by an earthen dam annually renewed; but in 1830 Colonel Colvin obtained sanction for the masonry Dadupur dam, providing a flush flow across the bed of the Somb, divided into 60 openings, the total width being 777 feet. The dam is closed by planks hooped with iron, with an eye for an iron hook, by which they are lifted. The Putralla made an attempt to turn the east flank of the dam, which was frustrated by a series of spurs placed *en echelon*, in 1842. Then the Jamna itself commenced an attack upon the left bank, which was defeated by means of a new channel, and a series of crib spurs *en echelon*. But the Somb still threatened destruction to the works. Lieutenant Durand surveyed the country drained by it, and made a beautiful map of the Somb and Putralla drainage, in the hope of mitigating the force of the Somb floods, by turning a portion into one of the Satlej tributaries. But this was found to be impracticable. Then a new channel, called "Baker's Cut," was excavated, to check the encroachments of the Somb. After a prolonged battle between Colvin, Baker, and Durand, on one side, Western Jamna  
Canal.

V.  
IRRIGATION.

and the Jamna, the Somb, and the Patralla on the other, the victory was finally secured by the skill and perseverance of the engineers. The turbulent enemies were made captive, and the precious stream was safely convoyed past the dangers which are common to all the canals when they first leave the head-works, and have to encounter the lawless mountain floods and torrents.

The canal is then taken through an excavated channel parallel to the Jamna, into an old nulla near Burea, and thence partly down natural ravines, to Karnal, 60 miles below Dadupur, still in the *khádar* or low lands of the Jamna. At Karnal it gains the level of the high country, and soon afterwards separates into two branches, one passing on to Hansi and the other to Delhi. The Delhi branch has a very winding course, the size gradually diminishing, as water is taken off by the numerous irrigation outlets. It enters the *khádar* land of the Jamna, through which it is embanked, crosses the valley of the Najafgarh drainage by a massive aqueduct, traverses the rocky hills round Delhi by a deep irregular excavation in the solid rock, and enters the city near the Kabul gate. One branch flows in a masonry channel down the Chandni Choke; others water the gardens and supply the houses, and finally pass, through four sets of water mills, to the Jamna.

Delhi branch.

The Hansi branch follows the line of Feroz Shah's engineer, and the pastoral villages of Hissár are entirely dependent on it for the means of watering their cattle. At Hissár a travelled courtier of Feroz Shah erected a building to give his master an idea of a ship ("juhaz"). It is now used as a store house for the canal, for which purpose its ample "hold" renders it very suitable. The Rohtak branch is taken off from that of Hansi, and there is another short branch, that of Bootana, to irrigate villages near the Jhind boundary, which was excavated in 1835.

Hansi branch.

Rohtak branch.

Dimensions of  
Western Jamna.  
Results.

The united length of the main lines of the Western Jamna Canal is 445 miles; and in the famine of 1837-38 the value of the crops saved by its water was 1,462,800 L., supporting the inhabitants of 500 villages, who would otherwise have died of starvation. In 1866-67 the water rate on irrigation yielded 70,000 L., and the area irrigated was 447,171 acres (797 villages), the aggregate length of watercourses being 728 miles. The canal has also had the effect of raising the level of the water in the wells. The total outlay up to 1871-72 was 282,517 L., and the net receipts for that year 74,518 L., being 26 per cent. on the outlay; but the indirect income is placed at 37,256 L., which raises the percentage or outlay to nearly 40 per cent.

Water distribution.

The system of water distribution on the Western Jamna Canal was complicated by old rights. On the Delhi and Rohtak branches there were many distributing watercourses, the proprietary right to which was well understood by the people. As regarded new channels, it was made compulsory on all villages bordering on the canal to permit excavations for such watercourses as were approved by the superintendent. The *rajbuhas* are joint stock channels, executed by the canal officers, for the use of two or more villages. The original cost was formerly defrayed by the Government, and ultimately recovered from the villages. But this system has been abandoned, and all the main watercourses are now constructed at the cost of the Government. The distribution of water in the branches has to be regulated with reference to the probable demand. Fixed gauges are established at certain points, and the height of the water is regularly reported.

Water rates

It was found difficult to estimate the value of a given outlet, but a system prevailed until 1833 of letting out these outlets on contract, the rates being fixed at 2 rupees per annum per square inch of area for natural flow irrigation, and 1 rupee for wheel irrigation. But the discharge of the outlets varied with reference to the inconstant height of the canal. It was, therefore, determined to assess the outlets on the average of their irrigation for three or more years, the period of contracts being fixed at 20 years. The other system is to measure the irrigated land. It has been argued that the contract system has several advantages over that under which the irrigated lands are measured. Under it the villages are free from minute interference of canal officers; they are supplied first in times of scarcity; they can irrigate all crops at the same rate; while the advantages to Government are a steadier revenue and a smaller measuring establishment. There are, however, sufficient reasons for commencing with a system of measurement, as the basis of the assessment of the canal rates, though under certain conditions the contract system may be usefully adopted. Certain villages

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villages near the canal heads contribute labour in exchange for a supply of water for irrigation and for working *girals*, or rude corn mills.

Colonel Colvin's scale for water rates on the measured land was sanctioned in 1827, and again in 1845 (Act VII.) These rates discriminate the nature of crops and the method of employing water, whether *tor* or *daul*, that is, natural flow, or artificial raising by Persian wheels or otherwise. But from 1st November 1866, the rates were considerably increased. The rate, for each acre per annum, is 5 rupees for garden lands irrigated by natural flow, 3 rupees for sugar-cane and indigo crops requiring water for 10 months; *Rs.* 2. 4. for rice, cotton, and wheat crops; and *Rs.* 1. 10. 8. for the khurif crops of grain, barley, bajor, and jawová. When the irrigation is from water artificially raised, the rate is about a third less.

Of late years the necessity for dealing with the Western Jamna Canal has been much felt, with a view to remove the swamps which had formed along its banks and in the country which it irrigates; to remedy the evils caused by *reh* efflorescence, which destroys all vegetation; to increase the volume of its waters; and to improve its navigable character. During 1871 Colonel Crofton matured a scheme which was partly sanctioned by the Secretary of State, the works so approved being the new permanent head across the Jamna, distributaries from Indri to Delhi and Jhind, and drainage works. The estimate amounts to 214,267 *l.* The permanent dam across the Jamna is a most important work, as it is intended to supply both the Western and Eastern Jamna Canals, and to secure a due apportionment between the two systems. The construction of reservoirs for the storage of a supply of water for the cold weather cultivation in the arid tracts of Sarsa, is also under consideration.

Improvement of  
Western Jamna  
Canal.

There is a system of irrigation from *jhils* or large lakes which is in some degree connected with the Western Jamna system. The range of hills round Delhi is of inconsiderable height, and has few streams. The watercourses in the country to the east and west are dependent on the drainage of the country for occasional floods. The land is disposed into a series of natural hollows, each lower than the one next to it, and all connected by channels; a chain of natural reservoirs is thus formed, the largest of which is the Najafghar jhil, which receives the drainage of slopes from Delhi to Badshâhpur. The villagers keep their cotton crops on the high ground, while their sugar cane and wheat fringes the whole jhil; but the land, both on this and other jhils, was subject to be submerged, and the supply of water required regulation. Of late years the whole area of the Kotila jhil has been drained, and 4,500 acres brought under cul-  
tivation during the cold weather; embankments have been formed, and the drainage of the whole system passes under the great aqueduct of the Delhi Branch Canal into the Jamna.

Najafghar jhil.

Kotila jhil.

The Eastern Jamna Canal was originally projected by Shah Jehan between 1628 and 1659, and had been partially restored in 1764 by a Rohilla chief named Zabitha Khan. In 1823 Captain Robert Smith reported upon its restoration, the scheme being to carry it centrally along the high land between the Hindaun and the Jamna, and excavation was commenced at the close of 1823. In 1825 the late Sir Proby Cautley joined the canal establishment as assistant to Captain Smith. The canal was opened on 3rd January 1830, by Sir Proby Cautley, and the water reached the Jamna again, after traversing its whole length, on the 14th. Rapids formed in the sandy sections, which were remedied by falls of masonry. In 1836 the bunds of the Western and Eastern Canals were placed across the Jamna, and the river was laid entirely dry. The *Nayashahr* dam, for the Eastern Canal, was formed on the Budhi Jamna with 30 sluices and a regulating bridge in the canal. The dam was built of ancient bricks brought from the old palace of Badshah Mubul. The Eastern Jamna Canal passes, from the main river, down the shingly bed of the Budhi Jamna for four miles to Nayashahr. From this point it enters upon the difficulties peculiar to these lines, which have to cross mountain drainage at right angles to their courses. The Raipur, the Jatowala, Naugong, and Muskurra, mountain torrents of greater or less dimensions, are passed within a distance of 10 miles from the deep cutting at Nayashahr. These torrents are provided with masonry dams for floods during rains. The canal then continues on the high land of the country. Large plantations of *sál*, *sissú*, and other trees were formed at Nayashahr for planting the banks of the canal. The *râjbaha*, or distributing arrangement, was for

Eastern Jamna  
Canal.

V. IRRIGATION. —	the landholders to subscribe for watercourses to be dug from the canal by the superintendent, the expense being charged to the applicant, except that of the masonry outlets in the canal, of which there are 592. The water rate fixed by Sir Proby Cautley was given in beegas (55 square yards), but it has since been raised. It is now the same as for the West Jamna Canal.
Dimensions.	The embankments to retain the canal in its bed are 40 miles long, and the canal flows between them at a height of from six to twelve feet above the surface of the country. (The canal system consists of 130 miles of channel and 619 of distributaries, watering a tract about 120 miles long by 15 broad, between the Hindaun and the Janina. The net revenue in 1871-72 was 32,881 L., giving a return of 16.6 per cent. on the outlay.) The area irrigated was 192,749 acres, the season of 1871-72 having been most unfavourable for irrigation.
Revenue.	
Ganges Canal.	The Ganges Canal, a purely British work occupying a field previously untouched, is the greatest work of irrigation ever constructed. In 1836 Sir Proby Cautley examined the country, and in 1848 the work was commenced.
Head works.	The head of the canal is two and a half miles north of the town of Hardwar, close to the foot of the Sawalákh mountains, where a well-trodden footpath once led down a ravine to the water's edge in a branch of the Ganges. At the head of this ravine, and overhanging the river was a large peepul tree, and at its foot a lingam. The spot was called Gunes Ghat. Here a bridge was constructed with 10 openings across the mouth of the canal with shutters, and a line of revetments connect the bridge with a dam across the branch of the Ganges. The Gunes Ghat was converted into an extended line of stone steps, washed by a running (among the many) stream, offering conveniences for pilgrim bathers.
Mountain torrents.	After leaving the Ganges, the canal had to encounter the difficulties of the mountain torrents, analogous to those which were overcome by the engineers of the Jamna canals. There are three methods of meeting and passing these torrents. They can be made to flow across the canal channel on the same level, or taken over it by a super-passage, or the canal can cross the torrent on an aqueduct. All three ways were adopted by Sir Proby Cautley on the Ganges Canal. At Dhanairi, about 14 miles from the head works, where the canal is still in the khádar land, the Rutnú torrent is encountered. Here a masonry inlet and a dam were constructed. The flood waters enter the canal channel through the sluices of the inlet, and are discharged through 47 sluices in the dam. They bring down branches, roots, whole trees, and masses of grass, and no obstruction, except the piers of the dam, is offered to their passage across the canal channel. Further on, the flood waters of the Ránpur and Puttri torrents are conveyed over the canal channel, without coming in contact with the canal water, by means of well protected and parapeted masonry super-passages. The next great work on the canal is the aqueduct, which takes it over the Solani river, which is 18 miles from the head works.
Solani aqueduct.	The Solani aqueduct is 920 feet long in 15 arches of 50 feet span each, connected on either side with an earthen embankment, raised nearly 30 feet above the valley of the Solani, which it traverses for a length of about three miles. The canal continues along the centre of the country between the Ganges and Jamna, throwing off branches at intervals, all adapted for internal navigation as well as for irrigation. The main channel is 348 miles long, the branches 306, and the distributaries 3,078 miles in aggregate length, and 767,000 acres are watered by them in 5,061 villages. Irrigation commences 22 miles below the head works and is diffused over an area 320 miles long by about 50 broad. The Ganges Canal was opened by Lord Dalhousie on the 8th of April 1854.
Dimensions.	
Erosion in the bed.	Experience has shown that, in the original design, too great a slope was given to the bed of the Ganges Canal, and considerable erosion in the bed has been the result. In 1863 Colonel Crofton was appointed to report in detail on the whole question, and his conclusions have been generally adopted by the Government. The main point to decide was whether the existing canal should be modified, so as to be able to carry with safety the whole volume of water for which it had been originally designed, or whether a second channel should be made to carry that part of the supply which the canal in its existing state could not carry with safety. The remodelling of the canal was shown to be the most economical alternative, and it was adopted. In August 1864 an outlay was sanctioned for the protection of the falls that were most injured, and the precautions taken were
Report by Colonial Crofton.	
Improvements.	



so successful that the full supply has been maintained in the canal, for a considerable period, without any appearance of renewed injury. Meanwhile projects are in preparation for the re-arrangement of the Cawnpúr, Fathigarh, and Etáwah branches of the canal, and the re-modelling of the first was sanctioned in 1868. The net profits of the Ganges Canal, for 1871-72, were 66,234 £, or 2.78 per cent. on the capital sunk; but the net navigation returns were only 1,421 £.

Revenue.

The Agra Canal is a project, now approaching completion, for watering the thirsty lands of Delhi, Gurgáon, Mattra, and Agra from the Jamna. A weir, 2,428 feet long, has been built across the Jamna, below Delhi, at a point where a spur of quartz from the Arávali range abuts upon the river. It consists of two parallel masonry walls, 26 feet apart, resting on the fine sand of the river bed, with stone packed between them, with slopes and scouring sluices. The Agra Canal is designed to irrigate 350,000 acres, and will probably be partly opened this year.

Agra Canal.

There is also a project for completing the system of the Ganges Canal, by the construction of a Lower Ganges Canal, with a capacity equal to that of the present Upper Canal, on an estimate of 1,825,000 £. The scheme has been sanctioned by the Secretary of State, and work was commenced in 1871-72. This, with the Upper Ganges and Eastern Jamna Canals, will complete the irrigation of the whole country between the two rivers. The weir across the Ganges, for the Lower canal, is to be at Rájghat.

Lower Ganges Canal.

An Eastern Ganges Canal is to be constructed, taken off at the foot of the boulder formation, which is to irrigate 455,000 acres, equal to 35 per cent. of the area of the districts commanded. The scope of the project has now been finally determined.

Eastern Ganges Canal.

The Rohilkhand Canals are for irrigating the belt of country along the *terai* where much rice is raised. On the failure of rain, water can only be obtained by damming up the hill streams, and leading small canals over the country, on which the *rubbee* crop depends. In 1824, there were 1,930 dams, and 915 canals. All the country between the Rānganga, which passes by Murádabad, and the frontier of Oudh, is intersected by numerous hill streams whence canals could easily be led. The Nūgína Canal was taken from the right bank of the Koh, and opened in 1840, and there are Murádabad Canals. Two others, the Paba and Kailas, have recently been sanctioned, and are in course of construction, and a project is to be prepared for utilising the waters of the Rānganga. But, with regard to a general and comprehensive scheme for Rohilkhand irrigation, the present orders of the Government are only of a character to elicit further and more complete information.

Rohilkhand Canals.

There is a compact little system of irrigation in the Dehra Dun, between the Ganges and Jamna, and confined on the north by the Himalayas, and on the south by the Sawálakhs. The valley is 48 miles long, and in the centre it is considerably elevated, the ridge extending from the Himalayas to the Sawálakhs, and dividing the valley into two portions with two distinct slopes of drainage to the east and west. The Asnu and Súsua rivers rise on this central ridge, the former going to the Jumna, and the latter to the Ganges. All the elements of a good system of drainage are here naturally provided. On the Asnu side there is a torrent called the Tonse, across which a dam is thrown, and watercourses are carried in various directions from the other streams, to irrigate the valley. There are five canals, aggregating 67 miles in length, and irrigating 11,039 acres.

Dehra Canals.

In the Arávali hills, there are no such rivers as water the Dehra Dun. Isolated and surrounded by the parched-up plains and deserts of Northern India, the cultivation on these hills mainly depends on water stored in tanks, and some of the landholders preserve the thorny scrub on the hill sides, in order to regulate the filling of the tanks from rain. The district of Mairwára, in the Arávali, was brought into subjection by Colonel Hall, in 1820, and his successor, Colonel Dixon, in 1835, constructed tanks and reservoirs on a large scale. Between 1836 and 1846, as many as 2,065 tanks and 9,915 wells were constructed in Mairwára. The tanks have a total area of 8,675 acres, and irrigate 14,826 acres of land. The once wild and unruly Mairs became a thrifty, peaceful, and industrious

Arávali tank irrigation.

Tanks in Mairwára.

V  
IRRIGATION.

trious peasantry, under the influence of these improvements, and of such men as Hall and Dixon.

Bandalkhand irrigation.

For Bandalkhand large schemes of irrigation have been devised. The rainfall is carried off with great rapidity, owing to the granite and trap formations, leaving the river beds almost dry soon after the rain ceases. One proposal is to build a weir across the river Betwa, which flows near Jhansi, to retain the water, and a canal will then irrigate 120,000 acres in the Jalaun and Hamirpur districts. Other weirs are projected across the rivers Desan and Kan, with granite weirs and canals; while 15 lakes, now irrigating 1,300 acres, will be made to water 22,000. These measures will secure Bandalkhand and Jhansi against famine, and restore this region to its pristine fertility. There is every prospect of these anticipations being fully realised. A survey has also been prepared for a canal to be derived from the river Sardah, to irrigate the western part of Oudh and eastern Rohilkhand; but in deference to the expressed wish of the landholders, the construction of this work has been abandoned.

Sardah Canal.

Extent of irrigation in the N.W. Provinces.

Such has been, and still are, the efforts to supply irrigation in the upper part of the basin of the Ganges. They cannot be considered insignificant, seeing that there is nothing that in any way approaches them in magnitude and importance in any other part of the world. The area irrigated by the canals of the North West Provinces in 1870-71 was 1,050,808 acres, but in 1871-72 only 852,494 acres, yielding an income of 217,573*l.* to the canal administration. The charges for establishments are high, and the net profit was only 94,734*l.* The demand for water depends in a great degree on the rainfall, so that the irrigated area varies in different years, but the average for the last five years has been 1,065,450 acres.

Son project.  
Bahar.

As the Ganges approaches the sea, the rainfall increases, and the general need for irrigation becomes less and less; but the variation of rainfall in different districts is considerable, and the local condition of climate are such, that a great scheme for utilising the waters of the Son, the chief southern tributary of the Ganges for the irrigation of part of the province of Bahar, has long been under consideration, and its execution has now been commenced. It was originally undertaken by the East India Irrigation Company, on a plan proposed by Colonel Dickens, and their project was accepted by the Government in 1867, on the understanding that the agreement must end, if the company did not make satisfactory progress with the works. An application of the company for a guarantee of interest on their capital was rejected; they never commenced work, and at length they were induced to agree to an arrangement by which they were bought off. The Government then took up the Son project with energy. It consists of a dam across the river, and two main canals led off from it, which will supply irrigation for 2,000,000 acres in the districts of Patna, Gaya, and Sháhabad. The estimated cost is 3,775,000*l.*

The works at present in progress are the weir across the Son at Dehri, and the head works of the two main canals, also a portion of the main canals on each side of the river, and the Arrah and Patna Canal. The weir will be two and a half miles long between the abutments, and eight feet high. In 1870-71 the well blocks of masonry which form the foundation of the upper or breast wall, were sunk right across the river. In 1871-72 those for the second wall were also sunk, and good progress was made with the head and under sluices, and with the head locks; but the operations were hampered by the unusually large volume of water in the river. The stone is brought from quarries at a distance of seven miles, on the left bank of the Son, 200 waggons and four locomotives being employed to convey it. On the western main canal 22 miles were in progress, the earthworks were well advanced, and five large bridges were under construction; while eight miles of earthwork were completed on the eastern canal. On the Arrah Canal, which is to be 70 miles long, and to irrigate 430,000 acres, ground had been broken over 60 miles. The Patna Canal is to connect the Son with the Ganges at Patna. It is to be 84 miles long, and to irrigate 390,000 acres. On the whole, the progress of the Son works, during the last two years, has been most satisfactory.

Bengal.  
Midnapur Canal.

The Midnapur Canal, part of which was open and in use in 1871-72, supplies a country which is within the zone of 60 inches of rainfall. This canal is 52 miles long; 23 of which, comprising the lower section, connect the rivers Cossaye, Rúpnarain,

Rápnarain, Dámodar (Dumooda), and Hugli. Considerable progress was made in the upper section, where is the heaviest work, and a weir across the Cossye at Midnapur was completed. In another year the canal will be open for traffic, from the Hugli to Midnapur. The scheme comprises the irrigation and drainage of 200,000 acres, as well as a navigable canal from Calcutta to Midnapur. The estimated cost is 700,000 *l.* About 101 miles of distributaries have been made, commanding 60,000 acres, and are in use. But smaller branches to villages are much needed. They could not be made by the people, or at least the people would not make them, so it was determined, as an experimental measure, that Government should do so for the first 50,000 acres in the upper reach of the canal. The people did not care for the channels, grudged the land, and viewed their construction as a grievance. Irrigation is not popular in Midnapur, a proof that the rainfall is abundant.

This completes a review of the chief irrigation works in the valley of the Ganges; and the Orissa canals and embankments, in the delta of the Mahánadi, next claim attention, as they, with the Son and Midnapur works, are under the jurisdiction of the Lieutenant Governor of Bengal.

The Mahánadi river drains the fertile plain of Chatisgarh, in the Central Provinces, and falls into the bay of Bengal. It is 529 miles long, and its basin covers an area of 45,000 square miles. But the Mahánadi basin is extraordinarily compact. It has a mean diameter of 225 miles, excluding the neck, so that but a very moderately wide spreading rain storm will ensure rain falling on every square inch of the area simultaneously. The form of the basin is that of a round and compact body, with a narrow neck and bell-shaped mouth, like a water decanter, than which it is difficult to conceive one more calculated to empty itself rapidly, while the position is one of very close proximity to the sea, the source of rain clouds. Thus the Mahánadi is pre-eminently fitted to produce what are actually met with, namely, floods ranging extremely high, but of brief duration. The Province of Orissa, at the deltas of the Mahánadi and Bráhmáni, has long suffered from these periodically devastating floods, and the maintenance of its embankments has always been of the first consequence to the inhabitants.

The East India Irrigation Company undertook the execution of the necessary works for the irrigation of Orissa, and the protection of the country from floods, with an unguaranteed capital. Their offer was accepted by the Government; Colonel Rundall, an eminent Madras engineer, was allowed to act for them as chief engineer for five years, and they commenced work in 1862. One of the most serious evils suffered by Orissa, at that time, arose from its isolation. The one little harbour at False Point was scarcely ever visited, there was no proper survey of the coast, and the road to Calcutta was barely passable during six months in the year. The leading principles to be observed in projecting the works were means to prevent the recurrence of drought, protection of the harvests from being destroyed by floods, and the opening of communications.

The region in question extends along the coast from the Chilka lake to the Sálánda river, and is traversed by the deltas of four rivers, the Mahánadi, Bráhmáni, Baitarni, and Sálánda, which, in time of floods, may be looked upon as one vast delta; while immediately above the point where these rivers begin to overflow their banks, the country begins to slope up steeply to the hills. The limits of the area, within which the works should be confined, are thus clearly marked out. This area is perfectly flat, and the staple crop is rice, grown during the monsoon months. The amount of rainfall averages 57 inches; but as the whole dependence is on the monsoon crops, it is not the quantity of rain, but the time of its fall that is all important. If the rains cease early, a famine is inevitable. In 1865 the rains ceased on September 14th, and the crops consequently perished. The main object of the works must be to secure the principal crop of the district from all risk of failure from drought.

Immediately upon issuing from the hills, the Mahánadi bifurcates, one arm retaining the name of Mahánadi, and the other taking that of Katjuri. The Beropa branches off from the Mahánadi opposite Cattack, and after 35 miles joins the Bráhmáni, whose estuary is called the Dhamrai. The head works were planned to consist of three weirs across the Mahánadi, Katjuri, and Beropa, 6,400, 3,900, and 1,980 feet long respectively; the two first 12½, and the third 9 feet high.

Orissa.  
Mahánadi.

Floods.

East India Irriga-  
tion Company.  
Colonel Rundall.

Isolation of Orissa.

Description of  
region.

Rainfall.

System of rivers.

Head works.

V.  
IRRIGATION.

## Canals.

high. The canal for the country between the Mahánadi and Katjuri, called the Central Delta, is taken off from the right flank of the Mahánadi dam, and a junction canal is to connect it with the Katjuri. Two canals are led off from the Beropa dam, that on the left bank being the high level canal to connect Cattack with Calcutta, and that on the right being intended to irrigate the country between the Mahánadi and Bráhmáni. Embankments are built round the city of Cattack to protect it from floods.

The Kendrapara Canal takes off from the right flank of the dam across the Beropa, to irrigate 270,000 acres of what is called the Northern Delta, at the rate of one cubic yard per hour per acre; it is 160 feet wide, and seven deep. The distributaries measure in all 171 miles, and there is a branch called the Pattamundi, taking off from the fourth mile and passing down the right bank of the Beropa and Bráhmáni to Pattamundi, the port on the Dhamrai, a place of export for grain. This branch irrigates 113,000 acres. The Taldundah Canal takes off from the right flank of the Mahánadi dam and runs to Taldundah, the limit to tidal navigation to which the steamer brings goods and passengers from the anchorage; it has a branch called the Machgong, and the two are to irrigate 155,000 acres of the Central Delta. (The high level canal is designed as a line of navigation from Cattack to Calcutta, while its power as an irrigating canal is limited.) The whole cost of the Orissa works was estimated at 1,120,963 £; but the total sum has since been placed at 2,772,500 £ to irrigate 1,600,000 acres.

## Cost of works.

## Failure of the Company.

The Company was unable to carry on the works, and they were handed over to the Government in 1868, together with the Son project, for the sum of 1,050,000 £, since which time the gradual prosecution of the Orissa scheme to completion has been sanctioned. The three great weirs had already been constructed by the Company, and have since been maintained in perfect order and security. During 1871-72 the work in progress was the raising and strengthening of the embankments of the Kendrapara Canal, and the excavation and embankments of the Taldundah and Machgong, 81½ distributaries had been completed. But there is a want of appreciation of the value of irrigation on the part of the cultivators of Orissa; the available supply is even now out of proportion to the demand, and there is a disposition only to resort to irrigation when the rain fails. The Company asked for a rate of five rupees per acre, which was refused by the cultivators; the Company then lowered the rate, but the ryots still refused the water. It was again lowered, and is now one rupee per acre. Only 14,740 acres are irrigated in Orissa, and there is great difficulty in collecting the water rate. The assessments were disputed at every step, and howling mobs followed the canal officials, representing their grievances. There is indeed a story that the ryots were charged for water rates, when banks burst, and the inundation damaged their crops. Demand after demand had to be abandoned, and finally the net income in Orissa on account of irrigation for 1871-72 was only 1,772 £, out of an original demand for 12,982 £. The Ooryas are slow and conservative; but at the same time shrewd and suspicious, and the Lieutenant Governor considers that they must not be harassed by charges, and that the water rate must be settled for a period of years, five at least. This has been done, the water being supplied, on written application, at the rate of one rupee per acre, which rate is not to be altered for five years. The management of the Orissa works will require tact and judgment, but there is reason to hope that eventually their great value will be fully appreciated by the people.

## Works in progress.

## Attitude of the people.

## Water rates.

## Difficulty of assessment.

## Charge for water fixed for a term of years.

NARBADA AND TAPTI BASINS.  
Central Provinces,  
Narbada.  
Tapti.

## Nemar.

On the other side of the hills which bound the basin of the Mahánadi, are the fountains of the Narbada, and of tributaries of the Godávári. The Narbada and Tapti flow across India, confined on either side by ranges of mountains; the Vindhyan range, with its steep cliffs bounding the Narbada valley on the north; the Sápura range separating the Narbada and Tapti, and the Deccan plateau confining the Tapti and its affluent the Purna to the south. These streams flow through the richest cotton districts of India to the Gulf of Cambay; in a country the rainfall of which is from 30 to 50 inches. The area of the Narbada basin is 36,400, and of the Tapti 27,000 square miles. Irrigation is necessarily on a small scale in these comparatively confined valleys. The district of Nemar, in the Narbada valley, was acquired from the Peishwa in 1818. The lake of Lachma, a tank three miles round, which was found in ruins, was restored, and 105 other tanks were put into working order within two years. In 1845 and 1846 Captain French, then in charge of Nemar, made a masonry dam across the ravine of Chuli,

Chuli, opening on the Narbada, and another large earthen dam across the Chapri, thus forming the great Chuli and Mandleswar tanks. The reservoirs and system of irrigation may be roughly described as being on the Madras system. The portion of Nemar north of the Narbada has now been made over to Holkar, together with Mandleswar, formerly the head-quarter station, which is now transferred to Kandwah, where the Holkar State Railway branches to Indor.

In their lower courses the Narbada and Tapti flow through the cotton-growing districts of Gujrat and Khandesh, where much attention has been given to well irrigation, and to improved methods of raising water from the rivers, as well as to works on a large scale. A project for the irrigation of 194,632 acres from the river Tapti, in Gujrat, has been sanctioned, and several works are either under construction or projected in Khandesh. A dam for the storage of water in the Girna valley has been commenced. The Jamda canals have been opened, and water was admitted in June 1869. The Mukti reservoir is under construction near Dhulia, the main dam being complete, and an outlet tunnel excavated to an extent of 80 feet. The Hurtola tank is nearly completed.

As regards rainfall, latitude, and jurisdiction, the country drained by the head waters of the Warda and Wainganga tributaries of the Godavari, in the Central Provinces, may be classed with the Narbada region. No great works have been completed in this region, but surveys have been made for the Kanhan irrigation project at Nagpur, which consists of a great storage reservoir, covering an area of 41 square miles, of a main canal 142 miles long, and minor canals with an aggregate of 400 miles.

The main features of the Madras system of irrigation are the dams or *anicuts* over rivers flowing across the peninsula from the western ghauts, just above their deltas, and the innumerable tanks. The river deltas, which have been the scenes of these excellent and highly remunerative labours, are those of the Godavari, the Krishna, the Ponnar, and the Kaveri, besides some smaller works. The rainfall along this western shore of the Bay of Bengal is moderate, and insufficient for the satisfactory production of rice, the crop which is most abundantly cultivated. At Vizagapatam it is 45 inches, at Madras 50, but further south only 30 and 22.

Commencing from the north, the projects for the Godavari works were sanctioned in 1844. At the head of the delta, at Dhauleswaram, the deep bed of the river is 22 feet above high-water mark, and the highest part of the delta requiring irrigation is 30 feet above the same level. From Dhauleswaram the river flows to the sea, on the crest of what may be termed a great natural embankment, 6 to 24 feet above the level of the country. The bed of the river, therefore, only required to be raised 10 or 12 feet to give a perfect command and establish a working and efficient head of water. This is effected by a dam or *anicut*, 12 feet high, at Dhauleswaram, where the river is three and-a-half miles wide, 1,000 yards of which is occupied by four islands. The *anicut* is a substantial well-protected mass of stone, in lime cement, 130 feet broad at the base, 12 feet high, and two and-a-half miles long. The delta, from the Kolair Lake to Samalkota, is a noble expanse of rich alluvial land, with an irrigable area of 2,000 square miles; and the Godavari can supply 3,000 cubic feet of water during the low, and 12,000 during the high period of the river's volume. The larger quantity may be depended on from July to October, when the rice-crop requires a constant supply of water (40 acres of rice to one cubic foot per second of water). The delta is divided into three natural sections, the first between Samalkota and the eastern Godavari, the second between the two branches of the river, and the third from the western Godavari to the Kolair lake. In the first section there is a channel along the river, and another, separating into two branches, to Samalkota and Cocanada. These and all the other main lines of canal are adapted for navigation, as well as for the supply of water for irrigation. The second section consists of 352,000 acres of a rich alluvial soil of surpassing fertility. A main channel passes down the left bank of the river, and, at the eighth mile, branches into two. The right-hand branch is again subdivided, six miles further on, and one line crosses a minor branch of the Godavari, by the Gunnarum brick aqueduct constructed by Lieutenant Haig, 2,248 feet long, on 49 arches. The third section has a main channel carried out for eight miles, when it breaks off into several branches, having a united length of 220 miles. Altogether there are 840 miles of main channels to irrigate 780,000 acres. In 1864 an extension

Gujrat.

Tapti project.

Khandesh.  
Girna project.  
Jamda Canals.  
Mukti reservoir.

Hurtola tank.

Kanhan irrigation project.

MADRAS SYSTEM OF IRRIGATION.

Delta works.

Godavari.

V.  
IRRIGATION.

of the Godávari line, completing the water communication between the Godávari and Krishna works was sanctioned, and since that improvements have been executed from loan funds. The traffic on the canals of the Godávari is of much importance to the district, and in 1871-72 was carried on by 58,471 boats and rafts.

Krishna.

The Krishna enters the low country at a distance of about 80 miles from its mouth; and both its banks, below Bezoarah, spread out into rich alluvial plains. The site of the *anicut* at Bezoarah is flanked by the last hills; thence the plain stretches uninterruptedly to the sea, and to the Godávari. The two rivers have formed the alluvial plains of the deltas, but half way between them is the Kolair lake, a low swampy tract representing the work the Krishna and Godávari have to do before this alluvial plain is complete. The English acquired the Krishna delta in 1766, and for 80 years they did nothing, while famines periodically desolated the land. When the rains failed in 1833 not less than 200,000 people died of hunger, and the Government lost revenue to the amount of 900,000 £. The Krishna delta covers an area of 10,000 square miles, with 1,100,000 inhabitants. The river flows to the sea on an elevated central ridge with the country falling off gently to right and left, and a general inclination to the sea. Bezoarah is exactly at the apex of the delta, where the river is 1,300 yards wide, flowing between two hills. The *anicut* consists of a broad basis of stone thrown into the river, and allowed to assume its own natural shape, 3,750 feet long, and 305 broad; faced with a casing of masonry, with scouring sluices at the flanks. From the east side the main channel is divided into two branches, one to Masulipatam and the other to Ellor. The main western channel divides into the Nizapatam and Comamur branches. In 1866 estimates were submitted for widening the channels so as to ensure a supply for 250,000 acres, making a total of 430,000. This work of enlarging, which is designed to develop and perfect the system of irrigation and navigation in the Krishna delta, was progressing in 1871-72, by means of loan funds.

Ponnár.

The construction of the Ponnár *anicut* was first proposed in 1849, at the ferry at Nellor, where the river is 520 yards in width; it was completed in 1855, but in 1857, during a hurricane, the *anicut* was breached for 282 feet, and the repairs were not completed until 1861. The area irrigated by the water thus obtained was 32,874 acres in 1863. The supply from the Ponnár is precarious, so that it is obliged to be supplemented by water kept in reserve in the Nellor and other tanks; and the water is only given out on one side of the river, the levels on the northern bank being too high. There is now a project to enlarge the main or Survapali channel from the Ponnár *anicut*, and so develop the irrigation.

Kaveri and  
Kalerun.

The Kaveri and Kalerun works are the most ancient, both as regards the native original portion and the English improvements. At the head of the island of Seringham, near Trichinapalli, the main river divides into two branches, the southern retaining the name of Kaveri, and the northern being called the Kalerun; which latter has a larger volume, a more rapid slope, and a more direct channel, and the tendency was for the smaller stream gradually to silt up, and the whole volume to pour into the Kalerun. This would have ruined the irrigation of Tanjor. The ancient native work, called the grand *anicut*, was a solid mass of rough stone 1,080 feet long and 40 broad, stretching across the bed of the Kaveri in a serpentine form, at the lower extremity of Seringham island. It was built upwards of 1,600 years ago.

Colonel (now Sir Arthur) Cotton's plans for the development of the Kaveri irrigation were sanctioned in 1836. Before the construction of his works the area of irrigation dependent on the Kaveri and Kalerun was 669,000 acres. The great object of Sir Arthur Cotton's plans was to send the excess of water in the Kalerun back into the Kaveri; by throwing a masonry *anicut* across the Kalerun, the crown of which should ensure about half the supply of that branch, passing into the Kaveri. The Kalerun *anicut* is 750 yards long, divided into three parts by two islands. The brick and stone mass rests on three lines of wells, six feet in diameter, sunk to a depth of six feet in the sandy bed of the river, and there are 22 sluices. The effect of this work was to deepen the bed of the Kaveri, and a masonry regulating dam was carried across that river in 1845. This has given regularity of current and decrease of violence in the Kaveri, and has also caused a clearing of the Kalerun; the two streams are thus

thus controlled in a most satisfactory manner. The Kalerun is the great drainage channel of the delta, while the Kaveri branch is a channel of irrigation only. All the numerous channels are solidly embanked, and an anicut was thrown across the Kalerun in 1836, 70 miles below Seringham, to regulate the supply for South Arcot. In 1836 the area irrigated from the Kaveri and Kalerun, in Trichinapalli, Tanjor, and South Arcot, was 630,613 acres. In 1850 it was 716,524 acres. The returns on the outlay may be estimated at 23½ per cent.

It is difficult to give the exact effect on cultivation of the great Madras delta works, because the irrigated areas are given by districts, not according to separate works, and may be due in part to supplies from tanks not receiving water from the delta works. But the areas of irrigation in the Godavari, Krishna, Nellor, and Tanjor districts, no doubt represent, very nearly, the areas irrigated by the Godavari, Krishna, Ponnár, and Kalerun delta works. This is—

Godavari district	-	-	-	225,032 acres.
Krishna district	-	-	-	144,591 „
Nellor district	-	-	-	176,927 „
Tanjor district,	-	-	-	698,142 „
				<hr/>
				1,244,692

This is probably below the truth, as the Kalerun works also irrigate tracts in Trichinapalli and South Arcot. The total area of irrigated land in the Madras Presidency amounts to 3,300,017 acres.

South of the Kaveri lies the district of Madura, which depends for its supply of water, other than the direct rain fall, from the river Vaiga, rising in the hills of Travancor. The streams which form it have their sources in the slopes immediately overhanging the eastern valleys, so that their volume is very little affected by the south-western monsoon, and the Vaiga, as it flows by Madura into Ramnad, is never able to meet the wants of those districts, while none of its water reaches the sea. Both in 1864 and 1865 the channel was dry, 24 miles below the town of Madura. Ramnad looks in vain for water to irrigate its fields, while the supply is quite inadequate to meet the wants of Madura. Yet, while a scanty and insufficient supply reaches the thirsty eastern plains, the great river Periaur, with a volume far beyond the possible wants of the western coasts, runs to waste in the Cochin backwaters. By a cutting 140 feet deep, and a quarter of a mile long, and a dam 60 feet high, it is believed that the river Periaur might be turned over from the well-watered western to the parched-up eastern coast. This would change the whole face of the country, and a garden would soon extend from the mountains to the sea. The plans and estimates are not yet matured, but in another year we may hope to hear more of this interesting Periaur project.

Tinneveli, the southermost district of Madras, is watered from the Tambrapurni river, by means of anicuts placed at intervals across the stream, whence channels are led either directly for irrigation, or to supply tanks, the number of which in this district is exceedingly large, giving some index to the demand for irrigation. The anicuts are earth embankments with masonry sluices; they are very ancient native works, the largest being the Canadien Channel, running parallel with the river from Popanassum to Shermadevi, the land between the river and the channel being one sheet of paddy. As some portion of the water of the Tambrapurni still escaped to the sea, the construction of the new anicut, below all the others, was sanctioned, so as to secure this surplus for irrigation, and to supply the port of Tutikorin with water; these works are now well advanced.

There remains the second zone of dry country, with a rainfall under 30 inches, extending down the centre of the peninsula to leeward of the western ghauts. It comprises the eastern half of the Bombay Presidency, great part of the Nizam's territory, the Ceded Districts of Madras, Mysor, and a great part of the Carnatic; it is watered by the upper courses of those rivers, the Godavari, Krishna, Ponnár, and Kaveri, the deltas of which have been so admirably fertilised by Sir Arthur Cotton and his great school of Madras engineers; it is emphatically the region of tanks.

## V. IRRIGATION.

## Tanks.

The Nizam's territory, Mysor, and the Carnatic are covered with thousands of tanks. In the fourteen districts of Madras there are said to be 43,000, all of native origin, with probably 30,000 miles of embankments, and 300,000 separate masonry works. The revenue dependent on tanks was 1,500,000 *l.* yet, in 1853, not one new one had been made in Madras by the English, though many had been allowed to fall into disrepair. In Mysor, until quite lately, the arrangements for their maintenance were also far from satisfactory. Tanks are formed in various ways, according to the accidents of the ground. Embankments are thrown across the gorges of valleys, high enough to retain a volume of water proportioned to the irrigable acres situated below. Descending terraces of land are occupied by a succession of reservoirs, the higher feeding the lower from its surplus supply. Long slopes have portions embanked on three sides, and the included space form a storage area for such volume of water as local wants may call for; some of these works are very ancient. The Viranum tank has an area of 35 square miles, and an embankment 12 miles long, still in full operation after an existence of fabulous duration; it secures an annual revenue of 11,450 *l.* The Chembrumbaukum tank, in Chengalpat, looks like a picturesque natural lake. The embankment is over three miles long, and the tank maintains a sheet of rice cultivation, nearly 10,000 acres in extent. Its safety, during floods, is secured by six waste weirs (*calingulas*) with a total width of 676 feet of escape channel; the supply is from rainfall, and merely local drainage. The enlargement of this fine tank was sanctioned in 1867, at a cost of 41,000 *l.* In 1871-72 the excavation and earthwork was well advanced. The Kaveri-pauk tank, in North Arcot, is also of great antiquity. It is fed from the Pallair river, and has an embankment nearly four miles long, revetted along its entire length with stone; it irrigates nearly 7,700 acres. The most formidable cause of injury to tanks is the action of waves on the embankments during gales; it is counteracted by long slopes on the water face of the bank, and protecting coverings of rough stones. Most tanks are supplied with an outlet, called a *calingula*, generally of masonry, built in the land near one end. It is so much lower than the land itself that any superabundant water can pass over it. Towards the end of the rainy season, the *calingula* is closed, so as to keep the tank quite full. This is done by means of straw and turf, the crown of the *calingula* being usually supplied with a row of rough granite posts, three or four feet high, to support the wall of turf built up in front.

## Mysor.

In Mysor there was much activity with reference to the repair of tanks during 1871-72. As many as 645 tanks were repaired, and the cultivators themselves contributed no less than 1,514 *l.* towards tank maintenance, and voluntary labour to the value of 1,100 *l.* In future they will maintain the tanks themselves, as regards ordinary earth work and revetment repairs, as soon as they have been put into thorough working order by the Government. The chief new irrigation work in Mysor is the Sriramadevara *anicut* over the Hemávati, which was completed in 1870-71. During 1871-72 the work on the first 26 miles of the channel was nearly finished. The supply of water is ample, and it will secure extensive rice crops.

## BOMBAY.

## Krishna.

The three rivers Bhima, Krishna, and Tungabudra, rising in the western ghauts, drain the greater part of the southern dry region, and unite to form what is usually called the Kistna, a short distance below the town of Karnal. On first issuing from the mountains, they and their tributaries traverse the thirsty lands comprised in the eastern section of the Bombay Presidency, the Deccan and the Southern Maharashtra country. Considerable activity has been shown, of late years, in suggesting and maturing projects for utilizing the water of the rivers, as they flow across the Bombay territory. But the difficulties are not trifling. The rivers have so slight a slope that their fall would not gain much on that of a canal, while the steep transverse slopes of the valleys prevent canals from getting to any distance from their parent streams. The rivers are filled at the time of rains, but during the long dry season of eight months they become mere threads. The two objects to achieve are the retention of the copious supplies which run to waste during the rains, and the command of the barren lands on the sides of the valleys. The natives in this region left the main rivers untouched for storage purposes, for the most part, and were contented with the construction of small tanks on tributary streams.

## Natural configuration.



V.  
IRRIGATION.  
—  
Krishna Canal.

The largest of the works in the Bombay Presidency that is completed is the Krishna (the name of the upper part of the Kistna River) Canal. A masonry dam is thrown completely across the river, on a rocky bed. A canal is excavated from above the dam, which is near Kurvar, in the S t r a district. Its bed is four feet lower than the crest of the dam, and it is provided with scouring and regulating sluices. It then meanders along parallel to the river, with a slope of a foot a mile, being carried across the drainage of the country by suitable works, and eventually recedes from the bank, so as to command a larger area of land. It is now in working order, and has ensured the safety of valuable crops over a considerable area. In 1871-72 the area irrigated was 2,038 acres, giving a revenue of 955 l.

The Ekruk tank is four miles north of the town of Sholapur, on the Adéla, a tributary of the river Bhima. The dam of earthwork, with masonry flanks, is thrown across the Adéla valley, and is 7,200 feet long, and 72 feet high in the centre, with a waste weir at the earth end. A lake is thus formed, with an area of six and a-half square miles, which submerged five villages, two of them in the Nizam's territory, causing an annual loss of revenue amounting to 100 l. On the other hand 35,840 acres are brought under the influence of the tank by three channels, two of them on a high level, to be used when the tank is full, for monsoon crops, which are 4 and 18 miles long respectively; the other a permanent channel, 28 miles long, for perennial irrigation. One of the high level-canals is now complete, and the permanent canal has been carried to the twenty-fourth mile. The dam was completed in 1869, and the Ekruk tank is now in working order. The water was given free of charge in 1871-72, it being the first year.

Ekruk tank.

The Púna and Kirki water-supply works, also within the basin of the Bhima, consist of a masonry dam of great height, and 2,900 feet long, across the valley of the Muta river, to form a reservoir. Two open ducts lead the water to Puna and Kirki, where it will be distributed by iron pipes. This work was designed by Colonel Fife, and is now progressing rapidly. The centre portion of the dam has been raised for a length of 250 feet, to a uniform level of 53 feet above the river bed; most of the masonry work is complete, and the Puna Canal is well advanced. The Mudduk tank, with canals, in Dharwar, is a scheme which has been carried out, as well as that of the Kalhola-nullah; and several others are engaging the attention of the Bombay Government. Such are the proposals for a canal from the Gokak river in Belgaum, for a canal from the Mulpurba river into the Dharwar plains, and for carrying out the Churdi project which was suggested by Sir George Wingate many years ago. The valley of the Yerla, a tributary of the Krishna, has also been surveyed for storage tanks, and the new canal from the Yerla is now in working order, as well as the Chikli Canal, both in Sátára.

Muta tank.

Mudduk tank.  
Kalhola Nulla.

Gokak project.  
Mulpurba project.  
Churdi project.  
Yerla Canal.

Chikli Canal.

There remain the Ceded Districts of Belary, Karnal, and Cuddapa, in the midst of the dry zone, with a rainfall at Belary of only 22 inches. The Tungabudra flows round the northern borders of Belary and Karnal, and offers the food-giving water to those who know how to get it. But the country beyond the mere valley of the river has thirsted for lack of sufficient water during long centuries. Often the monsoon rains fail, and then people die of hunger by scores. Yet on the banks of the Tungabudra, and within the Belary district, stood the famous city of Vizianagar, where the old travellers Conti and Cæsar Frederick saw cool channels flowing through the streets, and groves and gardens concealing the suburbs. The Rajahs of Vizianagar constructed dams across the Tungabudra in 1521, and in subsequent years, by throwing enormous stones on the rocky ridges in the river bed, and leading off canals. Nine such anicuts were built, and channels with a total length of 89 miles were led into the valley, to increase its fertility, and water the crops. But they were never brought to the country above, which really requires water; and this problem remained for us to solve.

CEDED DISTRICTS.

Tungabudra.

The arid plains of the Ceded Districts continued to thirst for water. At last it was resolved that an English company should have an opportunity of trying whether the employment of private enterprise and English capital could be advantageously adopted in aid of Governmental action, in the construction of works of irrigation in India; and these Ceded Districts were selected as the scene of the experiment. In 1860 the agreement was made with the Madras Irrigation

Madras Canal and  
Irrigation Com-  
pany.

Cana

V.  
IRRIGATION.Sankasala  
Project.

Canal Company; but one important element, the enterprise, was omitted, for the Company's capital of 1,000,000*l.* was raised by means of a Government guarantee to pay interest at 5 per cent.

The final project, which was sanctioned in 1861, is to divert, by means of an anicut at Sankasala, 17 miles above Karnul, a portion of the flood waters of the Tungabudra into the valley of the Ponnár, through a capacious canal along the right bank of the former river, and across high land, forming its watershed to the east; also to complete a line of water communication to the coast, by improving the beds of the Kundar and Pennair to fit them for navigation; and by excavating canals, overcoming the slopes of the country by a succession of locks, and providing water for the dry season by constructing reservoirs. The irrigation of the Bellary district was also a part of the original plan.

Sankasala anicut.

At Sankasala a reef of rocks forms a barrier in the river, and furnishes a base on which to erect an anicut. Its height is 12 feet, and the length 1,500 yards. From its right flank, the main canal is carried parallel to the river for 17 miles, with only one bank from 16 to 34 feet high, the other being formed by the natural rise of the ground. Thus a quantity of land is submerged, while the single bank is subject to violent action from waves, owing to the extensive spread of water. Close to Karnul, the canal is taken across the Hindri river on a fine aqueduct. At Metacondal, 72 miles from Sankasala, there is a cutting a mile long, which takes the canal from the Tungabudra basin, across the water parting, into that of the Ponnár, descending the valley of the Kolair, to the Ponnár itself, by a succession of locks, in a fall of 236 feet. From June to November there is plenty of water from the Tungabudra, but from November to June not a drop can be abstracted from that river, without injury to the Krishna delta irrigation, so that capacious reservoirs for storage are essential to the success of the scheme. The scheme was to continue the canal down the Ponnár valley, with an anicut in the Somaishweran gorge, to the sea at Krishnapatam. The canal is completed from Sankasala to the Ponnár, 143 miles, but not so as to be capable of bearing the full amount of water, owing to weakness of construction. Another defect is that sufficient waterway is not provided for the passage of flood waters either under the canal or by surplus weirs in its banks for the escape of storm waters, entering it when full.

Canal with one  
bank.Hindri aqueduct.  
Metacondal cut-  
ting.

The contract between the Secretary of State and the Company was signed on the 3rd of June 1863, and on the 10th of July 1864 water was first admitted from the Tungabudra into the main canal at Sankasala. In July 1864 a flood undermined a part of the anicut, and the body of the work was breached for 22 yards, right down to the rock. The damaged part was rebuilt in the following dry season. By May 1865, the Company had a balance of about 130,000*l.* out of their guaranteed 1,000,000*l.* It became apparent that the project could not be completed for the original sum, and on the 2nd of October 1866 the Secretary of State granted a loan of 600,000*l.*, at 5 per cent. interest, to the Company, on the condition that if the works were not completed and placed in perfect working order by the 1st of July 1871, the Company, if so desired, should surrender the whole of the works to the Government, which would pay the capital laid out on them. By that date the main canal was made, all the sluices in it were built, and the channels for distribution were in a more or less advanced state; 216 miles of them being finished, commanding 91,567 acres. The area irrigated in 1870-71 was, however, only 1,516 acres. It was hoped that in 1871-72, the area would be increased to 8,883 acres, yielding a return of 5,397*l.*; but it appears that if the full amount of water was admitted into the canal the embankments and walls would fail at many places. No project for a reservoir has been completed; and the irrigation of the Bellary district is still unprovided for, two estimates amounting to about a million and a half each, submitted in 1867 and 1870, not having been sanctioned.

Yet the main canal and works are considered by the Company, in a general sense, to have been completed by July 1871; and the Company propose to continue them, and to pay back the Government loan. The water rate, payable to the Company, is six rupees per acre per crop.

The experience of the Madras Irrigation and Canal Company is not generally considered favourable to the employment of companies, with guaranteed interest on their capital, to execute irrigation works in India. The company in Orissa, without guarantee, was unable to carry on the works it had undertaken, and

sold

Employment of  
companies.

sold them to the Government. Lord Lawrence, in 1864, decided that the State should undertake directly all the irrigation works that it could practically carry out, in preference to entrusting them to private companies, and that the funds for their construction should be borrowed, if necessary. The famines of 1837-38 and 1860-61 in the North West Provinces, and of 1865 in Orissa, had shown the urgent necessity of securing the country, by the provision of irrigation works, wherever it was possible to do so, from the recurrence of such calamities; and in 1867 the Secretary of State fully accepted the principles advocated by Lord Lawrence since 1864. In order to give the greatest possible efficiency to the action of the Government in relation to the spread of irrigation, an inspector general of irrigation works was appointed, and Major General R. Strachey was nominated to that important post in January 1867; he has since been succeeded by Colonel Rundall, who had previously had charge of irrigation in Bengal. In March 1867, Colonel Fife was appointed Irrigation Secretary in Bombay, and Colonel Anderson was nominated to a similar post in Madras. Colonels Greathed and Crofton received similar appointments in the North West Provinces and the Punjab. On the new system the first step is to fix the sum to be assigned for irrigation works from the ordinary revenues of each year, which is not to be transferable to any other classes of works. The grant thus made must first be wholly expended before any charge can be allowed to be thrown on the loan fund. Then the works to be aided by borrowed funds must have been sanctioned on regular designs and estimates, and the cost for any such work must not be less than 10,000 *l*. They must also be of a nature which will admit of a proper revenue account being drawn up, from which the exact results of each work can be seen. In special cases minor works may be grouped together to bring them within the requirement of the rule respecting the loan funds. Thus very great activity has been shown in the prosecution of works of irrigation; existing works have been watchfully maintained and extended; numerous important projects have been matured and commenced, and efficient machinery exists for the continuous prosecution of these great undertakings.

V.  
IRRIGATION

Irrigation works to be executed by the State.

Loans.

Inspector General of irrigation works. Irrigation officers.

Rules for works executed by loans.

In the moist belts, where there is a superabundance of rain, works of irrigation are superfluous; but works of equal importance, as regards the welfare of the people, become necessary in their place. Instead of bunds and channels to raise the water and spread it over the land, embankments are needed to preserve the crops and villages from destructive floods.

Embankments.

The maintenance of the river embankments in Lower Bengal is an important part of the duties of the Irrigation Department, for the cultivation of the land is entirely dependent on their efficiency. Vast tracts of thickly populated country are below the level of high tides on the lower part of the Hugli, and below the flood levels of the rivers, in every part of the valley of the Lower Ganges. There are 2,100 miles of embankments under the charge of the Irrigation Department in Bengal, most of them maintained at the expense of the State. An idea may be formed of the importance of this charge from the fact that a single breach in the embankment of the Cossye inundated 36 square miles, and completely destroyed the crops. The embankments have to be made up to the proper height and section during the dry months, and carefully guarded in the rainy season.

Bengal embankments.

A very extensive series of embankments is under construction along the banks of the Irawadi, in British Burma. During the year 1870-71 the works were in abeyance, but surveys were in progress on several lines on both banks of the river. In 1871-72 work was resumed. Two embankments were sanctioned (the Leymyethna and Zalun) which will afford protection to 150,000 acres at a total cost of 4 *s*. per acre; iron sluices were provided in the Henzada embankment for passing off water lying against it after the subsidence of the floods, and several surveys were in progress.

Irawadi embankments.

V.  
IRRIGATION.

VI.—COMMUNICATIONS.

VI.  
COMMUNICATIONS.

Importance of  
means of commu-  
nication.

THE influence of efficient means of communication between the various provinces of India on the welfare of the people is strikingly shown in several passages of the Administration Reports for 1871-72. It will be remembered, for example, how the short harvests in the Central Provinces were so efficiently made up by grain imported from Chattisghar, that the prices were not even affected. On the other hand, the famine of Orissa is to be ascribed to the absence of means of communication. There was no made road, no navigable canal, no survey of the coast. The subject of Indian communications includes railways, roads, navigable canals, and harbours. For sea-borne traffic, as was shown on the occasion of the Orissa famine, is quite as important as that by land.

Railways. ✓

Mileage com-  
pleted.

Main lines opened.  
Completion of the  
link between  
Bombay and  
Madras.

East India chord  
line.

Cost of railways.

Receipts in 1871.

Expenses in 1871.

Interest paid in  
1871.

East India Railway.

Great Indian  
Peninsula Railway,  
Madras Railway.

Bombay and  
Baroda.

Great Southern  
of India.

The main system of Indian railways is nearly completed; and the State railways, which are now under construction or proposed, will, for the most part, supplement the existing trunk lines. (In the year under review, there were 5,204½ miles of railway open for traffic, of which 5,136 were constructed by means of guaranteed capital, and 68½ by the State.) Of 2,438 miles in course of construction, 935 were by companies, and 1,503 by the Government. As no more lines will be entrusted to companies, all railway construction will eventually be in the hands of the Government. Lines are now open from Calcutta to Multan and Bombay, and from Bombay to Madras. The completion of the latter line was effected on the 1st of May 1871, on which day the Great Indian Peninsula joined that from Madras, by opening the piece between the Krishna and Raichur; but the bridge over the Krishna is not yet completed. In 1871 the chord line of the East India Railway was also opened, 124 miles long, and the branch (23 miles) to the Kurhbari coal fields. Up to March 1872, the sum of 90,009,622 £ had been expended by the guaranteed railway companies, and it will require 8,000,000 £ to complete their lines. The gross receipts in 1871 were 6,146,130 £; the working expenses 3,302,050 £; leaving a net profit of 2,844,080 £, of which 2,839,338 £ was earned by the guaranteed lines. The guaranteed interest was 4,422,243 £, so that there was a loss of 1,582,905 £ to the State. But the railways are now almost completed, so that with the cessation of heavy outlay on construction, the financial position may be expected to improve. The East India Railway, with its chord line, and Jabalpur branch, altogether 1,504 miles, is all open for traffic. The Great Indian Peninsula Railway (1,270 miles) is completed, with the exception of the bridge over the Krishna. The Madras Railway (862 miles) is all open, except a short branch to the foot of the Nilgiris. The Bombay and Baroda Railway is finished for 390 miles; and the Great Southern of India is open for 168 miles out of the 378, which will complete it to Tutikorin. Sanction was given in August 1871, for its extension, by Dindigul and Madura to Maniachi, with branches thence to Tinneveli and Tutikorin.

Oudh and  
Rohilkhand.

The Oudh and Rohilkhand Railway is progressing, and is opened for traffic for 120 miles, 42 from the Ganges at Cawnpur to Lucknow, and 78 miles in other directions. The bridge over the Ganges (three miles, two and a half of which is over the Khádar lands) is of wrought iron lattice girders. Between Lucknow and Murábad the railway crosses 32 rivers and 60 miles of inundated valley. The line will eventually be prolonged to the foot of the hills in the direction of Naini Tal, the survey for that purpose being at present in progress.

State Railways.

Lahore to  
Pesháwar.

Numerous State railways on the narrow gauge, either commenced or under consideration, will complete the network of communication over nearly every part of India. The most important State railway is that from Lahor to Pesháwar (270 miles). It necessitates the construction of bridges over the Punjab rivers, a most formidable series of works; but the operations are at present confined to the section between Lahor and Ráwal-Pindi. It is intended to construct it on a gauge of 3' 3½", which will be the same as that of the other State railways, but involves a change at Lahor, as the line from Calcutta is on the broad gauge.

Break of gauge.

gauge up to that point. The narrow gauge has been adopted for the sake of economy, an advantage which is believed to outweigh the inconvenience of a break of gauge at Lahor. There has been much discussion on this question, which is not yet finally settled. The next State railway in order of importance, is what is called "the missing link," the Indus Valley Railway (480 miles), running from Multan to Bháwulpur and Rohri, and thence to Kotri along the right bank of the Indus, which it crosses at Rohri. This line will complete the railway communication between the port of Karáchi and the districts of the Punjab.

Indus Valley lines.

The Rájputána State Railway (370 miles) has been commenced. It runs from Agra by Bhurtpur and Jaipur to the Sambhar Lake, being joined at Khera by a branch from Delhi. The Holkar Railway (86 miles), which has been begun under contract, is to connect Indor with the Khundwa Station of the Great Indian Peninsula Railway.

Rájputána State Railway.

Holkar State Railway.

In Bengal there are two State Railways. The Eastern Bengal, the extension of which to Gulundu was opened by Lord Mayo on 1st January 1871, now consists of 159 miles of single line. Unfortunately, the floods breached the line in August and November, and traffic was more or less interrupted. The Calcutta and South Eastern line can hardly be anything but a burden. It was made in the expectation that Port Canning would become a thriving place; but that scheme has been abandoned, and the goods traffic of the railway is confined to firewood and hay. The Nalháti and Azimganj State Railway, with a 4-foot gauge, connects a place near Murshidabad with the East Indian line, and is considered to be a most successful example of the working of a light cheap line. The Northern Bengal Railway is a projected line from the Ganges to the foot of the Sikkim Hills (211 miles). It has been surveyed, and as it will pass through the rich and populous districts of Pubna and Rájsháhi, and tap Kuch Behar and the tea lands of Darjeeling, it is likely to be remunerative.

Eastern Bengal.

Calcutta and South Eastern.

Nalháti line.

Northern Bengal.

In the Central Provinces the short State railways are very important, as completing the system of communications in the cotton and coal yielding districts. Those from Khámgaon and Amraoti, seven and a half and five and a half miles, are completed; and a portion, 15 miles long, to the coal beds of the Wurda Valley, is sanctioned. It will eventually be extended for 48 miles, on the narrow gauge of 48 inches, to the coal shaft at Warora. In the Nizam's territory lines of railway are sanctioned from Gulburga to Haidarabad, from Haidarabad to Chanda, and from Warangal to Masulipatam. Surveys are in progress for two alternative lines from Nágpur to the great corn-producing district of Chattisgarh, which will tap a country of great importance, where food has often been wasted for want of consumers. This district produces very largely in excess of the wants of its population, and a railway opening it to the rest of the world would be one of the most important works of communication that could now be undertaken.

Khamgaon and Amraoti.

Wurda Valley.

In Nizam's territory.

Nágpur to Chattisgarh.

In the Southern Mahratha country, through which the cotton of Dharwar and the Ráichur Doab has long wanted rapid and convenient means of transport to the ports of shipment, the necessary lines of railway have been projected. The survey of a line from the port of Karwar to Hubli and Gadak (144½) has been completed, and extensions from Gadak to Belary, and from Hubli to Sholápur, are also being surveyed. The line from Bangalor to Mysor has been indefinitely postponed, after 13,600 l. had been expended on surveys, in order that the surplus revenue of the State may be expended on the far more important work of repairing the tanks.

Karwar to Hubli.

Mysor lines.

Plans and estimates have also been prepared for a railroad from Rangún to Prom.

Line from Rangún to Prom.

The great undertakings connected with the construction of roads have, for the most part, been completed; and some of them have even been superseded by railways. The Grand Trunk Road up the Ganges valley is parallel with the East Indian railroad; and the monument recording the construction of the road up the Bhoze Ghaut, by Sir John Malcolm, must be a strange commentary, to the few who ever now see it, on the rapid changes typified by the adjacent wonderful line of railroad up the zigzag incline. But other great roads will not be superseded by the railways. The splendid engineering works leading to the Himalayan sanatoria, to the coffee districts of Wynaad, and to the Nilgiris, will

Roads superseded by railroads.

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Trunk Road.

be used for many a long year; as well as such a line as that called the South Western Trunk Road, from Calcutta, through Orissa, to Ganjam in the Madras Presidency, which is now declared to be fully completed throughout.

## Bengal roads.

Most of the new roads have been undertaken with a view to forming feeders to the railways, and the local roads have been maintained and constructed by local cesses. In Eastern Bengal roads, except in the hill tracts, are in competition with excellent water carriage, so that, as a rule, it is not considered necessary to spend very large sums upon them. This is the decision the Lieutenant Governor has come to with reference to the Silhet and Cachar Trunk Road. In Western Bengal a road has been commenced, 27 miles long, to connect the Girhidi station of the East India Railway with the Grand Trunk Road at Dunwi, and the Chota Nágpore districts; and the Bugodur and Hazaribagh road, which is to be completed, brings the latter station in direct communication with the railway. Much progress has also been made with a feeder to bring the Purulia, Ranchi, and Chaibasa districts into communication with the railway. The Ganges and Darjiling road is now completely bridged, with the exception of the Mahánadi at Dingughat, and metalled throughout. The hill portion is largely used for trade purposes. In the North West Provinces the principal work has been the completion of the Naini-Tal cart road, and of that from Sháhjehánpur to Sítapúr; and the progress made on those from Banda to Ságar, from Sursa Nadi to Rewári, and from Almora to the Ránikhet road. In Garhwal 123 miles of road from Srinagar to Niti Pass, have been completed to a width of 10 feet, where, four years ago, there was a mere path, in many places almost impassable; it is bridged throughout, and is an important line of communication for traders from Tibet. In the Punjab, notwithstanding the heavy floods of 1871, the trunk line of road from Delhi, by Jallandar, to Lahor, was maintained in a fair state of efficiency; but its continuation to Pesháwar has much deteriorated of late years, owing to heavy additional traffic caused by the construction of the railroad. In 1871 repairs and renewals had the effect of restoring it to efficiency. Many other repairs and improvements have been effected, especially on the Kangra valley road, and on those from Ráwalpindi to Umwi, and Pesháwar to Kohat. The grain markets show that the roads have provided a means of intercommunication in the Punjab, which is sufficient to equalise prices in a great measure, and to ward off distress when the failure of crops is local. In Oudh, also, much work was done in metalling and improving roads, and planting trees.

Roads in the North  
West Provinces.

## Punjab roads.

## Roads in Berar.

In Berár three principal lines of road, in addition to the branch railway, have been under construction for some years; namely, from Akola to Málígám, and Hingoli, from Murtizapur to Kariuja, and from Badnera, by Amraoti to Morsi, with a branch to Elichpur. The first has been completed as far as Basim. The need for good cotton roads in the Berárs, leading from the railway stations to the chief cotton marts, has long been felt; and as long ago as in 1863, 20,000 £. were granted with a view to making them passable during the dry season of seven months. (A committee in 1861 had recommended the construction of 14 roads across the Purna valley, averaging a length of 25 miles each. The black cotton soil of this valley is 40 to 100 feet deep, and the country is almost impassable during the wet season. Besides the above three lines, to be completed as first-class roads, the fair weather tracks will be available during the cotton season.)

Roads in the  
Central Provinces.

In 1862 there were not 18 miles of road fully opened throughout the Central Provinces. Now, two great trunk lines, called the northern and eastern roads, start from Nágpur as a centre. The northern road leads to Jabalpur, through Seoni, a distance of 165 miles. This route has ceased to be of more than local value since the railway has been opened through the Nárhada valley, from Khandwah to Jabalpur. But for many years the north-east terminus of the Great Indian Peninsula Railway was at Nágpur, and that of the East Indian Railway at Jabalpur; and in those days the line between Calcutta and Bombay passed over this so-called "northern road," which was a very important link of the chain of communication. The Seoni plateau is about 1,500 feet above Nágpur, and, until this road was made, its products could only be brought to a market by carriage on pack animals. The road, as regards engineering and alignment, is one of the best in the interior of India. The eastern road leads from Nágpur to Rápur, in Chattisghar. Very little work has been done on it during

during the last two years, because the prospect of a railway from Nagpur to Chattisgarh made it probable that it would not hereafter be required as a first-class line of communication. It is, however, most important as an outlet for the surplus grain of Chattisgarh, which is always an exporting country. The distance is 180 miles, of which one link of 30 miles is quite unmade. Some large streams are the only natural obstacles. The Sagar road is under construction, as the connecting link between Bandalkhand and Western India. The portion at present in hand is that from Sagar to the Kareli Station of the Great Indian Peninsula Railway, 12 miles west of Narsinhpur. This road is eventually to be continued up to Jhansi, but it will fully task the Central Provinces Budget for some years to come to make it up to Kareli (75 miles). Sagar is much higher than the Nerbada valley; and the ascent, with the crossing of many streams, will involve a very heavy outlay. Hitherto there has been no line of communication between Bandalkhand and Western India.

On all the roads of the Central Provinces foundations are easy, the mountain passes present no engineering difficulties but the one serious obstacle, common to all, is insufficiency of funds. Numerous district roads have been completed or improved, and the bridge over the Kanhan River, 80 feet long in 12 spans, is progressing.

In the Bombay Presidency much progress was made in completing the communications across the western ghats from the sea to the Great Indian Peninsula Railway. The embankment of the Konai nulla at the port of Karwar is nearly completed, and the Arbyle ghaut road thence to Dharwar has been repaired. On the Parpuli ghaut road, in Belgaum, seven out of the eight large bridges had been completed; and in the Kolapur district great activity was shown in road making, no less than nine roads having been constructed or improved. In Sátára road is in progress from the Konkan up the ghaut to Mahabaleswar; and a bridge was completed across the Krishna at Wái. A great deal of work has also been done in Khandesh. The most important bridges under construction are those over the Quoina, Shirwal, and Yerna in the Sátára district; the Khall bridge near Margam in Kolába, and the Gangawali bridge in Canara.

Bombay roads.

The amount of water communication in India is very great; and a part of it has been indicated in the chapter on irrigation, for several of the canals are also adapted for navigation. As soon as the Sirhind canal works are completed there will be navigable communication from Calcutta, up the Ganges, by the canals to the Satlej, and down the Indus to Karachi. The delta canals of Madras are also much used for boat traffic, as well as the high level, and Cochrane's Canal. But it is in the belts of greatest rainfall, the delta of the Ganges, the valleys of the Brahmaputra and Irawadi, and on the coast of Malabar, that water is most largely used as a means of communication. The rivers in the Bengal district of Naddea, namely, the Bhagirathi, Mattabangah, and Jalangi, have long been used as fluvial highways; and during 1871-72 a least depth of 4 feet, and a least width of channel of 150 feet, was maintained on the Bhagirathi. The revenue derived from tolls on the Naddea rivers amounted to 20,000 £. The whole outlay on Bengal canals during the year was 18,962 £, and the income 36,334 £, showing the existence of a great and increasing traffic. There are two steam navigation companies running steamers on the Irawadi, which made 60 trips in the year. There are also 19,400 boats employed in the Irawadi carrying trade.

Water communi-  
cation.By navigable  
canals.

Naddea rivers.

Irawadi.

One great scheme, which has occupied much attention during the last 20 years was, after an enormous expenditure, finally abandoned in October 1871. This was the famous Godávári Navigation project, which was first urged upon the notice of the Government by Sir Arthur Cotton in 1851. Up to 1861 the sum of 20,000 £ had been spent on preliminary surveys and other arrangements. The drainage system of the Godávári, includes the rivers Wurda, rising in the Satpura hills, and separating the Berars from Nagpur, which is joined by the Painganga a little before reaching Chanda. The united stream flows on until it receives the Wainganga, and 90 miles lower down is the Godávári, which joins the other rivers after a course of 650 miles from the Western Ghats. From this point to the sea is a distance of 250 miles. There are three great obstructions to the navigation, caused by rocky barriers. The first is 90 miles above the anicut at Dhauleswaram, at a place called Badrachallham, and is

Godávári naviga-  
tion project.

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20 miles long. The second is 14 miles long, and is 68 miles above the first barrier. The third is 75 miles above the second, and is 35 miles long; while the distance of the third barrier from Chanda, in the Central Provinces, is 75 miles, and from the cotton mart of Hinganghát 115 miles.

Anticipations  
respecting the  
results of the  
Godávari works.

There never was any hope of the Godávari being made navigable all the year round; but it was thought that a boat might make a trip down in 10 days, and return the same season, by being towed up, in 2½ months. (Hinganghát is halfway between Bombay and the mouth of the Godávari, and it was calculated that the river would convey cotton at one-third the rate of the railroad.) Linseed, ghi, and gingelly, it was thought, would also be sent by the river; while the importations up stream would be salt, cocoa nuts, some European goods, and military stores. But these hopes have since been abandoned, so far as a remunerative return on the outlay is concerned.

Godávari works.

The Godávari works consist of dams or anicuts, canals and locks round the barriers, and clearances of rock in the river bed, including a cutting through a ridge of sandstone rocks at Albaka, between the first and second barriers. The preliminary work consisted of a survey of the river, and a complete profile of the river as far as Chanda. This was commenced in 1854, and the works at the first barrier were begun in 1861. Temporary tramways were constructed round the barriers, in anticipation of the completion of the canals. When Sir Richard Temple inspected the works, in January 1863, 700,000*l.* had already been expended. He recommended that the works at the first and second barrier, and in the river up to the foot of the third barrier, should be proceeded with, at an estimated cost of 255,000*l.*, so that the navigation might be open to the foot of the third barrier by May 1865. The road from Nágpur to Chanda was to have been extended to this point. By August 1865, two-fifths of the anicut at the first barrier, with masonry works, were completed. But in 1871, although the canal was almost completed, the anicut remained unfinished. A channel had, however, been cut through the Albaka reefs. The second barrier works were entirely suspended, and in an incomplete state. The third barrier works were not commenced. There was a steamer towing boats from the second barrier to the coast, which carried a total of 188,312 tons of cargo; and the "Wainganga" steamer continued the communication between the second and third barriers; but the amount of traffic was small.

Abandonment of  
the Godávari  
works.

In a Despatch, dated August 1871, the Secretary of State proposed that the navigation works should be completed on the smallest possible scale as far as the foot of the third barrier, whence a road should be made to Chanda. But in October of the same year, at the request of the Government of India, the whole scheme was abandoned, as involving expenditure which did not give promise of any adequate return.

Malabar back-  
waters.

The important line of water communication, parallel to the western coast of India, which is included in the Malabar and Travancor backwaters, was reported upon by Mr. Robertson in 1871. By the completion of the cut through the Warkallai barrier, and by making another cut from the Venjali lake to the Tirur station of the Madras Railway, there will be a continuous line of water communication from Budagivi, north of Depur, to Trivandram, the capital of Travancor, whence the Victoria Canal extends southwards towards Cape Comorin for 15 miles, which is to be extended 30 miles further. The great value of this system of natural canals is best shown during the south-west monsoon. In its centre is the harbour of Cochin, which is capable of being made the finest close harbour in the world; 10 miles broad at its southern end, and from 10 to 48 feet deep. The canoe boats on the backwaters draw half a foot of water, and carry 2,000 to 3,000 lbs. each. The only obstruction is the Warkallai barrier, between Cochin and Trivandram, a spur of the ghauts, consisting of a ridge of laterite hills, about six miles wide, with a summit level of 180 feet, ending abruptly in a line of cliffs washed by the sea. From the south a ravine, covered with paddy fields, and lined with cocoa-nut and jack trees, runs up to within half a mile of the summit ridge; and there is a similar ravine on the north side. The sea-cliffs are of soft laterite, intersected by five ravines, and contain a remarkable deposit of lignite. There have been four distinct plans for cuttings through the Warkallai barrier; but the one finally adopted is that of Mr. Barton, the engineer to the Travancor Sarkár. It consists of a cutting through the hill, which, when the

Warkallai barrier.



the depth reaches 70 feet, is to become a tunnel. This happens in two places, and the length of the two tunnels is 2,000 feet. The canal is 25 feet wide and four deep. The work is progressing towards completion, when there will be a continuous water highway for the whole distance from the Madras railway, at Tirur, to Trivandram, with a large and increasing traffic.

As a means of communication between India and the outer world, the harbours and anchorages have been the subject of much attention from the Government during the last few years; and in September 1870, Mr. Robertson, a civil engineer of éminence, was appointed to prosecute inquiries with a view to the improvement of some of them. During 1870-71 he examined the Madras anchorages on both sides of the peninsula, and in 1871-72 he was on the Bengal and Bombay coasts, and also investigated the schemes for a ship canal between India and Ceylon. The trade ports of India, if every place frequented by native craft be included, are exceedingly numerous. In a list of Indian ports and harbours, prepared for Dr. Forbes Watson by Captain Taylor, as many as 656 are enumerated and described. But it will only be possible in this place to pass the more important ports of India in review in their geographical order, from Karáchi to Chittagong.

Harbours and anchorages.

Mr. Robertson's mission.

The harbour of Karáchi, a few miles to the west of the mouths of the Indus, occupies a most important position as the port of Sind and the Punjab, with a large and rapidly increasing trade. Its western half is formed by a long narrow strip of sand ending with the rocky promontory of Manora Head; and its eastern by the island of Kiamari. Thus, there are two openings, one between the main land and the east end of Kiamari, called the Chinna Creek, and the other being the main entrance used by ships, between the west end of Kiamari and Manora Point. A bar had formed across the entrance, stretching for nearly a thousand yards, and the depth over it, at low water spring tides, was from 9 to 12 feet. This bar is the result of the waves raised by the south west monsoon acting on the loose sand lying immediately off the extremity of Manora Point. For the improvement of the harbour of Karáchi, the problem was to remove this bar and produce a deep channel. The depth upon the bar appeared to depend on the velocity and quantity of tidal water passing in and out of the harbour at each tide.

Karáchi Harbour works.

In 1856, Mr. Walker, the eminent harbour engineer, was consulted on the subject, and he afterwards reported in conjunction with Mr. Parkes, who is now the consulting engineer of the harbour works. Mr. Parkes visited Karáchi in 1858 and again in 1864 and 1870. Their advice was to increase the volume of water that passes through the entrance at each tide, to give it the right direction and to shut off, as much as possible, the heavy south-west seas from the mouth of the harbour. Sir Charles Napier had thrown a mole across, without openings, from Karáchi to Kiamari Island. To gain the first object, it was necessary to block up Chinna Creek, and open a passage in the mole, so that all the water might flow in and out at the same entrance. The second point was secured by running out a long groyne from Kiamari Island to seaward, so as to guide the whole force of the scour on to the bar; and the third by a breakwater extending from Manora Point.

Plan of the Karáchi works.

The opening in the Napier Mole (1,200 feet) was made at a cost of 48,742 l. The Kiamari Groyne was commenced in November 1861, and completed in 1865, at a cost of 48,317 l. The closing of Chinna Creek, 980 feet across, is not yet completed.

Progress of the works.

The present west channel began to deepen and open out as soon as the Kiamari Groyne was finished, and a spit off Deep Water Point, on the opposite side, had been removed. The construction of the Manora breakwater was then commenced, in 1869, and completed on 22nd February 1873.

Manora break-water.

This work is especially interesting as being the first that has been constructed in deep water, to break the force of the heavy seas raised by the south-west monsoon on the west coast of India. The breakwater runs in a S.S.E. direction from the southern extremity of Manora Point, and extends 1,500 feet from low water mark. For the first 500 feet the water is shoal, and the bottom irregular, consisting of conglomerate rocks wholly or partially imbedded in sand, and having a depth of water upon them of 12 to 16 feet at low tides. For the remaining 1000 feet the bottom is sand resting on a bed of clay, a few feet below the surface, and the depth at the outer end is 30 feet at low tides.

Nature of the ground.

The

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## Mode of construction.

## Concrete blocks.

The mode of construction adopted was novel. It consisted of throwing a bank of rubble stone out of boats, until its top reached the level of 15 feet below low water. The surface of this bank having been levelled by divers, a superstructure was built upon it consisting of concrete blocks, each 12 feet long, 8 high and 4½ wide, weighing 27 tons. They form a wall 24 feet high and 24 feet wide, the top being at about the level of high water mark. These blocks were made on shore, in moulds, of suitable proportions of conglomerate and sand, mixed with one eleventh of the total bulk of Portland cement, in Messent's patent concrete mixers. After being allowed a few weeks to harden, they were lifted by a specially designed hydraulic press on to the trucks, and conveyed to the breakwater. The trucks were then run under the "Titan," a strong frame work of wrought iron, resting on eight wheels which ran on rails, on the finished part of the breakwater. The top of the "Titan" consists of a platform, the outer end of which projects 25 feet beyond the foremost wheels, so as to command that distance in advance of the finished work. This projecting platform carries a "traveller" and "cub," capable of moving forward and sideways, which lifted the blocks from the trucks, and lowered them into their places. The whole is worked by a six-horse power steam-engine placed at the landward end of the platform, to which additional stability was given by a tank capable of containing 40 tons of sea water, to counterbalance the overhanging weight of the blocks and machinery.

## The "Titan."

## Mode of working.

When a sufficient length, about three rows of blocks, was completed, the "Titan" was bodily advanced into a new position, to set another length. The force to which the blocks are exposed by the weight of water falling upon them, when the sea breaks over the work, is enormous. A few of the harbour side blocks (26 in all) have been drawn out from this cause, but the damage has been repaired, and its recurrence can be prevented by the adoption of some simple means, when the foundation has become solid.

## Cost of the Karáchi works.

The total cost of the Karáchi harbour works up to May 1872 was 452,182*l.*, and when completed it will be 468,651*l.* They have effected considerable increase in the capacity of the harbour for tidal water, useful in scouring the bar; the Kiamari groyne has produced satisfactory results in removing sand from the harbour by scour; and the Manora breakwater, by protecting and sheltering the bar, will remove the causes of its formation, which are the monsoon waves breaking along its line. These, combined with dredging, are expected to secure a permanent and deep entrance to the harbour. The direct entrance to the harbour has now permanently superseded the old circuitous channel, and its depth increases every year. In 1868 it was 10 feet. In 1872 it was deepened to 17 feet before the monsoon, but it was shoaled by the action of the sea to 15½ feet. It has since been dredged to 20 feet nearly throughout. It is not, however, of sufficient width as yet to give confidence in that depth being fully maintained during the ensuing monsoon; but a substantial increase in the depth of last year may be expected. Mr. Robertson was inclined to think that 1,500 feet was not a sufficient length for the breakwater; but on the whole subject his opinion is favourable. He thinks that when the works are complete the Government may be congratulated upon having an excellent harbour in Karáchi, 500 miles from the nearest good harbour on either side, and out of the track of cyclones. During 1871-72 the number of vessels that arrived at Karáchi was 1,021 (tonnage 129,508).

## State of the entrance.

## Other good harbours.

But besides Karáchi there are, at least, eight ports on the west coast of India which are capable of being converted into first-class harbours; namely, Poshetra, Seraia, Shalbet, Bombay, Jyghur, Vizianág, Karwar, and Cochin.

## Ports in the Gulf of Kách.

The two first are in the Gulf of Kách. Captain Taylor, who surveyed the gulf, describes them as being sheltered from all winds, and capable of receiving the largest ship in the navy at any time of the tide. They are 300 miles to windward of Bombay, in the south-west monsoon, when the cotton crops require carriage to Europe, but no use has hitherto been made of them. The third harbour, called Chuch Bunder, is on the south coast of Katiwár, about 30 miles east of Diu Head. It is formed by Shalbet Island, within which there is a perfectly sheltered harbour, with good holding ground in five or six fathoms. These excellent harbours were passed over by Mr. Robertson, who, however, visited the ports in the Gulf of Cambay, where the Malacca banks and the rushing tides render navigation very dangerous. He recommends that the mouths of the Narbada and Tapti should be surveyed, but thinks that nothing can be done to

## Ports in the Gulf of Cambay.

improve

improve the approaches, either at Súrat or Broach. On the opposite side of the gulf, Bhonágir has almost extinguished the trade of Gogo, from which it is distant about 15 miles. The former port is a broad creek in which small vessels can lie without grounding during all tides, and can cross the bar at half tides. Kurbunder, the port of Dholera, a name well known in connection with the cotton trade, is a creek into which the tide rushes with great rapidity, but dry at low water; and Mr. Robertson pronounces it to be the most wretched looking place he ever saw. There is no prospect of these ports being improved; and, indeed, the railways into Katiwár, and from Ahmádabad to Bombay, will very much reduce their importance as places of export for cotton.

Bombay harbour is the best on the west coast, but it still wants suitable accommodation to enable ships to load and unload alongside wharves. The problem of sufficient dock accommodation has, however, at length been solved by the erection of one of Mr. Clark's hydraulic lifts at Hog Island. The old docks at the Government yard, as well as the fine new docks at Mazagon for the Peninsular and Oriental steamers, have one fatal defect; they are on the foreshore of Bombay Island, which cannot be approached by large vessels except at spring tides. The requirements of the case were the means of frequently docking and undocking with rapidity, at any time of tide, and with everything on board, vessels of at least the dimensions of the Government transports, which are 381 feet long, with an extreme beam of 49 feet, a load draught of 21 feet, and 4,173 tonnage. This has now been provided by Clark's hydraulic lift dock, which has been set up at Hog Island, on the opposite side of Bombay harbour. It is now in full working order, and one of the largest frigates on the station has recently been docked.

The number of vessels in 1871-72 that arrived in Bombay harbour was 3,178 (aggregate tonnage 853,157), and 1,998 vessels sailed.

South of Bombay there are four good ports. Jyghur affords facilities for a commercial port, accessible during the south-west monsoon; and Viziadrug is an excellent harbour with similar advantages, and at a trifling expense it might be made a first-class harbour of refuge. Karwar is the port for North Canara, and for the cotton district of Dharwar. It is protected by a point of granite, under the shelter of which there is a safe anchorage during the south-west monsoon, and it is capable of considerable improvement. By throwing out a break-water from Karwar Head for a mile and a half a perfectly quiet harbour might be formed, four square miles in area, with a depth varying from 14 to 32 feet. Mr. Abernethy, c. z., submitted plans for these works in 1860. Nothing, however, has been done beyond the construction of a landing place and wharves, of an iron screw pier, and of a lighthouse on the Oyster Rock.

Jyghur, Viziadrug, and Karwar were not visited by Mr. Robertson, but he examined the more southern ports in 1871. He proposed some works at Mangalore, with the object of fixing the harbour mouth; but thought that nothing could be done at Cannanor and Calicut, and little at Bepur. He was, however, much struck with the advantages of Cochin, and its splendid backwater. The backwater is of great value as a tidal reservoir to keep the entrance clear, and renders it independent of flood waters for scouring purposes; and every foot of water gained in depth over Cochin bar is permanently retained, and kept almost unvarying by this splendid tidal reservoir. (Until 1862 the only communication between the backwater and the sea was at Cochin; but in that year the sea burst through at a place called Cruz Milagre, a mile and a half to the northward; and the opening is now 720 feet wide, with a strong current. Yet the body of water in the backwater is so great, that the escape at this gap has only a trivial effect on the scour at Cochin. In order to improve Cochin harbour, Mr. Robertson's advice is to strengthen the current and confine it, so that it may be concentrated on the bar. With this object, he would project long groynes on each side of the entrance, 3,000 and 2,300 feet long, which would have the effect of keeping a depth of 20 to 21 feet, at low-water springs, in the approach to Cochin. He would also stop up the Cruz Milagre gap.) In the backwater, the entrance to which would thus be made accessible, there is room for 50 ships of 700 tons, and any amount of area can be got by dredging. The rise and fall is so small that the backwater is practically a wet dock of greater area than all the docks in Great Britain put together. On either side of Cochin harbour, to the north and south, there are the very remarkable mud banks of

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Narakal and Alepy, which are most useful as natural harbours of refuge subsidiary to Cochin. No other harbour in the world has such adjuncts. Thus Cochin is admirably adapted to become the great western outlet for the trade of South India.

Kolachul.

Kolachul is a port on the Travancor coast, near Cape Comorin, which has never been properly surveyed by the authority of Government, but was practically discovered by the coffee planters in the adjacent hills. They found that large ships could sail between some outlying rocks, and ride at anchor to leeward of them in still water. The first ship called there in March 1871, and since that date two other ships have loaded at the port of Kolachul. The place was not visited by Mr. Robertson.

Tutikorin.

He, however, examined Tutikorin, in the Gulf of Manaar, the port for all the large trade of Tinneveli. Here vessels are obliged to lie two and a half miles from the shore, and the cargoes are brought out in boats carrying 20 tons. The harbour is well sheltered, but it only has a depth of eight feet; and when the railway extension reaches to Tutikorin, it should be completed across the harbour to Hare Island, when the terminus will be brought much nearer to the ships in the roadstead. There is a stretch of water, seven miles long by four and a half, a short distance from Tutikorin, and on the south side of the Rámnád Promontory, where stands the famous temple of Rámeswar. It is completely sheltered by reefs and islands, and has an average depth of from 20 to 30 feet; but the entrance between Musel and Muli Islands only has a depth of  $2\frac{1}{2}$  fathoms, with a sandy bottom. If this entrance was dredged out, so as to admit large vessels, there would be a splendid harbour, infinitely superior to Tutikorin, for shipping the produce of South India. At present it is only occasionally used by coasting craft, and the shores are uninhabited. This harbour has been named Port Lorne.

Mutapeta.

Ship canal.

The question of cutting a canal for large ships between India and Ceylon has recently been investigated with much care. The Rámnád Peninsula is separated from the Rámeswar Island by the Pamban Passage. Rámeswar Island is divided from that of Manar by the shoals and rocks known as Adam's Bridge; and the whole line is so shallow, or so occupied by land, that a railroad could be made, without much difficulty, from India to Ceylon. But the problem was to construct a canal from the Gulf of Manar to Palk Strait, so as to save the distance round Ceylon. In 1822 Ensign (now Sir Arthur) Cotton proposed alternative schemes, and that for improving and deepening the Pamban Channel was selected. From that time the work has steadily progressed in the hands of the Madras sappers, with a gang of convicts. The passage now consists of two tortuous channels, the northern one, 4,232 feet long, through a sandstone reef, dry at low water, with a depth from 11 to 14 feet, and a navigable width of 80 feet; and the southern one 2,100 feet long, and 150 wide, through a sandbank which has been dredged out to a depth of 12 feet. It would be useless to make the channel deeper, because there is no greater depth in the approaches on either side. But the Pamban Channel has long been of use to the native craft, and to this extent it must be considered a great success, for 12 feet is quite sufficient for the local trade. The average number of vessels annually passing through the channel during the last 10 years, is 2,100, with a tonnage amounting to 173,894. In 1871-72, the number of vessels that passed through the channel was 2,723 aggregating 239,376 tons, a good deal above the average. One of these was the "Harefield," a steamer of 1,000 tons, 218 feet long, and drawing 11 feet. Before entering the channel her draught was reduced to 9 feet 4 inches. She was bound from England to Akyab.

Pamban Channel.

Rámeswar  
Canal.

If a canal for large ships is to be constructed, the line must be sought for elsewhere; either across the promontory of Ramnad, as urged by Sir James Elphinstone and Captain Taylor; or across the Island of Rámeswar, as proposed by Sir William Denison and Mr. Robertson. The site selected by Mr. Robertson is across Rámeswar Island. The southern entrance of the canal would be from a well-protected piece of anchorage nearly a mile long, with a depth from 29 to 26 feet. The surf breaks on the reef between Curesadi and Shingle Islands, leaving still water between them and the shore. The line of the canal, from this point, crosses the island, where it is one mile and one furlong in width, about a mile east of Pamban Lighthouse. It traverses a sandy plain, only 6 to 7 feet above

above high-water mark; but as the 30 foot line, on the north side, is at a distance of a mile and a quarter from the shore, a large amount of dredging will be necessary there. Mr. Robertson estimates the cost of this ship canal at 440,000 *l.*; and he mentions that it will be the only point, from Calcutta to Karachi, where a large vessel will be able to land and discharge her cargo direct on to a quay, without the intervention of a cargo boat.

He preferred the Rameswar project to that of the Rámnád Promontory, because the cutting would be longer across the Ramnad Promontory; the level above the sea is higher, and there is probably much rock. The distance from the shore to deep water on the north side is also greater. On the other hand, it is more conveniently situated as regards railway communication, and represents a more complete and grander scheme; but he is in favour of the Ramiseram plan, in preference to that of Rámnád, because it is more economical, and on the whole the cheapest satisfactory short cut to the eastern side of India. But Captain Taylor maintains that no practicable entrance to a ship canal can be found except by Port Lorne or Mutapeta; and that, therefore, the canal must take the line across Toritory Point, the east end of Rámnád. When a ship canal is made, the short cut will save a steamer 350 miles in the voyage from the Red Sea to Madras, and will bring Madras nearer to Bombay by about 370 miles.

Rámnád Canal.

Results of a ship canal.

Mr. Robertson took an unfavourable view of the practicability of improving the harbour of Nágapatam, and reported that the gradual silting of Korangi (Coringa) Bay by mud brought down by the River Godávári could not be arrested. The improvement of the port of Madras, and of Blackwood's Harbour, also engaged his attention.

Nágapatam.  
Korangi.

A Committee appointed in 1868 recommended a breakwater as the only practicable improvement for Madras Roads. Mr. Robertson concurs in preferring it to a closed harbour, but he says that it should be in at least seven fathoms, perfectly straight, and 2,000 yards long, and also that a screw-pile pier must be run out to the site of the works while under construction, with two lines of rails. His estimate of the cost is 1,311,000 *l.*, and he thinks the breakwater could be completed in six years. In place of a breakwater, however, a close harbour has since been proposed by Mr. Parkes. Two piers, constructed on the same principle as the Manora Breakwater, would be run out, 1,000 yards apart, for a distance of 1,200 yards, where they would approach each other, leaving an entrance, and enclosing an area of nearly 250 acres. The cost is estimated at 650,000 *l.* Mr. Parkes is to visit Madras, and report on the subject.

Madras.  
Proposal for a breakwater.Mr. Parkes's pl  
for a close har-  
bour.

About 55 miles north of Madras is Blackwood's Harbour, a sheet of water between the coast and Armegan shoal, which protects it from the heavy groundswell. A breakwater on the shoal, three miles long, might easily be constructed, and would completely shelter a fine stretch of water.

Blackwood's  
Harbour.

It is not, however, for the unfrequented coast at Blackwood's Harbour, but for the great commercial town of Madras that improvements on such a scale are required. The number of steamers registered at the ports of the Madras Presidency is 641 (tonnage, 565,374), and of sailing vessels 7,461 (tonnage, 603,191), of which 253 sailing vessels and 216 steamers belong to the port of Madras; 383 vessels arrived at Madras during 1871-72 (tonnage, 334,127), besides 86 native craft. Throughout the ports of the Presidency the arrivals were 4,545 (1,018,022 tons), and 3,557 native craft.

Shipping of  
Madras.

The harbour for the province of Orissa, called False Point, at the mouth of the Mahánadi, is analogous, as regards position, to Korangi (Coringa) Bay at the mouth of the Godávári; but fortunately the action of the Mahanadi does good, while that of the Godávári is most mischievous. Point Reddie, which protects the anchorage at False Point, has increased more than two miles in length since the survey of 1835, and this increases the deep-water area and the shelter for boats. Mr. Robertson pronounces False Point to be the most sheltered anchorage on the east coast of India, and to be of incalculable value for the development of Orissa.

False Point.

The Hugli involves a question of expenditure so enormous that there is little chance of its improvement being undertaken on an adequate scale. The river is so large, the floods in it so great, the nature of the bottom so soft, the quantity of silt brought down so immense, that any attempt at improving even a single shoal should only be undertaken when it becomes a matter of absolute necessity. The river is not one for experiments. Mr. Robertson was consulted respecting the

The Hugli.

removal

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removal of the Moyapur shoal. At present, spars have been thrown out from the river banks. He pronounces this measure to be a mistake, and dredging is out of the question as too expensive. The widening out of the river permits each of the scouring agents, flood and ebb, to take distinct courses, leaving a strip of river never fully acted upon. The way to improve Moyapur shoal is to confine the two scouring powers in one channel, so that there should be a coincidence in the curves of direction of the flood and ebb. Mr. Robertson would effect this by a longitudinal training wall nearly parallel to the left bank, and 1,100 yards from it, about 1,500 yards long, to train the young flood and the last of the ebb into the same channel, but the cost would be enormous. The traffic on the Hugli is very considerable, and is increasing. (In 1871-72, 658 sailing vessels and 301 steamers (total tonnage, 999,614), arrived in the river, and 637 sailing vessels and 293 steamers (total tonnage, 957,523) sailed.) There were 68 Government and 46 licensed pilots in active service, and during the year there were 77 cases of vessels grounding and 6 collisions. The gradual substitution of steam vessels for the brigs and steamboats now doing the work of the port is in contemplation. Six sailing vessels and two steamers are registered as belonging to the port of Calcutta (tonnage, 6,050). (In 1871-72 the number of vessels that arrived was 933 (aggregate tonnage, 961,717), and 930 sailed.)

## Chittagong.

Chittagong was the easternmost port visited by Mr. Robertson. The port is 10 miles up the River Kurnofali, which enjoys the peculiarity of having no bar. The efforts of the waves to throw one up are counteracted by the strong flood and ebb coast currents sweeping up and down the estuary of the Meghna. Instead of a bar, the river at once falls into deep water, and the mouth is kept clear by the scour of the coast currents; but there is a shoal or flat at the entrance, and extending nearly three miles up, which is probably caused by deposits of silt in suspension in the river water. It is kept to a depth of 10 or 11 feet by the action of the scour in and out, and the depth might be increased by raking. Mr. Robertson considers Chittagong to be one of the best ports in India.

Cyclone at  
Madras.

The Madras Administration Report is the only one which furnishes complete information respecting disasters at sea. A cyclone visited Madras on the 2nd of May 1872 with the most disastrous consequences, owing to the ships in the roads not having been warned in time to slip their cables and run out to sea. Nine English and 20 native vessels were driven on shore, and 19 lives were lost. Eleven wrecks are recorded during 1871, with a total of 29 lives lost.

## Wrecks.

## Bengal Marine.

The Bengal Government employed four sea-going steamers during 1871-72; the "Undaunted" at the Andaman Islands; the "Celerity," unsafe in any sea, and fit only for calm weather; the "Agitator," only intended to dredge, and not fit for that; and the "Nemesis," employed in British Burma. There are also 12 Government river steamers, 11 pilot vessels, 16 boats, and 2 hulks, besides 4 light vessels.

## Bombay Marine.

The Bombay Marine consists of the "Comet" on the Tigris; the "Amber-Witch" employed in connection with the Indo-European Telegraph Department; the gunboat "Clyde," dismantled; the gunboat "Hugh Rose," under the orders of the Political Resident in the Persian Gulf; the steamer "Satellite," under the orders of the Commissioner in Sind; the steamer transport "Dalhousie;" the steamer "Sind," under the orders of the Political Resident at Aden; the steamer "Quantung," in the Persian Gulf; and the Governor's yacht, "May Frere." The two turret ships, "Magdala" and "Abyssinia," for the defence of Bombay Harbour, are in every respect efficient for service.

## Lighthouses.

The lighting of the coasts of India is not perfect, is not even in so complete and satisfactory a state as the lighting of the coast of Spain, or that of Greece; but a good deal has been done, and on the coast of British Burmah the system of lighting is admirable. At Bombay the long spit, called the Prongs, running out from Kolába, has bristled with wrecks, owing to the lighthouse being built, not at the extreme end of the danger, but far within it, on Kolába Island. Now the new light is being erected on the Prongs. The lantern had been received in January 1872, and the tower, at the close of 1871-72, was 114 feet above the foundation. This is the only lighthouse mentioned in the Bombay Administration Report for this year. It may be added, that there is one on Manora Point, 40 feet high, lighted in 1848, for Karáchi. One maintained by the Rao of Kach at Mandavi, and six in the Gulf of Cambay. Besides the Prongs Lighthouse, the entrance to Bombay

Harmour

Harbour is shown by two light vessels, a light on Dolphin Rock, and, on the south side, the lighthouse on Kundari Island. This is an octagonal tower 75 feet high, with a dioptric light of the first order, 161 feet above the sea. It was first lighted in 1867. A lighthouse was finished at Ratnagiri in 1867, and at Karwar, on the Oyster Rock, in 1864. The latter is a circular tower, 45 feet high, with the light 205 feet above the sea. Lights are also much needed at Dwarka Point, on Diu Head, at Shalbet Island, and at Viziadrug. Along the shores of the Madras Presidency there are 19 lighthouses, besides the fine tower, 90 feet high, with dioptric light of the second order, built by Mr. Crawford, at Alepy. Another is much wanted at the Crocodile Rock, 17 miles to the west of Cape Comorin, which has been ordered, besides that now building on Cape Comorin itself. A new lighthouse to cost 1,000 l. has been sanctioned for Tutikorin, and will be finished this year. There is a light in good order at Pamban, and there ought to be another on Point Calimere. On Hope Island, at the mouth of the Godavari, a new tower is to be built five miles north-east of the old one, in consequence of the silting of Korangi (Coringa) Bay. On the Bengal coast there is a light at False Point, and a tower 82 feet high on Sagar Island, at the mouth of the Hugli, made of iron, with a copper roof. The lighthouses on the Burmese coast are mainly due to the skill and energy of Colonel Fraser. The Alguada reef lighthouse, at the mouth of the Bassein River, 160 feet high with a dioptric light of the first order, was commenced in 1859, and completed in 1865. The others, to guide ships to Rangún, are the Cocos, Double Island, Krishna Shoal, China Buckir, and Eastern Grove lights.

The great ocean and coasting trade of India renders the provision of accurate charts on adequate scales of the coasts and anchorages, a very important part of the duty of the Government. But, since the abolition of the Indian Navy, nothing has been done, except a survey of the mouths of rivers in Orissa and at Chittagong, and no proper arrangement has been made for the execution of much-needed marine surveys. New surveys are urgently required of the coasts between Calicut and Bepur, from Santopillay to Point Palmyra, from Nizampatam to Cocanada, and of various shoals on the Coromandel coast. A survey is also much-needed of the new port of Colachul, and another of Palk Strait and the Gulf of Manar; and there should be a periodical examination of the river mouths of Mangalor and Cochin, and of the mud banks off Narakal and Alepy. Mr. Robertson has pointed out the need for surveys of the mouths of the Narbada and Tapti, and several others are much wanted. The adoption of effective measures for securing the due execution and continued revision of marine surveys and charts on a systematic imperial plan, is a question which yearly becomes more urgent. In a despatch, dated March 30th 1871, the subject of marine surveys was brought to the notice of the Government of India by the Secretary of State as one of very great importance, and as deserving of early and serious attention. But the despatch has not yet been answered, and the subject is believed still to be under the consideration of the Government of India.

The electric telegraph is now in working order along every line of railway, and connects every important place in India. By the last returns, the number of service messages during the year (1870-71) was 37,606, and of private messages 539,755, and there had been a great improvement in the receipts of the department. Much attention has been given by Colonel Robinson to the education of the staff. In 1867 two experienced electricians were engaged to go out to India as travelling instructors. They went from office to office, teaching the modern system of testing, correcting errors in practice, and lecturing on electricity and galvanism. The education of the subordinate staff of the Electric Telegraph Department has thus been raised quite to the standard prevailing in Europe. Officers have also been allowed to go through a course of physics in Europe, and to acquire a knowledge of recent improvements in telegraphy, and six, who have availed themselves of the permission, have reaped material benefit from their studies. A system has been adopted of instructing soldiers, and employing them in the telegraph offices. There are classes for the instruction of soldiers at 40 stations; and those at Kampti, Mattra, and other places, are now worked by soldiers. The railway companies are at present allowed to carry on a sort of independent competition with telegraph wires of their own; and it seems very desirable that they should be compelled to aid in developing

Marine surveys.

Electric telegraph.

Number of messages.

Education of the Telegraph Department.

Studies of officers.

Employment of soldiers at telegraph stations.

Railway telegraphs.

- VI.**  
**COMMUNICATIONS.** the correspondence of the country, as part of one homogeneous system. It is also represented that, to remove the deficit, the tariff should be revised. The cost of the signalling establishment has been considerably reduced, but in 1870-71 it still exceeded the receipts, and the rates might well be higher without reducing the number of messages materially.
- Financial position of the Telegraph Department.**
- Lines from India to England.** India has now three lines of telegraph whereby to communicate with England, and for a short time even had a fourth, by China and the Great Northern Company's line, which, however, is now interrupted. There are alternative lines of telegraph from England to India, through Turkey and Persia. The first leaves the European system at Constantinople, and, traversing Asia Minor, passes through Mosul to Baghdad. This section was constructed by the Turkish Government in the year 1863. In 1864 a line, on iron standards, was erected by the Indian Government, from Baghdad to Fào, at the head of the Persian Gulf, which was subsequently transferred to the officials of the Porte. From Fào a single submarine cable was laid to Karáchi, in the spring of 1864, repeating stations being established at Bushire, Ras Mussendom, on the north-east extremity of Arabia, and Gwador, in Baluchistan. A land line had previously been erected along the coast from Gwador to Karáchi by the Government of India, to ensure communication in case of interruption to that section of the cable which might be endangered by the gales that rage on that part of the coast during the south-west monsoon.
- Turkish line.**
- Alternative Persian line.** The wire from Bagdad to Fào, passing through a country where the Turks have little or no authority, was considered to be the most unsafe portion of the line; and in 1863 a line was constructed by British officers to supplement it, at the expense of the Persian Government, from the cable station at Bushire to Tehran, and thence to Bagdad.
- Services of Colonel Stewart.** This complete system of telegraphic communication between Europe and India was planned and carried out by the late Lieutenant Colonel Patrick Stewart, of the Bengal Engineers, on the failure, a few days after completion, of the cable laid from Suez to Bombay in 1859, capital for which had been raised by a company on a 25 years' guarantee from the Government of India. Colonel Stewart did not, however, live to see the successful result of his labours. He died at Constantinople in January 1865, from the effects of exposure and over-exertion, a very short time before the lines were formally opened.
- Abuses on the Turkish line.** The main line above described remained the principal means of telegraphic communication with India until the spring of 1870. During the interval, the Turkish Government, having refused to allow British officers any share in the management of their lines, permitted them to fall into dis-repair. The greatest abuses were allowed in their office management, and, although the cable from Fào to India continued to work well, delays and errors were the rule on the Turkish section. This evil was partially mitigated by an extension of the Russian Government lines from Tiflis to the Persian frontier, and thence by the Persian Government to Tehran. The new line, however, did not work much better than the Turkish; though the section from Tehran to Bushire was kept in good order by the exertions of the officers and men of the Royal Engineers, who were in charge of it.
- Alternative Russo-Persian line.**
- Cable from Suez to Bombay.** In the spring of 1870 a new era dawned on the history of Eastern telegraphy. Almost simultaneously with the successful laying of the Red Sea cable, the Indo-European Telegraph Company's line was opened to Tehran. The submarine cable between Suez and Bombay was opened on the 6th of March 1870. The line of the Indo-European Telegraph Company is carried from Tehran to London by way of Tabriz, Tiflis, Kertch, Warsaw, Berlin, and Nordeney, and is constructed in the most solid manner. The Anglo-Persian line, from Tehran to Bushire, had previously been much improved, and a second wire erected. An alternative cable had also been laid from Bushire to Cape Jash, whence it was continued by land wire to Gwador. The Turkish Government was stimulated by this competition to improve their telegraphs, but they have not hitherto succeeded in attracting more than 10 per cent. of the traffic, although they carry messages at lower rates.
- Indo-European Telegraph Company.**
- Three lines from England to India.** By these three routes the English and Indian public enjoy facilities for the transmission of intelligence, which leaves nothing to be desired on the score of rapidity and correctness. On financial grounds, however, none of the lines can be considered successful.



Up to the date of the completion of the Red Sea cable in 1870, the Government lines in the Persian Gulf earned not only enough to clear their own working expenses, and to leave a small surplus, but also to support the heavy charges for maintenance of the lines through Persia, to which the Government of that country contributes little or nothing. Since 1870, the lines from Suez to Bombay, which, from circumstances unnecessary to detail, enjoy exceptional advantages, pay only 8 per cent. on a capital of 1,200,000 *l.*, a per-centage which does not exceed the yearly depreciation in the value of the cables. The Indo-European Company, with a capital of 450,000 *l.*, has not hitherto earned enough to pay its working expenses, after deducting the heavy tax payable on each message to the foreign Governments through whose dominions its wires are carried. It must, however, be added, that it is not worked up to a tenth of its powers of transmission.

The Indian Government, since 1862, has expended upwards of 1,150,000 *l.* on telegraphic communication with Europe, in addition to 18,000 *l.* a year, being half the guarantee on the original Red Sea cable; but since 1868 it has obtained no immediate return for this large outlay. The tariffs have been revised twice. The charge for a single message of 20 words, originally fixed at 5 *l.*, was at one time lowered to 2*l.* 18*s.*, and again raised to 4*l.* 10*s.*, without any successful result from a financial point of view.

The cable from Madras to Penang and Singapore was opened on the 4th of January 1871, and that from Singapore to Hong Kong on the 10th of June 1871. The licenses of these companies require that the ends of the cables be brought into a Government office; that the signallers shall work in a room adjacent to the Government signal-room; and that the companies shall work under the International Telegraph rules.

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COMMUNICATIONSFinancial aspect  
of the working of  
the lines.Expenditure on  
telegraphy by the  
Government of  
India.Cable from  
Madras to Singa-  
pur.Agreement with  
the companies.

## VII.—FORESTS.

The Forest Departments in most provinces of India have not been in existence for more than 15 years, and much will have to be done, many difficulties and obstructions must be removed, before they will be in thoroughly effective working order. The importance of their work is, however, beginning to be understood, and when the forest revenues largely increase, the value of conservancy will be recognised even by the numerous class which looks upon any thought for future generations as a waste of time and money.

Forest conservancy effects many objects, among which the natural influence of trees on the drainage of a country is probably of most importance. Though every grove and clump in the dry tracts is a blessing, the value of which cannot be too highly estimated, yet Dr. Brandis, and other officers of great experience, are doubtful whether there is sufficient evidence to show that a material deterioration of climate has been the result of denudation in any part of India, or that the preservation and extension of forests will increase the rainfall. But there is one obvious consequence of the destruction of forests which does not admit of doubt. Where the mountains are bare, the rain rushes down in torrents, giving rise to sudden and destructive floods at the outlets on the plains, and to most injurious freshes in the irrigating rivers; and the supply is uncertain and capricious during the dry season. The same rapid surface drainage destroys roads and bridges, and does other injury, both in the hill tract and the plains. On the other hand, where the forests are preserved, the superficial drainage is gradual, the springs are better supplied, and the dry weather discharge is gradual; so that the water is husbanded, either to supply tanks and lakes, or to ensure regularity and safety to great irrigation works in the plains. These are the indirect, though most important, objects of forest conservancy.

The direct objects are, first, to meet a rapidly increasing demand throughout India for enormous supplies of timber and fuel. The cultivators, as their condition improves, require to exchange miserable huts for better built houses and better furniture. There is an immense demand for railway sleepers, for fuel for steamers and railways, and for timber and fuel for large towns. The interests of trade, which have a direct bearing on the prosperity of the people, also require consideration, in order to meet the demand for teak, sandalwood, catechu, lac, caoutchouc,

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servancy.Its effects on  
drainage.Other objects of  
forest con-  
servancy.

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caoutchouc, and other forest products. The rapid increase in the magnitude of these demands is strikingly shown by the effect it has had on the export timber trade in some parts of India. The export of timber in North Canara was formerly all to seaward; but now there is a great demand in the inland provinces, and a brisk trade in timber and bamboos with the Southern Mahratta country. In the *dangs*, or forest tracts along the foot of the Khandesh ghauts, a similar change in the direction of the traffic has taken place. Unless the small extent of remaining available forest is very carefully managed, there will be great difficulty in meeting the demands for timber, bamboo, and fuel, which are increasing everywhere, and extensive plantations, as well as careful management of existing trees, are necessary.

Commencement  
of conservancy.

The urgency of adopting measures for forest conservancy in India has been very gradually perceived. In 1846 a department was organised in the Bombay Presidency, under Dr. Gibson, mainly with a view to ensuring supplies of timber for the dockyard; but it was not until 1856 that Dr. Cleghorn commenced work in Madras, and Dr. Brandis arrived in British Burma in the same year. Dr. Cleghorn not only created the department in Madras, but also laid the foundation of forest administration in the Punjab, and was subsequently associated with Dr. Brandis in organising the Forest Department in the Bengal Presidency. His great scientific acquirements were combined with judgment and tact, through which he succeeded in extending the operations of the Department in the Madras Presidency over 20 forest ranges before his final retirement in 1867. In 1864 Dr. Brandis was appointed Inspector General of Forests to the Government of India.

Necessity for re-  
served forests.

It has been found necessary to retain as many important forest tracts as possible in the hands of the State for exclusive management, as it is impossible to control the forests efficiently when in private hands, and the Government forests offer the only means of training an experienced body of foresters with practical knowledge. In some provinces the establishment of the absolute right of the State in forests has been easy, owing to local causes, and this has especially been the case in Sind and the Central Provinces. In others, much tact and conciliatory treatment of the people has been required to secure a gradual adjustment of rights, and to save at least a portion of the forest tracts from destruction. Many are still burdened with heavy rights of pasturage and other prescriptive demands. The reserved forests are under the exclusive management of the department.

Unreserved  
forests.

But the largest portion of the forest area is still unreserved, and the people retain rights of pasturage, of destructive burning, of desultory cultivation, which is equally destructive, and of collecting products. These unreserved forests are generally under local district officers; and, when well managed, they yield a good revenue available for roads and other public improvements.

Three classes of  
forests.

Thus the forests under the control of Government are divided into three main divisions, reserved forests, unreserved forests, and plantations. The forests reported to have been reserved and secured to the State cover 6,200,000 acres, as compared with 6,000,000 acres in Prussia, 2,500,000 in France, and 112,000, comprising the Crown forests in England. Much time must elapse before the Forest Department in India can reach a really prosperous condition as regards financial results.

Financial results  
of conservancy.

The great mass of the forests, owing to past neglect, is in a poor and exhausted state; and large sums must, for a long time, be annually spent on surveys, demarcation, boundaries, roads, and plantations. The income of the last three years has fluctuated between 420,000 £. and 465,000 £., and the highest annual net profit has been 160,000 £. In 1871-72 the total revenue of Indian forests was 501,924 £.; and the expenditure 354,616 £. In the part of Bombay, however, where the administration of forest lands was commenced in 1846, there is a large and steady revenue, fluctuating, in the last six years, between 82,000 £. and 123,000 £., half of which is net profit. The objects of forest conservancy are not those of an opium monopoly or a salt tax. They are to protect the land from destructive floods, to ensure supplies of timber and fuel for the use of posterity as well as of the present generation, and to increase the well-being of the people. The surplus is a satisfactory incident in the management of forests, and it is a sign of that management being good and efficient, but an immediate revenue is not the object in forest conservancy.

The existence of forests, and their character, mainly depends on climatic conditions of temperature and rainfall. In the arid tract of Sind and the Punjab, forests of babúl (*Acacia Arabica*) line the Indus at various points, which in Middle and Upper Sind are mixed with tamarisk and the Euphrates poplar, while *jhund* or *kundi* (*Prosopis spicigera*), an acacia-like tree, *Salvadora*, and an arbore-scent leafless caper (*Capparis aphylla*), occupy vast tracts in rear of the babúl forests. The dry belt of the Punjab has woods, on the high land between the rivers, called *rakhs*, also composed mainly of *Prosopis*, *Capparis*, and *Salvadora*. The woodlands of a portion of Rájputána are mainly composed of a beautiful tree, with small leaves and drooping branches, a species of *Anogeissus*; and the southern dry belt, in Mysor, is the region of sandalwood. Outside the dry zones, the teak extends over the peninsula to the northern slopes of the Vindhya Hills, while the sal (*Shorea robusta*), the most important timber tree of India next to teak, forms extensive forests along the foot of the Himalayas in the eastern part of the Central Provinces, the Rewah territory, and the adjoining districts of Bengal. Luxuriant evergreen vegetation is only met with in the two moist belts, the first extending along the Himalayan range to Burma and Tenaserim, the second along the western coast, and thence to the summit of the ghats. From the Himalaya come the supplies of pine and other coniferous trees. The deodar has its eastern limit in Kumaun, but it is succeeded by other coniferous trees, one of which, the *Pinus Khasiana*, extends into Burma. The *Ficus elastica*, yielding caoutchouc, is found along the foot of the Himalaya from Sikkim to Asam, and more sparingly at the foot of the Khasia and Cachar hills. In Burma there are extensive forests of *Pinus Khasiana* on the high mountains; famous teak forests between the Salwen and Sitang, and the Calcutta magnificent evergreen forest vegetation in the moister valleys, where trees grow to a height of 200 feet. The western ghats are the region of teak and blackwood trees, of poon spars, and of other trees, such as angelly (an *Artocarpus*), vengay, and irul, yielding excellent timber.

Forest conservancy has had to struggle against numerous difficulties arising from the immemorial practices of the natives, as well as from natural causes. The two worst of these obstacles to progress are jungle fires, and the clearing and burning the jungle for cultivation. In the spring the leaves and grass of the deciduous forests dry up, and everything becomes inflammable. The smallest spark is sufficient to create a conflagration, and fires are intentionally made every year either for cultivation or to cause fresh tender shoots of grass to spring up as fodder for cattle.

Obstacles to forest  
conservancy.

Fires.

The thriftless system of jungle cultivation is most destructive. It is called *kumari* in Mysor and Canara, *jhúm* in Bengal, *kil* in the Himalaya, *dhya* in Central India, and *toungya* in Burma. A patch of forest is cut down and burnt, and a crop is raised in the open space, no ploughing or digging being necessary. In the following year the field is abandoned, and another patch of forest undergoes the same wasteful and lazy process. The damage done by these fires is incalculable. Millions of seeds and seedlings are destroyed, the bark of the trees is scorched, the wood is exposed to the air, and the trees become hollow and useless for timber. Thus a large proportion of trees in Indian forests are unsound, mainly owing to these fires. Steps have been taken to prevent them by isolating the tracts to be protected, and in the Central Provinces the active exertions of Colonel Pearson have achieved the exclusion of fire from the valuable Bori Forest, in the Satpúra range, for the last eight years. But much damage is still done by forest fires in most parts of India, though Dr. Cleghorn obtained the prohibition of *kumari* cultivation in Mysor and part of the Madras Presidency.

Jungle cultiva-  
tion.

Another difficulty of the Indian forester is to clear the valuable timber trees of huge creepers, which stretch over them, and completely smother the crowns of the trees with their foliage. The creepers eventually enclose the trees with a network of branches, destroy their growth, and finally kill them.

Destructive  
creepers.

The only legislation for the management and preservation of Government forests is comprised in Act VII. of 1865, passed by the Governor General in Council. By this Act forest tracts may be rendered subject to the provisions of the Act by Government notification, provided that no existing rights are affected; and the local governments are empowered to make rules, applicable to such tracts, for

Forest legislation

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the preservation of trees by prohibiting girdling, lopping, or felling, the kindling of fires, the collection of products, and the grazing of cattle. Rules may also be made for the regulation of the use of streams within the forests, for the safe custody of timber, and for levy of dues and infliction of penalties. Forest rules, under the provisions of Act VII., have been drawn up for Mysor, Curg, the Central Provinces, Berár, Oudh, and Burma. There are also local rules for Assam and the Chittagong forests, and for the Hazáribagh district, but these forests are administered by the civil officers, who have forest officers placed under them for carrying on the executive work. Forest affairs are not yet sufficiently advanced in Bengal for any codified form of rules. In the Punjab there are rules for the Hazára, Ráwal Pindi, Kangra, and Chamba forests, and for the regulation of waif and drift timber on the rivers. In the North West Provinces there are rules for the Kamaun and Garhwal forests. The Act does not apply to Madras or Bombay, and the Madras Government has always declined to legislate on the subject, but Bombay has prepared a draft Forest Act of its own, which is under consideration. A more complete draft of an Act was drawn up in 1871 for the management and preservation of forests in India, but there is no prospect of its receiving sanction at present.

Principles of forest conservancy.

Meanwhile the main principles of forest conservancy are the definition and demarcation of reserved forests, the prevention of jungle fires, the exclusion of cattle, the opening of roads, and the cutting and clearing away of creepers and grass round the young trees.

Bengal.  
Sikkim.

In Bengal the principal forest tracts are in Kuch Bahar, Bhutan, Asam, Cachar, Silhet, and Chota Nágpur. In Sikkim, on the Himalayan range, at 6,000 to 8,000 feet, the chesnut, oak, walnut, cherry, and magnolia abound; while along the Tista Valley, and in the Terai, at 3,000 feet, there are forests of *sal* and *sissu*, and in Bhutan the *sissu* occupies half the area of the forests. In Asam it is intended that the Forest Department shall eventually have the management of the reserved forests only, the open forests being under civil officers. Orders were issued to demarcate the Kamrúp Duars, the Nambur, and Dhunsiri, and Naugong forests, which are to be made into forest reserves; but the demarcation has not been effected. In Kuch Behar the forests had been marked off on the revenue maps, and placed under the Department; but in June 1872 they were declared to be open, except as regards certain kinds of trees. The forests of the Sikkim Terai, which were declared to be reserved in 1866, are also to be thrown open.

Asam.  
Reserves.

India-rubber in Asam

One of the most important products of the Asam forests is caoutchouc, obtained from the *Ficus elastica*, and there have been three proposals with respect to the conservancy and working of the trees. One is that Government shall annually sell the right to collect india-rubber; the second, that the india-rubber should all be purchased by Government; and the third, that Government officers should manage the forests. But much of the rubber is brought in from forests, by wild and half-subjugated tribes, and still more by tribes that are under no subjection at all; so that conservancy is impossible, and a Government monopoly very difficult. Only two courses seems possible, either to allow speculators to make their own bargains with the hill men as they liked, or to enforce an effectual Government control. Sir George Campbell considers the latter course to be the right one. Very little progress has been made in Bengal in the important work of demarcation, although several reserves have been selected.

North West Provinces.

Excepting in Jhansi, the forests of the North West Provinces are within or at the foot of the Himalaya. In Kamaun and Garhwal the characteristic trees at 3,000 to 8,000 feet are the chil (*Pinus excelsa*), the chir (*Pinus longifolia*), but very little deodar. Below lie the great sal and bamboo forests, which have been much worked, millions of bamboos being annually exported down the Ganges. But there is still a fair amount of native timber near the Kosi and Ramganga rivers. The demarcation of these great sal forests was completed, some years ago, by Colonel Ramsay, then Commissioner of Kamaun. This demarcation went hand in hand with the clearing and settlement of the Bhabar, a tract the nature of which has been explained in the section on irrigation. The scattered population was easily induced to leave the forests and settle in the irrigated region below. A broad road was then constructed from the Ganges to the Sarda, for 160 miles, as a boundary to the forest, above which all cultivation was interdicted. The

Demarcation of Kamaun forests.

result

result of these measures has been that the forests are rapidly recruiting themselves, while the Bhabur tracts shows many thousands of acres of rich cultivation.

North of the Dehra Valley, near the sources of the Tonse and the Bhagirathi, lie the deodar forests of Gangotri and Jaunsar. The Tonse deodar forests are now demarcated, the people being compensated by grants of certain portions for their sole use. The Bhagirathi deodar forests have been leased from the Tiri Rajah. In Gorakhpur *sal* is the characteristic tree, mixed with *terminalia* and *acacia*, but there is very little timber left, the forests being mere coppices and utterly exhausted. In Dehra, too, the forests have been felled and re-felled until they are quite worn out, this having been the chief source whence the Upper Doab has drawn its supplies of timber for centuries. In Jhansi, too, the forests contain mere scrub. But in Gorakhpur and Jhansi the Government forests have been clearly defined by the settlement survey, and progress has been made in the Dehra Dun. The deodar forests in the North West Provinces are the main source of supply for sleepers for the Rájputána State Railway, from Delhi to Agra and the Sambhar Lake, a distance of 400 miles, requiring 800,000 sleepers. Much timber has been felled, many sleepers delivered, and others sawn in the Tonse forests, ready to be floated down. The cost of each sleeper delivered at Delhi, from the Tonse and Bhagirathi, is Rs. 3. 9. 6., including dues, floating, and cartage. The *sal* sleepers from Kamaun will cost Rs. 1. 2. each at the depôts outside the forests, and an extra rupee for conveyance to Agra.

Deodar forests.

Gorakhpur.

Dehra.

Jhansi.

Supplies of sleepers.

In 1871-72 the number of sleepers supplied to the Rájputána Railway was 272,381, besides 8,550 tons of sawn timber, 48,451 *sal* sleepers, and 78,344 cubic feet of *sal* in scantlings were also sold.

In the Punjab the principal forests of deodar are in the valleys of the Satlej, Bias, Ravi, Chenab, Jhiam, and their tributaries.

Punjab.

In the Kashmir forests, on the Ravi and Chenab, the number of accessible full-grown deodars is estimated at 117,000, but a most wasteful system of working prevails.

Kashmir.

The forests of the Chamba and Busahir States are leased by the Government, and managed by the Forest Department. The Chamba forests, at a height of 5,000 to 9,000 feet in the Ravi and Chenab valleys contain deodar only on steep mountain slopes. The Busahir forests, also containing deodar, are on the Satlej. A large proportion of the deodar in the north west Himalaya is on the top of high precipices, in side valleys and gorges, and cannot be worked without an expensive system of roads and slides, but there seems hopes that what remains will, for some time at least, suffice for the requirements of the Indus Valley railways, as well as for those of large cities and public works in the Punjab. For the future, however, a permanent supply of deodar can only be secured by plantations on a large scale.

Rented forests.

A large portion of the *rakhs*, in the Doabs between the rivers, consisting of about 8,000 square miles of jungle, have been made over to the Forest Department within the last three years. Much progress has been made in the adjustment of claims between the Government and the people, as regards these *rakhs*; the principle being for the Government to concede definite rights to certain portions, whence the village communities can take fuel at their pleasure, on condition that the Government right to the rest is to be considered absolute.

Rakhs.

The general want of wood throughout the Punjab was so much felt that great exertions have been made, of late years, to make up for past neglect. The Changa Manga plantation, in the Bari Doab, is on the canal, and 44 miles below Lahor. It is supplied with water from the canal for irrigating the young trees: 4,200 acres have been planted with *sissu*, *ber*, and *kikar*, and the whole area is doing well. It is to be completed to 7,000 acres in two years, and in 1881 is expected to yield 33,000 rupees. Plantations are also being established on the Jhiam, near Ludhiána, and near Delhi; and there are avenues along the banks of most of the irrigation canals.

Changa Manga.

In Oudh the forests in the Kheri, Bhabraich, and Gonda districts, are on high ground, along the Nepal frontier, and are in reality only strips cut off from the great Nepal jungle. They consist of *sal*, *Terminalia*, and *Conocarpus*, interspersed with open glades of grass land. These forests have been demarcated,

Oudh.

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and the trees have been thoroughly cleared of creepers. The Oudh and Rohilkhand Railway will run chiefly on iron sleepers, but fuel for the locomotives will be required from the forests, as well as for the towns.

Central Provinces. In the Central Provinces there are enormous tracts covered with jungle, but only a comparatively small portion is properly forest.

Teak on the Narbada. The forests in the Mandla district, at the head of the Narbada river, contained large quantities of teak trees, but in 1860 they fell into the hands of speculators and the trees were ruthlessly felled. Thence to Raipur there are most extensive sal forests, but they are very distant from the markets. Lower down the Narbada there is an extensive forest called Dela Kari, near Pachmari, which is the most westerly position of the sal tree in Central India. Still further west, in Baitul and Hoshangabad, are the forests of teak, from which the cities of Ujjain, Indor, and Malwa were built, but there is little now left. The hills, between the Narbada and Nagpur, though covered with forest, contain little timber of any value.

Teak on the Godavari. The vast forests to the eastward, the magnificent teak along the Godavari, and the great sal belt round Chatisgarh, extending across the centre of India from the head of the Narbada to Cattack, are also far from the centres of demand. Proper supervision is impossible, and the jungle tribes cut down and destroy at their own will and pleasure.

Demarcation. But the demarcation of the accessible forests has progressed favourably. A tract of 125 miles has been reserved and demarcated to the north of Nagpur, in the Seoni hills, to supply that city with buildings, timber, and bamboos, while Jabalpur is supplied from the Narbada jungles. The 23 reserve forests of the Central Provinces, grouped in five divisions, comprise a total area of 1,832½ square miles. Broad demarcation lines have been cut through the jungles, pillars erected to define boundaries, and fires successfully excluded from selected tracts.

Unreserved forests. The open or unreserved forests in the Central Provinces are managed by the Deputy Commissioners, and are the property of the Government. Householders take out a license, enabling them to obtain, from the forest lands, the products they require, and the herdsmen take out licenses for grazing. The revenue from these sources is 39,885 £., and the total revenue from the forests of the Central Provinces, 61,497 £.

Berárs. In the Berárs there are 646 square miles of reserves, consisting of the Bhairagarh Forest to the north, and five smaller tracts in the southern division.

Mysor. In Mysor and Curg there are three great forest belts, the evergreen, the mixed, and the dry. The first is on the western ghats, and yields wild jack (*angelí*), *pun*, ironwood, and blackwood. The second is a belt on the eastern slopes of the ghats, from 10 to 40 miles wide, yielding teak and sandalwood, the latter being a Government monopoly, giving a revenue of 1,600 £. The third comprises the eastern part of Mysor, where the *Hardwickia*, *Terminatia*, and *Conocarpus* grow. The area of reserved forests in Mysore is 398 square miles, of which 247 are already demarcated. A map of the Mysor forests has recently been published.

Curg. In Curg there are 347 square miles of forest, but little demarcation work has yet been done there. In Mysor several plantations have been formed, comprising 368 acres of sandalwood, 123 of teak, and 180 of firewood in course of formation. In Curg there are 300 of teak, and 600 of sandalwood, besides the *Devada Kadu*, or sacred forests, which are the residences of demons, and the hunting grounds of departed heroes. They are never entered, and it seems very desirable that this belief should be encouraged, as it is most conducive to forest conservancy.

Burma. In British Burma the forest land covers 4,480,000 acres out of a total of 60,000,000. Of this, the teak producing forests take up 1,534,080 acres, the forests devoid of teak, but in similar localities, 2,945,920, and there are also low lying forests not included in the above estimate. In Arakan, forest conservancy is restricted to rules for the protection of the ironwood tree (*Xylia dolabriformis*). In Pegu are the four main forest divisions of Rangún, Tharrawaddi, Prom, and Sitang; the richest teak localities being on the hills between the

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the Irawadi and Sitang. The teak forests in Tenasserim, which are now much less valuable in mature timber than those in Pegu, form another divisional charge. After Tenasserim was annexed in 1826, a system of licenses for felling timber was introduced, which would have eventually led to the extermination of the teak trees. Rules were promulgated at various times, intended to secure the preservation of the forests, but without much real success. On the annexation of Pegu, all forests in that province were declared to be the property of the Government, and the felling of teak timber without a license was prohibited. In 1856 Dr. Brandis became superintendent of forests in Pegu, and in 1857 the forests of Tenasserim were added to his charge. Rules for preserving the forests were promulgated in 1856, which were afterwards embodied in the Forest Rules drawn up under Act VII. of 1865.

Tenasserim.  
System of li-  
censes.

Pegu forest rules.

Great progress has since been made in the demarcation of reserved forests, and up to 1872 a total area of 85,538 acres, or 133 square miles, had been sanctioned as forest reserves. Next to teak, the most important forest product is the *cutch*, from *Acacia Catechu*, of which no less than 138,142 maunds, valued at 135,330 *l.*, were annually exported from the province, being collected within British territory. The *cutch* manufactories of the Prom and Thayetmyo districts find employment for 4,000 persons with their families, so that the preservation of the supply is a matter of some consequence. Yet there is no restriction on the felling, and the destruction has been most reckless. The demarcation of the more valuable *cutch* tracts has been sanctioned for treatment as reserved forests.

Demarcation.

Cutch.

The teak plantations commenced in 1856 are in large compact blocks on the river, above Rangún, with a separate system on the Sitang, near Tounghu. They are eventually to extend over 30,000 acres; and up to 1871-72, 1,648 acres had been planted. The calculation is, that after the plantations arrive at maturity, the yield will be 1,200,000 cubic feet, or 24,000 tons per annum.

Teak plantations.

The timber trade of Mulmein is regulated by the establishment of the Kado Depôt on the Sáiwen river, six miles above Mulmein. Here all timber imported from independent territory is stopped under charge of the Forest Department until it is sold. It is stored on the banks of the river, and a duty of *Rs.* 2. 12. for each log of 5 feet girth and upwards, and *Rs.* 1. 6. for timber below that standard is paid to the British Government (about 6s. a ton). The amount of timber from foreign territory at the Kado Depôt in 1871-72 was 81,343 tons, paying a duty of 20,857 *l.* By the Sittang river 15,252 tons came down, and by the Irawadi, 1,814.

Timber trade.

During 1871-72 the out-turn of the teak forests in British territory was 56,204 logs (52,126 tons), which is considered satisfactory. The whole receipts of the Burma Forest Department was 77,239 *l.*, and the expenditure, 37,919 *l.*, showing a net revenue of 39,320 *l.*

Financial results  
of conservancy in  
Burma.

The forests in the Bombay Presidency are spread over a very large area, from Canara in the south to the Mahi river in the north, a distance of nearly 500 miles: The best forest tracts are, as a rule, near the line of the ghauts. Canara, Thana, Kolába, and Khandesh are the districts which contain the largest and most productive Government forests.

Bombay.

In the revenue survey, a certain area of each village was set aside as forest land, and the people also enjoyed privileges connected with the public forests, such as cutting grass and brushwood for manuring rice fields, cutting firewood, and free grants of wood for agricultural and building purposes. The two first privileges have been disposed of by assigning to each village a tract of common and of grazing ground; and the other two were provided for by marking off certain forest tracts as special Government reserves, and granting the ryots free access to the rest, with a restriction as to cutting seven valuable kinds of timber trees for firewood.

Commercial  
rights.

In accordance with these arrangements, the work of demarcation has been pushed forward, and in 1870 it was nearly completed in the Thana and Colaba Collectorate. It is also proceeding in Sátára and other districts.

Demarcation.

Forest business, in Bombay, is thus closely connected with revenue administration, and in accordance with the advice of Dr. Brandis, who was employed at the request of the Bombay Government in 1870 to visit the forests in the Bombay Presidency, and to submit proposals for their administration; a district forest

Organisation of  
the Forest Depart-  
ment.

officer

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officer is appointed to each collectorate, subordinate to the Collector, but corresponding with the Conservator of Forests in his division on all technical subjects connected with his work. There is a Conservator of Forests for each division; Mr. Shuttleworth in the north, and Colonel Peyton in the south. The general control of all forest business rests with the Conservators, and they will take the initiative in forest matters, but their orders to district officers must be sent through the Collector. These new arrangements came into operation during the year 1871-72. The receipts from the two divisions for the same year were 93,237 l., and the expenditure, 43,872 l., so that the net forest revenue was 49,365 l. Plantations have been formed in Canara and Dharwar.

**Sind.** The forests in Sind, along the banks of the Indus, were originally set apart by the Amirs of the country as their hunting grounds, and thus on annexation were entirely at the disposal of Government. They have long been demarcated as Government reserves, and now cover an area of 352,460 acres.

**Beylas.** These forests, or *beylas*, depend upon the overflow of the Indus, without which they would speedily disappear. But this inundation fosters the growth of tall dense reed grasses, which require much labour and expense to repress. The loss of forest land by erosion has also been considerable. Some of the forests are but skeletons of what they once were, and the subject is becoming very important. The best remedy, if such were practicable, would be to give up the idea of maintaining permanent forests immediately on the river banks, and to look to their extension in some safer position. The receipts for 1870-71 were 20,135 l., and the expenditure 17,068 l., only leaving a profit of 3,067 l.

**Madras.** Forest conservancy in the Madras Presidency was founded by Dr. Cleghorn, who presided over the Department from 1856 to 1867, when he was succeeded by Major Beddome. The Government of Madras recorded their satisfaction at the results of Dr. Cleghorn's labours, and their conviction that these results had been attained without any infringement of the privileges of the people. The causes of the want of satisfactory progress, since Dr. Cleghorn's resignation, are the absence of organisation in the Department, and the want of a cordial understanding between the forest and revenue officers.

**Changes in the organisation of the Madras Forest Department.** In 1871-72 the Forest Department was reorganised somewhat on the plan adopted in Bombay; the district forest officers being placed under the collectors, while the office of conservator of forests was abolished. Major Beddome was appointed inspector of forests with no direct authority over the officers of the Forest Department, who are even prohibited from corresponding with him, but with the duty of visiting the different districts, and offering advice to the collectors.

**The system of dual conservancy.** When the Forest Department was formed in 1856, the Government forests had for some time been nominally under the charge of collectors of districts, and as soon as the operations were extended to a district, portions of the forest or jungle, more or less extensive, were retained on a separate footing, under what was styled "Village Jungle Conservancy," with the management of which the forest officers were allowed to have nothing to do. Yet there was no demarcation, and no distinct line drawn, so that the forest officers had no means of knowing the exact boundaries of their jurisdiction; and, as Act VII. of 1865 was not accepted in Madras, there is no forest law in the Presidency.

**Confusion.** Dr. Cleghorn ascertained where forests existed, and what revenue was to be derived from them, and his researches into the forest capabilities of Madras were most ably seconded by his Assistant Major Beddome, who explored the forests throughout the length and breadth of the Presidency, and is the author of the first Indian forest flora. Felling and slipping operations were conducted in the Annamalai and Mudumalai Mountains; the establishments were organised, and three maps were prepared, one of the Denkanikota range in the Salem district by Captain Walker; another of South Canara by Mr. Cadell; and a third by Lieutenant Fullerton of the Wynaad forests.

**Examination of forests.** The first attempts at demarcation were made in 1868-69, when a few jungle tracts were marked off as fuel reserves for the railways in Salem, Cuddapah, and North and South Arcot; but in no case were they surveyed or mapped. Mr. Puckle, the collector of Tinneveli, also did something towards forming reserve forests in his district, by fixing certain limits for grazing, and cutting firewood, which were notified in the district Gazette. But these reserves were never even roughly demarcated. In 1870-71 some tracts in the Madura district

**Railway fuel reserves.**



district were selected for the supply of wood for agricultural implements and fuel; and in the same years portions of jungle were set apart in the Madura, Tinneveli, and Trichinapalli districts as reserves for railway fuel, but no demarcation or survey has been undertaken.

In the Animalle there are reserved teak forests, and during 1870-71 there were 363 teak and two blackwood trees felled, and 2,507 teak and blackwood planks were dragged into forest depôts. The receipts from Animalle timber amounted to 4,600 *l.* There is another reserved teak forest at Mudumallai, under Colonel Morgan, but little work was done in 1870-71, owing to the slight demand.

Animalle and  
Mudumallai teak  
forests.

The finest teak plantation in the Madras Presidency, and indeed in all India, is the Conolly Plantation on the River Bepur, in Malabar. It was formed by Mr. Conolly, the collector of Malabar, in 1844; and in 1862 Mr. Ferguson, the present superintendent, took charge. He continued to plant 100 acres a year. The plantations are on undulating ground, along both banks of the river, in a climate where the rainfall is 150 inches. They are in narrow belts, extending for six miles, with a width from half a mile to a mile. The river is navigable to the sea, so that there are great facilities for the removal of timber.

Conolly teak  
plantation.  
Mr. Ferguson.

In planting new ground the jungle is felled and prepared for burning at the close of the dry season. Nurseries are formed in April. The seed is steeped in cold water for 48 hours, and sown on raised beds of fine mould covered with straw, to prevent too rapid evaporation, and constantly watered until the seeds germinate in 12 to 20 days. When the rains commence, the plants are put out in lines six feet apart, in pits a foot square and deep, filled with good surface mould. The ground is hoed and weeded from time to time, but after four years the young plantations keep down the grass and jungle by their own shade. Thinnings are made in the fifth year.

Planting new  
ground.

The largest teak trees are now five feet in girth, with noble straight stems, without a branch for 60 or 70 feet. Up to 1865, the number of seedlings planted was 1,678,679, occupying 1,696 acres, and at the rate of 1,000 trees to an acre there are now about 1,800,000 trees. The yield in 1870-71 was 4,075 saplings floated to the depôt at Calicut, being the thinnings of the plantation, which more than repay the annual outlay.

Largest trees.  
Number of trees.  
Sale of saplings.

Numerous other plantations have been formed in the various districts, 26 for railway fuel reserves, three or four for teak, and two for sandal wood. At Mudumallai there is a plantation of 20,000 teak trees now six years old, and the two sandal wood plantations contain 38,000 trees. Australian gum trees were introduced into the Nilgiri hills about 20 years ago, and now form magnificent plantations, and ornamental clumps round the stations.

Other plantations.

The receipts of the Madras Forest Department for 1871-72, were 41,886 *l.*, and the expenditure 34,691 *l.*, leaving a net profit of 7,195 *l.* The receipts are derived from the sale of timber at depôts, removed by purchasers, or supplied to other departments, from permit fees, grazing fees, sales of products, fines, and sales of confiscated timber.

Financial results  
of forest con-  
servancy in Mad-  
ras.

This brief review of forest administration shows that great progress has been made in the demarcation of reserved forests, which is the most important work in the department, in the North West Provinces, Oudh, the Punjab, the Central Provinces, Bombay, and Sind; but that in Madras little progress has been made, and no systematic measures have been adopted for securing this great desideratum in forest management.

General progress  
of demarcation.

It is considered of such paramount importance by Colonel Pearson that, last year, while officiating as Inspector General of Forests, he obtained sanction for the constitution of a special branch of the Forest Department to survey, demarcate, and prepare working plans for all the reserve and communal forests. The work is to be done on a uniform plan, district by district, the forest survey branch working in concert with the revenue and topographical surveys, and settling the forests, as the revenue officers settle the cultivated land, in consultation with all who claim to be interested in the matter. This is the same procedure as is followed in Bavaria, Prussia, Saxony, and other German States.

Surveying branch  
of the Forest  
Department.

Many exotic trees have been introduced into India by the Forest Department since its formation. The Australian eucalyptus and acacia are established on the

Introduction of  
new trees.

## VII.

## FORESTS.

Cultivation of  
Para India rubber.

Mr. Collins's  
Report on caout-  
chouc.

Para rubber.

Asam rubber.

Beddome's *Flora  
Sylvatica*.

Brandis's *Forest  
Flora*.

Reports on Ger-  
man and English  
forests.

Training of candi-  
dates for forest  
appointments.

hills in India, and the chinchona trees of South America will also soon clothe their higher slopes. It is also in contemplation to introduce the cultivation of the *Hevea Brasiliensis*, yielding the Para India rubber of commerce, which has been proved to be superior to the article collected by the hill tribes of Asam from the *Ficus elastica*. An exhaustive report on the caoutchouc of commerce has been prepared by Mr. James Collins, in which all the India-rubber yielding trees are botanically described, and an account is given of their cultivation, relative values, and uses. The information thus carefully and systematically collected and arranged by Mr. Collins has established the importance of introducing the cultivation of Para rubber into India, and steps have accordingly been taken to obtain seeds. At the same time a good deal may be done to improve the yield of the Asam caoutchouc, by the establishment of plantations on a large scale, and in accordance with a well-considered plan. This measure is strongly recommended by Dr. Brandis, who has added a valuable memorandum to Mr. Collins's report.

Books are much needed for the use of forest officers, especially handbooks for reference in the field, and accounts of systems of forest management in other countries. Major Beddome, in his "*Flora Sylvatica*," of the Madras Presidency, has just completed a most valuable work.

Dr. Brandis is now engaged in completing a "*Forest Flora*" for the Punjab and North West Provinces, commenced by Dr. Stewart, and which has been designed with great care to contain all the information a forest officer is likely to need respecting every important forest plant, and yet to be of such moderate dimensions as to be carried about with ease.

An interesting series of reports has also been published on forest management in Germany, Austria, and Great Britain, by Captain Campbell Walker; with a memorandum by Dr. Brandis on the professional studies of forest officers on leave. It contains full particulars respecting the management of forests in Hanover, Prussia, Saxony, Bavaria, Austria, of the Crown forests in England, and of woodlands on private estates in Scotland; and will be most useful in India, as well as an invaluable guide to officers on leave.

For the management of a vast system of forest conservancy in India, the provision of thoroughly efficient officers, with a scientific knowledge of forestry in all its branches, is essential. It is also necessary that such officers should be men of strong constitutions, active habits, and aptitude for work. In 1866, Dr. Brandis, the Inspector General of Forests to the Government of India, represented the necessity for adopting some plan to ensure a supply of such men, and his proposals have been adopted with the most satisfactory results. The system for preparing candidates for forest service was commenced in 1867. In that year candidates were allowed to go up for examination before the Civil Service Commissioners, and the seven most promising were selected. It was arranged that these young men, between the ages of 17 and 23, should undergo a regular course of training for two years and a half in the management of forests and the science of forestry, in surveying, road making, and the natural sciences, either in Germany or France. A knowledge of either German or French was, of course, made compulsory at the preliminary examination. M. Burekhardt, Director of the State Forests in Hanover, and M. Nanquette, head of the Forest School at Nancy, kindly undertook to superintend the training of the young men, and have continued to watch over their progress and direct their studies with the greatest zeal and interest. Between 1867 and 1872, 40 candidates have been selected, of whom 21 have been sent to France and 19 to Germany. The number of young officers already in India, who have gone through this professional training, is now 24, and, although sufficient time has not yet elapsed to judge the merits of the present system by the work accomplished through the agency of the officers trained under it, yet the Government of India has already expressed great satisfaction at the attainments and general tone of those who are now in India. The gradual formation of a thoroughly well-informed and efficient staff will, no doubt, be the means of eventually completing the work of forest conservancy, and of introducing correct principles of forest management into all parts of India.

VIII.—MINERALS.

VIII.  
MINERALS.

THE mineral wealth of India is practically confined to its coal seams, salt mines, and iron ores; and the latter have not yet been worked profitably on a large scale. Although coal was known to exist as long ago as 1774, and was actually worked in 1775, it is to the more recent labours of Dr. Oldham, and his staff of zealous geologists, that the exploration of the coal fields of India, as well as the geological survey of vast areas in all parts of the country, are due. Mr. Blanford thoroughly examined the Raniganj fields, and those of Chanda and the Godávari. Mr. Medlicott has explored those of the Narbada valley, and other areas have been investigated by Mr. Hughes and Mr. Willson, all members of the Geological Survey.

Mineral wealth of India.

Examination of coal fields.

The coal fields of India lie in a region bounded by the Ganges on the north, and extending beyond the Godávari on the south; while, from east to west, they stretch from the neighbourhood of Calcutta to some distance down the Narbada. Outside this limit, the only coal fields are in Upper Assam and the Khasia Hills. Nearly all the coals come from one geological formation, called "Damuda," from the name of the river (Damodar), in the valley of which the principal coal seams occur. It is the same as that of the Australian beds, and differs very little from the carboniferous group of beds in Europe. But the coal is very different, both in quality and appearance. Its most characteristic distinction is its excessive lamination, and it contains from 10 to 30 per cent. of ash, while the proportion of fixed carbon rarely exceeds 60 per cent., and averages 52 per cent. In average English coal, the ash is 2·7 per cent., and the fixed carbon 68 per cent. Indian coal is only capable of doing from one-third to two-thirds of the work performed by the same amount of English coal.

Coal fields of India.

Mr. Blanford divides the coal fields of India into four groups; 1st, those of the Rajmahal Hills and Damuda Valley; 2nd, those in Rewah, Sirgújah, Chota Nágpur, Tálchir, &c.; 3rd, the coal of the Narbada Valley and Satpúra Hills; and 4th, the new fields in the valleys of the Wardha and Godávari.

Division of coal beds into groups.

On the Rajmahal Hills there are small coal basins in every large valley traversing the range, with seams from three to 12 feet thick. But Raniganj is far the most important of the Indian coal fields, and nearly the whole coal mined in India is obtained from it. The latest returns are for 1868, in which year the number of tons extracted throughout India was 497,000, of which 493,000 came from Raniganj, and 4,000 from all other sources. The field commences about 120 miles north-west of Calcutta, and is 18 miles long from north to south, by 40 wide, with an area of from 500 to 600 square miles. The seams are numerous, and those that are mined vary in thickness from 4½ to 35 feet. Dr. Oldham has roughly estimated the coal available at 14,000,000,000 tons; but many seams vary in thickness, and there are not data for accurate determinations. There are now 44 coal mines at work. The East India Railway has been worked with Raniganj coal ever since it was opened, and the yield of the mines has doubled in the last 12 years. The coal field is now traversed by the chord line of the East India Railway, with a branch line to some of the collieries.

Rajmahal coal.  
Raniganj coal fields.

There are four other coal fields in the Damuda Valley. At Jherria, 10 miles west of the Raniganj coal-bearing tract, there are numerous seams of great thickness, which have not yet been worked. The Bokaro field is a long strip of coal-bearing rocks, commencing within a mile of the Jherria field, and extending for 40 miles; but the coal has not been worked, and, so far as is known, it is inferior to that of Raniganj. Ramgarh is a small field, of 30 square miles, to the south of the Bokaro field, and of the same character. Karanpura consists of two basins of coal-bearing rocks, lying west of Ramgarh, and due south of Hazáribagh. They contain a considerable quantity of coal of fair quality. These four, with Raniganj, are all in the valley of the Damuda, and form a belt of coal-bearing rocks extending 150 miles, and occupying 1,500 square miles of country. Over at least half this area workable coal seams of considerable thickness occur, within a distance not exceeding 1,000 feet from the surface; but there is a gradual diminution in thickness of the coal-bearing formations to the westward. Where the Damuda formations attain their greatest thickness, they

Jherria coal field.

Bokaro coal field.

Rámgarh coal field.  
Karanpura coal field.

Extent of coal fields in the Damuda valley.

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- they consist of two groups, the upper one 5,000, and the lower 2,000 feet thick, each containing several seams of coal; but to the westward the upper group thins out and disappears, while the lower one gradually diminishes in thickness.
- Kurhurbari coal field.** The Kurhurbari coal field, in the valley of the Barakar, a tributary of the Damuda, is to the north west of the Raniganj collieries, and covers an area of 18 square miles. Mr. Hughes calculates that there is a sufficient supply at Kurhurbari to supply 250,000 tons a year for 800 years. The collieries belong to the East India Railway, and a branch line 25 miles long has been made to them from the chord line. There are two very small fields containing no workable coal near Deogarh, in the Santhal Parganahs, and a third, at Itkuri, to the west of Kurhurbari.
- Deogarh coal field.**  
**Itkuri coal field.**
- The second group consists of a number of basins scattered thinly over an immense tract of the wildest country in India, and none have been thoroughly explored. The Palamau fields in Chota Nágpur belong to the Government, but there is not much coal. In the South Rewah field the coal exists over an area 40 miles long by 20 broad; in the Upper Son Valley the seams are very numerous, but thin, and of poor quality; in Biláspur and the country west of Chota Nágpur there are seams of coal in several places, some of them of great thickness, and at Talchir, on the Bráhmáni river, there is a coal field, but containing no coal of any value.
- Palamau coal fields.**  
**South Rewah coal fields.**  
**Coal in the Son Valley.**  
**Biláspur coal field.**  
**Tálchir coal field.**
- The third group is included in the Narbada Valley and the Satpúra hills, which form its southern boundary. Here the Mopani collieries belong to the Narbada Coal and Iron Company. The average thickness of the coal seam is 25 feet, and, though there are numerous faults and dykes, it is believed that a large quantity exists, and that the quality is little inferior to that of Raniganj. At Umret, near Chindwara, there are several seams of fair coal over a considerable tract; and also in the Tawa valley, between Baitul and Hoshangabad. The Mopani coal fields were examined by Mr. Medlicott during the season of 1870-71; and in the following year, 1871-72, he was engaged on similar work in the Sápura hills.
- Coal in the Narbada Valley.**  
**Mopani collieries.**  
**Umret coal field.**  
**Tawa coal field.**
- The fourth group of coal fields lies on the edge of the great sandstone tract which occupies the valley of the Godávari, and its tributaries, the Wurda and Pranhita, from the neighbourhood of Nágpur to that of Ellor. Workable coal is known to exist in several localities, which have been examined by Mr. Blanford and by Mr. Hughes. The existence of coal in the Chanda district, in the Central Provinces, was first pointed out by James Prinsep in 1830, but the geologists of the survey were the first to trace out the limits of the field, and to make a detailed examination of it, which is still in progress. The existence of a very thick seam of coal and carboniferous shale has been ascertained, 50 to 70 feet thick, over a large area of the Central Provinces and Berár, and again a few miles further south in the Nizam's territory. The quality of the coal hitherto mined is inferior to that of Raniganj, but good enough for railway purposes. There are several borings in the Chanda district, but the principal shaft is sunk at a place called Warora. It was impeded by water, and new and more powerful pumps were ordered from Bombay, to be ready by August 1872. New machinery has also been sent for, and sinking was to have been recommenced in December 1872. Sixteen borings have been made to prove the area of the Warora beds. Six of them proved coal 12 feet thick, and it is estimated that 5,000,000 tons are available, sufficient for a yield of 50,000 tons a year for a hundred years. In 1870-71 Mr. Whyte, who is engaged on similar investigations in the Nizam's territory, proved the existence of coal at a place called Sastu, more than 50 feet in thickness.
- Coal in the Godávari valley.**  
**Chanda coal.**  
**Warora colliery.**  
**Sastu coal field.**
- Mr. Blanford during 1870-71 carried on the general mapping of the extent of the sandstone area in the eastern part of the Nizam's territory, and southwards into the Madras Presidency, towards Ellor. These sandstones appear to belong to the true coal-bearing rocks, but they are for the most part devoid of coal. At Kamáram, in the extreme east of the Nizam's dominions, and 100 miles north-west of Ellor, there are two seams, 9 and 6 feet thick respectively, of good quality, but only occupying an area a quarter of a mile square. In 1871-72 Mr. King, of the Geological Survey, discovered coal at a place called Sinharani, 30 miles south-east of Kamáram, where about two feet of the seam are visible. Further research
- Sandstones in the Nizam's territory.**  
**Kamáram coal field.**

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research is necessary, but the Sinharani bed is interesting as the most southern coal yet discovered in India. Mr. Blanford in 1871 mapped the coal-bearing rocks of the Godavari, and a series of borings were taken, in accordance with his suggestions, near Dumagudem, the head quarters of the navigation works at the first barrier of the river; but the coal was found to be of inferior quality.

Singareny coal field.

Dumagudem coal field.

Outside these four groups of coal fields there are two to the eastward of Calcutta. One, where some coal has been found of excellent quality but of limited extent, is on the Khasi hills, 4,000 feet above the level of the plain; the other is one of the most promising fields that has hitherto been discovered. It occurs in the Dibrugarh and Sibsagar districts, in the extreme east end of the Assam valley, and there are several seams of excellent coal; but the country is densely covered with forest and very thinly peopled, which makes it unfavourable to commercial enterprise.

Coal in the Khasi hills.

Coal in Assam.

Indian coal, on account of the quantity of ash, is ill suited for use in sea-going steamers. The development of the coal-producing industry of India will be caused by the local demands of the public works, of railways, river steamers, and manufactures, and hereafter Indian coal will probably be employed in manufacturing iron.

Use of Indian coal.

Iron-producing minerals are widely scattered over India, and consist, 1st, of magnetic and specular iron ores and red hematite, in beds and veins; 2nd, of clay iron ores from the coal-bearing strata; and 3rd, of surface deposits derived from the waste of metamorphic and sedimentary strata, and from laterite. The latter formation contains from 20 to 30 per cent. of iron.

Iron ores in India.

Some of the most remarkable deposits of magnetic iron ores are in the Salem district of the Madras Presidency. The ores occur in immense beds, 50 to 100 feet thick, the outcrop of which may be traced for miles. On one hill, six miles from Salem, there are five bands of magnetic iron from 20 to 50 feet thick. At Lohāra, in the Chanda district of the Central Provinces, there is a hill two miles long and half a mile broad, the surface of which is covered with masses of almost pure iron ore. In Bandakhand and in the Narbada valley there are large quantities of hematite ores, the supply in many cases being practically inexhaustible. The clay iron ores in the Raniganj and other Damuda coal fields yield 39 per cent. of iron. The Kamaun iron ores form an argillaceous band, containing large quantities of red hematite, the ore bed being 10 to 20 feet thick, and extending for a long distance. The surface deposits supply the greater proportion of ores used by native smelters, but much labour is necessary in the collection.

Iron in the Salem district.

Iron in the Chanda district.

Iron in Bandakhand and the Narbada valley.

Iron in the coal districts.

Kamaun iron ores.

Iron has been manufactured in India from time immemorial, and weapons of that metal are even found in the ancient cromlechs and kistvaens, but there never were any large works. The production of iron is the work of poor people of very low caste scattered over the country. They have small clay furnaces, with charcoal for fuel, and the blast caused by foot or hand bellows. The smelting goes on for eight or ten hours, at the end of which time from 10 to 20 lbs. weight of iron is found at the bottom of the furnace, and is purified by re-heating and hammering, the resulting iron being generally of excellent quality; but the native manufacture is rapidly decreasing, owing to the difficulty of obtaining charcoal.

Native manufacture of iron.

All attempts to manufacture iron, made by the English, have hitherto utterly failed. In 1825 Mr. Heath, of the Madras Civil Service, obtained a Government advance, and formed a company to establish iron works at Porto Novo, near Cuddalor; at Polamputi, near Salem; and at Bepur, where the iron was obtained from laterite. The Porto Novo works were commenced in 1833, and those at Bepur some years later; but, in spite of help from Government, there was nothing but failure, attributed to the distance of the works from the source of supply, to scarcity of charcoal, and to other causes. Company succeeded Company, and at last there was an utter collapse. In 1857 Mr. Sowerby, an engineer, reported on the iron ores in Kamaun, but the repeated attempts to work them have ended in financial failure; and a similar attempt by a Calcutta merchant, who started works near Suri, in Bīrbhum, was also abandoned.

Experiments in iron manufacture.

Madras iron works.

Kamaun iron experiment.

Bīrbhum iron experiment.

Government iron works at Burwai.

The enterprise of the Government in the Narbada valley, however, promised well, and might have been most successful. Works were erected at Burwai, on the Narbada, under the auspices of Colonel Keatinge. Mr. Miander, a

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## Burwa iron works.

very able Swedish metallurgist, was induced to take charge of the works, and, after many experiments, all difficulties were overcome, and the works were ready for the production of iron. Suddenly, in 1864, the Government, after spending 75,000 £. on these preliminary expenses, dismissed Mr. Mitander, closed the works, and offered them for sale, without success. They have now, with the ground on which they stand, been made over to Holkar. Iron ore and limestone abounded in the neighbourhood; large forests, furnishing supplies of charcoal, extended for many miles to the east and north-east; and Mr. Mitander was an excellent manager as well as a scientific metallurgist. No record has even been preserved of the experiments and plans of Mr. Mitander for burning and storing charcoal, and for other processes, which would have been useful hereafter.

## Mission of Mr. Bauerman.

The Government are now once more anxious to foster the iron manufacturing industry of India. In 1872 Mr. Bauerman was sent out to report on the subject; and the increasing price of iron in England is most favourable to the prospect of the manufacture proving profitable in India. The use of Indian coal for smelting iron has never yet been tried.

## Salt mines.

The supply of salt from the Salt Range running through the Jhilm and Sháhpur districts, and on to Kalábágh, is practically inexhaustible. The principal beds occur in the southern slopes of the range, and are from 150 to 200 feet in thickness. The mines are of two kinds: one where the salt rock is approached by galleries and excavations, and the other where, as at Kalábágh, the salt is at the surface, and is quarried. It is excavated at four places, namely, at Kheora, now called the Mayo Mine, and the Sardi Mines, in the Jhilm districts; at the Warcha Mine in Shalipur; and at the Kalábágh quarry. Salt exists in large quantities at eight other places, but these mines are closed to prevent smuggling. In the Kohat district, salt is obtained from five quarries in the chain of hills running from the Indus towards Bohadur Khel, and is of a black or dark green colour, being found near the surface. With reference to the supply from the Salt Range, Dr. Oldham says, that nowhere else in the world are salt deposits of such vast extent and purity known to exist.

## Kheora Mine, or Mayo Mine.

## Sardi Mines.

## Warcha Mine.

## Kalábágh quarry.

## Kohat salt.

## Supply from the salt range.

## Copper mines.

There are copper mines in Kamaun, Garhwal, Nepal, and Sikkim, which are worked on a very small scale by natives, and the produce is very considerable.

- There is a small mine at Jaipur, in Rájputána, and copper ore is found in the hilly portions of the Gurgáon and Hissar districts, and in Kulu and Spiti. There is also copper ore in Singbhum, to the westward of Midnapur, extending over 80 miles; and old workings abound, but much fine ore remains. Lead occurs, in the form of sulphuret or galena, in Kulu, Garhwal, and Sirmur, in the north-western Himalayas. There is also a lead mine near Sabáthu, in the Simla district, worked by the "Patiála and Subáthu Mining Company," which yields about 40 tons of ore a month, containing 16 to 72 per cent. of lead. In 1869 Mr. Blanford examined a promising lead vein at Chicholi, near Raipur. There are very rich tin deposits in Tenaserim and Martaban, and a project has been submitted to the Government for working them; but the country is very wild, covered with dense forest, and thinly inhabited, and there are no roads or means of carriage. Gold occurs in many parts of India, but always in very small quantities in stream gravels. It is occasionally extracted in the north-west Himalayas, Chota Nágpur, Assam, Sinbhum, the Godáviri valley, and some other places. In the Punjab not more than 3 or 4 annas' worth of gold can be obtained by a hard day's labour at washing. Silver occurs, associated with lead, in Kulu. Antimony, in the form of what the natives call *surma*, is produced in great abundance in the Himalayan range, and, reduced to fine powder, is sold by druggists as a cosmetic for the eyes. The ore occurs in Kulu and Lahaul. An ore of cobalt, in small quantities, is obtained near Jaipur, in Rájputána, and is used for colouring enamel.

## Lead ores.

## Tin deposits.

## Gold.

## Silver.

## Antimony.

## Cobalt.

## Petroleum.

Petroleum is procured in considerable quantities from Upper Burma, and some is known to exist in Pegu and Asam. Mr. Theobald, of the Geological Survey, reports its discovery in Pegu, in several localities, but nothing but experimental shafts can satisfactorily settle economic value. A little oozes from the ground at several places in the Punjab, and gasworks were erected at Ráwal Pindi,

Pindi, with the intention of utilizing this mineral oil for lighting the station. But the supply was found to be insufficient.

Dr. Oldham and the staff of the Geological Survey have done all that was possible, in the time that has elapsed since their labours commenced, 22 years ago, to acquire and disseminate an accurate knowledge of the mineral resources of India, while their investigations, embracing the whole range of geological science, of which inquiries into the economic value of minerals form but a part, have achieved most satisfactory results. In spite of all difficulties of climate, inaccessibility of districts, and slowness of means of travel, they have examined an area about four times as large as Great Britain. The detailed and matured results of the survey of each district are published in the "Memoirs," with maps and illustrations, while the "Palæontologia Indica" is a superb series, containing figures and descriptions of organic remains collected during the progress of the survey. The ninth volume of the "Memoirs," published in 1872, is chiefly devoted to the geology of the native principality and remarkable island of Kach (Kutch), together with the desert Runn, the district of Nuggur Parkur, and the lower course of the Puraun, the most easterly of the deserted channels of the Indus Delta. Many geological doubts and difficulties had been caused by former partial examinations of Kach, and as they had an important bearing in the solution of similar questions in other parts of India, their investigation was undertaken. The map constructed by the geologist, Mr. Wynne, is on three large sheets, printed in colours in Colonel Thuillier's establishment at Calcutta, and under the charge of Captain W. Murray. It is altogether a work that cannot fail to attract scientific notice.

Labours of the  
Geological Survey.

## IX.—TRADE AND MANUFACTURES.

### IX. TRADE AND MANUFACTURES.

THE trade of India is only represented in a small degree by the returns from the great seaports, for the bulk of production is consumed in India itself, and external commerce is only a fraction of the internal trade. (Yet the exports, exclusive of treasure from Calcutta, Bombay, Karáchi, and the ports of Madras and Burma, amounted to 63,185,847 *l.* in the year under review, and the imports to 31,083,747 *l.* 11,673,813 *l.* of gold and silver were imported, and only 1,476,093 *l.* exported, so that the precious metals to the amount of 10,097,720 *l.* remained in India.) This process has been going on from time immemorial, and has always been the most curious and interesting feature of Indian trade. Vast quantities of gold and silver are used as ornaments, or buried and hoarded, but still the increasing flow of silver to the East continues, without apparently affecting the general course of trade or of prices.

Trade of India.

Exports.

Influx of precious  
metals.

The value of Calcutta exports is above those of any other port, amounting to 27,477,127 *l.*, exclusive of treasure, while those of Bombay are 24,121,108 *l.*; of the Madras ports 7,006,227 *l.*; of Burma 2,790,752 *l.*; and of Karáchi 2,806,246 *l.* The Bombay imports are worth 10,792,758 *l.*; those of Calcutta 15,667,233 *l.*; of Madras 2,615,078 *l.*; of Burma 1,391,217 *l.*; and of Karáchi 1,500,000 *l.*

Imports.

The great article of export from India, if not in value, certainly in quantity, is rice, on which there is a duty. The rice trade is flourishing, and improving everywhere, and, exclusive of transport from one Indian port to another, its value is close up to 4,446,588 *l.* Over 16,000,000 cwts. are exported, of which more than half is shipped from Burmah; Calcutta exports 5,000,000 cwts.; Madras about 2,000,000; Bombay and Karáchi another 500,000. In Burmah the rice exports have enormously increased. Saigon and Bangkok are not only quite unable to compete with British Burma in the European markets, but Burmese rice also goes to China, and supplements the supplies from Siam and Cochin China. There are now no less than 26 mills for cleaning rice at the seaports of Burma, worked by steam machinery.

Cotton

IX.  
TRADE AND  
MANUFACTURES.

## Cotton.

(Cotton comes next to rice as an article of export. The total quantity shipped from Bengal, Bombay, Sind, and the Madras ports is 809,246,087 lbs., valued at 21,272,430 l.) Here Bombay takes the lead, and distances all competitors; she exports 540,404,613 lbs. of cotton, worth 14,820,737 l.; and Sind, 15,344,129 lbs., worth 438,676 l. Bengal follows, with 164,476,961, worth 4,036,956 l.; and then come the Madras ports, with 73,771,643, worth 1,684,942 l.

Cotton manufac-  
ture in India.

The largest quantity in Southern India is grown in the Tinneveli district, 26,600,000 lbs. being shipped from the port of Tutikorin; and 17,000,000 lbs. come from the Godávári district; but the largest shipments, amounting to 29,000,000 lbs., are made at the port of Madras itself. There has been a great increase of cotton exports from the Burmese ports, and the shipments amounted in 1871-72 to 13,831,000 lbs. Piece goods and twists are also exported from the chief ports of the Madras Presidency in no inconsiderable quantities. But a vast quantity of cotton is worked up in India, and the heavy duty on imported piece goods necessarily fosters and encourages the home manufacture. There are no less than 11 spinning and weaving companies in Bombay, and eight in other towns of the Presidency; those in Bombay working 404,000 spindles, and 4,294 looms, by means of 19 steam engines. These are quite independent of the old native manufactories, and were started entirely in consequence of the inferiority of the piece goods imported from Manchester. The deterioration of Manchester goods is undoubted. The first factory was started at Kurla in 1863. This Kurla factory now has 35,836 spindles, and 730 looms; and at Súrat, Broach, and Ahmadabad, there are also large factories. Several thousand hands thus find employment, and a very lucrative branch of industry has sprung into existence. There is also the Elgin Cotton Spinning and Weaving Company at Cawnpúr, and the Goosey Cotton Mills Company near Calcutta, for the manufacture of mule twist from Indian cotton. The pressing and cleaning of cotton for exportation also gives rise to a thriving branch of industry. (In Bombay there are 28 pressing and ginning companies, besides a factory in Ratnagiri, and several worked by steam power, at Khangaon in Berár. There is another such company at Mirzapur, and another at Madras, besides works for pressing at Karwar, Tutikorin, and other ports.) But cotton is still more extensively manufactured by the natives themselves in all parts of India. There are 84 cotton manufactories in the Punjab, and the value of the goods annually turned out is 1,800,000 l.

## Cotton pressing.

Cotton manufac-  
tories.

In the North West Provinces the same industry exists, and in Oudh there is a vigorous trade in coarse homespun cloths. In the Central Provinces there is a large demand for cotton for home consumption, which checks the export materially, and there are considerable manufactories at Nágpur, and one or two other towns. (In Mysor cotton cloths are woven in nearly every district, and in Astagram alone there are 10,730 looms, employing 32,240 workmen, and turning out cloths and cumbles to the value of 64,000 l. a year.) In Madras there is actually a considerable export trade in piece goods and twists. In British Burma quantities of cotton goods are made, chiefly for home use, in small hand-looms. A loom is a usual article of furniture in the house of every Burmese; yet the amount of imported cotton goods is enormous, their value at the port of Calcutta alone being nearly 10,000,000 l.

## Hides and skins.

Rice and cotton are products which are common to all the Presidencies, and figure in the export returns of their ports. Hides and skins are also exported largely from all the ports, upwards of 20,000,000 having been shipped during 1871-72. In this item Calcutta stands highest, having sent off 11,000,000, worth 1,900,000 l.; then comes Madras with 7,000,000; and Bombay and Sind follow with smaller quantities.

## Opium.

The other exports are to a great extent peculiar to special districts or provinces. Thus indigo, tea, and jute specially belong to Calcutta, and opium to Calcutta and Bombay. Of these the opium is most valuable, the 49,455 chests exported, being worth 6,850,000 l. But by far the largest quantity, and the most valuable special article of export from Calcutta, next to opium, is jute. This fibre was always well known, and is described by Buchanan Hamilton, and Roxburgh, but the increased demand for it in Europe and America arose during the American War, and has gone on steadily increasing. It is chiefly cultivated in Dacca, Purniah, Malda, and Rungpur, all Bengal districts; and there are four jute companies with factories for the manufacture of gunny bags, for which there is an enormous demand.

## Jute.

The



The importation of jute into Dundee alone amounts to 1,000,000 bales (about 140,000 tons) a year, and it is an interesting fact that nearly all the whale oil from the Arctic regions is used up by the Dundee jute factories. A great trade in gunny bags, for packing grain, has sprung up between Calcutta and Burma, and in 1871-72 as many as 5,700,000 bags were sent to Burma, worth 180,000 L. They are also in demand for packing sugar. In 1871-72 the quantity of jute exported from Calcutta was 6,100,000 cwts., worth 4,900,000 L., which is an enormous increase on the previous year, besides jute manufactures, valued at 190,000 L. The export of indigo amounted to 67,000 cwts., worth 2,500,000 L., which is also an increase on the previous year; and of tea 17,000,000 lbs., valued at 1,400,000 L. The tea trade is steadily increasing, and is not confined to Calcutta altogether, for some of the Punjab tea finds its way down the Indus, and has successfully competed with foreign tea in Sind, having checked the imports at Karáchi to the extent of 11,540 L. Indiarubber, from the *Ficus Indica* of Asam, is also a product peculiar to the region whose commercial centre is Calcutta. Its export is largely increasing, and in 1871-72 amounted to 15,623 cwts.

Gunny bags.

Indigo.

Tea.

Indiarubber.

[Sugar is one of the most profitable crops, and is grown on the best lands in many parts of India; but no very great quantity is exported, about 372,000 cwts., Madras taking the lead with 200,000 cwts., valued at 125,000 L., and Calcutta and Bombay following.]

Sugar.

The special product of the Madras Presidency is coffee, the great mass of which is brought down the ghauts from the hill districts of Curg, Wynaad, and the Nilgiris, to be shipped from the Malabar ports. Some is also shipped in South Canara, and at Tutikorin. The whole quantity exported in 1871-72 is given at 56,363,000, valued at 1,363,000 L. But this does not include coffee grown in the hills of Travancor, and shipped from the ports of that State. There has been a steady increase in the last few years in the yield of coffee, which is now one of the most important products of the South of India. Chinchona bark is now annually exported, both by Government and by private planters, and the quantity will now rapidly increase year by year. Small quantities of tea, amounting, in 1872-73, in all to 33,000 lbs., and 45,700 cwts. of indigo, and 4,800 of jute, were also exported from Madras. Its other leading exports are oil seeds, spices (including black pepper), tobacco, and cocoa-nuts.

Coffee.

Wool is an export confined almost exclusively to Bombay and Sind, for the shipment from Calcutta only amounted to 1,183 lbs. In Bombay there was a considerable increase, owing to the very high prices ruling in Europe, the export of wool from Bombay in 1871-72 amounting to 22,000,000 lbs., and from Karáchi to 2,000,000. In British Burma, besides rice, the great exports are timber and *cutch*. The demand for timber is increasing, and 42,637 tons were exported, valued at 291,262 L. *Cutch* is manufactured in large quantities for export to Europe from the *Acacia catechu*, chiefly in the Prom district. In 1871-72 the amount exported was 115,755 cwts., valued at 70,142 L.

Wool.

Cutch.

The shipping for the carriage of this great Indian trade is represented by about 1,230 square-rigged vessels, 948 steamers, and over 50,000 native craft, besides 1,414 steamers and sailing vessels trading to British Burma. At Bombay and Karáchi the steamers preponderate, while sailing vessels are more numerous at Calcutta and Madras. The chief present interest in the seaborne traffic of India lies in the development of the transport of merchandise by the Suez Canal. Calcutta and Bombay reckon up their relative advantages with some anxiety in reference to the great changes caused by the completion of railways, and of the canal through the isthmus. As regards the railway traffic from the interior, Bombay is 850 miles from the junction of the lines, while Calcutta is only 560. Moreover, coals are cheaper along the route to Calcutta, the gradients less, and consequently there is less haulage. On the other hand, Bombay is 10 days nearer to Europe by the Suez route than Calcutta; and much of the import trade of Karáchi has already been diverted to Bombay since the opening of the railway lines and the Suez Canal. During the year 1871-72, there were 88 arrivals, and 90 departures, of Suez Canal steamers at and from Bombay, against 75 and 76 in the year before; and the opening of the canal has caused the gradual rise of a trade between Bombay and Trieste, Genoa, Constantinople, and Odessa, which did not exist previous to 1869. The largest trade is with Trieste, amounting to exports valued at 800,000 L., and imports to 77,000 L. The

Shipping.

Suez Canal.

Rivalry of Calcutta and Bombay.

Suez Canal.

Suez Canal steamers.

New routes of trade.

Russian

IX.  
TRADE AND  
MANUFACTURES.Russian trading  
venture.

Russian ventures were largely subsidised by Government. In March 1871 two steamers were sent as an experiment from Odessa to the Indian Seas with a cargo of coal, returning with cotton, rice, coffee, gum, and pepper. In 1872 one of the steamers made two more voyages to Bombay, but the venture was not a commercial success. It was supported by a Government grant, with a view to forcing an Indian trade forward, under the Russian flag.

## Land traffic.

## Afghan povindahs.

In addition to the seaborne commerce of India, there is the land traffic through the passes of the Himalayas, which lead from Sind and the Punjab to the lofty plateaux of Afghanistan, Turkistan, and Tibet. (In 1862 Mr. Davies estimated the trade beyond the mountain frontier at 1,000,000 L., and it has no doubt considerably increased during the 10 years that have since elapsed.) The class of Afghan traders, called Povindahs, pasture their numerous camels on the plateaux of Ghuzni and Kelat-i-Ghilzi, paying tribute to the local chiefs. These Povindahs number some 12,000 fighting men, with 60,000 camels, and their trade, by the Gomul Pass, is worth 60,000 L., in spite of the serious disadvantages with which they have to contend. Every year they lose a hundred or more men, and at least two per cent. of the camels, besides some hundred loads, at the hands of Wuziri and Suleiman Khyi tribes: the latter, as well as the Povindahs, being subjects of the Amir of Kabul. The Povindahs are also the victims of most unequal and heavy exactions at the hands of the Amir's officials. For instance, from among the imports to Hindustan, camel loads of assafœtida and of walnuts, worth respectively, 130 rupees and 16 rupees, pay equally 18 rupees per camel load. Camel loads of pistachios and pomegranates, worth 120 rupees and 30 rupees, pay 32 rupees and 18 rupees. Among exports from Hindustan, English cotton goods, worth 1,000 rupees the camel load, pay 74 rupees; indigo, valued at 400 rupees, pays 72 rupees; tea, worth 800 rupees the load, pays 98 rupees duty. If the route was made safe, and the duties were fixed at a moderate *ad valorem* rate, the Povindah merchants might make four trips in the year instead of one, because they could proceed independently, instead of being obliged to collect in strong caravans; and the value of the trade would assume much larger proportions. The Kafilas move towards the plains in October, leaving their families at the foot of the hills. (The largest proceed to Multan, and thence find their way to the chief marts of India, going by Bhawalpur and Sirsa to Delhi, Benares, and Calcutta. They bring down the wool of Kerman to Amritsar and Ludhiana, which places do not attempt to rival Kashmir in the production of the higher descriptions of shawls, but prefer to produce the coarser and cheaper article most in demand. As the same looms do not suit both staples, the demand in these towns for the finer Turkistan pashmina (the Kuchári and Turfani) is small, and they draw their supply of the coarse staple from Changthán. It is only used to give quality to the Wahab Shahi fabrics made out of Kerman wool. In 1851-52 the import of Kerman and pashmina wool into Amritsar amounted to 1,250 maunds of the last and 100 of the first; and ten years later there were 1,000 of the first and 500 of the second. Now Kerman wool is one of the most important Povindah imports by the Gomul and Gwaleyri route. The Povindahs also import raw silks, gold and silver wire, dried fruits, and almonds of Kabul, horses and ponies; returning with cotton and woollen goods, scarves, the gold thread of Delhi, the brocades of Benares, indigo, and drugs. This traffic has existed from time immemorial, but the commercial relations between British India and Eastern Turkistan, across the Himalayas, only date from 1867, when Dr. Cayley was first sent as Resident to Ladak. In 1870 the Maharajah of Kashmir was induced to abolish transit dues on goods passing from India to Central Asia, the negotiations being conducted on the part of the English Government, by Captain Grey. The equivalent given was the remission of all Indian sea-board duties on trade between the Maharajah's territories and Her Majesty's dominions. It was arranged that the Maharajah should found a town on the route by the Changchemmo Pass, to be a free market where the Indian trade in tea, cotton goods, cutlery, &c., brought so far on good roads made by ourselves (there being a cart road up to Kulu, and a good mule and camel road in course of construction through Lahoal), might meet the Turkestan pashmina, Tibetan wool, and Changthán borax. A central mart will permit of two yearly journeys being made by the Turkestan traders, instead of one, and at once develop the trade, already much increased by the removal of duties and other impediments, and by the improvement of the communications. One item of trade for which there

Duties levied by  
the Amir of Cabul.

## The Kafilas.

Establishment of  
central mart.

there is a great demand in Europe, is borax. It is procurable at Rudok, in Changthán, at 10 annas per maund, of such quality that only about a quarter is lost in refining, whereas that obtained at Puga, the Maharajah's monopoly, loses one-half. The former, however, has now to be brought on sheep to Rampur, on the Satej, at the rate of two miles a day, so that the price in the plains becomes 6 to 7 rupees a maund, raw, and 15 rupees per maund refined; and it is exported at 25 rupees a maund at the sea board. Notwithstanding this profit the export is small owing to the difficulties under which the supply new labours. The consequence of the abolition of transit duties was, that by 1871 the traffic had increased seven-fold; in that year it amounted to 124,177 *l.* The Yarkandi merchants used to meet the Indians from the Punjab at Leh, but now the Amritsar traders find that the Yarkandis are coming down in yearly increasing numbers to the Punjab to attend the Palampur fair in Kangra, so they do not trouble themselves to undertake the weary journey up to frozen Ladak. It is to be regretted that nearly 50 per cent. of the total imports from Turkistan consists of bhang. But next in importance comes gold dust. £. 8,590 worth was bought in 1871, and the supply is likely to increase, as a new goldfield has been discovered near Khotan. Next comes pashmina, or shawl wool, most of which goes to Kashmir, hardy baggage ponies, silver ingots, carpets, felt sheets, and raw silk. The latter article is capable of great development. The Yarkandis take back cotton piece-goods, for which there is an immense demand, Kashmir shawls, sugar, Kangra tea, gold brocades of Benares (kincobs), and spices. Mr. Shaw has recently called the attention of the manufacturers of Manchester and Bradford to the importance of developing this trade. Kashgar is only 390 miles from Jhiam, in the Punjab; and it is demonstrable that English merchants could convey their goods to Turkistan at a cheaper rate than the Russians, and that they could, therefore, undersell them. The cost of transport of 1 cwt. of cotton piece-goods from Moscow to Eastern Turkistan is 4 *l.* 7 *s.* 8 *d.*; the same from England is 3 *l.* 17 *s.* 5 *d.* All that is necessary is to send suitable goods to the markets, and to study carefully the tastes of the buyers. The goods brought in exchange are admirably suited for a long and difficult mountain route, being of small bulk and great value, raw silk and gold dust. A great development of this interesting trade may be expected in the near future. In the Eastern Himalayas there are fair trade routes from India to Tibet, by Nepal, by Darjiling, by Bhutan, and by Asam and Tauang. The latter is most used, and there is a great fair twice a year at Udelgiri; but it is

IX.  
TRADE AND  
MANUFACTURES.  
Trade with Eastern  
Turkistan.

Yarkandi traders.

Trade with Eastern  
Turkistan.

Sudya Fair.

hopeless to expect anything but opposition from the Chinese Government. An annual fair is held at Sudya, near the north-eastern frontier of Asam, which is frequented by Mishmis, bringing indiarubber, wax, skins, and other produce from beyond the frontier, and by people of the Abor, Miri, Khampti, and Singpu tribes. The total value of the forest products brought to the fair is estimated at 2,570 *l.*; and, in exchange, the tribes take away with them Asam cloths, brass loias, silver earrings, beads, brass wire, and opium. There is an evident wish for an active and extensive trade with the markets of the plains, and the fair is tending more and more to cement friendly feelings with the hill people. It is extremely important, because the Sudya fair is the forerunner of future direct commercial intercourse between Asam and the western provinces of China.

As the largest portion of the products of India is consumed in the country, the internal trade is even more important than that with foreign countries; and the condition of the people may, to some extent, be shown by the character of the traffic between province and province. The materials for such an examination are not, however, very complete. In the Punjab the exports and imports nearly balance each other; the latter slightly preponderating, 2,350,000 *l.* against 2,780,000 *l.* The trade on the Indus, valued at 105,000 *l.* for the up traffic, and 630,000 *l.* for the down, is registered at Sakkhar, in Sind. The Punjab is an important manufacturing country, the value of the yield from looms and workshops being 4,850,000 *l.* From the handlooms come white and coloured cotton cloths, and thick floorecloths with coloured stripes. The woollen manufactures are from the exquisitely soft fleeces of Rampur and Kerman, from country sheep, wool, and goat and camel hair. The silk manufactures of the Punjab form an important branch of industry. The chief seats are at Amritsar, Lahor, Multan, Bhawalpur, and Jalandur; and the raw silk is obtained from the Afghan and Yarkandi merchants, from Bengal and China. The manufactures are valued

Internal trade.

Punjab.

Indus traffic.

Punjab manu-  
factures.

## IX.

TRADE AND  
MANUFACTURES.Manufactures of  
Delhi and Benares.Bombay silk  
manufactures.

## Exhibitions.

at 150,000 *l.* a year. From Delhi come the silk embroideries, and Benares is famous for its gold brocades. In the Bombay Presidency there are extensive silk manufactures, all by handloom weaving, and all consumed at home, the raw silk coming chiefly from China and the Persian Gulf. At Ahmadabad there are manufactures of brocades rivalling those of Benares. The exhibitions at Lahor, Rurki, and Calcutta, in 1864, at Nágpur in 1866, and at Madras, and other places in India, have been very useful in stimulating manufactures, and making designers mutually acquainted with the products of the different parts of a vast empire. The commencement of European influence of the best kind on Indian manufactories is beginning to be clearly perceptible. An advance is being made in every department, but schools of design are much needed, and one at Lahor has been determined on. The labours of Dr. Hunter at Madras in this direction have been most useful.

Prospects of Indian  
manufacturing  
industry.

If the once famous manufactures of Bengal, the silk stuffs and Dacca muslins, have nearly disappeared, it has only been to change their seats, but not to be destroyed. These industries not only still exist, but they are growing in importance, and in some respects are likely to hold their own against the imports from Europe. The very fine and richly decorated tissues, for instance, will probably always be better and more cheaply manufactured by hand.

## Oudh trade.

Trade in the  
Central Provinces.

In Oudh there is great excess of exports of agricultural produce over imports, and the province is dependent on outside trade for all manufactured goods, except coarse cotton cloths. The Central Provinces have large cotton manufactories, and the railways carry the great bulk of the traffic. A good deal of China silk is also used up in making the ornamental borders of the better sort of Nágpur cottons; and a considerable quantity of coarse brown silk, commonly called tussac, is raised in the Chattisghar country. (The importation of cotton and grain from Málwa is increasing, the arrival of cocoanuts from the North West Provinces has nearly doubled, and the imports from the east coast consist of salt and tobacco. Cotton is, of course, the great article of export. The whole external trade of the Central Provinces is valued at 14,003,917 *l.*) In Mysor there is no regular system of registering the trade; but the value of the exports for 1871-72 is given at 1,100,000 *l.* They consist of betel nut, coffee, cotton, cardamoms, rice, silk, and sugar. The imports were 1,070,000 *l.*, consisting mainly of iron, gold, pepper, salt, and pulses. Silk and cotton manufacture is carried on to a considerable extent, as well as the working of cutlery, copper vessels, and gold and silver lace. There is a large sugar manufactory at Palahalli, in the Ashtagram division. In the Madras Presidency complete information respecting internal trade and manufactures is wanting.

## Mysor.

## Mysor trade.

Mysor manufac-  
tures.

## Fairs in India.

The numerous fairs held all over India, generally on occasion of pilgrimages to shrines, are most useful as stimulants to trade, and as extending the knowledge and increasing the wants of the people. At the great Delhi fairs 50,000 persons assemble, some of them coming from distances of 500 miles; and at the last great solar eclipse at Thanesar, in Ambála, in 1861, 200,000 persons assembled, from distances extending to 1,000 miles; and there are 127 other fairs in the Punjab, at which the assemblies number 10,000 and upwards. A set of rules has been promulgated for police management, water supply, conservancy, and medical aid, during the more important fairs. In the Bombay Presidency the *jaltras*, or fairs, are held in all parts of the country; and in Sind, where they are held in honour of Moslem saints, the fairs are very numerous. This custom of assembling at shrines, and of taking the opportunity of the occasion to display merchandise, prevails in all parts of India, and is of immense advantage to the commerce of the country.

## Use of Exhibitions.

The exhibitions have served similar useful ends, but on a much more extensive scale, by disseminating knowledge of the products of India throughout all parts of the country, and by giving merchants and manufacturers broader and more enlightened views of their own interests, and of the interests of their customers. Mr. Baden Powell's handbooks of the manufactures and arts, and of the economic products of the Punjab, are most valuable results of the Lahore Exhibition. Dr. Forbes Watson has done much to furnish the means of obtaining an accurate knowledge of Indian wants to manufacturers in England. He has collected specimens of textile manufactures of India, in 18 volumes, of which 20 sets

Dr. Forbes  
Watson's volumes  
of textile manu-  
factures.

have been prepared. They may be looked upon as 20 industrial museums to promote trade operations between the East and West in this department of commerce. They exhibit tissues which suit the Indian markets, and illustrate the principles which must be observed in all attempts to introduce into them designs which will satisfy the tastes of the people. These volumes have been presented on condition of their being kept in suitable buildings, and made readily accessible to 12 of the principal centres of manufacture in Great Britain, and to seven of the cities of India.

Dr. Forbes Watson has also submitted an elaborate and carefully thought-out scheme for an industrial survey of India, with a statement of the measures required to make its results available to commerce. There is still a want of a really exhaustive and systematic knowledge of the various products of India. There are abundant materials for a general superficial acquaintance with the subject; but more precise and comprehensive information is required, in order to render such knowledge really useful and practical. There are 2,000 articles named in trade returns, and 7,000 more are mentioned in various works, while the list is doubtless very incomplete, and there is some confusion about almost every article. A complete collection and identification of raw produce and of manufactured goods are required; trade museums might be formed, and an industrial survey organised. Limited markets are a bar to improvements, and production on a small scale is wasteful and costly. The proposed survey, among other useful results, might promote an extension of the demand for products of all kinds, by affording to every part of India easily accessible means of information with regard to the productions of the whole country. Dr. Forbes Watson's proposals are now under the consideration of the Government of India.

Industrial survey  
of India.

X.—CONDITION OF THE PEOPLE.

X.  
CONDITION  
OF THE PEOPLE.

THE order for taking a general census of the population of British India, and the measures that have been adopted for introducing a system of birth and death registration, show the pressing need that is felt for accurate statistics in all administrative work. Without correct information regarding the numbers of the people, there is no basis on which to found conclusions on the growth and rate of increase, on the sufficiency of food supplies, on the incidence of taxation, or on the spread of education. Such information is also necessary in order to show the health and general condition of the people, and the extent to which the rate of increase is modified by variations of seasons, conditions of water supply, and other causes. The only complete results of the census that have been received are from Bengal, in the form of a most interesting and elaborate report by Mr. Beverley, the Registrar General. In the North West Provinces, Central Provinces, Madras, Bombay, and British Burma, the details of the census operations had not yet been worked out, although the general results for Madras are given; and in the Punjab and Oudh no census was taken, because measures of the kind had been adopted so late as in 1868 and 1869.

Census of 1871.

Importance of a  
census.

Bengal Census  
Report.

Returns of census  
not made up in  
other provinces.

In the Provinces under the Administration of the Lieutenant Governor of Bengal the want of statistical information had reached an extreme point. One or two examples will show the sort of dependence that can be placed in figures that are given in previous Administration Reports. In 1870 the population of Naddea was given at 568,712, according to the "latest returns." The population, according to the census, is 1,812,795. The same Report of 1870 gave the population of Cattack at 215,835. It is really 1,449,784. The census was taken under the superintendence of Mr. Beverley, between December 1871 and March 1872. It was found impossible to make a synchronous census, or to adhere closely to all the details of the system adopted in England. All attempts to lay down any detailed scheme of operations to be adopted everywhere alike were abandoned, and plans were devised which seemed best adapted to attain the

Inaccurate esti-  
mates in Bengal.

Mr. Beverley.  
Synchronous  
census impossible.  
Principles of the  
census.

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object in different localities. The English method was adhered to as closely as possible, and departed from as little as was practicable; and in some of the more important districts, including Rájsháhi, Dacca, and Calcutta, the enumerations were taken simultaneously.

Arrangements for  
the census.

The plan generally adopted was as follows:—The old divisions of the country were into villages, pergunnahs, chucklas, circars, and soubahs or vice-royalties. But the judicial divisions were different, so that the limits of a collector's jurisdiction as regards revenue matters are often not conterminous with his magisterial jurisdiction. There was too much uncertainty about such boundaries, and they were unsuited for census purposes. The country is also divided into police jurisdictions, called *thannahs* (by Regulation XXII. of 1813), each with an area of about 20 square miles, and as the agency of the police was resorted to, it was found most convenient to take the census according to these *thannahs*. The first step was to cause a list of villages and hamlets in each *thannah* to be prepared. Two enumerators were then appointed for each village, who were generally the head men. Their first duty was to submit a list of houses, with the names of occupants, and the correctness of a certain number of these lists was tested by the police. The census forms were then distributed, to be filled in and returned. The municipalities were called upon to make their own census arrangements, and the hill chiefs made lists of their followers. The boat population, which was an important item, consisting of 300,000 persons in 60,000 boats, was reached by taking a census at every landing during several days, the boats being marked as they were counted to prevent their being taken twice over.

List of villages.  
Enumerators.

Municipalities.  
Boat population.

Feelings of the  
people.

The census appears to have been regarded in some districts with much suspicion by the people, who naturally believed that it was the forerunner of a new tax; and all sorts of rumours were spread abroad. One man hid his babies, on the ground that they were too young to be taxed. In Murshidabad it was believed that the authorities intended to blow the surplus population away from guns; in other places it was reported that it was to be drafted to the hills, where coolies were wanted. But generally the people patiently resigned themselves to their fate, and were counted without making any actual resistance; and they are doubtless waiting, in great suspense, for the expected consequences of the measure. The form distributed to the enumerators had columns for the number of houses, the names of adult males in each, the number of adult females, boys, girls, and the totals, with caste, nationality, and occupation. The census was not scientifically accurate from not being simultaneous, but it was taken with great care, and the population is, if anything, under-stated. Its total cost was 21,600 *l.*, or about a farthing a head.

Forms for the  
census.

Results of the  
census.

This was the first regular enumeration of these Provinces, and the result is most surprising. Indeed, Sir G. Campbell observes that it may almost be said to revolutionise our ideas both in regard to the amount of the population and relatively in regard to its distribution in different districts, races, and religions; while by showing that the numbers vastly exceed any former computation, it wholly altered calculations with respect to the incidence of taxation, the consumption of salt, and many other matters. The total number of persons counted in the provinces under the Government of Bengal was found to be 66,856,859; of whom about 2,000,000 belong to the tributary States. The population given in the Administration Report of 1870-71 was 42,500,000; so the reality was more than half again, and all calculations based upon those figures are wrong to that extent. Half the area of the Bengal Government consists of the hilly and thinly populated tracts of Chota Nágpur, and Assam, with only 87 and 63 souls to the square mile. But the other half is one of the most densely peopled countries in the world. In Bardwán there are 573, in Patna 553, in Rájsháhi 500 souls to the square mile, as compared with 262 in the United Kingdom, and 422 taking England alone. For the whole of Bengal, in the restricted sense of that word, the number is 430, for Behar 465. But, if the unculturable or uncultivated lands at the foot of the hills, or waste and marshy, are left out, the food-producing area cannot average less than 650 souls to the square mile, or one for each half acre, crops being excluded which are not food producing. This enormous population, moreover, inhabits a country which exports

Population of  
Bengal.

Enormous popula-  
tion.

exports grain, so that the supply of food is abundant in ordinary years. But the consequences of a failure of crops are terrible to think of, and the bare possibility points to the urgent importance of a perfect system of communications between all the grain-producing provinces both by sea and land.

The census shows that the number of men and women is nearly equal, there being 99.6 females to every 100 males; and a tendency to excess of males over females nowhere appears. In some districts the male, in others the females, preponderate. Proportion of men to women.

About two-thirds of the population are agriculturists. But the most interesting results are those which show the proportion of Hindus and Muhammadans. In Central and Eastern portions half the population is Muhammadan, while in some of the districts the latter largely preponderate. Yet it is very remarkable that this preponderance does not prevail around the old seats of Muhammadan power. In Dacca there are comparatively few, round the site of ancient Gour hardly any, at Patna only 12 per cent. of the inhabitants, and at Murshidabad the vast majority of the people is Hindu. The conclusion is that the Bengal Muhammadans are not descendants of the old conquerors, but of converts, who were low-caste Hindus, and embraced Islam to escape from their ignoble position under the Hindu system. These provinces contain 21,000,000 Muhammadans, more than in any other country in the world; and they are probably on the increase. It is asserted (but the assertion must be taken with reserve) that it is a mistake to suppose that the Hindu religion is not proselytising. Any number of outsiders, so long as they do not interfere with established castes, can form a new caste, and call themselves Hindus, and the Brahmins are always ready to receive all who submit to and pay them. Muhammadans.  
Hindus.

In the North West Provinces the figures of the new census give the population at 31,300,000, and the density at 374 souls to a square mile; that of the thickly-peopled district of Benares, being 797 to the square mile. There are reported to be 25,000,000 Hindus to 4,000,000 Muhammadans, the latter being divided into Syeds, and the descendants of Arab, Mogul, and Pathan conquerors. In the Punjab, too, the returns for 1872 give a population of over 17,600,000, with a density of 172 to the square mile. Here the Muhammadans largely preponderate, numbering 9,000,000, to 6,000,000 of Hindus, and 1,000,000 Sikhs. In Oudh the returns of 1869 give 11,200,000, and a density of 465 to the square mile, there being 1,000,000 Muhammadans to 10,000,000 of Hindus. In the Central Provinces a census was taken in January 1872, according to which the population amounts to 9,225,000 souls, the density being 109 to the square mile. In 1866 the population was given at 9,000,000, and 79 to the square mile. In the Berars, a portion of the Haidarabad territory, in 1867, the population was 2,230,000, and 131 to the square mile. Population, North West Provinces.  
Population, Punjab.  
Population, Oudh.  
Population, Central Provinces.  
Population, Berars.

The census of 1872 was very carefully taken in the Madras Presidency, and the general results have been announced, although the details are not yet worked out. The houses were first enumerated, and the house to house enumeration was commenced on the 15th of July 1872, and completed by the end of the month, at a cost of 20,000 l. The population of the Presidency in 1872, is given at 31,300,000 souls. In 1856 it was stated to be 26,000,000. Of the four nationalities the Tamils are by far the most numerous, numbering about 16,000,000 souls, while about 8,000,000 speak Telugu, 6,000,000 Canarese, and 2,000,000 Malayalma. The wild tribes and travellers were counted for the first time in 1872. In the Bombay Presidency the returns of the census are not yet available. The old return gave 14,000,000, with a density of 94 to the square mile; the population being thickest in Ahmadabad, where there are 185 souls to the square mile. In Sind there are only 34 to the square mile; but this again probably gives a very erroneous impression, the area including a large extent of desert land. In British Burma a census was taken in 1872, but the results are not yet known. No regular census had ever been taken before, but among the returns of district officers there is a nominal roll with reference to the capitation tax, and the population in 1872 is stated to have been 2,500,000. The density is said to be 27 to a square mile in the whole of British Burma, and 53 in Pegu. Population, Madras.  
Population, Bombay.  
Population, British Burma.

## X.

CONDITION  
OF THE PEOPLE.Registration of  
births and deaths.Registration,  
Bengal Govern-  
ment.Registration, North  
West Provinces.Registration,  
Punjab.Registration,  
Oudh.Registration,  
Central Provinces.Registration,  
Berar (Hyderabad  
Territory).Registration,  
Madras.Registration,  
Bombay.Condition of the  
people.

Bengal ryots.

North West Pro-  
vinces, ryots.Wages in the  
Punjab.

Wages in Oudh.

Wages, Central  
Provinces.Wages, Mysor  
and Curg.

Wages in Wynaad.

There have been attempts to introduce a regular system of registration of births and deaths in all parts of India, and much improvement has been effected in this respect; but the returns are still very unreliable. In Bengal they appear to be made by the Sanitary Commissioner, and are stated to be quite unreliable. In the North West Provinces a new system of mortuary registration has been introduced through the agency of the village police who make reports to the regular police, and the civil surgeon is the district registrar. The great increase in reported deaths is no doubt due to more careful registration, but 19 per 1,000 must still be far below the real mortality; for the death rate in England is 22 per 1,000. Great pains have been taken in the Punjab to test the accuracy of the mortuary returns, and to render them more complete, and they are said to be increasing in accuracy year by year. The rate is given at 24 per 1,000. The system of birth registration in the Punjab has only hitherto been introduced in the large towns, and Jallandar is the only district in which it has been extended to rural circles. In Oudh the death returns are based on the verbal reports of the village police, and are evidently quite unreliable, for the rate is stated to be as low as 16·8 per 1,000. In the Central Provinces the registration forms, which had been issued by the Government for all the provinces of India, were brought into use in 1870. The system is for the *kotwárs*, or village messengers, to report the births and deaths at the police stations once or twice a week, but merely from memory. There are about 52 villages to each registration station, and the returns are necessarily very imperfect, as is shown by the death rate, as in Oudh, being stated to be only 16 per 1,000. In Berár the registration was carried on through the agency of district and municipal police, the country being mapped out into 99 rural circles, and 31 towns.

In the Madras Presidency the system is better, but still the returns are evidently very far from the truth. An attempt has been made to record births, as well as deaths, by the village accountants. The rate of births is given at 21, and of deaths at 18 per 1,000. In Bombay there is a great dearth of all statistical information, and there are no trustworthy maps. Registration was introduced in 1865, with a view to ascertain and record the mortality of each district in proportion to the population, to investigate the cause of excess in any district, and to adopt precautionary and preventive measures. It is the duty of the village officers to record the births and deaths, and report them in a given form at the mamlutdar's office, where they are tabulated. The death-rate is, again, far too low, being stated to be 19 per 1,000. It is clear that a vast number of deaths are concealed or never reported in all parts of India.

The absence of correct statistics makes it difficult to arrive at correct conclusions respecting the actual condition of the people, and the extent to which they can enjoy life. For instance, the enormous error in the estimate of the population of Bengal entirely vitiated previous calculations with reference to the consumption of salt in each family, and confidence is destroyed in any such estimates for other parts of India. The comparison between rates of wages and prices of grain is another test which is not always applicable. In Bengal the agricultural ryots, or small farmers, are a more numerous class in most districts, and they benefit by a rise in prices. The Calcutta Missionary Conference had dwelt on the miserable, abject condition of the Bengal ryots; and there is evidence that they suffer many things, and are often in want of absolute necessities. In the Punjab and the North West Provinces the people are more prosperous, though the rural towns and villages are in a very backward state, and wages are low. In the Punjab, wages range from 1s. to 6d. a day for skilled, and 6d. to 2d. a day for unskilled labour; and there has been a steady rise in the price of grain. In Oudh they are only 3d. for skilled and 1½d. for unskilled labour a day. In the Central Provinces skilled labour fetches 1s. to 6d. a day, and unskilled 3d. to 1½d.; while prices fluctuate and vary very much in different districts. Rice, 2s. 6d. a maund of 82 lbs. in Nágpur, and about 2s. in Raipur. In Mysor and Curg the wages range higher, in consequence of the great demand for labour, caused by the proximity of the coffee plantations of Curg and Wynaad. Many thousands of coolies annually come up to Wynaad both from Mysor and Malabar. In 1860 the wages were three annas a day; in 1865 they received four annas (3d.) a day; and now the pay of an unskilled labourer in Mysor is stated to range in some places as high as 6d. a day.



day. The Mysor people, who are Canarese, live on a small dark coloured grain called *ragi*, and the natives of Malabar on rice; and the rise in the price of grain has nearly, if not quite, kept pace with the increase in wages. The Mysor people store their *ragi* in underground pits, for use in time of scarcity, where it will keep for 40 or 50 years.

On the coffee plantations the labourers are supplied with suitable huts of split bamboo plastered with mud, and as soon as the coffee crop is picked they return to their homes in Mysor and Malabar, to look after their own crops and spend their money, returning to the plantations for the weeding during the monsoon. In the hill district of Curg the wages of skilled labour are 10*d.*, and of unskilled, 3½*d.* a day.

Labourers on coffee plantations.

In the Bombay Presidency wages are much higher, from a variety of causes; a skilled labourer receives from 2*s.* to 8*d.*, and an unskilled labourer from about 6*d.* to 3*d.* a day; and the price of rice ranges from 14*s.* to 7*s.* a maund. Famine prices ruled in part of the Deccan towards the end of 1871. The best account of the Bombay peasantry is still, probably, that by Mr. Coats, written 50 years ago. The clothes of a man then cost about 12 shillings, and the furniture of his house about 2*l.*; and his food consists, not of rice, but of dry grains, such as *bajri* and *jowari*, with pulses and salt. The people of Mysor, and most of those in the Madras Presidency, also live on dry grains and pulses. Dr. Forbes Watson has shown the proportion in which certain Indian pulses must be eaten with dry grains, in order that the mixture may contain the same proportion of carboniferous and nitrogenous matter as is found in wheat, namely, six to one. The natives habitually combine these two classes of food in their dishes in such proportion as to give the same amount of nourishment as wheat, and thus show how wonderfully correct their immemorial experience has made them. Their weary round of labour is brightened by several festivals, and by annual pilgrimages at the temples.

Wages, Bombay.

Bombay peasantry.

As to the morals of the people, whatever may be said of the larger towns, the residents of villages are no better and no worse than the same classes elsewhere; singularly temperate, as a rule; chaste, honest, peaceful, singularly docile, easily governed, and patient. Of course there is great variety of temperament and character, as there is of physical appearance in the different latitudes over which British India extends.

Morality.

The climate and sanitary condition of India give rise to pestilences which periodically carry desolation over the country, while disease in its worst forms is never absent. Hospitals, richly endowed and admirably regulated, supported as well by Government as by private munificence, exist in all the large towns; and great efforts are constantly made to bring the benefits of medical skill and knowledge within reach of the poorer classes. In Bengal there are 160 dispensaries scattered over the country; and certain medicines have also been supplied to villages for sale at cost price. In the North West Provinces there are 90 civil hospitals where patients are received for treatment, and 41 dispensaries where medicines are given out, and patients advised. The dispensaries are managed on the principle of grants in aid. When the people of any place erect a suitable building at their own cost, and guarantee a fixed subscription, the medical staff is granted and paid by the Government. The dispensaries are also made use of for training medical pupils, who are passed on to the medical college at Agra. At Bareilly and Naini Tal, women are regularly trained in medical and surgical science; and one or two have set up successfully as private practitioners.

Diseases in India.

Hospitals.

Dispensaries in Bengal.

Dispensaries in the North West Provinces.

In the Punjab there are 110 hospitals and dispensaries, being one to every 160,000 persons. The grant-in-aid system of the North West Provinces was introduced in 1866, and since then the number of dispensaries has been increased by 41. The Mayo Hospital, connected with the Lahor Medical School, was completed in March 1872, with accommodation for 114 patients. A system prevails in several districts of the Punjab of furnishing medical aid to the people through the instrumentality of native *Hukims*, whose sons are now frequently educated at the Lahor Medical School, and then sent back to their own districts for employment by the local authorities. The *Hukimi* system in the Punjab is the utilisation of native doctors in times of epidemics, by giving them elementary instruction,

Dispensaries, Punjab.

X.  
CONDITION  
OF THE PEOPLE

Dispensaries,  
Oudh.  
Dispensaries,  
Central Provinces.  
Dispensaries,  
Madras.  
Dispensaries,  
Bombay.

instruction, medicines, and pay. In Oudh there are 26 Government dispensaries and one private. The number of such institutions in the Central Provinces during the year under review was 92, of which 76 are partly supported by Government aid, by the appointment of a native medical officer, and the supply of medicines; all other charges being met by local subscriptions. In the Madras Presidency the dispensaries are numerous and work well; and the demand for additional establishments of the same kind are received from many quarters. They are held in high estimation by the people, who are generally willing to support them by direct taxation. In Bombay there are 121 dispensaries in the different districts, 30 attached to civil hospitals, 30 wholly supported by Government, one self-supporting, and 60 called charitable dispensaries.

Sanitation.

Much of the disease in India is due to bad water and bad drainage; and, as regards rural towns and villages, improvements must mainly be the work of the people themselves. Works of this kind have been undertaken with excellent results, as regards the large towns. The new water supply has had a very marked influence in improving the health of the city of Calcutta, and a similar result may confidently be expected from the works at Madras. The great drainage scheme at Cawnpur is also progressing. A very important sanitary question has long been under consideration, with reference to the effect of irrigation canals on the health of the districts through which they pass. As long as in 1847 it was found that an extensive epidemic influence had pervaded a large portion of the North West Provinces of late years, and that disease was more prevalent and severe in canal irrigated districts. A committee reported on the subject, suggesting that irrigation might be stopped at a distance of 200 yards from the village sites, and a double row of trees planted round the unirrigated space; and that shallow pools about villages should be drained, when the soil is stiff and clayey. Salubrity depends, in a great measure, on the nature of the soil and the efficiency of surface drainage. It was found that the percolation of water caused an efflorescence of soda to rise up on the surface of the land, causing not only destruction of the fertility of the soil, but sterility of women and cattle; in certain localities all the inhabitants of villages were found to have enlarged spleens from the continuance of fever. At present there are several water-logged tracts in Saharanpur and Muzaffarnagar, where the people are fever-stricken. Canal irrigation is to be restricted where the spring level is near the surface, and the cuts are to be deepened, which are now unequal to carry off natural drainage. Meanwhile, special medical aid is given, and native doctors have been sent round to dispense quinine from village to village. In the Madras Presidency an opinion prevails that no connection has been proved between canal irrigation and the increase of fever; for the disease affects districts quite irrespective of wet or dry cultivation.

Water supply of  
Calcutta and  
Madras.

Drainage at  
Cawnpur.

Effect of irrigation  
canals on health.

Water-logged  
lands in Saharan-  
pur.

Effects of canals on  
health in Madras.

Fevers.

Deaths from fevers.

Importance of  
cheap supplies of  
quinine.

Bardwan fever.

Fever is by far the most prolific cause of death in India, carrying off, except in exceptional years when cholera is raging, very many more than all other diseases and accidents put together. The returns, exclusive of Bengal and the North West Provinces, and Burma, give upwards of 900,000 deaths from fever in 1871, so that the total number in all India cannot be far short of a million and a-half. At least half these lives might be saved if we could put quinine retail into every native druggist's shop at 1 rupee per ounce. It is the only real remedy, and the people believe in it, and are ready and anxious to take it. The vast importance of the introduction of chinchona cultivation into India cannot, therefore, be over-estimated; and there is now every prospect of being able to manufacture the febrifuge alkaloids at the plantations at a cheap rate, and of thus conferring a priceless boon on the people. Never was it more needed than now, when fevers are breaking out, in some localities, with unprecedented virulence. (The fever which ravaged Bardwan in 1869 was not got under until early in 1870, leaving the people exhausted in body and means. In July 1871 it again broke out, in the same district, with renewed violence.) Five dispensaries were opened in the town of Bardwan, and 20 in the district, to which the Maharajah contributed 5,000 L., and at the close of the year there were 50 dispensaries and 12 food relief depôts. A grant was made of 10,000 L. from Imperial funds in aid of operations for medical relief; quinine was supplied, native doctors were sent to the district, and 40,000 patients received medical aid. The Bardwan fever is attributed to the bad effects of the silting up of the natural drainage channels

X.  
CONDITION  
OF THE PEOPLE.

Fever in Madras.

nels of the country. Malarious fever also prevailed in the tracts that had been inundated in Murshidabad and Rájsháhi, but otherwise Bengal was comparatively free from epidemic disease. In the Madras Presidency there was a great increase of deaths from fever, as compared with the returns in the three previous years; and it is suggested that there is a great epidemic wave of malaria passing over the peninsula from north to south, decreasing in the Northern Sarkárs, and increasing in the extreme south.

There was very little cholera in the north of India during the year under review; and, though the death-rate from that scourge was heavier in Madras, the Presidency was nearly free from cholera by the end of 1871. But there are indications of a new wave of the disease in the north, and warnings have been given of its possible approach, to the municipalities.

Small-pox, as a preventible disease, has decreased steadily, but with repeated reactions, since the introduction of vaccination, and vigorous efforts are being made throughout India to promote the spread of the protective check upon the ravages of the disease. Nearly two million persons were vaccinated during the year under review in the different Provinces of India. In the North West Provinces vaccination made steady and continued progress; the number of vaccinators was increased to 270, and the operations were 10 per cent. more numerous. The Lieutenant Governor looks to a steady increase until the vaccinating establishment is strong enough to afford complete protection from small-pox to the whole infant population. In the Bombay Presidency important changes have been effected in the vaccination department, which were introduced in August 1871. Each talúk is to be provided with an itinerant vaccinator, paid from local funds, and each collectorate is to have a superintendent of vaccination. In the Madras districts, especially in South Canara, the small-pox has broken out with some violence, the deaths from it being double what they were in the previous year, the small-pox increasing with the decline of cholera. It has been observed that these two pestilences run in cycles, the one breaking out afresh as the other declines.

Mortality is fearfully aggravated by the passion of the people for pilgrimages. All ages and sexes traverse vast areas, and die by hundreds on the route. Dr. Hunter's book on Orissa has made an awful disclosure, and it is not easy to say what remedy the Government can devise. The Muhammadans go in numbers to Mecca, Kerbela, and Jerusalem, and many never return.

One extraordinary feature of Indian life is the number of human beings destroyed by wild beasts. Rewards are offered by the Government for the killing of these animals; but in some districts the loss of life is very great, and in others, where it is less excessive, the reason given is that goats are very abundant, and that wolves prefer kids when they can get them. Deaths by snake bites are very frequent, no fewer than 14,529 persons having lost their lives in that way in 1869, while in 1871 the total deaths caused by dangerous animals of all classes amounted to 18,078. Dr. Fayrer is of opinion that if systematic returns were kept, the annual number of deaths from snake bites (exclusive of all doubtful cases) would be found to exceed 20,000. The inhabitants of the border lands between jungle and cultivation are killed and eaten by tigers in such numbers as to require the immediate and serious attention of Government both in India and in England. The following are a few out of many instances: "A single tigress caused the destruction of 13 villages, and 256 square miles of country were thrown out of cultivation." "Wild beasts frequently obstruct Government survey parties. In 1869 one tigress killed 127 people, and stopped a public road for many weeks." "In January 1868, a panther broke into the town of Chicola, and attacked without the slightest provocation, the owner of a field. Four persons were dangerously wounded, and one died." "Man-eating tigers are causing great loss of life along the whole range of the Nallai Mallai Forest. There are five of them. One is said to have destroyed 100 people." "Writing from Nuydunka, 1869, a gentleman says one tigress, in 1867-8-9, killed respectively 27, 34, and 47; total, 108 people. This same tiger killed a father, mother, and three children; and the week before she was shot she killed seven people." "In Lower Bengal alone, in a period of six years, were killed by wild beasts, 13,401. In South Canara in July 1867, 40 human beings were killed by wild beasts." The Chief Commissioner of the Central Provinces in his reports shows the following terrible returns of human beings

Cholera.

Small-pox.

Vaccination.

North West Provinces: progress of vaccination.

Vaccination in Bombay.

Pilgrimages

Destruction by wild beasts.

Snake bites.

Destruction by wild beasts.

X.  
CONDITION  
OF THE PEOPLE.

beings killed by tigers: In 1866-67, 372; 1867-68, 289; 1868-69, 285; total for three years, 946. It appears that there are difficulties in the way of killing down these tigers. First, the superstition of the natives, who regard the "man-eating tiger" as a kind of incarnate and spiteful divinity, whom it is dangerous to offend; secondly, the failures of Government rewards; thirdly, the desire of a few in India actually to preserve tigers as game, to be shot with the rifle as a matter of sport. Mr. Frank Buckland suggests an organised destruction of the tiger cubs in the breeding season, and the attraction of full-grown tigers to traps, pit-falls, and other devices, by means of a drug of valerian, of which tigers (which are only gigantic cats) are exceedingly fond.

Emigration. ✓

The dense population of the Provinces under the Bengal Government represents a state of things in which the number of inhabitants might at any time begin to press on the means of subsistence, and emigration, when efficiently watched and regulated, is certainly a good thing. Movements of this kind are sure to take place from one Province to another within British India whenever there is a great demand for labour on the one hand, and a crowded population on the other. Thus the tea planters of Assam, Cachar, and Silhet, have attracted a great number of coolies from the valley of the Ganges. The total number of such emigrants now employed in the tea districts is 39,904, and in 1871 the number despatched thither was 7,022, against 4,863 in the previous year. The mortality in the passage up the rivers has been excessive, but the condition of the coolies on the tea estates is, on the whole, satisfactory, large numbers of time-expired labourers showing that they are contented with their bargain, by remaining. A special law has been passed by the Bengal Government to regulate this. The wages are five rupees to six rupees a month, and strict rules are enforced respecting the provision of lines or quarters of medical aid, and of food for the coolies.

Emigration to tea districts.

Emigration to Straits Settlements.

But beyond the limits of British India there is a constant movement, and there is also emigration from Tanjore to the Straits Settlements.

Emigration to Ceylon.

In the south of India a great annual emigration has long gone on from Tinnevely and other Madras districts to Ceylon, for the coffee-picking season; and satisfactory arrangements have been made by the Colonial Government for their protection. But these Tamil emigrants usually return to their homes in India when the season is over, or after a stay of two or three years. The Government of Ceylon has recently passed an Ordinance to provide for the medical wants of these coolies on the coffee estates. It enables districts to make their own arrangements to supply their medical wants, and it empowers planters to appoint a committee to make regulations for the medical service of their district, subject to the approval of the Government. But if any district fails to make the necessary arrangements, power is given to the Government to step in and take the management into its own hands, imposing an assessment not exceeding one rupee per acre in cultivation. There are 254 vessels engaged in the native passenger trade between Tutikorin and Ceylon during the year 1871-72. The number of Tamil people from Southern India that embarked for Ceylon was 14,625; while, in the same year 13,007 returned to their homes.

Medical aid for emigrants to Ceylon.

Passenger traffic from India to Ceylon.

In the same way the labourers of Mysor and Malabar annually go to the coffee estates on the hills of Curg and Wynaad. In British Burma there were 75,090 emigrants and 97,679 immigrants in 1871-72. The immigrants are mostly coolies from India, who come for the high wages at the rice and saw mills, and return with the money they have saved. Many also come from Upper Burma, for employment on the embankment works.

Emigration to Wynaad and British Burmah. Emigration from and to British Burma.

Distant emigration.

But emigration to distant colonies is not altogether a natural process, is not caused by the spontaneous action of the people, but is brought about to a considerable extent by the persuasion of agents and recruiters. It therefore requires very close supervision on the part of the authorities in India; and accordingly the Indian Emigration Act (VII. of 1871) was passed for the protection of the coolies, and is a consolidation of all previous laws.

Emigration Act.

Emigration agents.

It was provided that the Government of any place to which emigration is lawful, might appoint a person to act as Emigration Agent at Calcutta, Madras, and Bombay, subject to the approval of the local Government; and each local Government is to appoint a proper person to act as protector of emigrants, who

Protectors of emigrants.

is

is not to hold any other office. The duties of the protectors are to inspect vessels, inquire into the treatment of returned emigrants, to report, aid, and advise. The local Governments are also to appoint medical inspectors of emigrants. A suitable depôt for persons engaged as labourers is to be established by the agents at each port to be licensed, after inspection by the protector and medical inspector, but no license is to be in force for more than a year. Emigrants in the depôts are to be inspected at least once every week. Recruiters of labourers, who are to wear a badge, must be licensed by the protectors, and none may engage men without licenses. Contracts may be made with natives of India to Mauritius, Jamaica, British Guiana, Trinidad, St. Lucia, St. Vincent, Grenada, Natal, St. Kitts, Seychelles, so far British Colonies; French Guiana, Réunion, Martinique, Guadeloupe, foreign territory; Dutch Guiana, and St. Croix; and the Governor General may, from time to time, declare emigration lawful to any other place. This Act, however, was almost entirely a consolidating measure. All the more important parts of the system had been long in force.

Every recruited emigrant must appear with the recruiter before the magistrate of his district, who is to see that he understands his engagement, and is willing to fulfil it. The magistrate is then to register the name, age, and village of the emigrant in a book, with the depôt to which he is proceeding, the rate of wages and period of service agreed upon; and copies are to be forwarded to the emigration agent and to the protector at the port. The emigrant is to be conveyed to the depôt, and the recruiter is bound to provide him suitable lodging and food on the journey, and to report his arrival. No vessel may take emigrants without a license from the local Government, stating her tonnage, and the number of men, women, and children she may carry, and the protector is to cause each vessel to be carefully surveyed. The height between decks is not to be less than 5½ feet; one adult for every 12 superficial feet of deck, and for every cubic space of 72 feet; women and children are to be apart from men, and there must be proper supplies of fuel, provisions, and water, a double blanket for each emigrant outside the tropics, a distinct place fitted up for a hospital, and a surgeon on board. No emigrant may be forced to embark, but he will incur liabilities for breach of contract. Steamers may sail at any time. Sailing ships may also leave for places east of the Cape at all times of the year, but for places west of the Cape only between the 31st of July and the 1st of March.

A convention with the French Government was made in July 1861, by which emigrants were to be allowed to be embarked for Réunion, Martinique, Guadeloupe, and French Guiana, at which places the British Government was to appoint agents; and the rules for recruiting are to be the same as those enforced for the British Colonies. The contracts are not to be for more than five years. The work is not to exceed 9½ hours a day for six days out of the seven. Wages and rations are to be fixed. Medical treatment is to be gratuitous; and return passages are to be provided at the expense of the French Government. The proportion of women to men in each ship is to be one quarter. A similar Convention has since been made with the Netherlands Government for emigrants to Surinam.

In 1870-71 the West India Colonies applied for 9,423 emigrants, and 7,315 were dispatched; but there was great difficulty in getting the quota of 40 females to 100 males. In 1871-72, the number of emigrants who left Calcutta was 8,231, and the rule as to the proportion of females was fully complied with. The number returning was 3,383, in 11 ships; and the death-rate, either going or coming, never exceeded two per cent.

Owing to the want of supervision in the selection of recruiters, the Lieutenant Governor of Bengal ordered that no license should be given to any recruiter whose character was not known to the protector, or regarding whom the magistrate of his district did not report favourably. The emigration agents remonstrated against this order, as tending to cause delay; and on the ground that magistrates, opposed to emigration, would refuse to sign recruiters' licenses; but the magistrates were cautioned not to throw obstacles in the way. Another ground of complaint was, that the Lieutenant Governor of Bengal had issued a Circular (No. 74, 2nd December 1871), desiring the magistrates to explain to the emigrants that there was no binding contract as to the rate of wages in the Colonies, and that this column in the agreement must be left blank. The Jamaica agent

X.  
CONDITION  
OF THE PEOPLE.

Medical inspectors  
of emigrants,  
Depôts.

Recruiters of  
emigrants.

Places approved  
for emigration.

Rules for  
recruiting.

Emigrant ships.

French Emigration  
Convention.

Dutch Emigration  
Convention.

Number of  
emigrants from  
Calcutta.

Rules as to licenses  
for recruiters.

Warning as to  
wages by the  
Lieutenant Go-  
vernor of Bengal.

X.  
CONDITION  
OF THE PEOPLE.

Laws respecting  
wages passed in  
the Colonies.

Emigration from  
Madras.

Emigration from  
Pondicherry.

Returned emi-  
grants, Bombay.

Condition of  
emigrants.

Returned  
emigrants.

agent complained that illegal obstacles had been thrown in the way of the recruiters; and, in fact, a mistake seems to have been made by the Bengal Government, through not having being furnished with recent information on the subject of colonial legislation. In 1869, Sir J. P. Grant, the Governor of Jamaica, had made important arrangements by which the coolies are efficiently protected and cared for, and a minimum wage of 1*s.* a day for men, and 9*d.* a day for women and boys, was enforced. Hospitals had been provided by the Government at the cost of the immigration fund; medical men appointed by the Governor, or being paid out of the same source, instead of by the employer, as formerly. British Guiana and Trinidad have also guaranteed a minimum wage of 1*s.* 0½*d.* a-day. On learning these facts, Mr. Campbell withdrew the Circular, and now gives every facility to emigration. During 1871-72 four vessels left Madras for the Mauritius, with 1,114 emigrants, the due proportion of women being maintained; but none sailed for the French, or for any of the other English colonies. Five vessels arrived from Mauritius, two from Natal, with 793 and 335 returned emigrants respectively. But several emigrant ships sailed from Pondicherry and Karical. Two left for Guadaloupe with 938 coolies, one for Martinique with 443, and one for Réunion with 358; altogether 1,639; a decrease of 620 from 1871. Six vessels arrived from Réunion with 339 returned emigrants, and one from Guadaloupe with 329. The French ship "Souvenance" sailed from Pondicherry with 376 coolies for Martinique, and was lost off the Cape of Good Hope, with all on board. There has been no emigration for many years from Bombay; but in 1871 two ships brought back 250 and 25 returned emigrants respectively.

The Indian emigrants appear, as a rule, to improve their condition by their service in the West Indies. From 1861 to 1871 there were 84,463 emigrants from India to British Guiana; and in 1871 the Indians in the Colony numbered 48,363, or 15,763 more than the number introduced. During the same period Trinidad received 19,538; and in 1871 there were 27,425 in that Colony. In Mauritius there were 217,091 in the same year. But the best criterion for judging of the emigration is by the number and circumstances of the returned labourers. Since 1869 as many as 3,367 have returned to India from British Guiana and Trinidad, with 127,861*l.*, or about 30*l.* a piece.

There is a constant immigration of Chinese into India, but the male sex only come, and do not seek a permanent domicile. The immigration of Arabs into India to recruit the military service of the Nizam of Haidarabad has been interdicted; but there is a large domiciled settlement of Arabs in the Nizam's territory. The immigration from Eastern Africa requires further elucidation. No slave can be imported into British India, but there is a large influx of Africans connected with the mercantile marine. From beyond the north-west frontier of India, and the hills of Afghanistan, there is a steady annual influx and reflux of merchant and camel drivers. From the same direction aliens of the wild tribes beyond the Indus descend in thousands to seek service in the native British army, or private employment, and form an element in the floating population of the towns.

XI.—POLICE AND JUSTICE.

The work of preserving the peace of the country, suppressing and detecting crime, and executing decrees in British India, is performed by a body of about 190,000 police constables; aided by the village chaukidars and watchmen, who have continued to occupy their immemorial positions, in most parts of the country, as a supplement, and often a very important one, to the regular police force.

In Bengal, besides 22,000 regular district policemen, there are 6,600 municipal, 2,500 Calcutta suburban, 800 river, and 600 railway police. Their drill is said to be unsatisfactory, for the Bengali, though well adapted for the work of detecting crime, is almost useless as a guard. It is suggested that the force should be recruited from among the bolder and sturdier men of Bahar. The work of the Bengal police in 1871-72, as regards criminal prosecutions, is represented by 72,817 arrests, out of which 38,813 convictions were obtained; but of 312 murders only 139 were detected. The worst cases of gang robbery, and the most numerous, were in the districts of Bäckarganj and Purniah. But in addition to the regular police force, there are some 200,000 chaukiúars or village watchmen in Bengal. The enrolled constabulary have many duties to perform in addition to the detection of crime and preservation of order. They are used as guards and orderlies, on frontier duty in the hills, as revenue preventive officers, serving writs, and summonses, and last year in carrying out the census operations. They are liable to be employed on any miscellaneous executive work, so that much, if not most of police work falls upon the village watchmen, whose proceedings are not included in the police reports. Under the Chaukidari Act they are under the control of a *puncháyat*, selected from the inhabitants of the villages; and some particulars respecting the work they perform and their organization would be a very important addition to the Reports. In the administration of criminal justice, the high court disposes of appeals, and has cognizance of all capital sentences, of which 66 were carried into execution in Bengal during the year under review. The courts of session, aided by juries or assessors, try cases committed by magistrates. The magistrates have power to imprison for two years, and inflict fines up to 100 £, and subordinate magistrates can commit for six months, and inflict fines up to 20 £, and whippings. During 1871-72 juries were employed in 437 and assessors in 1,182 cases coming before the sessions courts. Before the high court 100 cases were tried by juries. Of the criminals, nearly 37 per cent. are Muhammadans, eight per cent. Hindu cultivators, and six per cent. Brahmins.

In the North West Provinces the police force is recruited from all castes, the Muhammadans, and Brahmins, and Rájputs being in nearly equal numbers, about 5,000 of each, the Muhammadans slightly preponderating. During the year under review, the criminal classes have remained stationary, while the police are said to have improved the time, and to have made a decided advance. They obtained 39,641 convictions out of 51,049 trials; and of 301 murder cases 155 ended in conviction. The village police in the North West Provinces have been re-constituted; hitherto they have generally been paid by grants of inferior land as jagheers, and sometimes in grain or money. They now receive regular wages of 3 rupees a month, in addition to their ancestral perquisites, paid by the cultivators from the threshing-floors. The Chaukidars are also housed and uniformly clothed, and a great improvement is reported to have been effected in their efficiency.

Two duties of special interest are entrusted to the police of the North West Provinces, namely the supervision of the hereditary thieves, and the suppression of infanticide.

Various tribes in the Punjab, the North West Provinces, and Oudh carry on theft and robbery systematically. They live quietly for part of the year in their own districts, and spend the rest in wandering about the country to rob and plunder, the gains being divided according to a fixed rule. In the North West Provinces there are 29 tribes which support themselves in this way. In October

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Legislation with reference to thieving tribes.

Colonies of thieves.

Infanticide.

Test of guilt as regards infanticide.

Measures of repression.

Villages proclaimed as tainted with infanticide.

Success of measures for suppressing infanticide.

Causes of infanticide.

Punjab police.

Increase of crime in the Punjab.

Murders in the Punjab.

Oudh police.

Central Provinces police.

Bombay police.

Cost of police.

1871, an Act was passed (XXVII. of 1871), empowering the Government to declare a tribe criminal; a register is then to be made of its members. The criminal tribes may be removed and formed into reformatory settlements, and any member of them found beyond prescribed limits may be arrested. Under the provisions of this Act, two colonies have been formed in the North West Provinces, one of a tribe called *Bowrias*, in Muzaffarnagar, and another of *Bhuduks*, in Ghurukpur. Land is given to them at low rates, and every inducement is held out to them to lead an honest life, while every member is placed under rigorous police supervision.

The measures for the suppression of infanticide are enforced under the provisions of Act VIII. of 1870, by means of the police acting under rules published in March 1871. The crime of infanticide can be put down by accurate registration of all domestic events among proclaimed families, combined with frequent inspections of female infants by the village police. It is held that where the number of girls is less than 40 per cent. that of the whole number of children there must be foul play, and a suspicion of guilt becomes justifiable. The census returns have been utilized for the purpose of detecting the low percentages of girls among the suspected tribes of Rájputs and Jats. The head of a proclaimed family is obliged to report all births and deaths to the police, and, if foul play is suspected, the bodies are forwarded to the civil surgeons for post-mortem examination. The police officers visit proclaimed villages once a month, and compare the actual numbers in each family with their registers, annual reports being furnished to the magistrates. As many as 3,707 villages, in different districts, have already been proclaimed as having their percentage of girls below the prescribed limit; and the rules of repression have been applied. The crime of infanticide is unknown in five of the North West Provinces (Dehra, Kamaun, Garhwal, Goruckpur, and Lullutpur), but in others it is very prevalent among different classes of Rájputs and Jats. Much good has already been done, girls are beginning to survive in numbers which accord with the laws of nature, the people are, it is believed, becoming ashamed of the crime, and seem to be glad of an excuse to drop it. The power of imposing the cost of repression of the guilty tribes has been very sparingly used, but where an extra force of police is required, a cess has been imposed of eight annas a year on every house. Although the tax is so small, it is most unwelcome, and acts as a further stimulus to the people to abandon their ancestral crime. There have been very few convictions, but the Act is intended rather to prevent crime than to create evidence.

The causes that give rise to the crime of infanticide are very obscure. It has been ascribed to ancestral pride and to poverty; but on the one hand, it is practised by the poor and base-born castes, and, on the other, by the rich and well-to-do Rájputs and Jats. Moreover, the Jats and Tugas receive, and do not pay, dowries on the marriage of their daughters, yet they also practise infanticide. Possibly the crime is mainly attributable to hereditary custom and habit, in which case its total eradication will not be difficult, now that active measures have been adopted.

In the Punjab, under Act V. of 1861, the police force is divided into Trans and Cis-Sátlej divisions, the whole numbering 20,070 men; of whom 53 per cent. are Muhammadans, 29 Hindus, and 17 Sikhs. There has been a serious increase of crime, which is partly attributed to deterioration in the working of the police. The conduct of the men was, however, satisfactory; 8,512 are armed with muskets, 10,928 with swords, and 453 with batons only. Of the murders, 25 per cent. were committed in the Pesháwar district alone, and out of 93 only 11 were convicted. The total number of murders in the Punjab was 366, sentences of death were passed in 105 cases, and 81 were confirmed. In Oudh and the Central Provinces the police force has been organised under Act V. of 1861, and its strength, under these two Governments, is 6,888 and 7,352 respectively, exclusive of municipal and railway police.

In the Bombay Presidency the new police system consists in the creation of a distinct and complete executive for police purposes, the Police Commissioner in each division being also the Revenue Commissioner. The pay of a constable is fixed at seven or eight rupees a month, and he cannot receive promotion unless he can read and write. The railway police was organised by the Government in 1866. By Act II. of 1871 the Government is enabled to call upon municipalities



palities to contribute to the cost of the police to the extent of one half, but this power has as yet only been put in force at Súrat and Ahmadabad. Crimes are increasing, and convictions bear a small proportion to them; out of 186 murders, there were only 66 capital sentences.

The village police, under the control of the magistrates, is composed of the old mahars or watchmen in the ancient village system of the Mahrattas. The mahar was the 10th in order of the Bara Balúta, or body of village officials, of whom the Patel is first, and has supervision of all revenue and police matters. The mahar is immediately under the patel, or head man of the village; and the ancient mode of remunerating him was by a grant of rent-free land. The reform of the village police is now under consideration, with a view to introducing a better and more adequate system of remuneration, such as has been adopted in the North West Provinces. The duties of village policemen are to keep order, to report crime, and to assist the regular police.

Two bodies of police are still maintained in the Bombay Presidency with semi-military organization, namely, the Khandesh Bhíl Corps of 840, and the Gujrát Bhíl Corps of 603 men. The Bhíls were the aborigines of Khandesh, a fierce mountain tribe, dwelling among steep rocks and pestilential jungles, whose profession was robbery. They were the object of mingled terror, contempt, and detestation to the people of the plains, and in their sudden forays they spared neither age nor sex. In 1818 Khandesh was ceded to Great Britain, and in 1826 Mountstuart Elphinstone conceived the idea of establishing the Bhíls in agricultural colonies, and organizing a Bhíl regiment. The agricultural colonies were confided to Captain Ovens; to Lieutenant Outram was assigned the dangerous task of disciplining these lawless barbarians, while Mr. Willoughby established peace and order among the wild Bhíls of Rajpeepa. Outram commenced by attacking the Bhíls in their fastnesses, at the head of a small detachment, and compelled them to sue for mercy. Having convinced them that their rocky defiles were not impregnable, he sent back his troops, and, throwing himself among his recent foes, unarmed and unattended, he claimed and received a reciprocity of the confidence thus reposed in them. He accepted their hospitality, listened to their wild legends, taught them many simple mechanical devices, dressed their wounds, prescribed for their ailments, accompanied them in the pursuit of tigers, and won their admiration by showing his superiority in those very qualities which they most valued in themselves. In less than a year he had formed a Bhíl corps which, when Outram gave over its command in 1835, consisted of 600 well-disciplined men. The two Bhíl corps are still continued, to maintain the peace of the country, and give employment to a naturally restless people.

In the Madras Presidency the police force consists of 21,836 men, besides the village watchers; but, as in Bengal, the regular policemen are also employed on the salt preventive and excise establishments, and as gaol guards. In Burma there are 5,634 Imperial and 579 municipal policemen, and here at last a decrease in the number of murders is reported.

Since the introduction of railroads, the formation of numerous plantations under European management, and the increase in facilities of communication, a new class has sprung up, which has caused some anxiety. European vagrants or "mean whites" have begun to spread over the country, and are increasing in numbers. A Vagrancy Act was passed in 1869 (Act XXI. of 1869), which was intended to grapple with this evil, and it has been acted upon in all three Presidencies. Government workhouses have been established at Calcutta, Madras, and Bombay. In Calcutta the workhouse is in the Presidency gaol. In 1871-72 the number of vagrants arrested and transported, under the provisions of the Act, in Bengal, was 67. In Madras the Vagrancy Act is stated to have put down begging in the towns; but it has created a class of voluntary vagrants who go to the Government workhouse on their own representations, where they are clothed and fed. The cost connected with them, in 1871-72, was 2,094 l., including passage-money for those who were deported. There were 95 cases in the year, of whom 85 were shipped off, 19 being grooms, eight soldiers, five engine drivers, four sailors, and the rest miscellaneous vagrants. In April 1871, a shed was erected in the new house of correction at Bombay, to serve as the Government workhouse; and in 1871-72 as many as 150 vagrants were admitted. A dozen were arrested up country, along the lines of railway,

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Increase of crime  
in Bombay.

Bombay village  
police.

Reform of village  
police.

Bhíls corps.

Lieutenant Outram  
and the Bhíls.

Madras police.

Burmese police.

European vagrants.

Vagrancy Act.  
Bengal vagrancy.

Madras vagrancy.

Bombay vagrants.

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and the rest in the town of Bombay. They were nearly all strong healthy men, able to work; and the cost of feeding and clothing them was 440 *l.* The daily average of workhouse inmates at Bombay was 43 for the year.

Reported importation of slaves at Calcutta.

It was reported by Colonel Herbert, the Political Resident at Baghdad, that slaves were regularly imported at Calcutta by pilgrims returning from Mecca, to serve as concubines, attendants, and eunuchs; and that they were smuggled on shore in women's clothes, without creating suspicion. Inquiries were made by the police without any success, and it was reported that most of the pilgrims were poor, and not in circumstances to purchase and transport slaves. The Commissioner of Police has, however, been instructed to keep a careful watch on vessels arriving from Jeddah.

Gaols in India.

The gaols throughout India are generally in a satisfactory state, discipline is preserved, industry is enforced, and to some extent instruction is given, while much care and thought has been devoted to the sanitary arrangements. Indeed the Lieutenant Governor of Bengal considers that almost too much attention has been given to industrial and sanitary considerations, and that the penal effect of imprisonment has been more or less lost sight of. He thinks that the punishment of short-term prisoners is not sufficiently stinging, that the prisons are made too comfortable, while classification scarcely exists, partitions having been almost universally cleared away for the sake of ventilation. The district gaols have been placed immediately under the control of the magistrates; but there is no gaol of this class in Bengal that can be looked on as a model, or that can be recommended for imitation as based on scientific principles. Standard plans have, however, been drawn up for gaols of different classes by the new Inspector General, Mr. Heely. His predecessor, Dr. Mouat, worked a great improvement in the health, habits, and discipline of the Bengal gaols. There are seven central, and 54 districts gaols, and 87 lockups, and the number of prisoners during the years was 18,928, of whom 2,214 were flogged for breaches of gaol discipline. Gaol labour is divided into *penal*, consisting of treadmill, stone breaking, and lime and flour grinding; *hard*, including excavation work, drawing water, cutting wood, and blanket weaving; and *light*, such as tailoring, dyeing, weeding, garden work, and writing. Penal work is given to three months' prisoners during the whole time; for prisoners for 18 months during half the time; and for long-term prisoners, only as a punishment. The profits from gaol industry amounted to 9,880 *l.* for 1871-72.

Bengal gaols.

Classification of gaol labour.

Gaols in the North West Provinces.

In the North West Provinces there are six central gaols for long-term prisoners, 33 district gaols, and 22 lockups. During the year under review, 58,419 prisoners were confined; and 24 per cent. were employed on manufactures. The profits amounted to 7,026 *l.* The cost of the gaols was 68,000 *l.* In September 1871 there was a daring outbreak at Bareilly Gaol, caused by disturbed feelings among the Brahmins who had been ordered to remove their *janeos* threads, which was worked upon by Muhammadan prisoners, until they gained over their discontented comrades to a project of forcing the gaol. They armed themselves with portions of the weaving looms which were heaped up in the yard, and were actually escaping over the outer wall, when the police opened a cross fire upon them from both sides.

Outbreak at Bareilly Gaol.

Punjab gaols.

In the Punjab there are 34 gaols, of which six are central and divisional, and the remaining 28 district gaols. The number of prisoners confined was 42,160, but the daily average only came up to 13,443; of whom 4,308, were flogged for breaches of gaol discipline. The profits from gaol industry amounted to 32,000 *l.*, but this is made to include value of labour, not only on public works but also in the performance of gaol duties. The expenditure was 76,800 *l.* A ticket-of-leave system has been introduced, by which prisoners who have served three-fourths of their time are selected, on account of good conduct, and admitted to special privileges of probation, eventually being allowed to return home under surveillance.

Gaol industry.

Ticket-of-leave system.

Oudh gaols.

Gaols in the Central Provinces.  
School of industry at Jabalpur.

In Oudh there are 13 gaols with a population of 16,658 prisoners, of whom 653 were flogged during the year. In the Central Provinces the gaol accommodation is ample, consisting of two large central gaols for long-term prisoners, and district lockups. The number of prisoners in 1871 was 9,175. They are employed on public roads, in grinding corn, and making prison clothes, and on manufactures.

factures. The Jabalpur school of industry was established in 1837, to give employment and instruction to Thag and Dacoit prisoners and approvers, who it was desirable to keep under surveillance. It continues to perform good work as an industrial institution. The approvers, with their wives and families, numbering 2,500 souls, live in a village surrounded by a wall, while the prisoners, 50 in number, are confined in a separate gaol. The institution is famed for its tent making.

In the Bombay Presidency, 19,784 prisoners were confined during the year 1871. This is an increase on the preceding year, but famine prices ruled in part of the Deccan, and scarcity of food always produces increase of prison population. The number of executions has steadily increased for the last five years, and there were 62 in 1871. The prison labour was worth about 28,000 *l.*; but the net profits of gaol factories was only 2,500 *l.* In the Madras Presidency the total number of gaol prisoners was 21,522, and the daily average 9,364. The total value of gaol labour was 34,000 *l.*, and the profits of the year on manufactures amounted to 12,000 *l.* The cost of the gaols was 58,600.

In British Burma there are two central gaols, at Rangún and Mulmein, and the average daily number of prisoners was 4,413, nearly all opium eaters or smokers. The cost was 24,000 *l.*, and the earnings 8,900 *l.*; but it is intended to introduce jute spinning and weaving into the Burma gaols. The health of most of the gaols in British India was good, and the death-rate low as compared with that of the rest of the population. The gaols in the North West Provinces and the Punjab form an exception. There was an outbreak of cholera in the Jaunpur gaol, and much sickness in some of the others. In the Ráwalpindi gaol there was great mortality arising from an epidemic of fever, and the death-rate was heavy throughout the gaols of the Punjab. In the Madras Presidency the prisoners were, as a rule, remarkably free from disease.

The penal settlement at Port Blair, in the Andaman Islands, contained 7,569 convicts. They are under two systems: the first, which is very popular, by which they receive money payments and nothing else, except clothing; the second, by which they also have rations, and money gratuities after a certain fixed period. Over 40 marriages have taken place between male and female convicts, and 439 others have their wives with them. There are schools for the children of convicts. There is little crime in the settlement, beyond numerous cases of petty theft, and the sanitary condition of the place is satisfactory. The labour is devoted to clearing jungle, cutting up timber, and making bunds and tanks. There is an area of 900 acres under cultivation, 500 belonging to ticket-of-leave and self-supporting convicts, and 400 to the Government, the crops consisting of Indian corn, paddy, and pulses, while the "Royal Dover Garden," commenced in 1868, occupies 357 acres, covered with guinea grass, plantains, fruit and spice trees. Its profits, for 1871-72, amounted to 258 *l.* There is another penal establishment at the Nicobar Islands, where there are 227 convicts near a large swamp, which makes the place very unhealthy.

In the year under review, there were 1,088,153 civil suits in India. The Lieutenant Governor of Bengal expresses a fear that the tendency to uphold doctrines of bare law, the literal enforcement of contracts alleged to have been entered into by ignorant and improvident people, lead to a hard measure in cases which affect poor men, and reduce them to slavery or drive them to despair. Every case against a poor man may be a rule to lead to the subjection of a hundred other poor men; and such a system is a great advantage to the rich and litigious. Cases are the subjects of an amount of litigious power which, Sir G. Campbell believes, is unprecedented in any other country in the world. The general use of that lawyer power, in stage after stage, process and process, appeal after appeal, and suit after suit, bred out of the execution of a decree, is enormous. People are often driven to despair. The Lieutenant Governor of Bengal tells a story of an estate being in litigation between the members of a family originally belonging to one of the hill tribes. One of the parties, after litigating through all the Courts of India, got a decree in the highest Court. But there was an appeal to the Privy Council, and the suitor's funds were exhausted. So they caught an old man, carried him to the top of a hill, and sacrificed him to propitiate the gods who rule the decisions of the Privy Council. Among the Sonthals the civil procedure

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cedure code was introduced, and worked such mischief that the position became dangerous. The people were exasperated, and they have been removed from the operation of the laws which are applicable generally in Bengal.

Civil suits in the  
North West  
Provinces.

Civil suits in Oudh.

Litigation in the  
Central Provinces.

Bombay litigation.

Registration of  
deeds.

In Bengal.

Rural registration  
of deeds in Bengal.

Wills in Bengal.

Registration of  
deeds in the North  
West Provinces  
and Punjab.

Registration of  
deeds in Oudh.

Wills in Bombay.

Registration of  
deeds in Madras.

In the North West Provinces, litigation reached the highest figure of any year since the mutiny, and there is also a great increase in the value contested. In Oudh the number of civil suits has doubled in four years; and the reports observe that, under our rule there is a progressive proneness to civil litigation. The sales of houses and lands bear a large proportion to the total number of processes, and in many cases there is failure to realise the amount decreed against the debtor, because he is absolutely devoid of means, already wrung dry. In the Central Provinces, litigation increases from year to year, which is considered to be a sign of the great indebtedness and poverty of the people. The suits are generally for money on written promises to pay, and on very small sums. It is the general impression that the courts are merely used for the purpose of coercing debtors to enter into new engagements on less favourable terms. The principal is never paid off, but the interest is mercilessly exacted, and the people become slaves to the money-lenders, the most wretched and degrading form of slavery. In the Bombay Presidency, litigation is most active in Thana and Khandesh, the majority of suits being for debts on written contracts (114,688).

Registration of deeds and other documents in India is of two kinds, compulsory and voluntary. To the former class belong deeds having reference to land. In Bengal, about 250,000 deeds are annually registered, but the great majority are contracts, the registration of which is compulsory; and documents which it is not obligatory to register only number about 30,000 a year. This is a mere drop in the ocean, compared to the whole transactions of the people; and the registration agency does not touch the mass of the business of the country. Sir G. Campbell proposes to appoint Muhammadans of position and learning as registrars of marriage contracts and other deeds used by that community; and he has commenced a system of rural registration. The number of wills registered in Bengal has increased from 646 to 934, a fact pointing to a revolution in the ancient property law of India, which is gradually being superseded by the English doctrine of freedom of testamentary dispositions.

In the North West Provinces and the Punjab, the Tahsildars are registrars, and the registry districts are the same as those for revenue and police purposes. The number of documents registered in the Punjab was 95,746. A compulsory registration of decrees of civil courts was abolished, for which optional registration of certified copies of decrees and orders was substituted. In Oudh it has been a matter of surprise and disappointment that the registration of leases has not been more common. Only 56 wills have been registered, and not one has been deposited for custody; but this is the first year in which the experiment has been tried. In the Bombay Presidency, there has been an increase in the registration of wills from 119 in 1870 to 279 in 1871, and of authorities to adopt from 3 to 22. In the Madras Presidency, 287 registry offices; and there has been a gradual and steady growth of registration; but that of miscellaneous documents has declined. The Acts referring to registration are XX. of 1866, and VIII. of 1871.

## XII.—EDUCATION.

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EDUCATION.

THE education of the people of India is based on the system inaugurated by the Sir Charles Wood's Despatch of the 19th July 1854, the objects of which were two-fold, to provide first-class education for the wealthier classes and instruction for the masses of the people. The main principle of the Despatch is that European knowledge should be diffused through the medium of the languages which are alone understood by the great mass of the people; that education in India should have for its object the diffusion of the improved arts, science, and philosophy of Europe very widely among the people; but that the teaching of English should always be combined with careful attention to the study of the vernacular languages. At the same time the importance of studying English was fully recognised, and there was no wish to diminish the opportunities which were afforded in special institutions for the study of Oriental literature.

The Despatch of 1854.

Its objects.

Its main principles.

With a view to attaining these objects it was first ordered that education departments should be created in every Presidency and Governorship, with inspectors to report upon the colleges and schools supported and managed by Government, to conduct the examinations and to aid the schoolmasters by their advice. This admirable machinery is now in full working order throughout India.

Education Departments to be created.

A complete scheme was then laid down for the higher education of the wealthier classes. It was declared that the time had arrived for the establishment of universities in India, conferring degrees, and based on the model of the University of London. They were not to be places of education, but to test the value of education obtained elsewhere, and to confer degrees in arts, law, medicine, and civil engineering. All colleges and schools capable of supplying a sufficiently high order of instruction for candidates at the university examinations, were ordered to be affiliated to universities which were to be established at Calcutta, Bombay and Madras. At that time there were five Government colleges in Bengal, besides the Sanscrit College and Muhammadan Madrasa at Calcutta; five in the North West Provinces, including the Rurki Civil Engineering College; the Elphinstone Institution, Puna College, and Grant Medical College in Bombay, and the High School at Madras, besides certain missionary schools. These were named in the Despatch as adapted to become affiliated colleges of the universities. Below them the zillah, or middle class schools, were to prepare for the colleges and for the entrance examinations at the universities. The system was to be tied together, and, as it were, rendered homogeneous, by attaching scholarships, leading the best pupils up from the zillah schools to the colleges, and thence to university degrees. With the object of combining with the agency of the Government the aid which could be derived from the exertions and liberality of private persons or societies, a system of grants-in-aid was adopted, in order to bring all private schools within the scheme. It was hoped that far more rapid progress would follow from thus encouraging private efforts, while fostering a spirit of self-reliance, itself of no mean importance to the well-being of a nation. The grant-in-aid system was to be based on entire abstinence from interference with religious instruction conveyed in the assisted schools; and this principle has led to considerable assistance and encouragement being given to missionary schools of all denominations.

Higher education.

Universities.

Affiliation of schools and colleges to the Universities.

High schools existing in 1854.

Zillah schools.

Scholarships.

Grants in aid.

This was the scheme for securing the first object laid down in the despatch. But it was intimated that as regards the upper classes the Government should not go further, and that an artificial stimulus should no longer be necessary to create a demand for such an education as is conveyed in Government colleges. These colleges and the universities were as much as the Government could do, to place the benefits of education practically before the higher classes. Indeed the despatch went further, and looked forward to the time when any general system of education, entirely provided by Government, might be discontinued with the gradual advance of the system of grants-in-aid; and when the existing Government schools and colleges, especially those of the higher order, might be closed or transferred to the management of local bodies aided by the State.

Limit of Government aid for higher education.

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EDUCATION.**

Education of the masses.

This would have the effect of placing the highest class of education almost entirely in the hands of the missionaries.

The second object of the Despatch was considered still more important. It was to convey useful knowledge, suited to every station in life, to the great mass of the people who cannot possibly obtain it by their own unaided efforts. The Government of India was desired to take active measures in future, with this object in view, for the attainment of which a considerable increase of expenditure would be sanctioned. There should be schools using English as a chief medium of instruction in every district in India, as well as others of inferior order conveying instruction through the vernacular, subject to constant inspection, with the inducement to scholarships at higher schools, as a means of encouragement to the pupils. Lastly, efforts should be made to extend the system of indigenous schools, such as Mr. Thomason had established in the North West Provinces some years before, capable of imparting elementary knowledge to the great mass of the people; with scholarships to places of higher education as rewards. Grants-in-aid were also ordered to be given to girls' schools, and to special institutions, and orders were given for the establishment of training schools for masters and mistresses in each Presidency, recruited from pupil teachers. In admissions to the public service it was ordered that preference should be given to educated men.

Female education.

Normal schools.

Measures adopted for carrying the orders of the Despatch of 1854 into effect.

Education Departments created.

Universities.

University examinations.

Affiliation of colleges and schools.

Zillah schools improved.

Normal schools established.

Slower progress of primary education.

Progress of education.

This is the main outline of the system of education which now prevails throughout India. It is based on the Despatch of 1854. Steps were taken at once to carry out its orders. Directors of public instruction were appointed with a staff of inspectors and sub-inspectors in all three Presidencies. The three universities were created, with chancellors, vice-chancellors, and senates as governing bodies, conferring degrees in arts, law, medicine, and civil engineering, and with the same scheme of examinations. These consist of an entrance or matriculation examination, a first examination in arts, an examination for the bachelor's degree, and honours for master's degree. The first entrance examination took place in March 1857, when 162 candidates passed; and the first degrees were conferred in 1858. At the Bombay University the first entrance examination was in October 1859, and at Madras in the same year. The colleges and high schools enumerated in the Despatch were affiliated to the universities, and some of them were re-modelled. The Zillah or Anglo-vernacular schools were expanded and improved through grants-in-aid, and normal schools were established. All this had been accomplished by the end of 1859; but the more important work of bringing instruction within the reach of the masses has made slower progress. This could not be effected by grants-in-aid, and required active assistance and support from the Government.

Regular progress has since been made in all parts of India in advancing and promoting the education of the people, mainly on the principles laid down in the Despatch of 1854. This progress is more in one direction in some provinces, and in another in others, as they are influenced by local circumstances on the bias of different minds, and it will be desirable to refer separately to the administration of the educational system as it has been developed under the several local governments.

Calcutta University.

The Calcutta University was incorporated in 1857. It is deserving of note that the three universities of India were calmly founded in the regular way of routine during the worst time of the mutinies, when our power seemed at its lowest ebb. The Calcutta University exercises functions over Bengal, the North-West Provinces, the Punjab, Oudh, and the Central Provinces; the governing body is the syndicate, consisting of the vice-chancellor and six members of the senate; it prescribes the text-books and subjects, and the examinations, and thus dominates and guides the course of instruction in all the Bengal colleges and schools except the lowest. The endowments amount to 23,700 *l.*, capital included, 20,000 *l.* given by Prenchund Raychund of Bombay. There is also an endowment under the will of the late honourable Proosana Coomar Tagore for a law professorship. There has recently been much discussion respecting the extension of physical science subjects in the university course. The graduates number about 1,500, and the undergraduates exceed 2,000.

Physical science.

Colleges in the Provinces under the Bengal Government.

The colleges are institutions which educate the undergraduates for the higher examinations, and their studies are regulated by the university. In 1871 there were

were 1,503 Bengal candidates for admission into the university, of whom 581 passed; 434 at the first arts examination, of whom 171 passed; 221 for bachelor's degrees, of whom 95 were successful, and 21 out of 28 obtained master's degree.

In the Provinces under the Bengal Government, there are nine colleges entirely belonging to the Government, at which the pupils pay fees at the rate of 10 s. a month. In the year under review they contained 930 pupils; and five private colleges, receiving grants-in-aid, have 394 pupils; there are also two unaided colleges. The Presidency College at Calcutta has seven foundation scholarships. In all the Government colleges there are teachers of drawing, surveying, and physical geography, and in the Hugli College there is also a lecturer on botany and chemistry. It is intended to appoint professors of physical science, botany, and agricultural chemistry to some of the colleges.

Science professors.

In June 1872 the Lieutenant Governor of Bengal applied for two science professors from England to teach physical geography, chemistry, and scientific agriculture, and to study indigenous agriculture in different districts, and the requirements of various native and exotic staples.

Next to the colleges come the high schools, where an education is given up to the university entrance examination; there is one of these at the headquarters of every district in Bengal, and one attached to every college. The number of Government high schools is 52, with 10,282 pupils; of aided high schools 78, with 8,112 pupils, and of unaided 48; those in Calcutta are self-supporting. The monthly fees at the Government high schools are 1 to 2½ rupees. Classes have been opened at 18 or 20 of them, in surveying, drawing, and physical geography.

High schools.

Next to the high schools rank the middle schools, which do not train so high as the university entrance standard. Many of them teach English, and others a vernacular, but with a training higher than the primary school course. Of these there are 1,658 in Bengal, with 80,000 pupils, of which 222 are Government schools, 1,240 aided, and 196 unaided. English is taught in one-third. These are the schools which receive most support from the people themselves; the yearly cost to a boy in a Government middle school being Rs. 11. 12., and in the aided schools Rs. 16. 3.

Middle schools.

Many of the middle schools, and all the high schools and colleges in Bengal educate their pupils with a view to the university examinations. The degrees enable students to enter the public service, and the professions of law, medicine, and engineering.

Schools educating for university examinations.

The work of bringing instruction within reach of the mass of the people has not been so successful in Bengal. There are about 13,500 indigenous rural schools, entirely supported by the people. The patshalas are the ordinary village schools where the vernacular is taught, the course including elementary arithmetic, bazaar accounts, reading and writing. There are also mukhtabs where the Koran is taught, and fols, in one or two districts, for instruction in Sanscrit and Hindu sacred books. The ordinary village schoolmaster gets about 5 rupees a month from fees, and the numbers vary from 10 or 12 boys to 50 or 60. If the average be taken at 15, there are then 200,000 boys attending these schools. About 10 years ago a system was begun of aiding the patshalas, by forming them into circles of four each, with a trained teacher over them to visit and direct the teaching of the schoolmasters; but the funds were stopped by the Supreme Government, and local taxation was suggested, a course which was not then adopted. Only 2,439 primary schools are now aided by the Government, although the Despatch of 1854 urged the importance of encouraging indigenous schools for the education of the lower classes. This year the Lieutenant Governor of Bengal has granted 53,000 l. for primary schools; and the result will appear next year, when the system of grants-in-aid to men of the purely indigenous schoolmaster class will probably have been introduced.

Village schools.

Support of village schools.

There are nine training schools for masters of the higher, and 19 of the lower class under Government, containing 1,417 pupils; and 13 aided, with 436 pupils. The training is intended for vernacular and primary schools, except at Patna, where there are English classes. The course is for three years in these training schools, and the instruction includes geography, history, geometry, mathematics,

Normal schools in the Provinces under the Bengal Government.

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EDUCATION.

mathematics, surveying, and the art of teaching, all conveyed through the vernacular.

## Female education.

There are 344 girl schools in Bengal, with 9,518 pupils. Of these two are Government, 292 aided, and 47 private; and 110 are in Calcutta. The education is of the simplest possible kind. But home teaching is preferred, and an American lady has organised a system in Calcutta, by which 40 or 50 governesses visit houses, and by this means 800 girls are taught in the zenanas. But at present there is no real demand for the education of women and girls among the natives.

## Expenditure on education in the Provinces under the Bengal Government.

The expenditure on education in Bengal in 1871-72, amounted to 318,705 *l.*; of which sum 181,403 *l.* was the Government grant, 77,021 *l.* derived from school fees, and 60,280 *l.* from subscriptions. In Bengal alone education has never been aided by local or municipal grants.

## Education in the North West Provinces.

In the North West Provinces the greatest advance has been made in the instruction of the lower classes, where Bengal is rather behind hand; while Bengal takes a lead in the higher education, and at the University. A little over half the candidates from the North West Provinces passed the entrance and first arts examinations; but none succeeded in obtaining a bachelor's degree during 1871. The Government of the North West Provinces think that the University aims at too high a standard and pushes the study of English too far. Sir William Muir would prefer to see an effort at uniting a fair knowledge of English and European science with a profound Oriental scholarship, so as to create a class of teachers and writers capable of influencing the rising generation, and training the national mind through native media of thought to a high civilisation. At present in its highest grades, the University is beyond the people of the North West Provinces. From its foundation only four students from the North West Provinces have attained master's, and 22 bachelor's degrees. The aim, therefore, will be to work up the Anglo-vernacular schools, by a system of rewards and examinations, to a higher state of efficiency.

## Affiliated colleges in the North West Provinces.

There are four Government colleges in the North West Provinces, affiliated to the University, at Agra, Bareilly, and Benares, with 84 students; and four private colleges receiving grants-in-aid. Of these, St. Peter's at Agra is Roman Catholic; St. John's at Agra, and Joy Narayan's at Benares belong to the Church Missionary Society, and the Victoria College at Agra is supported by natives. At present there is a paucity of demand for higher education, and the expense of educating the 84 students at the three Government colleges is excessive. But it is considered that the existing system should be prosecuted in the hope that it will lead to larger and better results hereafter. Of the students who have left the colleges, 16 have become teachers, 11 are in the Government service, and three are pleaders. With a view to enabling students, after passing the University entrance examination, to devote their undivided energies to Oriental literature, Sir William Muir, in June 1870, proposed the creation of a central college at Allahabad. A sum of 17,500 *l.* was subscribed by the wealthy natives of the province, and he applied for a grant of 5,000 *l.* for the building. There are, it was represented, two modes of education. In the Calcutta University system, English is the basis of instruction, as the language of the governing class, the key to offices of trust and emolument, and the means of introducing western science and philosophy; but this can never become a national system, and it is, to some extent, at variance with the Despatch of 1854, which urged the importance of careful study of the vernacular languages. The other mode, which, as the Lieutenant Governor of the North West Provinces thinks, has been too much lost sight of, is purely vernacular. He was anxious to form a central institution at Allahabad, which he believed to be necessary to combine this system into a homogeneous whole, by furnishing the stimulus of examinations and degrees. The Allahabad College will affiliate the vernacular schools, afford the means of education for undergraduates, and prepare them for the first arts examinations. The establishment for it was sanctioned in July 1872, the ground has been marked out, and a design for the buildings selected. With Sir William Muir's consent it has received the name of the "Muir University College."

## Allahabad College.

## High schools in the North West Provinces.

The Zillah or high schools of the North West Provinces, educate either up to the entrance standards of the university, or to the preparatory standard; there are nine



nine of the former, and 14 of the latter class, all with good school houses, except those at Mirat (Meerut) and Farakhabad, and generally with boarding-houses attached. The latter arrangement is necessary in order that the inhabitants of villages may share in the benefits of high and middle class education. Allahabad school is the largest in the North West Provinces, and Etawah (Hume's High School) has been most successful, especially this year, when all its five candidates passed. The highest Oriental teaching is at the Benares School, where there are 27 Government scholarships. Schools are also attached to the three colleges. A chain of scholarships binds together the university, the colleges, and the high schools, as was suggested in the Despatch of 1854. The Zillah, or high schools, receive 130 scholarships a year, worth 3 rupees a month; the undergraduates, 80, at 4 to 5 rupees; the graduates of the first arts examination, 50, at 10 rupees; the bachelors of arts, eight, at 18 rupees; and the masters of arts, five, at 25 rupees a month. The whole cost of these scholarships being 1,780 l. a year. There are also a great number of aided high schools, most of them belonging to missionary societies.

Scholarships.

The Tahsili schools of the North West Provinces are equivalent to the middle schools of Bengal. In 1845, when Mr. Thomason first began to provide a system of general education for the people, there were 7,361 indigenous schools in the North West Provinces, with 6,433 pupils. He determined to establish a school at the head-quarters of every tahsildar, and his plan was fully carried out. There are now 172 Tahsili schools, with 8,986 pupils. They do not teach English, but most of them give instruction in Persian, as well as in the vernacular.

Tahsili schools.

The Tahsili schools provided for instruction in the towns: but Mr. Thomason, ably assisted by Mr. Reid, also proposed to supply schools for the rural population. A system of circle schools was introduced, called Halkabundi, by grouping several villages together, and establishing a school in a central position, no village being more than a mile from it. There are now 3,336 of these Halkabundi schools, with 118,647 scholars. The prospects of this class of schools were never more encouraging, owing to the greater expenditure upon them, due to the introduction of the local cess in the new settlement, and to the acreage cess in permanently settled districts, under Act XVIII. of 1871. One-half of the former, and a part of the latter, are set aside for the education of the taxpayers, to be spent in the district. A sum of 40,000 l. has been so allotted. The Halkabundi teachers get from 10 l. to 11 l. a year, and give instruction in the vernacular (Urdu or Hindi), history, geography, and arithmetic. Some also teach Persian. These village schools are rising in number and importance, and are becoming more uniformly spread over the province, through the action of the new system of local taxation. There are also 4,609 unaided vernacular schools.

Halkabundi schools.

Progress of primary education in the North West Provinces.

There are 12 normal schools for training masters and mistresses, of which seven are maintained by the Government, and five are aided. Four hundred and seventy teachers are being educated for village schools.

Normal schools in the North West Provinces

The female schools belonging to the Government number 427, with 7,917 pupils, beside 108 private girl schools. But, as in Bengal, there is as yet no real response on the part of the people to the endeavours of the Education Department to popularise these schools. Progress is very slow, and "the dead slumber of ignorance still shrouds the women of North India."

Female education in the North West Provinces.

The missionary societies have many schools in the North West Provinces, and are very actively at work with educational agencies. They receive grants-in-aid, in accordance with the principles of the Despatch of 1854, where it is laid down that these grants are to be given wherever a school attains a certain standard, quite irrespective of religion. There has been a great expansion of the system of grants to aided schools. At present there are 324 schools receiving grants-in-aid, with 19,770 scholars. In 1860 there were only six.

Missionary schools.

Expansion of the grant-in-aid system.

The total number of pupils under instruction in the North West Provinces is 218,466, of whom 162,979 are educated, more or less, at the public expense, and 55,467 owe nothing to the State. The number learning English is 18,539; the school-going age being six to 14, and the number of boys in the population being 2,500,000. It is calculated that one in 11 boys are at school. In other words, there are 250 boys in every 3,000 people, and of these, 16 are at Government schools, 14 at vernacular schools, and two learn English. In the

Present extent of education with reference to the population in the North West Provinces.

same

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EDUCATION.Desire to learn  
English in the  
North West  
Provinces.

same 3,000 people there are 200 girls, and one is at school. So that a great deal remains to be done.

In the opinion of Sir William Muir the desire for a knowledge of English is daily on the increase. "There are now, what there never were before, spontaneous endeavours on the part of the Native community to acquire English learning." An English master is entertained at the Jaunpur School, which is a Muhammadan religious foundation. "Through the medium of English alone can we hope to impart the highest learning and purest morality, and this will continue to be the case till the enlightenment and scientific spirit of the West are transposed into a new and higher vernacular literature for India."

Expenditure on  
education in the  
North West  
Provinces.

During the year under review, education, as has already been explained, became a provincial charge; and there will now be less delay and trouble in obtaining sanctions, money will go further, and be more usefully expended. The cost of education in the North West Provinces for 1871-72 was 151,765 *l.* The revenue of 13,000 *l.* was derived from the contributions of municipalities, which are beginning to assume increasing prominence, and amounted to 4,340 *l.* in 1871-72, from fees, endowments, and gifts. But the Government has now nearly reached the end of its means. The transfer of the Education Grant from Imperial to provincial accounts was made on the understanding that it should never be increased, except by means of local taxation; and the full amount of cesses has already been imposed. There cannot, therefore, again be the same rapid expansion in the number of schools as took place between 1860 and 1870. The further development of education must depend on the expenditure of the people themselves; and it is hoped that there may yet be large expansion from the efforts of an increasingly enlightened population.

Education in the  
Punjab.  
Affiliated colleges.University  
College.

In the Punjab, there are 1,325 Government, and 547 aided schools and colleges. The two colleges, affiliated to the University, are at Lahore and Delhi; and during the year two of their students received master's, and three bachelor's degrees. There are 56 students in each of these colleges. The Punjab University College, like that contemplated for Allahabad, has for its objects the encouragement of the study of Eastern classical literature, the improvement of the vernacular, the promotion and diffusion of European science, and the association of the learned and influential classes of the province with the Government in promoting and supervising popular education. Its scholarship amount, in the aggregate, to 8,400 rupees. Among special schools in the Punjab, there is a Government Ward School at Ambala, for the education of Government wards, and the sons of natives of rank, where there are 10 pupils; and at Delhi there is the Anglo-Arabic school, endowed by a legacy of Nawab Fazl Ali Khan, for the furtherance of education in that city, but managed by the Government. It gives instruction to 243 students in Arabic, who are all Muhammedans. There are five Government and 11 aided high schools, and 103 Government and 50 aided middle schools, corresponding to the Tahsili schools of the North West Provinces. The village or primary schools number 1,060 Government, and 166 aided, with an average of 35 scholars each. There are three Government and six aided normal schools. The condition of the female schools in the Lahor circle is decidedly improving, and the female normal schools are beginning to send out trained teachers. There are now 125 Government, and 314 aided girl schools, with 7,959 pupils. There has been real progress in the education of Punjab children, yet only 100,000 receive any instruction out of 3,000,000; so that there is still plenty of work to be done. The expenditure, in 1871-72, was 61,685 *l.*

Ward School at  
Ambala.Anglo-Arabic  
School at Delhi.Punjab high  
schools.  
Middle schools.Primary  
education.Normal schools.  
Female education.Expenditure on  
education in the  
Punjab.

Oudh education.

In Oudh there is, at Lucknow, the "Canning College," with 720 pupils, of whom 56 are in the college department. There are also 11 high schools with 3,096 pupils. The number of village schools is 747, and there is now a Government, or aided school within  $4\frac{1}{2}$  miles of every child in Oudh. Every class of school has its own curriculum, printed and suspended in each school-room, with the hours of assembly and holidays, and every schoolmaster has a manual of duties, with a few plain directions in school management. Each district also has a library for the use of village schoolmasters. The training school for masters is doing well, and has 151 scholars; that for mistresses, 36; and there are now 81 girl schools, with 1,908 pupils. The total number of schools of all classes in Oudh, is 1,541, and of scholars, 54,596. The expenditure from provincial

provincial funds for 1871-72, was 23,522 *l.*; and from the cess and subscriptions, 23,898 *l.*

The Central Provinces are divided into three educational circles, each with an inspector. There is no college, and only one high school, that of Sagar, which is, however, well managed and efficient. Candidates for University distinction in the Central Provinces are divided in their allegiance between Calcutta and the *Alma Mater* of Western India. On the one hand, Calcutta has not yet added Marathi to the list of second languages in the matriculation examination. On the other, the Bombay matriculation is *visá voce*, and very strict. The Nágpur candidates take up Sanscrit as their second language, and go to Calcutta. Of 25 who went up in 1871-72, 14 passed. Besides Sagar, there is a missionary school at Nágpur of the same rank, receiving aid. There are 47 Government middle schools; and 683 village or vernacular town schools, with 38,500 scholars. The four normal schools for masters are at Nágpur, Jabalpur, Ráipur, and Sambalpur; and there are three for mistresses, but they are reported not to be satisfactory institutions. The total number of schools in the Central Provinces is 1,825, with 85,956 scholars. In the Berárs, there are 344 schools, and 13,727 scholars; while in 1866, there were only 35, teaching 1,880 boys.

Education in the  
Central Provinces.

Education in  
Berár.

In Mysor there are five high schools, which train up to the Bachelor of Arts degree at the Madras University, and seven which give education sufficient to pass the entrance examination. The Bangalor high school is efficient and popular, and it is here that a branch examination of the Madras University is held annually, in December. In 1871-72, out of 122 candidates, 55 passed the matriculation, and three out of 13 succeeded in the First Arts examination. Seven Mysor undergraduates obtained bachelor's degrees. There are 487 village or Hóbli schools, as they are called in Mysor, besides 1,900 unaided. These Hóbli schools are very popular, and the number of scholars has increased to such an extent in some parts of the country that assistant masters are required; and the interest felt in them by the people generally is shown by their eagerness to build or rent suitable premises. There are three normal schools for Hóbli, and for Muhammadan training. The question is under consideration, whether it is feasible to have simple, but carefully compiled agricultural treatises of the most rudimentary description, prepared in the vernacular, to form part of the curriculum in the village schools. In Curg there is one school which trains up to the matriculation standard, but no Curg boy has yet passed; four middle schools, with 171 pupils, to qualify for the higher school, and 27 lower schools, which are to be increased to 84, all teaching in Canarese. There are now 1,512 pupils, and, as there is no female school, the little girls, 161 of them, go to school with their brothers, and learn needle work, in addition to the regular course.

Education in  
Mysor.

Hóbli schools in  
Mysor.

Education in  
Curg.

British Burma is said to be under the influence of the Calcutta University, but at present the connection is only nominal. Three boys have been sent up for the entrance examination, but all failed. The five high schools in Burma are reported not to be deserving the name, although they may become so in time, and all belong to Missionary Societies. A college is needed at Rangún; there are now only four Government middle-class schools and 12 aided, but they are stated really to be very second-rate Anglo-vernacular schools. Altogether, Government has seven schools, educating 505 boys, where the teaching is of a most inferior kind; and there are 15 aided missionary schools. Outside the towns of Rangún and Mulmein, there are only 774 children under instruction, and the education cess, with which little has yet been done, remains unspent. Fortunately, the Burmese people are provided with a system of primary education of their own. The monastic schools of the Buddhist priests afford an excellent means of obtaining gratuitous primary instruction to the mass of the people. The wild Karens are taught by the American Baptist Missionaries, whose schools are among the best in the province. They have prepared books and maps, and teach the Karens entirely through their own vernacular.

Education in  
British Burma.

Karens.

The Madras University, founded in 1857 by Lord Harris, grants the same degrees, and has the same system of examinations as that of Calcutta. It has several endowed scholarships, such as a 1,000 *l.* given by the Maharaja of Travancor

The Madras  
University.

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Travancor for a Travancor graduate in medicine or civil engineering, a similar one for a Cochin student, to the value of 650 *l.*, given by the Raja of Cochin, and prizes for Tanjor students by Sir Madava Ran. The graduates number 350; the undergraduates over 500. The results of the University examinations in 1871-72 were considered satisfactory. Out of 1,419 candidates for matriculation, 492 passed; while 205 passed the First Arts examination, and 131 that for Bachelor's degree. The Brahmins are far ahead as scholars, then come other Hindoos, and the Muhammadans are nowhere; none passed the First Arts examination, and only 12 matriculated. There are 13 colleges affiliated to the University in the Madras Presidency, and 52 high schools. The Presidency College has six professors, and 135 matriculated students. At the Combaconum Provincial College there are 65 undergraduates, besides 520 other pupils. The Tanjor High School has 762 in various classes; and the Central Institution of the Free Church of Scotland, the strongest among the aided schools, has 73 students in its college department. These are the four high schools which are most successful in the University examinations. In the south, most of the best schools belong to missionaries; and in Tinneveli there are no Government schools, the field being given up to the two Anglican Church Societies. There are 484 middle schools, and 3,373 lower schools, to 2,037 of which grants-in-aid have been sanctioned, on the principle of payment for results. The local and municipal education funds are to be applied mainly to primary education. The area where the rate is raised is to be called a union, and the schools are not to be more than 2½ miles from the houses of any of the ratepayers. The only Government primary schools are the hill schools in Ganjam and Nellor, established for the civilisation of the Yenadies. There are 183 students in the normal schools, and the Government training school for women has made a fair beginning. In 1871-72 there were 163 girl schools in the Madras Presidency, with 8,267 pupils. Altogether, there are 4,400 schools and colleges, and 135,192 pupils; the proportion of scholars to population being reported as from 1 in 68 in the Presidency town to 1 in 380 in Bellary. But there has been a great increase in the number of schools and scholars during the last year.

**Madras affiliated colleges.**

**Missionary schools**

**Madras middle schools.**  
**Lower schools.**  
**Madras primary education.**

**Madras normal schools.**  
**Madras female education.**  
**Prospects of Madras education.**

**The Bombay University.**

The Bombay University was founded by Lord Elphinstone in 1857; to consist of a Chancellor, a Vice-chancellor, and Senate, for faculties of art, law, medicine, and engineering, and the same system of examinations as at Calcutta and Madras. The Bombay University sets the standard of higher education, and examines for degrees. It has been enriched and endowed by the wealthy settlers of Bombay. The endowments for prizes amount to 970 *l.*; sums of 10,000 *l.* have been given by Sir Cowasjee Jehanghir Readymoney for the University Hall; of 40,000 *l.* by Premchund Roychund for the library and tower; and a sum of 120 *l.* from other benefactors for a grant of arms, and for the University silver mace. The hall and library have been erected on the esplanade at Bombay. The graduates and undergraduates now exceed 600, many of whom have taken distinguished places in the public service, and in the liberal professions.

**Bombay affiliated colleges.**

**Elphinstone College.**

**Deccan College.**

**Middle schools.**

**Primary education in Bombay.**

**Bombay night schools.**

There are six colleges affiliated to the University, 17 high schools and 133 middle schools, besides 2 aided colleges, 19 aided high schools, and 94 aided middle schools. Of the colleges, the Elphinstone College at Bombay occupied a handsome building in front of the Victoria Gardens, towards the erection of which Sir Cowasjee Jehanghir gave 20,000 *l.* The college now has 114 students, for whom eight professors are provided. The Deccan College at Puna has 83 students. There were in 1871-72 altogether 875 candidates for matriculation from the high schools, of whom 227 passed. The first grades of middle-class schools prepare boys for the high schools. The vernacular or village schools number 2,909, with 145,330 boys, supported by the Government and several unaided indigenous schools. Their chief source of support has been from one-third of an anna cess on every rupee of land revenue, besides a special grant; and hitherto there has been a slight but steady increase in the number of these primary schools. Now, things have come to a stand-still. Much success has attended the establishment of night schools for artisans and workmen. There are now 38, with 1,013 scholars, and it is intended to add technical instruction, the Dharwar factory and other similar works being utilised for

for the purpose. There are 177 Government and 27 aided girl schools, and three training schools for women; the men's normal schools are more numerous. The Rajkumar College is established for the education of young chiefs in Katiwar. There are now 17 inmates, including the Thakur of Limri, who is at the head of the institution. They all have ponies, and a good gymnasium is provided, where they show considerable spirit, as well as in the play-ground games. It is proposed to have a preparatory school at Ahmadabad, for the Rajkumar College. The total number of schools in the Bombay Presidency is 3,446, with 191,684 scholars.

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EDUCATION.  
Bombay female education.  
Bombay normal schools.  
Rajkumar College for chiefs.  
Number of schools in the Bombay Presidency.

There are, in addition to the University colleges, several special institutions for training students for the professions of civil engineering, medicine, and law; as well as schools of design and museums. The first of these, in point of importance, is the Thomason College at Rurki, founded in 1847, which was designed to give instruction in civil engineering to Europeans and Natives, with a view to their appointment to situations connected with the public works of the country. It has a library of 11,796 volumes; a press for printing, lithography, engraving, and binding; an instrument depôt; and publishes a valuable series of professional papers on civil engineering. The students are of various classes, officers in the army, non-commissioned officers, and privates, English civilians and Native youths. There are now 197 students at Roorkee, 120 of whom are qualified for certificates. Forest apprentices are also to be sent there, after two years' work in the forests, for a training in drawing and surveying. A college for civil engineers, to supply the Indian Public Work Department, has now been established in England, but Rurki must continue to perform a similar part for Anglo-Indians and Natives of India. It has already played this part for 26 years, expanding its scope of usefulness, creating an engineering profession among natives, and disseminating an engineering literature adapted to Indian wants and experiences. At Calcutta, there is another Civil Engineering College, with 116 students; and another at Madras for officers, soldiers, and natives, with 130 students. The Puna Civil Engineering College is affiliated to the University, and has 170 students. The building for it was commenced in 1865, and completed in 1868, at a cost of 18,000 £, of which Cowasjee Jehanghir contributed 5,000 £. It consists of a main hall, with lecture, drawing, and photograph rooms, to which is now being added a set of workshops. There is another small engineering college in Sind.

Civil engineering colleges.

Rurki College.

Calcutta Civil Engineering College.  
Madras Civil Engineering College.  
Puna Civil Engineering College.

The medical colleges in India also prepare for university degrees. The Calcutta Medical College is said to have a larger number of students than any other in the world; namely, 1,046. Its students have obtained four degrees of Doctor of Medicine at the University, 26 of Bachelor, and 439 as Licentiates. Many of these native doctors are employed in the public service, and many more settle down to private practice in Bengal towns and villages. The Agra Medical College receives pupils who have been trained in the numerous dispensaries; and similar useful work is done by the Lahor Medical School, which now has 42 students. The Grant Medical College at Bombay has 75 graduates and undergraduates, 69 hospital apprentices, 40 vernacular students, and 38 native medical pupils; and it is liberally endowed with scholarships and prizes. Sir Cowasjee Jehanghir gave 20,000 £ for adding an Eye Hospital to the Grant College. There is a wide field for private practice in Bombay, and many of the medical students have the means and energy to proceed to England and compete for appointments in the covenanted service. The Madras Medical College has 73 students in the college, and 762 in the school class. A Nagpur School of Medicine has existed for five years.

Medical Colleges.  
Calcutta Medical College.

Agra Medical College.

Lahor Medical School.

Grant Medical College at Bombay

Madras Medical College.  
Nagpur School of Medicine.

The schools of art and museums are also powerful instruments in the spread of education. Dr. Hunter's School at Madras has long been famous for the tasteful designs produced under his instruction, and for the amount of useful work done. The School of Art at Calcutta was formed in 1864, and gives a three years' course in drawing, lithography, and decorative art. There are now 76 pupils, and much good work is turned out. Among other things, the pupils did the water-colour drawings of venomous snakes, from specimens, for Dr. Fayrer's work, and a series of pen-and-ink etchings of carved ornamentation on temples in Orissa. At the School of Art in Bombay there are 57 pupils, who learn drawing, painting, and modelling. Museums have long been estab-

Schools of art.  
Dr. Hunter's School at Madras.  
School of Art at Calcutta.

School of Art at Bombay.

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EDUCATION.

Calcutta museums.

Madras museums.  
Bangalore Museum.

Bombay Museum.

Dr. Birdwood as  
curator.

Victoria and Albert  
Museum at  
Bombay.

Dr. Birdwood's  
services.

Museum at  
Karachi

Lahore Central  
Museum.

Lahore Museum.

Rocks and news-  
papers.

The press in  
Bengal.

Bengal press.

Literature in the  
North West  
Provinces.

lished at Calcutta and Madras. The Indian Museum at the former city was formed in 1866, and there are also a geological museum, and one belonging to the Asiatic Society. The Government Central Museum at Madras was visited by 116,691 persons in 1871-72; and there are small local museums at Rájmahendri and Utakamund. The Bangalore Government Museum, founded in 1864, had 162,897 visitors in 1871-72.

The Bombay Museum was founded by Lord Elphinstone, under the name of the "Government Central Museum," for the illustration of the economic products and natural history of Western India. The late Dr. Buist, LL.D., F.R.S., was the first curator, and the Rev. Dr. Fraser, LL.D., succeeded him. The collections organised by these gentlemen were lodged in the town barracks, and on the breaking out of the Mutiny in 1857 they were destroyed, the brigadier commanding the Bombay garrison having ordered them to be thrown out of the windows. In the same year Lord Elphinstone appointed Dr. Birdwood as curator, who, with the aid of Dr. Bheu Daji, raised a large sum of money by subscriptions from the public, for the erection of a building. It was erected in the Agri-Horticultural Society's garden; and thus was established the Victoria and Albert Museum and Gardens, at a total cost of 100,000*l.* The first stone was laid by Sir Bartle Frere in November 1862; but the works were stopped in 1865 for want of funds, and it was not until 1868 that the Government again undertook to complete them. The new museum was opened in 1871. During the interval of its building, Dr. Birdwood arranged the collection in the Town Hall, and zealously worked at the task of making it a really useful institution, until his retirement in 1868. He drew up valuable reports on the *Tasar silk* and on the Indian blister fly, and in connection with the museum, he published a catalogue of the economic vegetable products of Western India. It was also through his connection with the Victoria Gardens that he was enabled to identify the sources of frankincense (*gum olibanum*), and to complete his important monograph on the genus *Boswellia*.

There is also a small museum at Karachi. The Lahore Central Museum was visited by 66,069 persons during 1871-72. It contains a fine collection of coins, and a most interesting gallery of Græco-Bactrian sculptures. The Lahore Museum was visited by 96,104 persons; and 88,000 visitors came to the Nagpur Museum in 1871-72. There are institutions of the same kind at Agra and other places, and the numbers of visitors who flock to them show that they take their share in the education of the people.

But one very important criterion for judging of the intellectual movement that is going on in India is the number and character of the books and newspapers that are published. In Calcutta there are 34 daily, weekly, and monthly newspapers published, of which 18, or a little over half, are English, and the remainder Native; but there are only six English newspapers published in other towns of Bengal, against 32 Native newspapers. The number of magazines published at Calcutta is 19, of which three are Native, and the rest English, against eight Native, and two English published in other towns in Bengal. The number of books published in Bengal during the year under review was 1,005, of which 759 were Native and 246 English; but the return gives no particulars as to their character. The Native press in Bengal, in the opinion of the Lieutenant Governor, is a very active and important power, and shows much talent and intelligence. It is free spoken, and perhaps hypercritical, in its comments on the measures of the Government; but the educated Natives of Bengal are believed to be, in reality, thoroughly loyal.

There were 30 Native newspapers published in the North West Provinces in 1871-72, with an average circulation of 253 copies each, and nine magazines. Of the two languages, Urdu keeps a decided lead in relation to Hindi, the great majority of the newspapers and magazines being in the former language. As a rule, there is nothing that is offensive to morality or good taste in these publications, and much that is useful. The Government takes a large number of copies, with a view to stimulating the circulation; and it is considered that the intellectual progress resulting from the reading of these papers is not unimportant. Three hundred and seventeen books were published in 1871, of which 90 were in Urdu, 53 in Hindi, 56 in Persian, 47 in Arabic, and 33 in English. Of the Urdu books, 13 were on religion, 11 poetry, 10 fiction, and

10 on law. Religion and poetry are the subjects on which books are most in request. The Government grants rewards for meritorious authorship in the vernacular.

In the Punjab, 12 Native and six English newspapers are published; and in 1871-72 the books were 355 in number, of which 20 were English, and the rest Native. In Oudh there are four English and three Native newspapers. No information respecting newspapers is given in the Madras Report; but 508 books were published in that Presidency during the year 1871-72, of which 98 were original. In English there were 70; in Tamil, 177; in Telugu, 115; in Malayalam, 26; in Canarese, 22. 159 were on religion; 77 on poetry; 39 fiction; and 24 law. Of the four languages in the Bombay Presidency, Marathi and Gujrathi show signs of intellectual activity; but in Canarese and Sindi there are few books, and no newspapers. A reporter on the Native press is maintained by the Bombay Government, who draws up a weekly report. Of the 59 Native newspapers in the Presidency, 29 are in Marathi, 26 in Gujrathi, three in Urdu, and one in Persian. They are published in most of the large towns, and their general tone is loyal, the advantages of British rule being understood and confessed, although there are acrimonious attacks on particular measures, and on the conduct and actions of individual officers of Government. In 1871 the number of books published in the Bombay Presidency was 779, out of which 157 were English, 214 Marathi, and 243 Gujrathi. Four hundred and thirty-three were original works, and the rest translations or reproductions. The taste of readers seems to run in the same direction as in the North West Provinces and the Madras Presidency. There were 180 on poetry, 105 on religion, and 69 on law. The general tone of vernacular literature, in respect of morality, is reported to be good and progressive.

Punjab press.

Oudh press.

Books in Madras

Bombay newspapers.

Bombay books.

The growth of scientific and literary societies among the Native communities is a very remarkable sign of progress and of intellectual activity which deserves careful attention. There have always been societies in India in which Europeans and educated Natives meet on common ground, and such institutions continue to increase and flourish. The Bengal Asiatic Society was founded by Sir William Jones in 1784 as a centre to which individual inquirers might forward their materials, and from which they might derive assistance and advice; and the Madras Literary Society was formed in 1818. The Bombay branch of the Asiatic Society dates from the year 1804, and in 1817 it was grafted on to the Royal Asiatic Society in England as the Bombay branch. Its Journal was established in 1841, and the publication has been regularly kept up ever since at intervals of one or two years. During ten years Mr. William Frere was its president, and Dr. Carter its secretary, men of high literary and scientific attainments; and on the retirement of Dr. Carter, who may be looked upon as the father of Indian geology, Dr. Birdwood succeeded to the secretaryship. During his brief incumbency the number of members was more than doubled, and the annual receipts were increased from 1,000 l. to 3,400 l., in addition to 800 l. from Sir Cowasjee Jehanghir for the purchase of coins, and 500 l. for the purchase of standard works on Oriental literature; 1,000 l. from the late Honourable Jugernath Sunkersett for books on natural history, and 1,000 l. from Premchund Raychund for library fittings. Altogether 6,200 volumes were added to the library by Dr. Birdwood. He was succeeded by Mr. James Taylor, the distinguished Secretary to the Bombay Chamber of Commerce, and the Society has continued to flourish and to publish its Journal with regularity. The Bombay Geographical Society dates from 1830, and its Journal contains many valuable papers, chiefly from officers of the Indian Navy; and the Medical and Physical Society, though it languished from 1863 to 1869, has now been revived, and published a large volume of transactions in 1871. In Calcutta, besides the venerable Asiatic Society, there are the Bethune Society, for the promotion of intercourse between European and Native gentlemen, the Dalhousie Institute for the literary and social improvement of all classes of the community, the Bengal Social Science Association, and others. In other parts of India there are several societies, such as the Rangun Literary Society, with lectures and classes, established in 1857. But in addition to these societies of European origin, there are now throughout India, and especially in

Scientific and literary societies.

Bengal Asiatic Society.

Madras Literary Society.  
Bombay Branch of the Asiatic Society.

Bombay Geographical Society.

Medical and Physical Society.

Calcutta Bethune Society.

Dalhousie Institute.

Bengal Social Science Association.

Rangun Literary Society

Bengal,

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EDUCATION.  
Native Societies.

Bengal, many associations, some of them literary or scientific, but others political, which were founded by and are composed entirely of natives. In Bengal, among many others, there are the "People's Association" and the "Radical League." The Lieutenant Governor says of them that "if not very completely justifying the titles they assume, they are nevertheless an earnest of things to come, and are on the whole much to be encouraged. Some of them are already interesting societies, with much reality and substance in them." In Oudh there are three native Reform Clubs, at Lucknow, Faizabad, and Gonda. In the Central Provinces the associations appear to be chiefly formed by schoolmasters, to afford opportunities for self-improvement, but there are also native clubs. The information on this interesting subject from other parts of India is very incomplete; but it is clear that these native societies and institutions are advancing with rapid growth, and springing into existence in all directions.

Missionary work.

The numerous excellent missionary schools receiving grants in aid in the various provinces have already been referred to; but the whole subject of missionary enterprise in India has such an important bearing on the intellectual advancement of the people, that any notice of Indian education would be incomplete without giving some details respecting the work of the missionaries. A recent inquiry into the statistical details of missions in India, combined with the ordinary sources of information, furnish materials for estimating their progress, which are authoritative and complete.

Number of societies and missionaries.

The Protestant missions of India, Burmah and Ceylon, are carried on by 35 missionary societies, in addition to local agencies, and now employ the services of 606 foreign missionaries, of whom 551 are ordained. They are widely and rather evenly distributed over the different presidencies, and they occupy at the present time 522 principal stations, and 2,500 subordinate stations. The entire Presidency of Bengal, from Calcutta to Pesháwar, is well supplied with missionaries, and they are numerous in the southern portion of the Madras Presidency. The various missions in Calcutta, Bombay, and Madras are strong in labourers, and almost all the principal towns of the Empire have at least one missionary. A great impulse was given to the efforts of these societies by the changes in public policy inaugurated by the Charter of 1833, and since that period the number of missionaries, and the outlay on their missions have continued steadily to increase. In 1852 there were 459 missionaries in India at 320 stations, and in 1872 the number of missionaries were increased to 606, and of stations to 522.

Stations.

Co-operation of missionary societies.

This large body of European and American missionaries settled in India, bring their various moral influences to bear upon the country with the greater force, because they act together with a compactness which is but little understood. Though belonging to various denominations of Christians, yet from the nature of their work, their isolated position and their long experience, they have been led to think rather of the numerous questions on which they agree, than of those on which they differ; and they co-operate heartily together. Localities are divided among them by friendly arrangements, and with few exceptions it is a fixed rule among them, that they will not interfere with each other's converts and each other's spheres of duty. School books, translations of the scriptures and religious works, prepared by various missions, are used in common; and helps and improvements secured by one mission, are freely placed at the command of all. The large body of missionaries resident in each of the presidency towns, form missionary conferences, hold periodic meetings, and act together on public matters. They have frequently addressed the Indian Government on important social questions involving the welfare of the Native community, and have suggested valuable improvements in existing laws. During the past 20 years, on five occasions, general conferences have been held for mutual consultation respecting their missionary work; and in January last, at the latest of these gatherings, at Allahabad, 121 missionaries met together belonging to 20 different societies, and including several men of long experience who have been 40 years in India. The railway system rendered such a gathering easy, and brought the members of the conference from all parts of the Empire.

Various forms of labours.

The labours of the foreign missionaries in India assume many forms. Apart from their special duties as public preachers and pastors, they constitute a valuable



valuable body of educators; they contribute greatly to the cultivation of the native languages and literature, and all who are resident in rural districts are appealed to for medical help to the sick.

No body of men pays greater attention to the study of the native languages than the Indian missionaries. With several missionary societies (as with the Indian Government) it is a rule that the younger missionaries shall pass a series of examinations in the vernacular of the district in which they reside; and the general practice has been, that all who have to deal with natives who do not know English, shall seek a high proficiency in these vernaculars. The result is too remarkable to be overlooked. The missionaries, as a body, know the natives of India well: they have prepared hundreds of works, suited both for schools and for general circulation, in the fifteen most prominent languages of India and in several other dialects. They are the compilers of several dictionaries and grammars; they have written important works on the Native Classics and the system of philosophy; and they have largely stimulated the great increase of the Native literature prepared in recent years by educated Native gentlemen.

Knowledge of the native languages.

The mission presses in India are 25 in number. During the 10 years between 1852 and 1862, they issued 1,634,940 copies of the Scriptures, chiefly single books; and 8,604,033 tracts, school-books, and books for general circulation. During the 10 years between 1862 and 1872, they issued 3,410 new works in 30 languages; and circulated 1,315,503 copies of books of Scripture; 2,375,040 school-books; and 8,750,129 Christian books and tracts. Last year two valuable works were brought to completion, the revision of the Bengali Bible, and the first publication of the entire Bible in Sanskrit. Both were the work of the Rev. Dr. Wenger, of the Baptist Mission in Calcutta.

Mission presses and publications.

The missionary schools in India are chiefly of two kinds, purely vernacular, and Anglo-vernacular schools. The former are maintained chiefly, but not exclusively, in country districts and small towns; the education given in them is confined pretty much to reading, writing, geography, arithmetic, and instruction in simple religious works, such as the "Peep of Day." In the Anglo-vernacular schools a much higher education is given, not only in those subjects which are taught in English, but in those in which the vernacular is employed; a higher knowledge even of the vernacular languages is imparted in these schools than is usually given in purely Native schools. These schools are most in demand in country towns, in the Presidency cities, and in the districts immediately around them. Bengal has long been celebrated for its English schools; and the missionary institutions in Calcutta still hold a conspicuous place in the system and means of education generally available to the young Hindus of that city. All the principal missionary institutions teach up to the standard of the entrance examination in the three universities of India; and many among them have a college department in which students can be led on through the two examinations for B.A., even up to the M.A. degree. A Table showing the number and range of these schools will be found in the Appendix.

Missionary schools.

Anglo-vernacular schools.

In addition to the work of these schools it should be noted that several missions maintain training colleges for their Native ministers and clergy, and training institutions for teachers. These colleges and institutions are 85 in number, and contain 1,618 students. The training institutions for girls are 28 in number, with 567 students. An important addition to the efforts made on behalf of female education is seen in the Zenana schools and classes which are maintained and instructed in the houses of Hindu gentlemen. These schools have been established during the last 16 years, and now number 1,300 classes, with 1,997 scholars, most of whom are adults. Of these, 938 classes, with 1,523 scholars, are in Bengal and the North West Provinces. The effort has not yet much affected the other provinces of India.

Training colleges.

Zenana schools.

The great progress made in these missionary schools, and the area which they occupy, will be seen from the following fact. They now contain 60,000 scholars more than they did 20 years ago. The figures are as follows: In 1852 the scholars numbered 81,850; and in 1872 the number was 142,952.

Increase in the schools.

The high character of the general education given in the college department of these institutions may be gathered from the following facts. Between

University examinations.

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1862 and 1872, 1,621 students passed the entrance examination in one or other of the three Indian universities; 513 students passed the first examination in Arts; 154 took the degree of B.A.; 18 took the degree of M.A., and six that of B.L. A considerable proportion of the amount expended upon education by the missionaries in India is provided by school fees, which, in recent years, have been much increased. The statistical tables, however, do not give the exact amount, neither do they state the amount received from the Government grants-in-aid. In the higher education it is believed that little expenditure falls upon the missionary societies beyond the salaries of the superintending missionaries.

Protestant  
converts.

The statistical returns now referred to state very clearly and completely the number of the converts who have been gathered in the various Indian missions, and the localities in which they may be found. They show also that a great increase has taken place in the numbers of these converts during the last 20 years; as might be expected from the lapse of time, the effects of earlier instruction, and the increased number of missionaries employed. In 1852 the entire number of Protestant Native converts in India, Burma, and Ceylon, amounted to 22,400 communicants, in a community of 128,000 Native Christians of all ages. In 1862 the communicants were 49,688, and the Native Christians were 213,182. In 1872, the communicants were 78,494, and the converts, young and old, numbered 318,363.

Rate of increase.

A very large number of the Christian communities scattered over India are small, especially in the country towns; and they contain fewer than 100 communicants and 300 converts of all ages. At the same time some of these small congregations consist of educated men, have considerable resources, and are able to provide for themselves. From them have sprung a large number of the Native clergy and ministers in different churches, who have received a high education in English institutions, and who are now taking a prominent place in the instruction and management of an indigenous Christian church. The Native ministry contains also men who have been well trained through the medium of the vernacular languages; but this important body of men are encouraged to master the English language also, that they may secure access to the vast store of Biblical literature which it contains, and which will give them direct aid in their duties. The Native converts are thus distributed at the present time:—

Number of small  
congregations.

Native Protestant Converts in India, 1872.

Divisions.	Communi- cants,	Native Christians.	Native Ordained Ministers.	Native Contributions.	
				Rs.	
Lower Provinces -	13,502	46,968	85	8,937	
North Western Pro- vinces and Oudh.	3,031	7,779	10	5,265	
Punjab - - -	707	1,870	14	1,661	
Bombay and Central India.	2,256	6,686	26	6,583	
Madras - - -	83,820	160,955	131	62,675	
Burmah - - -	20,514	62,729	77	42,736	
Ceylon - - -	5,164	31,376	79	31,267	
TOTAL - - -	78,494	318,363	381	159,124	= £. 15,912

Populations of the  
towns.

The missionaries in the course of their efforts have found the populations of the great cities much more tenacious in their opinions, and firm in their social relations, than those of country districts. On the other hand they are more intelligent; they are good listeners; appreciate argument and illustration; and their children flock to the mission schools. The rural population have been much more open to their instructions; the peasantry of large districts have been less bound by caste ties; and the aboriginal tribes and classes in the community, both in the hills and in the plains, have embraced Christianity in large numbers.

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The religious movements which took place 40 years ago among the peasantry to the south of Calcutta, among the indigo ryots of Krishnagar, and in the thickly-peopled swamps of Barisál, gave to the Province of Bengal three large Christian communities, which now number nearly 16,000 persons. They have been steadily cared for and well instructed, and have been consolidated into prosperous, well-conducted communities. Within the last 20 years the German mission among the Cole tribes in the hills of Chota Nágpur, now divided into two branches, has greatly affected these simple yet manly people; and, notwithstanding considerable social persecution, has led more than 20,000 persons among them to profess themselves Christians. Very recently the Santál tribes, in the same line of hills, have followed in their steps.

Converts in Bengal.

Among the Coles and Santáls.

In the year following the mutiny a new Mission was commenced by an American Society in the provinces of Oude and Rohilkhand; and the Christian congregations already include 2,000 converts. The largest congregations in the North West Provinces are found in Benares, Allahabad, Fathigarh, Agra, and Mirat (Meerut), and sprang from the boarding schools, established in the great famines of 1838 and 1861. An important religious movement has recently occurred in the dominions of the Nizam, under the conduct of native missionaries; and 1,100 persons have become Christians.

In Oudh and Rohilkhand.

In the Nizam's dominions.

A similar movement has taken place among the Telugu people of Ougole, under the American mission, which has resulted in 6,000 converts. More than 7,000 are now included in the two missions at Cuddapah; and the Telugu missions in Guatoor, in the Masulipatam district, and on the Godávári, have increased during the last few years from 1,500 native Christians to more than 6,000.

In the Telugu districts.

But it is in the southern portions of the Madras Presidency that Christianity has most largely affected the rural populations. The Province of Tanjor, first instructed by the Danish missionaries, amongst them by the respected missionary Schwartz, has long possessed a large number of Christian congregations. These continue under the care of the Lutheran and the English Episcopal missions, and are reported to be in a prosperous condition. The Christians now number 11,000 persons in the Tanjor and Trichinapalli districts. In the neighbouring district of Madura the Americans have a flourishing mission, with 7,000 converts and a normal school.

In Tanjor and Madura.

The Tinneveli and Travancor missions are well known; and are reported to be in every way in a higher position, and exerting greater influence than ever before. These two provinces contain a very large aboriginal population, which has been but little affected by the Hinduism of Southern India. The Shanar tribe and their kindred, connect themselves by tradition with the great demon-ruler of Ceylon, the celebrated Ravana; and from the numerous and marked peculiarities of their social and religious life have proved a most interesting study to the missionaries who have lived among them. They have been under instruction from the commencement of the present century. Good schools have flourished among them, by which girls have benefited as well as boys. Training schools have supplied well-taught schoolmasters; theological schools have in recent years provided a full supply of Native ministers and clergy; while the congregations have steadily multiplied, and the character of the whole people has been raised. Three missions have been carried on among them by the Church Missionary Society, the Society for the Propagation of the Gospel, and the London Missionary Society, and a large and influential English staff has conducted the affairs of these missions. The result is reported to be highly satisfactory. At the present time, 99,000 persons of all ages are professing Christians among the Shanar people; the districts are dotted over with flourishing villages and Christian churches; there are hundreds of Native teachers employed among them, of whom fifty-six are ordained, and are supported to a great extent by their congregations. Order and peace rule these simple communities, which give the Government little trouble, whether in the Madras Presidency, or under his Highness, the Maharajah of Travancor; while large tracts of country have been brought under cultivation, and the peasantry generally enjoy a larger share of material comfort than in days gone by.

In Tinneveli and Travancor.

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EDUCATION.

The Syrian  
Christians of  
Malabar.

Mission in  
Burmah.

Total number and  
importance

Much the same may be said of the Church mission among the Syrians of Upper Travancor and Cochin. The congregations among them now include some 14,000 people, and the Syrian Christians at large have been greatly stimulated and improved through the efforts of the English missionaries carried on in their midst. Only one other mission needs special mention here, the American mission in Burmah. This mission has drawn its converts chiefly from the Karen tribes, the aborigines of Burmah, and the Shan States, who have so heartily welcomed the English rule. Information respecting them has been scanty of late; but it is certain that 60,000 of them are Christian converts, and that the mission is largely supported by the people themselves.

Taking them together, these rural and aboriginal populations of India, which have received a large share of the attention of the missionary societies, now contain among them *a quarter of a million* native Christian converts. The principles they profess, the standard of morals at which they aim, the education and training which they receive, make them no unimportant element in the Empire which the Government of India has under its control. These populations must greatly influence the communities of which they form a part; they are thoroughly loyal to the British Crown; and the experience through which many have passed, has proved that they are governed by solid principle in the conduct they pursue. Dr. Hunter has recently set before the Government the importance of the hill races and other aborigines of India, reckoned at 70,000,000 in number, and both because of the simplicity of their habits, their general love of order, their teachableness, as well as their great numbers, has urged that new and large efforts shall be made for their enlightenment. In the same way many able missionaries advocate that the Christian efforts among them shall be increased. There is reason to believe that these estimable races will occupy a more prominent position in the Empire, in the future, than they have done hitherto.

General influence  
of missionary  
teaching.

But the missionaries in India hold the opinion that the winning of these converts, whether in the cities or in the open country, is but a small portion of the beneficial results which have sprung from their labours. No statistics can give a fair view of all that they have done. They consider that their distinctive teaching, now applied to the country for many years, has powerfully affected the entire population. The moral tone of their preaching is recognised and highly approved by multitudes who do not follow them as converts. The various lessons which they inculcate have given to the people at large new ideas, not only on purely religious questions, but on the nature of evil, the obligations of law, and the motives by which human conduct should be regulated. Insensibly a higher standard of moral conduct is becoming familiar to the people, especially to the young, which has been set before them not merely by public teaching, but by the millions of printed books and tracts which are scattered widely through the country. On this account they express no wonder that the ancient systems are no longer defended as they once were; many doubts are felt about the rules of caste; the great festivals are not attended by the vast crowds of former years; and several Theistic schools have been growing up among the more educated classes, especially in the Presidency cities, who profess to have no faith in the idol-gods of their fathers. They consider that the influences of their religious teaching are assisted and increased by the example of the better portions of the English community; by the spread of English literature and English education, by the freedom given to the press; by the high standard, tone, and purpose of Indian legislation, and by the spirit of freedom, benevolence, and justice, which pervades the English rule. And they augur well of the future moral progress of the Native population of India, from these signs of solid advance already exhibited on every hand, and gained within the brief period of two generations. This view of the general influence of their teaching, and of the greatness of the revolution which it is silently producing, is not taken by missionaries only. It has been accepted by many distinguished residents in India, and experienced officers of the Government; and has been emphatically endorsed by the high authority of Sir Bartle Frere. Without pronouncing an opinion upon the matter, the Government of India cannot but acknowledge the great obligation under which it is laid by the benevolent exertions made by these 600 missionaries, whose blameless

less example and self-denying labours are infusing new vigour into the stereotyped life of the great populations placed under English rule, and are preparing them to be in every way better men and better citizens of the great Empire in which they dwell.

XII.  
EDUCATION.

The Catholic Missions in India are efficiently continued; but they are almost entirely confined to their Christian converts and have little to do with the non-Christian population. The missions are divided into two branches, those which maintain a connection with the Portuguese portion of the Church, under the Archbishop of Goa, and those which are under the vicariates of the Jesuit Mission. During the last 40 years both branches have been renewed and revived from the decay into which they had fallen, and seem to be well supplied with foreign as well as with native clergy.

The Goa Church has the largest number of its converts and followers in Bombay and its coast districts, in Travancor, around Madras, and in Eastern Bengal. The number in Bombay is not known; but in other parts of India they are about 48,000.

The vicariates of South India, which sprang from the celebrated Madura Mission, are 10 in number; they contain about 160 regular clergy, who are foreigners; and more than 400 native priests. The converts under their charge are reckoned at more than 600,000; of these 150,000 are in the district of Madura; 90,000 in the French district of Pondicherry, and over 250,000 in North Travancor. A few years ago a large secession took place from the last named mission. The fishermen on the coasts of South India, amongst whom St. Francis Xavier laboured with so much earnestness, still continue to profess the Christian faith, and regard him as their patron saint. There are six seminaries conducted by the Mission in South India, employed both as boarding schools for lads and as training schools for native priests. Two of these are at Virapalli, the head quarters of the Romo-Syrian Mission in Travancor; another is at Pondicherry, and a third at Negapatam was established through the earnest exertions of Father Clifford, though opened only after his lamented death. The number of the students in these institutions is not known; and very little information is given respecting the Catholic schools in India generally. A statement, however, giving the population and number of converts in the several vicariates, will be found in the Appendix. It was prepared for the recent Ecumenical Council at Rome.

XIII.—POLITICAL.

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THE frontiers of India, from the mouth of the Ganges, on the shores of the Arabian sea, to where the Pakchan divides Tenasserim from Siam, are fringed by numerous tribes of various races inhabiting the Hala and Suleiman ranges, the valleys of the Himalayas, and its offshoots; while beyond them are the more powerful and settled States of Kelat, Afghanistan, Eastern Turkistan, Tibet, and Burma. Owing to the wild and predatory habits of the mountain tribes, which form a somewhat disorderly fringe round the skirts of our empire, there are frequent disturbances in one part or other of the long frontier line, requiring notice in an annual report. In the year under review the Lushai Expedition took place, which was organised for the purpose of checking the inroads of the wild tribes on the extreme eastern frontier, and to prevent a recurrence of outrages committed in the Cachar tea plantations in the spring of 1871. Two columns were formed, under the command of Generals Brownlow and Bouchier, the one to advance north from Chittagong, into the wild mountainous region, and the other south from Cachar. The objects of the expedition were to obtain the surrender of British subjects, and to establish permanent friendly relations with the savage Lushais, by convincing them that they had nothing to gain and everything to lose by placing themselves in a hostile position towards the British Government. Success depended more on the efficiency of the transport department than on any other contingency, and a corps of coolies was carefully organised.

The Cachar column, accompanied by 178 elephants and 1,200 coolies, marched from Tipai Mukh, on the frontier, in December 1871. The villages of

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the robber chiefs were occupied, fines were levied, and hostages taken. The troops returned to Cachar, after having made an advance of 110 miles from Tipai Múkh to the stronghold of Lalburah, the most powerful of the Lushai chiefs. The Chittagong column was chiefly composed of Gúrkha regiments. It assembled at its advanced base at Demagiri, on the river Kurnafali, in November, and thence advanced into the mountainous fastnesses of the Sailus and Haulongs. The latter had kidnapped a little girl, named Mary Winchester, from one of the tea plantations. The troops captured and burnt the strongholds of the hostile chiefs, with their stores of grain. The Haulongs then submitted, gave up Mary Winchester and all other captives, and engaged to live amicably with their neighbours in British territory, and to give free access through their country. The force returned to Chittagong in the end of February 1872, an advanced post being left with a garrison of a hundred local police.

Assam border  
tribes.

There has been little trouble with the other hill men on the eastern frontier, during the year under review. Several frontier districts are excluded from the operation of regular laws, and the Deputy Commissioner of Assam has an annual meeting of the hill tribes which fringe the upper valley of the Brahmaputra. Of these the Bhuteas, Abors, Mishmis, Miris, Singphus, Khamptis, and Nagas were most troublesome in former years, making frequent raids into the settled districts. The Abors are a savage race, but have given little trouble of late. The Mishmis annually come down to trade peaceably. The Miris (6,500) are on the banks of the Brahmaputra, and pay a capitation tax. The Nagas (2,865) in the southern hills, are now peaceable. The main object of having dealings with these hill people is to protect the low lands from their incursions. From 1854 to 1865 the Angami Nagas made 19 raids into the plains and killed 236 people; but in the latter year Lieutenant Gregory occupied a post in their country, and the raids have since ceased. A colony from another hill race, the Kukis, were also given some rent free land on the east side of North Cachar, in such a position as that they should form a screen between the Nagas and the plains. In May 1871 these Kukis made a raid against a Naga village, as they declared in self-defence, but Captain Butler conveyed to them an expression of the displeasure of the Government at their conduct.

The Nagas.

Hill tribes.

The tribes in the Khasia, Jayanta (Jynteah), and Garo hills have been quiet, and there was only one attempt at a raid in the hill tracts of Chittagong. The hill tracts of Northern Arakan are inhabited by five tribes of Burmese physiognomy, but all speaking different languages, who have long been very troublesome. The Khamis and Miros are notorious for murder and rapine, as are the Khyns, in the hills which divide the kingdom of Burma from Arakan, who raid indiscriminately into British Burma and Burma Proper, armed with bows and poisoned arrows. Captain Hughes has been appointed to superintend these hill tribes of Arakan with satisfactory results, and order is being gradually introduced.

Tibet.

Beyond these Himalayan tribes, are the more powerful states of Central Asia, but that of Tibet, which lies on the other side of the eastern ridges, has always been sealed up by the jealous policy of its Chinese rulers. In 1869 Colonel Houghton, the Commissioner of Kuch Bahar, strongly recommended the policy of cultivating friendly relations with the Lamas, who are said to have great influence with our troublesome neighbours the Bhuteas. In any future treaty with China the subject of opening a trade route between India and Tibet is to be borne in mind, and meanwhile a letter was sent, in June 1871, by the Sikkim Raja to the Tibetan authorities. It was, however, returned unopened, and a more favourable opportunity will have to be taken hereafter. It is much to be regretted that intercourse should thus be sealed up between India and the Tibetan highlands, in this direction. As regards Nepal and Bhotan, the frontier lines are to be surveyed and clearly demarcated.

Punjab frontier  
tribes.

The frontier tribes along the Punjab and Sind frontiers have been tolerably quiet. There was one raid by the Akazais, in Hazára, in June 1871. In the Dera Ismail Khan district there was an attack upon a kafla of the Waziris by a party of the Bhattani tribe, in September 1871, and in February 1872 it was necessary to send a small force against the village of Dour, beyond the Banne frontier. From Hazára to Dera Ismail Khan the tribes are Patan Afghans, and thence to the sea they are of Baluch race. Beyond the Himalayas are the independent

Embassy to East-  
ern Turkistan.

Independent states which intervene between British territory and the countries occupied by the Russians. To the east the Atalik Ghazi, ruling over Eastern Turkistan, has shown a strong desire to open friendly intercourse with India, and to promote trade. His envoy has recently been received by the Governor General, and an English return embassy, from which the best results may be anticipated. Shir Khan, the ruler of Afghanistan, is a cordial ally and friend of England, and the recent arrangement, by which the Russian Government has acknowledged the Amír's right to Badakshan and Wakhan, may have the effect of strengthening his position, and will be an additional motive for a continuance of loyal relations with the British Government. But during the year under review the territories of Shir Khan were not without internal trouble. During April 1871 his son Yakub Khan attacked Herat, obtained possession of the town by treachery in May, and killed his father's faithful servant Fateh Muhammad Khan. The young chief then came to Kabul, and appeared at his father's durbar, expressing great penitence, and in October 1871 was allowed to assume the governorship of Herat. Abdulrahmar Khan, son of Shir Khan's elder brother Afzul, remains in exile at Bokhara.

Afghanistan.

The Khan of Kelat is ruler of Baluchistan, a country which intervenes between India and Persia, and which, equally with Afghanistan and the Turkistan State, it is to the interest of the British Government to keep in a state of prosperity and peace; but unfortunately Baluchistan has long been torn by internal dissensions. The present Khan succeeded in 1857, and his dominions have ever since been the scene of almost unceasing disturbances, owing to the disaffection of the chiefs, and the designs of two of them, the Jan of Lus and the Chief of Kharan, on the throne. The feudal chiefs are losing their ancient power owing to the inevitable march of events, and the real cause of their turbulence is the sense of this change which is taking place. The presence of English power on the frontier has established peace, and has freed the Khan from the necessity of calling out the military strength of his nobles, while he receives a yearly subsidy, which enables him to increase the strength of his mercenaries, and to maintain an independent position. In March 1872 Sir William Merewether, the Commissioner of Sind, acted as arbitrator between the Khan of Kelat and his nobles, at Jacobabad. He decided that their forfeited lands should be restored to them, on condition that they were true in their allegiance to the Khan, and that they restored all property plundered from kafilas and cultivators, while they were in rebellion. This has restored peace, but time alone can remove the source of discontent. As between the Khan and his nobles, there can be no doubt that the former should be supported. A strong Government is necessary in Baluchistan, and a mere confederacy of chiefs offers no promise of stability.

Kelat.

While the Khan of Kelat has needed our friendly intervention on the western frontier of India, our neighbour in the far east has been a source of trouble from quite a different cause. The King of Burma has taken to trade, by ordering all piece goods to be sold direct to himself or to his agents, in quantities far in excess of the demand. He thus glutted the market, and brought ruin upon the bazaar people. He also made advances to the cultivators, to be repaid in produce, to such an extent that the merchants found great difficulty in purchasing rice, and the whole trade of the country was thrown out of gear. His Majesty appears to have engaged in these short-sighted operations to meet his own liabilities, but he has now yielded to the remonstrances of the Political Agent, and trade has returned into the old channels, accommodating itself to the laws of supply and demand. The King also sent an embassy to England without consulting the Political Agent, in the hope of opening a direct communication with Her Majesty's Government, and thus increasing his own importance. In this he was successful, for a letter arrived from Her Majesty the Queen, and was delivered to the King of Burma, at Mandalay, in April 1872. The Panthay embassy was less fortunate. An agency was established at Bhamo, on the Trawadi, in 1869, with the object of opening the old trade route with Western China, which had been closed by the civil war of the Panthays in Yunan. Major Sladen made an expedition from Bhamo, and was hospitably entertained by the Panthay Governor at Momaia. This appears to have suggested to Sultan Suleiman, then the Panthay Ruler of Yunan, the policy of sending an embassy

King of Burma.

Burmese Embassy.

Panthay Embassy.

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to Europe, in the hope of opening a route by which he might receive material aid, in his struggle against the Chinese. The embassy consisted of his son and nephew, and they were in London in the summer of 1872; but they returned to Rangun without having succeeded in obtaining what they sought; and it is now reported than the Panthays in Yunan have been conquered by the Chinese troops. The news which reaches Blamo is, however, most contradictory, and never to be relied upon.

Crowning of the  
Rangun Pagoda.

Another semi-political event connected with Burma, is the presentation of a new htee or umbrella to the Shwé Dagon Pagoda at Rangun, by the King of Burma, in October 1871. A htee is an ornament to crown a pagoda as a mark of reverence to Guatama Buddha. The present was brought down the Irawadi to Rangun, and consisted of seven successive circular tiers like inverted tambourines, diminishing in size and terminating in a spire. It is 47 feet high, and the lowest tier 13 feet in diameter, of iron, covered with plates of solid gold plating, studded with precious stones. It was valued at 62,000 *l.* A grand procession was formed, consisting of 50,000 orderly and well-conducted persons, to escort it to the great pagoda, which stands on three terraces or platforms on the spur of a hill, with the summit of the cone-shaped edifice 388 feet above the roadway. The whole of the labour and material for crowning the pagoda was gratuitously supplied by the people, and vast crowds flocked into Burma while the htee was being raised. The thousands of labourers, all arranged in white garments, with sacred white flags in their hands, displayed much earnestness and sobriety in their work; while the people kept holiday, and young girls scattered flowers and scented water, and distributed sherbet and lemonade. Throughout the whole period that the ceremony lasted, there was not only no increase, but an actual decrease, in the average number of offences at Rangun. There was a quasi-political significance supposed to attach to this event, because in 1755, and again in the year 1774, former Kings of Burma had asserted their sovereignty over Rangun, after suppressing rebellions, by the ceremony of crowning the Shwé Dagon Pagoda.

## Native States.

No event of political importance has occurred in connection with the Native States within the boundary of British India, during the course of the year under review. As a rule their progress has been satisfactory. Among the Sikh States, the administration of Pattiála, Jind, and Nabha, is excellent. The Maharajah of Pattiála has taken the utmost interest in the progress of his country and the good of his people, and has introduced the English systems of revenue and of criminal procedure. A branch of the great Sirhind Canal will be under his direct management. The Rajah of Jind, who will also have charge of a branch of the Sirhind Canal, performs all important administrative work himself, decides all cases, and conducts correspondence. The Raja of Nabha was only installed in August 1871, but he has shown considerable ability. The Nawab of the important State of Bháwalpur is a minor, and, during 1871-72, Captain Grey acted as Political Agent, and pushed forward the work on the inundation canals with much energy.

## Katiwár.

In Katiwár, in a smaller degree, there has been the same sort of change going on ever since the country first came into contact with the British Government, as has already been referred to in Baluchistan. The chiefs, recognised by us, have gradually become more and more influential, at the expense of the subordinate chiefs of their own kindred, known by the generic name of Bhyads, and of the Mul Girassias or lessor landlords. A scheme was brought forward to settle these grievances, with the concurrence of the Katiwár chiefs. Estates were to be surveyed and settled in the hands of the Girassias, and a tribunal was to be established to settle questions in dispute between the chiefs and the Girassias or Bhyads. This tribunal, called the Rajasthanik Sabha, was to have a President chosen by the Government from among persons proposed by the chiefs. The plan has been approved by the Government of India, and is to be tried, in the first instance, for three years. Bhawnagar is the best governed of the Katiwár States.

## Mysor.

In Mysor, the education of the Maharajah Chamarajendra Wadiyer Bahadur, who is nine years old, is making satisfactory progress under the guidance of Mr. Gordon, and meanwhile the country is administered by an English Commissioner,



missioner, the surplus revenue being set apart exclusively for purposes connected with the state of Mysor. The state of Travancor, in the extreme South of the Peninsula, with its revenue of half a million, is one of the best governed parts of India. The high school, at Trivandram, sends up candidates to the Madras University examinations, who have already obtained several bachelor's degrees; but the mass of the schools are closed to the lower classes. Public works have been zealously prosecuted, including the Warkallai barrier cutting, and the road across the mountains into Madura. The palace expenditure is conducted with strict regard to economy; and the whole administration is admirable conducted. Sir J. Madava Rao, K.C.S.I., who has now resigned the office of Dewan of Travancor, was an able statesman, and the present prosperity of the State is due, in a great measure, to his judgment and integrity.

Travancor.

Some disturbance which took place, in the Punjab and the North West Provinces, during the year 1871-72, seem to indicate a disturbed and unsettled state of feeling among some classes of the community. An unorthodox sect of Sikh was founded about 25 years ago in Ráwal-pindi, by one Bálak Singh, who died in 1863. His principal disciple, Ram Singh, then became head of the sect. His teaching was moral and monotheistic; idol worship was prohibited, distinctions of caste forbidden, marriages of widows permitted, morality and sobriety enjoyed. Ram Singh was a man of considerable ability, son of a carpenter in Bhaini, a village of Ludhiána. He acquired a reputation for extreme sanctity, and even the possession of miraculous powers. As his influence and the number of his followers increased, the tendency of his teaching became more political. Opposition to idolatry began to take an active form, and there were many disturbances during fairs and gatherings of Sikhs, which were due to the intolerant behaviour of the Kúkas, as the followers of Ram Singh were called. On the 14th of June 1871, they attacked the Muhammadan slaughter-houses outside Amritsar, when four men were killed, and three wounded; and another attack was made at Raikop, in the Ludhiána district. On 14th January 1872, 200 Kúkas attacked the little town of Malod to obtain arms, in order to make an assault upon Maleir Kotla, a few miles to the southward. After a sharp fight, they were repulsed, but the Darogah of Malod and several others were killed. Troops were at once dispatched from Delhi, where the camp of exercise was assembled. Mr. Forsyth, the Commissioner of Ambalah, and the Raja of Putiala, who were both at Delhi, hurried back, and the latter caused Ram Singh to be arrested. The main body of Kukas, without leaders, became powerless, and the outbreak completely collapsed. The rebels took refuge in a jungle, where they were attacked by the Putiala troops, and surrendered; there were 68 prisoners, of whom 29 were wounded. When Mr. Cowan, the Deputy Commissioner, arrived at Maleir Kotla, there was a general panic among the people, and he thought that a severe example was necessary. He caused the whole of the prisoners to be blown from guns; and the Lieutenant Governor of the Punjab considered it right to uphold the action of his officers. The Government of India took a different view; Ram Singh has been banished to Burma, and the Kukas have since remained perfectly tranquil.

Kúka outbreak.

In the North West Provinces the outbreaks arose from religious fanaticism. The Muhammadan festivals are based on the lunar months, and vary from year to year, while those of the Hindus, though also depending on the moon, are brought into agreement with the solar year by the use of intercalary months. In 1870, the Mohurrum fell at the same period as the Ramnumi. The former celebrates the martyrdom of Hosein and Hassan, and the faithful mourn for them by carrying *tazias* or biers, in imitation of the biers of the murdered saints, and burying them outside the city. On the Ramnumi the Hindus rejoice at the birth of Rama, with much pomp and beating of drums, carrying the idol in procession from the temple to a grove outside the town, and performing sacrifices there. On the 9th of April 1870, these two great festivals occurred together, and angry feelings began to ferment in the town of Bareli, in Rohilkhand. The Government first proposed that one procession should take place in the morning, and the other in the evening, but this was not acceded to; separate roads were then marked out to the burial place of the

Religious disturbances in the North West Provinces.

Clashing of Muhammadan and Hindu festivals.

Tazias,

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Riot at Bareli.

Tazias, and the grove of Rama; and the day passed over without any actual disturbance. In 1871, the Ramnumi fell on the 8th of Mohurrum, and the police of Bareli again arranged the two routes wide apart; but the blood of Muhammadans was up. The Rama procession was attacked, and, although the assailants were repulsed, the sacrificing priest was set upon on his way home, and murdered; tumults then broke out in the town of Bareli, when 17 persons were killed, and 158 wounded. At Pillibhit, 30 miles from Bareli, the processions were arranged for different hours; but here again, the Hindu procession was attacked, one man being killed, and 26 wounded, and the police were obliged to fire on the rioters. At an extraordinary criminal sessions at Bareli, to try the rioters, five were sentenced to death, eight to transportation, and 48 to vigorous imprisonment.

Durbar at Murádabad.

In November 1871, the Lieutenant Governor of the North West Provinces held a great durbar at Murádabad, to which the principal Muhammadans of Rohilkhand were invited. He addressed them on the subject of the riots at Bareli and Pillibhit, and announced to them that he would not put a stop to processions, though in future they would not be allowed to pass through the main street of Bareli, but by lines indicated by the magistrates. He expressed a hope that the animosity of the past would be set aside, and that in future contention might be for precedence in the race of well doing and beneficence. He urged them to join the Hindus, in a common endeavour to promote the spread of civilisation and the relief of want and distress; and quoted to them the lines of the poet Saadi:—

“The sons of Adam are members one of another,  
“Framed by the Creator from one common essence.”

Riot at Murádabad.

In 1872, the full moon or Huli of the Hindus fell with part of the Mohurrum; the Huli festival being a time of great rejoicing. Complete preparations were made by the police at Bareli, which prevented any disturbances. But at Murádabad, the mourning procession of the *tazias* was fixed for the morning; and the Hindu rejoicings were to take place in the afternoon. The Muhammadans of one of the *tazia* processions falsely declared that they had been attacked, and began to beat and plunder the Hindus, 14 being wounded, of whom two died; troops arrived, and 166 rioters were arrested, of whom 71 were sent for trial, four receiving sentence of death, two of transportation, and 32 of various terms of imprisonment. It is considered that this Murádabad outbreak was merely the work of lawless plunderers.

Fortunately the Mohurrum and Ramnumi will not fall on the same day again for 33 years; and the recurrence of these collisions between the two races is indefinitely postponed; for by that time some tendency may have been developed towards the state of feeling recommended at the Murádabad Durbar.

XIV.  
MILITARY.

## XIV.—MILITARY.

Military Force in India.

THE military force of British India numbers about 190,000 men; of whom about 120,000 are natives, and 60,000 English. Of the natives 47,000 belong to the army under the immediate command of Lord Napier of Magdala, 27,000 to the Madras Army, and 24,000 to that of Bombay. The British forces are chiefly stationed in the Punjab and along the valley of the Ganges. There are 37,000 English soldiers in the Bengal Presidency, of whom 12,400 are in the Punjab; 10,400 are in the Bombay Presidency, and 11,200 in that of Madras; including the Nizam's territory and the Central Provinces.

Distribution of Forces.

It may be taken as a general rule that where English troops are stationed there will be a larger force of Native troops, in proportion to the difference between the numbers of British and Native troops in the whole force; but of course there are many smaller and less important posts where only Native troops are stationed. Throughout all Bengal proper, north and east of Calcutta,

cutta, and Asam, except a few men at the hill station of Darjiling, there is not a single European soldier. The peace of the eastern frontier districts is entrusted to 4,800 Native troops, without cavalry or artillery, and to local police.

But up the valley of the Ganges the British infantry are stationed at regular intervals, 1,560 at Calcutta and Dum Dum, 910 at Hazáribagh, 739 at Dinapur, 395 at Benares, 783 at Allahabad, 831 at Cawnpur, 326 at Fathigarh, and 3,778 and 1,841 in Oudh and Rohilkhand. At Agra, Delhi, and Mirat (Meerut) there are 947, 476, and 581 respectively; while to the south of the Ganges valley 1,879 are stationed at Morar near Gwalior, 1,014 at Jabalpur and Sagar, and 431 at Jhansi. The rest of the British infantry are massed within the territory of the Punjab Government, 920 at Ambala, 672 at Jallandar, 434 at Lahor, 155 at Ráwal Pindi, 1,221 at Pesháwar, and 4,280 in the camp of exercise. Of the cavalry, the 21st Hussars are at Lacknow, the 15th at Mirat (Meerut), the 11th at Ambala, the 4th Hussars and 5th Lancers at Ráwal Pindi and Siálkot, besides 20 regiments of Native Cavalry. The artillery are distributed in due proportions, seven batteries in the Allahabad Division, five batteries in the Oudh Division, in the Sagar Division two batteries, in the Gwalior three, at Bareilly one, in the Mirat Division six, in the Sirhind four, in the Lahor six, in the Ráwal Pindi and in the Pesháwar one. The whole artillery force consists of 10 batteries of horse artillery, 26 field guns and garrison guns.

Positions in the valley of the Ganges.

Force in the Punjab.

British Cavalry.

Artillery.

The Punjab lies at the foot of those mountains whence India has been invaded from time immemorial, and here it is necessary that a considerable force should ever be on the alert, and that outposts should be stationed at the points where the passes open upon the plains. A large Punjab frontier force is placed under the orders of the Lieutenant Governor, numbering 12,400 officers and men; including 9,000 infantry, 2,800 cavalry, and 629 artillery. The infantry belonging to this force is composed entirely of Punjab, Sikh or Gurkha regiments, except 94 men of the 41st. The artillery, also, is all composed of native batteries, one Pesháwar and two Punjab mountain batteries, two other Punjab batteries, and the Hazára mountain battery. During 1871-72 two new outposts were established at the mouths of the Girni and Tanhi Zam Passes, in the Dera Ismail Khan district, to overawe the Masud Waziris. It was also necessary to send an expedition to Daur, beyond the Bannu frontier, in February 1872; but otherwise the unquiet tribes on the frontiers have been tolerably peaceable during the year under review.

Punjab Frontier Force.

For the last two years a force has been assembled, during the cool season, in a camp of exercise. In January 1872 the manœuvres took place in the neighbourhood of Delhi; and early this year the selected ground was at Hasan Abdul, between Attock and Ráwal Pindi. The camp of 1873 was composed of five regiments of British infantry numbering 2,000 men, the 4th Hussars and 5th Lancers numbering 740 men, 8,000 Native troops and six batteries of artillery, including two batteries of Native artillery belonging to the Punjab Field Force. There were about 14,000 men assembled altogether; but no official report on the subject of these camps of exercise has been received.

Camps of Exercise

The 10,000 British and 24,600 Native troops which form the effective force in the Bombay Presidency are stationed in Central India, along the West Coast, and Sind. In Central India there are 1,870 British infantry soldiers at Nasirabad, Mau, Indor, and Nimach, and 798 at Dísa. The principal Bombay military station is Púna, where there are 2,250 British infantry; at Bombay there are 470, at Sátára 211, and at Belgaum 974. The only English cavalry regiment in the Bombay Presidency is the 3rd Hussars; but the three regiments of Bombay Native cavalry number 2,000 men. In Sind there are 950 British, and 2,000 Native infantry, and the three regiments of Sind Horse, with their head quarters at Jacobabad. The Aden force is composed of 637 British and 424 Native infantry, 159 gunners, and the Aden troop of horse (100 men).

Troops in the Bombay Presidency.

The army under the Commander in Chief in the Madras Presidency numbers 38,500 men, including 25,000 Natives and 7,800 British infantry, 940 Native and 909 British cavalry, 11 field batteries and 8 batteries of garrison artillery. This force has to supply troops for the Central Provinces, the Nizam's Territory, Mysor, and Burma, as well as for the Madras Presidency. The stations for

Troops in the Madras Presidency.

English

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English infantry are Kampti (Nágpur), in the Central Provinces, where there are 730, Sikrandabad 880, Belari 930, Bangalor 1,550, Madras 674, Trichinapalli 171, and the coast of Malabar 880. In Burma there are 1,579 British soldiers but no cavalry. There are three corps not under the orders of the Madras Commander in Chief, the Nair Brigade in Tranvancor, which is a small force of Native infantry, six regiments of Mysor Sillahdar Horse, and the Haidarabad Contingent.

**Distribution of  
British Infantry.**

The geographical distribution of British infantry throughout India, shows 11,600 men along the valley of the Ganges from Calcutta to Ambala, 2,500 between Lahor and Pesháwar, 6,800 in Central India, and 900 near the mouth of the Indus. Along the west coast, from Disa to Belgaum, there are 5,500, besides 880 in Malabar. On the eastern side of the Peninsula, including Mysor and the ceded districts, the number is 3,300. There are no British troops south of Trichinapalli, but detachments of Native infantry are stationed at Paliamkota, Quilon, Trivandram, and Trichur. The railway system is now completed, and lines connect all the stations where British forces are stationed, excepting those in Sind.

**Sickness and death  
rates.**

**Hill sanitaría.**

During 1872, the number of deaths among the British troops was 60, and of sick 567; the per-centage of sick to the whole force being  $4\frac{1}{2}$ . The hill sanitaría, where there were about 2,500 convalescents, are so placed in the mountains overhanging the chief military stations, throughout India, as to supply health resorts for the different divisions. Darjiling sanitarium is provided for the troops in Bengal; Naini Tal for Oudh and Rohilkhand; Landaur, Ránikhet, Chakrata, and Kasauli for the North West Provinces; Dalhousie and Marri for the Punjab. In Central India are Mount Abu and Puchmuri. For the Bombay Presidency there is the hill sanitarium of Púrandhar, and the seaside convalescent stations of Kolába and Ghizri Bande. Rámandrug furnishes shelter from the burning plain of Belary, and Jakatala on the Nilgiri hills is the sanitarium for the rest of the Madras Presidency.

**Barrack accommo-  
dation.**

The great mass of the British troops, however, have not been stationed in the hills, though such a disposition of them has often been suggested; one of the great practical difficulties being the want of carriage to get them down on the occasion of an emergency. They are posted at the points of greatest strategic importance throughout the country; and the construction of healthy permanent barracks thus becomes a question of paramount importance.

**Barracks before  
the mutinies.**

In former days the accommodation for English troops in India consisted of low narrow buildings but slightly raised from the ground, and unprotected by verandahs. The men messed in their sleeping rooms, with tables between the rows of beds. The first improvement consisted in the erection of some upper-storied buildings, both floors being occupied as dormitories, and afterwards special quarters were supplied for married men. In Fort William, a lofty barrack of this kind was erected, and another called the "Ellenborough Barrack," in the fort at Allahabad. During Lord Dalhousie's time much was done to provide British soldiers with more healthy accommodation. Very lofty one-storied barracks, with rooms 25 feet high, and separate messing accommodation, were built in the Punjab at Lahor, Silkot, Ráwal Pindi, Nauwshahra, and Pesháwar. But the accommodation was incomplete even for the existing force of 45,000 men, before the mutinies. In 1857, additional European troops were thrown into the country, to the amount of 25,000 men; and there is a permanent increase, since the mutinies, of 16,000 men.

**Permanent bar-  
racks to be built.**

**Appointment of  
Colonel Crom-  
melin.**

In 1863, the Government of India resolved to adopt a regular plan for completing permanent barracks for the whole British force, at an estimated cost of 10,000,000 £., the expenditure of which was to be extended over a term of years. Colonel Crommelin was appointed as Inspector General of Military Works, to assist in dealing with the various questions connected with construction of barracks, and he prepared a series of recommendations and memoranda as to the designs of the buildings, the size of the rooms, the space per man, and the number of storeys. Specimens were prepared for guidance, suitable to different parts of the country; the Army Sanitary Commission approved the designs; and, from 1864, the work has been proceeded with as rapidly as the estimates could be submitted and sanctioned.

**Design for new  
barracks.**

The main feature of the new barracks is that they have an upper storey, which

which is occupied as a dormitory, while the lower storey is set apart for mess rooms, libraries, orderly and store rooms. The height of the rooms in the upper storey is 16, and in the lower 20 feet, and the space per man is 90 superficial feet. The height serves as protection against the effects of radiation, and as a means of efficient ventilation, and is also necessary in the construction of the verandahs; for the provision of a row of clerestory windows above the verandahs is found to be very important. The original models have been generally adopted, but at Peshawar and in Burma different descriptions of barracks have been built, and the plans have been modified in other places, according to the special requirements of the localities. In 1870, it was resolved that the order of confining the dormitories to the upper storeys need not be acted upon in dry climates, but only in damp situations, and where there is much rain. The old barracks have been utilised in the Punjab, and also those which were built immediately after the mutinies at Oudh; and other large barracks existing before the mutinies have been altered and adapted to present requirements.

It has been said that the upper storeys are excessively hot, but there is in reality no difference between the two storeys when the roofs are properly constructed. A number of thermometrical observations have been taken in all descriptions of barracks throughout India, and it is found that the temperature does not differ in lower or upper storied buildings. At night, indeed, when the dormitories are wanted, the upper storeys are cooler.

In the hill stations a different, and much less expensive style of buildings has been adopted, with an allowance of 71 instead of 90 superficial feet per man. The barracks at Dalhousie, built in 1872, are single storey huts of stone with slate roofs.

Barracks in hill stations.

The permanent barracks, though the original outlay for their construction is great, will largely reduce the heavy expenditure on repairs; while the estimated increase of cost is placed at one-seventh. Unfortunately there have been two serious failures in the new barracks at Sagar and Nasirabad, owing to the malconstruction of masonry, which will entail considerable additional expense.

Cost of new buildings.

From 1862 to 1871 the expenditure on new buildings in the plains has been 2,592,205 *l.*, and on improving the old barracks, 1,920,737 *l.* On the hills the sum of 371,500 *l.* has been expended during the same period, on new and old buildings, to which, for all barracks, must be added a sum of 371,856 *l.* for 1871-72. The total expenditure on all military works whatsoever, including barracks, fortified posts, roads, drainage, water supply in cantonments, and roads to hill sanitarium, from 1862 to 1872, has been 10,800,000 *l.*, or an average of about a million a year. But permanent accommodation for about 5,000 British troops remains to be completed. During the last ten years, including the old barracks, the new accommodation supplied in the Bengal Presidency provides for 41,956 married and unmarried men. The original estimates have been unavoidably exceeded, owing to the great rise of rates of all kinds in the last ten years. The cost per man, including hospitals and buildings of every kind connected with the barracks, has been from 189 *l.* to 286 *l.* The cost of Chelsea barracks per man was 168 *l.* A further sum of about 1,250,000 *l.* is required to complete the permanent barrack accommodation for all the British troops in India. All troops arriving in or departing from India now pass through Bombay. In 1871-72 the number of men that arrived in India was 9,206, and of officers 506. In the same year 4,179 men and 439 officers embarked for England, besides 2,294 invalids.

Expenditure on barracks.

The native troops are generally expected to hut themselves in their own lines (an allowance, however, being made), but shelter has been furnished for them at Silang, Alipur, and several other stations, and in the hills for the Gurkha regiments.

Shelter for native troops.

The defence of the wealthy seaports of British India against the attacks of any possible enemy is a question which, it is generally felt, should not be postponed until war actually breaks out or is imminent. Yet it is not altogether to be regretted that such defences have not been completed, and that where works have been commenced they are not so far advanced as to make an alteration in the plans very costly; for the science of attack and defence has been developed very rapidly of late years. The harbour defences of Bombay, as they were originally designed some eight years ago, consisted of six distinct

Coast defences.

Bombay harbour defences.

works.

XIV.  
MILITARY.

works. The most costly and important is the fort on the Middle Ground Shoal, in the midst of the anchorage, and 1,800 yards from the shore. There were to have been twelve 300-pounders on it, in iron-fronted casements, and two 600-pounders in a turret. The foundations of this work have been completed to a height of a few feet above high water. Another fort was to have been built on the Oyster Rock, a patch dry at high water near the south end of the anchorage, 1,000 yards from the shore, and 3,000 south-west of the middle ground. The foundations of this work have been completed and a temporary battery of eight 10 and 19-inch guns has been placed upon them. The third work is a battery on Cross Island, towards the north end of the anchorage, 1,000 yards from the shore, and 4,000 from the Middle Ground, to be armed with seven 300-pounders. The top of the island has been cut down, and a battery of six guns has been placed on the platform thus levelled. A tower on a shoal called the "twelve-foot patch," 4,000 yards north-east of the Middle Ground, is to have two 600-pounders, and the foundation of this work has been formed. There is an earthen battery with five 7-inch guns "en barbette," at Malabar Point, on the other side of Bombay Island, where it is proposed to erect a tower with two 300-pounders in a turret, for the defence of Back Bay; and at Kolába Point there is a battery armed with four 68-pounders "en barbette," and four 13-inch land service mortars.

Ironclads for  
Bombay.

Two iron-clad monitors, the "Abyssinia" and the "Magdala," specially designed to aid in the defence of Bombay Harbour, arrived there early in 1871; their armaments consist of four 10-inch guns in two turrets.

Colonel Jervois on  
the defence of  
Bombay.

Colonel Jervois reported upon this scheme for the defence of Bombay Harbour in April 1872. He pointed out that the numerous duties imposed upon a sea-going fleet render a dependence upon it for the defence of harbours unreliable; and that ports and coaling stations must, therefore, be rendered secure, independently of the action of a fleet. Monitors or floating batteries, although they are most valuable auxiliaries in conjunction with fixed defences, must not be exclusively relied upon. They afford an unsteady gun carriage, are liable to be penetrated by the guns of the present day, and may be ordered away from a particular post for general service. One important function of floating batteries would be to guard torpedoes at night, and prevent an enemy's boats from tampering with the mines, but this service would be as well performed by gunboats; and 18 suitable gunboats could be provided for the same cost as one monitor.

With regard to the scheme for the land defences of Bombay, Colonel Jervois has pointed out that an enemy might enter the harbour, passing 6,000 yards from the Oyster Rock, and take up a position 4,000 yards from the Middle Ground, and 5,200 from the Oyster Rock and the "twelve-foot patch," and thence shell the town or exact a few millions. An enemy should be prevented from entering the harbour at all. With this object Colonel Jervois recommends that forts should be built at the entrance of the harbour, similar to those at Spithead or Plymouth Sound, the depth being less than that on the side of the Plymouth Sound Fort, with a rocky bottom. He would build two such forts, circular, and each with 18 25-ton guns; one in 33 feet of water, 3,900 yards from Kolába Point, and the other on what is called the "10-foot patch," 4,000 yards west of the Coringa. They will be 5,400 yards from each other, and a fort on Kolába Point completes the line of defences. An enemy would be detained under their guns by electric torpedoes placed in the channel, and exploded by observation from the forts; while the two monitors and the three gunboats of the "Blazer" class, carrying 25-ton guns would complete the scheme. The cost of such a system of defences, including the gunboats, is estimated at 932,000 l.

Defence of  
Calcutta.  
Batteries on the  
Hugli.

The approach to the rich city of Calcutta by the River Hugli, still remains undefended, but the question has been receiving very careful consideration. It has been proposed to erect a fort at Chingri-Khal, 40 miles above the entrance of the Hugli at Ságar, where the passage narrows to a channel, half a mile wide, close to the left bank, and another 15 miles higher up at Falta. A torpedo committee, with Colonel Hyde as president, which has been making experiments with gun cotton, and it recommended that five distinct systems of torpedoes should be placed at different points of the river, with gun boats to aid in the defence.

Colonel

Colonel Jervois concurs in the proposal to construct batteries for powerful rifled guns at Chingri-Khal, and Falta, and in the scheme for employing submarine mines to detain an enemy under the fire of the guns from these works; and he also thinks it very desirable that gunboats, adapted for the defence of the Hugli, should be provided. Fort William will be looked upon as a secure arsenal or place of refuge in case of mutiny or a rising of the natives; the armament being three pieces on Moncrieff carriages to sweep the *maidan*, and two or three converted 64-pounders in each lower flank. The cost of the proposed works for the defence of the Hugli is estimated at 160,000 *l.* For the defence of Rangún Colonel Jervois recommends the construction of a battery at Chokey Point, 14 miles up the river, where it takes a bend, so that the fort would be able to rake a vessel approaching from seaward, and another battery might be erected for the defence of the approach to Mulmein.

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MILITARY.  
Colonel Jervois  
on the defence of  
the Hugli.

Rangún.

Mulmein.

At Aden the defences have been chiefly designed to guard against attacks from the land side, and the works on the isthmus leave little to desire. But in anticipation of an attack on the harbour, the western part of the peninsula should be converted into a strong defensive position, with a keep and three batteries.

Aden.

On the land side the borders of India are safe from attack, so long as a strong British force is massed in the Punjab, and the passes leading from Afghanistan are watched by the field force under the orders of the Lieutenant Governor. Still it is considered politic that a strong British garrison should be stationed at Pesháwar, numbering not less than 800 infantry. Works will at once be proceeded with, consisting of new barracks on a fortified position, with improved water supply, and every other appliance for preserving the health of the troops in a climate which has hitherto been found most prejudicial to Europeans.

Pesháwar.

At the time of the transfer of the Government of India to the Crown, funds existed in the several Presidencies in India to which military and medical officers and chaplains in the service of the East India Company contributed. The object of some of these institutions was to provide pensions for the widows and children of subscribers, at their death, and of others to provide annuities for officers on their retirement from the service.

Military service  
funds.

Soon after the transfer of the Government of India to the Crown, the subscribers were acquainted that if they were willing to transfer the assets, liabilities and management of the institutions unconditionally to Government, the Secretary of State for India in Council would guarantee to the subscribers and their families the benefits to which they were entitled under the regulations of the several institutions.

The following funds have been accordingly transferred to Her Majesty's Government, in accordance with the vote of the subscribers under the Act 29 Vict. c. 18, which was passed in 1866 to legalise transfers, and the business is carried on in the Military Funds Department of the India Office. The funds referred to are—

Bengal Military Fund.  
" Military Orphan Society.  
" Medical Retiring Fund.  
Madras Military Fund.  
" Medical Fund.  
Bombay Military Fund.  
" Medical Retiring Fund.  
Indian Navy Fund.

The valuations of, and reports on, several of these funds have, from time to time, been made by Mr. Samuel Brown, the well known actuary, and these have led the Secretary of State in Council to increase the benefits granted under the rules of the Bengal Military, and Orphan, and Bengal, Madras and Bombay Medical Funds. In the case of the Madras Medical Fund the increase was very considerable.

Increase of  
benefits.

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MILITARY.

New service fund.

In April 1871 Major General Hannington and Mr. Samuel Brown reported on General Norman's proposal for the establishment of a fund for the grant of pensions to the widows and children of military and medical officers and chaplains admitted into the service of the Government of India subsequently to the date on which the several Military and Medical Funds which have been transferred to Government were closed to new subscribers.

General Hannington's draft rules were approved, and the Government of India was authorised to create the fund, which came into operation on the 1st of January 1873.

The fund itself is founded on insurance principles, and the subscriptions and donations are therefore liable to alteration, the intention being to ascertain by periodical valuations that the payments are sufficient, and no more, to provide the pensions granted under the regulations. No burden will consequently be thrown on the revenues of India; nor, on the other hand, will they benefit by the institution of the fund, as the pensions will be granted in addition to those now allowed to Indian officers' families out of Indian revenues, under the Royal Warrant of 1855.

XV.  
SURVEYS.

XV.—SURVEYS.

The surveys of  
India.

THE surveys of India are now making steady progress towards the completion of the triangulation and of the mapping, for the first time, of the whole country. A general history of the operations of these surveys from the commencement will be found in the "Memoir on the Indian Surveys," published by order of the Secretary of State for India, in 1871, and in the two annual abstracts of the surveys for 1869-70 and 1870-71, which has since been issued. It will, therefore, be sufficient to give a brief account of their progress during the year under review. The great trigonometrical survey furnishes a basis for all geographical and topographical operations within the limits of the Empire, combined with geodetic investigations touching the figure of the earth and the length of its polar and equatorial axes. These investigations proceed *pari passu* with the trigonometrical and linear measurements, in order that the latter may be correctly utilised. A series of meridional and longitudinal triangulations are thus spread over India, as a skeleton which the topographical and revenue surveys fill in with useful details of mountains and rivers, towns and villages. The great trigonometrical survey is an undertaking of gigantic and imperial proportions, which has been steadily advancing towards completion, and increasing in scientific accuracy during the whole period included in the present century. It is over 70 years since Colonel Lambton began to measure the first base at Madras. Now the wonderful network is nearly completed, and the surveyors are bringing it to a termination by conducting their series through the wildest and most unfrequented districts of India. During the year 1871-72 the staff of the great trigonometrical survey was at work on five different series. It would be useless to enumerate these series without a map, but on the accompanying index chart the whole vast operation is displayed; and the uncompleted series, on which surveying parties are still at work, are clearly indicated.

The great trigono-  
metrical survey.

Bider series.

The Bider longitudinal series\* will be seen on the 18th parallel of latitude, with its unfinished end on the river Godávari, or its way to be connected with the Madras coast series. During the year under review, this Bider series was completed by the party under Mr. Rossenrode. They had to carry the great theodolite through a hilly and intricate country, covered with jungle and very thinly inhabited; where all the necessaries of life had to be brought from great distances. The jungle fires, which commence in February, added to their difficulties by obscuring the atmosphere and rendering observations impossible except at rare intervals. The precious but unwieldy instrument had

\* The previous history of the Bider longitudinal series will be found in the "Memoir on Indian Surveys," p. 115, in the abstract for 1869-70, p. 11, and in that for 1870-71, p. 18.



had to be carried up and down tortuous mountain paths strewn with large stones, and at times the man-eating tigers, which infest the footpaths and seize unwary travellers, took possession of the path that had been cleared for the theodolite, and delayed the advance of coolies for hours together. The people in this wild region could give little assistance. Steeped in ignorance and vice, they generally go naked, and men, women, and children drink sago palm toddy to excess. But their wretched huts only occur at intervals of many miles. This very difficult piece of work was completed in the end of April 1872, when a junction was effected with the Madras coast series.

The Biláspur meridional series connects the great longitudinal series, which crosses India from Karáchi to Calcutta, with the Madras coast series. It will be seen, on the chart, just issuing from the great longitudinal series, on about the 82nd meridian, with a line of country before it of the wildest character, including the upper part of the Mahánadi basin. It is intended to form a basis for the survey of the country between the parallels of Bombay and Calcutta; and was commenced in 1870 by Mr. Keelan. It has since been extended by the same surveyor, who, during the year under review, made an advance of 42 miles. His great difficulty was the total absence of all permanent buildings, the wild aborigines living in mere temporary huts; yet there were ruined temples, supposed to be Buddhist, hidden in the dense forest, and even the remains of large towns.\*

The Biláspur series.

The Bangalor meridional series consists of a revision of Colonel Lambton's old work,† executed in the beginning of the century, from Cape Comorin, through Bangalor to Bidar, in the Nizam's territory; and is part of the Great Arc series which is left white on the chart. It was completed, during 1870-71, by Captain Rogers, who also fixed the important positions of Haidarabad and Sikandrabad.

The Bangalor series.

The Mangalur meridional series crosses the ghauts from Mangalur on the west coast to join the Great Arc series. A direct advance of 100 miles was made, under Major Branfill, and the triangulation was taken across the mountains.‡ There is an important geographical result from the results of this party's work in the previous. Dodabeta, on the Nilgiri Hills, has hitherto been supposed to be the loftiest peak in India, south of the Himalayas. It now turns out that a peak in the Animalley hills further south, is 8,837 feet above the sea, or 500 feet higher than Dodabeta. In the valley of the Brahmaputra, the triangulation of the Asam eastern frontier series was pushed to the eastward, in the face of great difficulties, the country being either covered with forest or with gigantic tropical grass.§ It was taken up, somewhat out of its turn, to supply points for the revenue survey operations.

The Mangalur series.

The highest peak in South India.

Asam series.

Three topographical surveys are also being conducted, under the Superintendent of the Great Trigonometrical Survey, in the mountainous districts of Kamaun and Garhwal, in the sandy plains of Katiwár, and in Gujrát. The former work, during 1871-72, was progressing in the valleys of Mana and Niti, draining into the Alaknanda branch of the Ganges; and some of the stations had to be fixed at heights 17,000 feet above the sea.

Topographical surveys under the superintendent of the G. T. survey. Kamaun and Garhwal survey.

In Katiwár good progress was made, the old maps being found to be exceedingly incorrect, so much so that the Agent of the Bombay and Baroda Railway has entirely changed the line of route for the Katiwár branch since receiving sheets of the new maps. This is one out of many instances that might be given of the immense practical value of accurate surveys on scientific principles. The southern portion of the Gir range, in Katiwár, is one of the very few places in India where lions are still found. Captain Trotter, who commands the survey party, succeeded in shooting four. They are camel-coloured, and 8 feet 10 inches long from the nose to the tip of the tail. But there are said not to be more than 50 in the whole country.||

The Katiwár series.

Tidal

\* For the previous history of the Biláspur series, see the Memoir on Indian Surveys, p. 115; the Abstract for 1869-70, p. 18, and that for 1870-71, p. 12.

† For the reasons for this revision, see the Memoir on Indian Surveys, p. 112.

‡ For the previous history of the Mangalur series, see the Memoir, p. 115.

§ See Abstract for 1870-71, p. 17.

|| See Extract of Indian Surveys for 1870-71, p. 19.

XV.  
SURVEYS.

Tidal observations.

Tidal observations have received much attention from Colonel Walker, and one of the officers of the survey, Lieutenant Baird, has made himself master of the practical details of the method of tidal registration, and the harmonic analysis of the observations, as practised and recommended by the British Association. The investigation of the laws of tides of the Indian Ocean, the utility of which was originally pointed out by Dr. Whewell in 1832, will thus, at last, receive the attention it deserves. A series of tidal observations was completed at Tutikorin in 1871-72, and sites were examined for tide gauges at Mangalor, and near Diu on the Katiwár coast.

Pendulum observations.

The melancholy death of Major Basevi, while completing the important series of pendulum observations on the arctic plains of Tibet, made fresh arrangements necessary; and Lieutenant Heaviside has taken charge of the work, and will bring it to completion. There were also two parties occupied with latitude observations, and another taking a series of level in Northern India, which will eventually be extended over Madras and Bombay. Measures have also been taken for the preservation of the principal trigonometrical stations, the care of which has been entrusted to the local authorities. Very delicate and laborious calculations are made, year by year, and the publication of the results, in the form of photozincographed charts and maps, annual reports, tables of heights, and volumes of the final history of the survey, is regularly proceeded with. The whole cost of the Great Trigonometrical Survey, for 1870-71, was 61,865*l.*, or at the rate of 23*s.* per square mile for the trigonometrical work. But this estimate is no criterion of the value of the work done, unless there is also a knowledge of the nature of the operations in each instance.

Latitude observations.

Levelling observations.

Preservation of trigonometrical stations.

Computations.

Cost of the Great Trigonometrical Survey.

Topographical surveys.

The rest of the topographical surveys are under the immediate superintendence of the Surveyor General. As they progress, the parties have to penetrate into wilder and more inaccessible regions. There are seven parties now in the field, and they are all at work in very wild country, much of it being altogether uninhabited, so that all the necessaries of life have to be carried from great distances. Yet a marked impression is being made on the unsurveyed area, which becomes smaller at the rate of 16,000 to 18,000 square miles a year. A rigorous system of checks is applied to each survey by test lines run through each plane table. One party, under Captain Holdich, is surveying the country round Gwalior. Another, under Mr. Girdlestone, is surveying the native States between the Narbada and the Tapti. A third is in Jeypur and the Vizagapatam Agency, under Colonel Saxton. A fourth, under Major Depree, in the district of Biláspur and Mandhah, in the Central Provinces. Captain Riddell, with the fifth party, is in Bhopál and Málwa. The sixth, under Captain Bagley, accompanied the Lushai Expedition. Captain Strahan, with the seventh party, was in Rájputána, exploring and surveying the Aravalli range of mountains, and his maps will be of great practical value in maturing projects now in contemplation for drainage works in Mairwára.

First party.

Second party.

Third party.

Fourth party.

Fifth party.

Sixth party.

Seventh party.

Work in the Surveyor General's Office.

There has been very great activity in the engraving, lithographing, and photozincographing departments of the Surveyor General's office at Calcutta. The remaining sheets of the Indian Atlas are now compiled, drawn, and engraved in India; and in addition to this work, which made good progress during the year, many useful general maps have been published, or are in course of preparation; among them a standard map of India, a new map of Bengal, and a map of the eastern frontier. During the year 1871-72 as many as 37,375 maps were issued by Colonel Thuillier's department. One of its most useful features is the rapidity with which the results of the surveys are made available for general use by the photozincographic process.

Revenue surveys.

Meteorological observations.

Geological survey.

Cost of the surveys.

The work of the Revenue Surveys has been referred to in the section of Land Revenue, and the arrangements for the registration and reduction of meteorological observations in that on Agriculture. The annual Report of the Superintendent of the Geological Survey is dealt with in the section on Mineralogy. The total annual cost of the entire Surveying Department, including the Great Trigonometrical, Topographical, and Revenue Surveys, is 240,000 *l.*

The Madras Observatory has been the centre of astronomical work during the British occupation of India. It was founded in the days of Sir Thomas Munro, and has ever since been directed by a succession of able astronomers,\* whose series of observations extend from 1787 to 1873. Mr. Pogson, the present astronomer, continues to observe with most valuable results, but for some time his most important work must be the publication of observations already recorded, rather than the further accumulation of results. There are now 20,895 unpublished observations with the new transit circle. This year he records the extraordinary appearance of  $\mu$  Argus, a star in the constellation of Argo Navis, which is believed to be a permanent furnace world, maintained by burning gases of totally different character to any with which we are acquainted. Mr. Pogson has also obtained a difference of longitude between Madras and Batavia, by exchanging signals along the electric submarine telegraph, with Dr. Oudemans, the Surveyor General of Netherlands, India. But the chief work of the staff of the Madras Observatory, during 1871-72, was the observation of the total eclipse of the sun on 12th December 1871. Mr. Pogson's son, the Assistant Astronomer, had previously been sent home to study solar photography. Special instruments were sent out, and a village called Avonashi, on the railway to Coimbatore, was selected as the place for observing. Three fair photographs were obtained during the totality, which verify the existence of a luminous envelope round the sun's disc, to a height of 160,000 miles, and show other interesting features. Mr. Winter, the Telegraph Engineer of the Madras Railway, at the same time made polarisation measurements of the corona. The same eclipse was observed at Utakamand, on the Nilgiris, by Colonel Tennant, assisted by Mr. Hennessey and Captain Herschel, of the Great Trigonometrical Survey, and Captain Waterhouse, an admirable photographer, from the Surveyor General's Office. Six photographs were taken during totality. Colonel Tennant's conclusion is that the corona is solar; it is the atmosphere of the sun mainly shining by reflected light.

In December 1872, Mr. Pogson detected the comet of Biela, at the Madras Observatory, under circumstances of extraordinary interest. This comet was first seen in 1772; but in 1826 Mr. Biela discovered it again, when the orbit was carefully calculated, and the results showed that it revolved round the sun in about  $6\frac{1}{2}$  years. In 1832 it returned with the utmost punctuality; and again in 1846, it separated into two, each complete, with a short tail of its own, 150,000 miles apart. The phenomenon produced a profound sensation among astronomers. It, and its companion, were again seen in 1852, but 1,250,000 miles apart.

In 1859 it was due, but was too near the sun's position to be found; and, in 1866, it could not be found; it was missing. It was next due, agreeably to its former orbit, in October 1872. On November 30th, Mr. Pogson received a telegram from Professor Klinkerfues, of Gottingen: "Biela touched earth on 27th; search near  $\theta$  Centauri." Mr. Pogson searched day after day, and on the 3rd he found the comet, securing four comparisons of it with an anonymous star. The lost comet was re-found, but it had no tail. Next morning, December 4th, it was again seen, and with a short tail; it appears actually to touch the earth somewhere in latitude  $33^\circ$  south, and neither the earth nor the comet were conscious of the collision.

In the Kolaba Observatory at Bombay, under the direction of Mr. Chambers, the principal work consists in the production of perpetual records of the phenomena of meteorology and terrestrial magnetism, regular determination of time by astronomical observations, and its communication to the shipping by daily signal. A new volume of the observations from 1865 to 1870 has recently been issued.

Between 1862 and 1865, Lord Canning employed General Cunningham on an archæological survey of India, and much valuable work was done; but Lord Lawrence abolished the appointment. In December 1870 it was revived, and General Cunningham resumed his interrupted labours. In the conduct of this

\* For the history of the Madras Observatory previous to 1871-72, see the Memoir on the India Surveys, p. 238, and the Abstract for 1870-71, p. 51.

this important survey, which is of as much interest and value to the science of comparative geography as to that of archæology, he has divided it into five provinces of nearly equal size; the Punjab, the North West Provinces, Bengal, Madras, and Bombay. These provinces are again divided into three sections each, to be explored by one party in a single season. Not more than one-half of the archæological remains of India are now known to us; and inquiries and explorations will lead to fresh discoveries. The regular archæological survey was commenced in October 1871, under General Cunningham's personal superintendence, Mr. Beglar, an excellent photographer, and Mr. Carlleyle, the Curator of the Riddell Museum at Agra, will be the General's assistants.

During the summer of 1871, General Cunningham was superintending the reprint of his Archæological Reports made from 1862 to 1865, for the illustration of which he prepared 99 plates with his own hand. In the winter of 1871-72, he made researches in the Gangetic Valley, and Mr. Beglar and Mr. Carlleyle were at work in Delhi and Agra. The new and valuable information thus collected will form Vols. III. and IV. of the Proceedings of the Archæological Survey. General Cunningham explored many ancient places in the Punjab in 1872-73, and he proposes to make a survey of the Central Provinces in 1873-74. The time required to complete an archæological survey of the whole of India will extend over 10 or 12 years.

Archæology in  
Bombay.

It is proposed to appoint Mr. James Burgess, an eminent antiquary, to the superintendence of the Archæological Survey of the Bombay Presidency. He has already drawn up a memorandum on the architectural and archæological remains in the Bombay Presidency, and in the territory of the Nizam. But the most interesting piece of archæological work in Western India that has been undertaken during the year under review, has been the measures for replacing the grievous loss caused by the destruction of the oil-colour copies of frescos in the Ajunta Caves, in the fire at the Crystal Palace at Sydenham. The Government of India has sanctioned an expenditure of 500 £. with this object. Mr. Griffiths, the Decorative Artist, in the School of Arts at Bombay, who is an artist of no ordinary merit, was deputed to report upon the state of the frescos. He found the paintings in a most deplorable condition, wantonly defaced and hacked, with water percolating through the rock, and converting them into black unintelligible masses. Yet there are many fragments worthy of being copied, which, in a few years, will be entirely obliterated. Mr. Griffiths formed a high estimate of their value, and says, "These old Buddhist artists were keenly alive to the pleasures derived from, and thoroughly understood, the principles of decorative art, in its highest and noblest sense."

Paintings at  
Ajunta.

Geographical  
exploration.

During the year exploring work beyond British India has been executed both beyond the Himalayan peaks, and in Persia. In the former direction Major Montgomerie employed a native explorer, who succeeded in opening out the geography of a very large tract of country, as to which we had previously had but the vaguest conjectural indications.

Explorer No. 9.

These explorers are anonymous, and are carefully drilled to observe for latitude and elevation above the sea. The explorer of 1871-72 is known to the world as No. 9. His route led round the great Mount Everest, penetrating on the north to the Sanpu River, and thence south-west over the Tingri-maidan, the most extensive plateau on the south of the Himalayan watershed that is drained by streams flowing direct into India. The route taken by No. 9 corresponds, for some distance, with that of Dr. Hooker to the rest of Darjiling. The new ground commences with Dr. Hooker's most north-westerly point, and includes a large lake which had not previously been indicated on the maps. The positions of many peaks north of those which are visible from the side of India have been determined, as well as that of the celebrated Sakya Monastery. The route traversed by No. 9 is 844 miles long, 550 of which are over entirely new ground, and it elucidates the geography of the basin of the Arun, the largest feeder of the great Kosi River, which drains the whole of Eastern Nepal. The explorer took latitude observations at 11 points, and determined the height of 31 places.

During the years 1870-71 geographical information of great importance was obtained in Persia and Baluchistan by the frontier commissions, under Sir Frederick

Frederick Goldsmid. Early in the former year, Major Beresford Lovett, R.E., made route surveys from Gwador to Bampur, thence to Panjgur, and back again to Gwador. Much valuable work was also done in the same region by Lieutenant Colonel Ross, Political Agent at Gwador, and Quartermaster Serjeant Bower, R.E.

In the winter of 1871-72 Major Lovett surveyed the country from Bam in south-eastern Persia to Sistan, made a detailed map of that little known region, and thence continued his route surveys to Meshed, by the hitherto unvisited road through Birjand and Kaian, and from Meshed to Tehran.

Major St. John, R.E., was at the same time sent as special commissioner to complete the settlement of the Perso-Baluch frontier, of which he made a careful survey from the sea to Jalk on the edge of the deserts, a place previously unvisited by Europeans. He travelled thence, *via* Bampar, Bam, and Kerman, to Shiraz, surveying as he went. He was accompanied by Mr. W. T. Blanford, of the Geological Survey of India, who not only made geological notes of the country traversed, but a magnificent collection of the fauna. Both are of especial value in bridging over the gaps which has hitherto existed between the zoology and geology of India and the Mediterranean countries. Mr. Blanford's report will be published by order of the Secretary of State.

Latitudes of numerous stations were fixed astronomically by Majors St. John and Lovett, and a large number of altitudes ascertained by aneroid and hypsometric observations. Altogether, their work embraces 4,500 miles of route, and 140,000 square miles of country, of which two-thirds, or an area equal to Great Britain, was previously unknown to science.

Both officers are now engaged at the India Office in putting the results of their labours on paper, and when these are complete, Major St. John will prepare from them, and other earlier data, a map of Persia on an adequate scale. This will supply a want which is daily more felt, existing maps being in a very small scale, and full of inconsistencies and inaccuracies.

Besides the new map of Persia, Captain Felix Jones of the late Indian Navy, is engaged, under orders from the Secretary of State, on the preparation of a map of Western Asia, including the valleys of the Euphrates and Tigris, from the materials accumulated by the surveyors of the Indian Navy and other observers. A large mass of hitherto neglected material will be utilised, and a most valuable map will be the result. The map will consist of four double-elephant sheets. The first, or N.W. sheet, includes the range of the Taurus and the watersheds of the Euphrates and Tigris, from Erzeroum to the northern slopes of the Lebanon. The second, or N.E. sheet, will extend from Erzeroum to the frontiers of Russia, Persia, and Turkey around Ararat, and the Turco-Persian frontier, as far as the Fak-i-Gyrra Pass in Persian-Turkistan. The third, or S.W. sheet, will embrace Syria, south of the Lebanon, to the Suez Canal and Mount Sinai, besides a portion of the Euphrates. The fourth sheet takes in Mesopotamia to the Persian Gulf, and the rest of the Turco-Persian frontier. Captain Felix Jones has nearly completed the first, second, and fourth sheets in outline, and has finished the portions covered by the Mesopotamian Surveys, and the Turco-Persian frontier map. The third sheet will contain the new work now in progress under the auspices of the Committee of the Palestine Exploration Fund.

XV.  
SURVEYS.

Persia and Baluchistan.  
Sir F. Goldsmid's frontier survey.  
Major Lovett's work.  
Colonel Ross's work. \*  
Major Lovett's work in 1871-72.  
Major St. John's work.  
Mr. Blanford's geological investigations in Persia.

Astronomical observations and extent of new surveys in Persia.

New map of Persia.

New map of Western Asia.