



SATURDAY, JANUARY 8, 1927.

CONTENTS.

	PAGE
Forest Destruction and its Effects	37
Racial Likeness. By W. L. H. D.	40
Archæology of Iron	42
The New Thermodynamics. By J. R. P.	43
Our Bookshelf	44
Letters to the Editor :	
The Aurora of October 15, 1926, in Norway and Sounds Associated with it.—Hans S. Jelstrup ; Prof. Carl Störmer	45
Clerk Maxwell and the Cavendish Laboratory.—Sir Oliver Lodge, F.R.S.	46
The Mystery of Money.—Prof. Frederick Soddy, F.R.S. ; W. H. Coates	46
Transmission of Excitation in Plants.—Sir J. C. Bose, F.R.S.	48
The Behaviour of Cultures of <i>Leishmania tropica</i> , <i>L. infantum</i> , and <i>L. braziliense</i> in the Sandfly, <i>Phlebotomus papatasi</i> .—Dr. S. Adler and O. Theodor	48
The Origin of Fatuoids in Cultivated Oats.—C. Leonard Huskins	49
X-ray Evidence for the Existence of Different Modifications of Fatty Acids.—G. M. de Boer	50
A Rock of Unknown Origin from Glacial Gravel at Ipswich.—J. Reid Moir	50
Thermal Agitation of Electricity in Conductors.—J. B. Johnson	50
Oxygen = 17.0φ.—Prof. Henry E. Armstrong, F.R.S.	51
Temperature Coefficient of γ-Ray Absorption.—L. Bastings	51
The Supposed Law of Flame Speeds.—A. G. White	51
Popular Long-Range Weather Forecasts. By Capt. C. J. P. Cave	52
Regions of Compression. By Dr. J. W. Evans, F.R.S.	55
Obituary :	
Sir William Augustus Tilden, F.R.S. By Prof. W. P. Wynne, F.R.S.	58
Sir James Wilson, K.C.S.I.	59
News and Views	59
Our Astronomical Column	64
Research Items	65
The Pretoria Meeting of the South African Association for the Advancement of Science	67
The Fisheries of Ceylon. By F. S. R.	68
University and Educational Intelligence	68
Calendar of Discovery and Invention	70
Societies and Academies	70
Official Publications Received	71
Diary of Societies and Public Lectures	71

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Forest Destruction and its Effects.

THE question of the action of forests on rainfall has been debated by foresters, agriculturists, engineers, and others for a long period, the discussion probably dating back to the time at which scientific forest conservancy was first introduced. In the tropical and sub-tropical parts of the world this is not, however, the point of primary importance. The vital factor for the community at large is the determination of how far the destruction of forests in catchment areas and on the sides of hills and mountains in the drier parts of a country affects, in the first place, the level of the water in the big rivers, a matter of extreme importance when the rivers are utilised for irrigation or power works ; secondly, the decrease in the local water supplies and in local precipitations upon which the cultivator is dependent ; and, thirdly, erosion and avalanches, and the destruction they cause in the fertile valleys beneath. Sudden floods may also cause enormous damage to railways, towns, and so forth. In India, which was the first part of the British Empire to give consideration to this aspect of the forest question, the matter has been the subject of discussion and reports through the whole of the past century, a statement which will perhaps come as a surprise to many in Great Britain.

The problem of affording protection to forests for the above causes alone is by no means new. In France and Germany special laws for the protection and extension of the forests and the protection of agricultural lands by means of the forest have long been in operation ; and similar laws exist in the Italian States. So far back as 1475 the subject attracted the attention of the famous Venetian Council of X., by whom a law was passed on January 7 of that year, regulating in great detail the clearance of the forests on *terra firma*. The mountain forests especially were protected by judicious regulations, which were renewed from time to time down to the very year of the extinction of the old republics. Tuscany and the Pontifical Governments were equally provident.

History has since shown that the wholesale destruction of forests in Spain, Italy, Sicily, Greece, and Macedonia has resulted in a great deterioration of climate over considerable tracts, due to loss of moisture, the sterilisation of the soil, and excessive erosion.

Although now well known, the chief action of the forest may be stated briefly as follows : The great

factor in mountainous and hilly country is the maintenance of tree growth on parts of the area. In the case of bare slopes the rain rushes rapidly down, causing erosion, only a fraction percolating into the soil, and is carried rapidly away, giving rise to spates and perhaps to serious floods, since the old channels of these streams or rivers are no longer able to carry the excess water of flood levels. A hot sun bursting out on to the slope after the rain quickly dries up the thin layer of moisture covering it. In the hotter parts of the globe subject to heavy rainstorms or monsoons the rushing water starts gullies which eventually become ravines, all surface soil is rapidly washed away, and in the course of years the hillside is eaten into, rubble and boulders being sent down to cover up valuable lands below. When the area is under trees, a portion of the rain, falling on the crowns, drips slowly down on to the layer of humus beneath and sinks into it. The larger portion, perhaps, falls direct on to the forest floor, where it is gradually absorbed in the soft covering which takes it up as a sponge. The water then percolates slowly downwards, filling up springs and underground reservoirs, and reaches the streams in a retarded manner. The flow in the latter is consequently more even and regulated, as also the amount of water which eventually reaches the rivers. The latter can therefore be more depended upon to maintain a normal level when it is required to utilise them for irrigation or power works. The roots of trees protect the surface by holding up the soil, and thus directly prevent denudation.

It is possible to give some concrete examples of the effects of the destruction of teak forests in India during the first half of last century, owing to the large demands for this timber from rapidly expanding markets.

The slopes on the west coast of the Bombay Presidency were once, even in the early days of British occupation, covered with magnificent, valuable, and extensive teak forests. These have long since been cut out, some disappearing for good. The denudation of the Deccan Highlands and the Eastern Ghâts has resulted in excessive erosion and the gradual silting up of the rivers. When the Dutch, French, and English first built settlements on the Coromandel Coast, it was possible to take ships up the Godaveri and Kistna. The English port of Narasapur and the French one of Yunaon, both on the Godaveri, were once the chief ports on this coast. They can now be reached only at high tide by small native shallow-draught craft. Last year the present writer had arranged to go down the

Godaveri from Sironcha, on the frontier of South Chanda (Central Provinces) and the Hyderabad State, to Rajamundri, as he wished to carry out investigations in connexion with the effects of forest denudation on this river. It was early in March, the commencement of the hot weather season only. Inquiries elicited the fact that few rafts were now going down, owing to the extensive sandbanks already drying off in the river, and that even by dugout canoe, delays from stranding on sandbanks would be inevitable. Some hundred years ago this great river was the chief artery or high road into the interior! At Masulipatam, Dutch ships used to ride at anchor close up to the port, whereas at the present day even small native vessels have to anchor five miles out in the roads owing to the silting up. Between 1840 and 1850, Dr. Gibson, the first Conservator of Forests in Bombay, drew up a list of the rivers and creeks on the Malabar coast, where on arrival in those parts ships used to ride at anchor, all the creeks having silted up within the memory of men then alive.

Dr. Cleghorn, who afterwards became the first Conservator of Forests in Madras, directed attention to the destruction of tropical forests at the meeting of the British Association in Edinburgh in 1850. A committee was appointed to consider this matter. Dr. Cleghorn submitted its report, which was confined to India, the only country for which information was available, at the meeting of the Association at Ipswich the following year. The report summarised the position, as then known to the few in India who had given attention to the matter, pointing to the great and uncontrolled destruction which was taking place, both at the hands of timber merchants and owing to the careless habits of the native populations, who grazed their cattle at will in the forests and fired them every year in order to encourage the growth of new grass. The indigenous tribes in the hilly country also practiced unchecked shifting cultivation, a practice second only to the lumberer in the destruction of fine forests. Under this method, which was a common habit in Europe in olden times, a patch of good forest is felled and the material burnt *in situ*; coarse grains are then sown on the clearing. The cultivator then sits down and awaits the harvest. Two or three crops are taken off the area; the weeds then became too strong (as he never troubles to weed) and he moves on to a fresh area. The enormous destruction of virgin forest this practice entails, when practised for centuries, has to be seen to be credited. Yet many

of the tropical and sub-tropical forests in British Colonies and Dependencies are still subject to this the most pernicious and precarious form of so-called agriculture (as also to over-grazing and firing), the administrations responsible not having yet, apparently, understood the evils which attend it. The difficulties facing these Governments in prohibiting the practice or controlling it were all experienced in India, in one form or another, and overcome.

The encouragement given to the growth of tea and coffee and similar crops by British administrations in the Empire, whilst eminently praiseworthy if carried out on well-considered lines, has been productive of great harm in the past, and even the present day can scarcely be said to be free from anxiety on this score. In a report written in India in 1876 with reference to coffee planting, the following criticism is made :

“ The planters who come over from Ceylon are now giving a very high price for land, and the whole mischief may be effected in a very short time. It must not be supposed that coffee is at all a permanent cultivation ; we have only to look at the Sampajee Ghât in Coorg, the Sispara Ghât in the Nilgiris, and parts of the Annamalais to see at once that it is very often very little better than the shifting cultivation of the natives. It pays a coffee planter to take up a tract of primeval moist forest on our mountain slopes for a few years ; he gets bumper crops the third, fourth, and fifth years, but denudation of the soil and erosion goes on rapidly, and it does not pay him to keep it up many years.”

Two other examples may be mentioned. In Ajmere-Merwara in Rajputana, all the waste and forest land was handed over to the people by Government in 1850. The hills were rapidly denuded of timber and grazing was uncontrolled. The crops are irrigated from tanks (ponds) formed by building embankments across ravines. Some of these were very old. The rainfall is scanty and comes in heavy showers. The water, rushing down in torrents, quickly eroded the denuded hillsides, the tanks filled up with silt and debris or the embankments burst. In 1869, at the end of a two-year famine, the region was described as follows : “ The cattle had perished, the people had fled, large villages were entirely deserted and the country was almost depopulated.” All this was due to the mistaken policy of giving to the people what they had clamoured for, the uncontrolled use of the forest lands. An even more classic example is that of the well-known Hosiarpur *Chos* in the Punjab. These hills were formerly fairly well wooded. A rapid increase in population

followed the advent of British administration in 1846. The consumption of forest produce augmented, the herds of grazing cattle multiplied excessively, and complete denudation ensued. This was followed by erosion, broad stretches of sand invading the plains beneath, with the result that the arable lands of 940 once prosperous villages were covered with sand, which laid waste upwards of 70,000 acres of fertile lands. In 1900 this formerly rich district was traversed by numerous broad, parallel, sandy belts cut out of the crop-bearing and fertile area.

In India these matters are now well understood, and the Forest Department, supported by the Government, has control of the great forest areas. Proofs of the disadvantages and disasters following the uncontrolled wasteful utilisation of the forests in mountainous and hilly country are not therefore wanting. It is known that the same processes are at work, and the same mistakes are being made, in our Colonies. It is the habit of British administrations to work in water-tight compartments. Probably the major portion of the difficulties being experienced in different parts of the Empire have been solved, or are approaching solution, in one or other of the provinces in India. They present no new features, as some appear to think, as the above-quoted examples go to prove. The chief difficulty is that action is delayed until almost irretrievable damage has been done and then the forester is asked to reforest the areas so denuded. This entails an enormous expenditure, great skill, with success ever hanging in the balance.

Attention was directed to this subject at the meeting of the British Association in Edinburgh in 1920, when a paper dealing with the Indian forests was read. Resolutions of the same kind were also passed by the World's Forestry Congress held at Rome in May 1926. As an outcome of last year's meeting of the British Association at Oxford, the chairman of the Forestry Sub-Section, Lord Clinton, drew up for the council a brief statement dealing with the destruction of forests on hill slopes, with special reference to the tropical forests of the Empire. This memorandum has been submitted to the Secretary of State for the Colonies, by whom it is being communicated to the Colonies and Protectorates. It may be hoped, therefore, that the chief factors of destruction, namely, shifting cultivation, excessive grazing and the firing of forest lands, may receive that measure of considered control which the expert forestry services under the Colonial Office are fully capable of inaugurating if supported by the several administrations.