

A World Survey of Soil Erosion.*

THE Rape of the Earth was the title chosen by the authors, but was at first refused by the publishers as being too sensational and liable to disappoint a large public avid for thrills but not particularly interested in a work of soil erosion. When I met the authors at home last summer the match between themselves and the publishers was on, but apparently has since been settled in a victory for the authors, as their title has been accepted and used, though possibly it is the publishers who have introduced the less sensational sub-title of "A World Survey of Soil Erosion".

Both the authors are recognised authorities in their own particular spheres, Jacks as a soil chemist and Whyte as a grass-land ecologist, but it is a sign of the times that both should emphasise the social repercussions rather than the technical difficulties of introducing effective erosion control. We know roughly what are the agricultural, pastoral, forest and engineering principles which ought to be adopted to stop the present appalling waste of valuable top-soil but we cannot, or dare not, apply them forthwith on a scale commensurate with the gravity of the situation. "The problem of soil conservation is not solved merely by discovering the simple practices that will minimise erosion; when the right practices have been discovered, or, more correctly, when the need for adopting the practices has been recognised, the great task is to procure their general application."

In this connection it is interesting to read how in almost every country it is the method of land tenure which is proving the chief stumbling block to the introduction of organised control. No year-to-year occupier will spend labour or money on improvements. Tenant farmers all over the world, whether on a crop share or a cash basis, are forced through the very nature of their agreement with their landlord, to extract whatever they can from the soil, regardless of its ultimate productivity. The crop share is usually for edible crops, therefore the landlord does not encourage the tenant to grow the clovers and pasture plants which contribute something of good back into the soil. Short

leases prevent the introduction of soil-improving crops or of a rotation of crops which will conserve the soil fertility. The common holding of waste land is in India and many other countries the root cause of deterioration because common land is "nobody's child" and is inevitably neglected.

The book rightly emphasises the ultimate dependence of all industrial and scientific development upon the welfare of the cultivator and the productivity of the soil. This is, or should be, transparently clear in India, which is essentially a land of villages. In the present enthusiasm for industrial development in India the fact is often overlooked that the purchasing power of the country in absorbing manufactured goods depends directly and almost solely upon the prosperity or poverty of the millions of villagers who either own and till their own land or rent that of a neighbouring owner. The authors blame the introduced methods of cultivation for the serious erosion in many of the "younger" countries, but in India the trouble is due to the indigenous agriculture, whose uneconomic practices combine with over-population to destroy the valuable top-soil, even on comparatively level lands.

According to General Smuts, quoted in this book, "erosion is the biggest problem confronting the country, bigger than any politics". If this can be said of South Africa where politics are a dominant and violently disruptive force, it can be equally safely said of India. Does it matter much to the Punjab whether it has a Unionist or a Congress Government if its main army recruiting grounds, namely the Jhelum Salt Range, the Hoshiarpur and Ambala Siwaliks, and the Rawalpindi foothills, are being reduced to a desert which will sustain neither man nor beast? Out of the many striking photographs showing phases of erosion in such far countries as Texas, Australia, Peru, the Lower Don of Russia, Nyasaland, Natal and Basutoland, most could be replaced by photographs of Indian conditions without either the authors or the landowners realising the deception.

As a study of contemporary scientific developments this book is invaluable and should be in the hands of everyone who has to do with the land and its manifold agricultural uses. The later and more spectacular phases

* *The Rape of the Earth*, by G. V. Jacks and R. O. Whyte. (Published by Faber and Faber, London), 1939. Pp. 312. Price 21s.

of soil erosion have been subordinated in this study, and prime emphasis laid upon the *gradual loss of porosity* which is the most serious early symptom. This is accompanied by a loss of cohesion, and the insidious action of sheet-washing such as occurs on exposed fallow does its worst damage by destroying the *crumb structure*, that illusive but essential characteristic which is now coming to be recognised as of far more importance to soil fertility than any other single chemical or physical character.

In this connection the book gathers up the threads of contemporary research on the erodibility of both cultivated and uncultivated soils. It shows that this feature is only a relative term, because of the radical alterations which take place in the crumb structure of forest and grass-land soils whenever these are brought under cultivation. Each type of plant cover evolves a top-soil which is suitable to it; thus the coniferous forest builds up an almost structureless mass of light friable humus which is a permanent feature of the forest floor, but which disappears rapidly when the forest is felled and replaced by fields. The problem of the over-felling of private forests again brings forth a comparison of the United States with India, for in the Chota Nagpur plateau and the Hoshiarpur Siwaliks there is a crying need that the destructive tendencies of private ownership should be influenced by government control and advice. In South Africa the government is going in for the purchase of large areas of mountain land in the Union, the object being to check further abuses from over-grazing and the ploughing of steep slopes. Much of South Africa's most important catchment lies inside Basutoland, which is not under the Union Government, but here a 10-year programme of erosion control is being financed from the Colonial Development Fund by the Colonial Office, largely in order to help the Union.

Turning now to the authors' remarks on India, we read: "Over much of India the people have accepted a slowly deteriorating environment as part of the scheme of things; the vast majority is probably unaware that erosion is occurring". This is indeed an indictment which cannot be denied, but which ought to be taken up as a challenge. It is only by redoubling our efforts in educating the cultivator that we can alter this. The authors emphasise that the stabilisation of eroding lands cannot be effected by purely

dictatorial legislation. The greatest recent advance in erosion control is the establishment by law of "conservation districts" in the U.S.A., where a majority vote of the farmers in an administrative unit can now form a district committee. This committee has very wide powers to coerce those who refuse to come into line with the experts' recommendations as laid down in their working scheme, which is more or less the forester's "working plan" of our Indian practice, but widened to make erosion control recommendations for every type of land in the vicinity. Starting in 1933 with demonstration projects scattered over most of the states, the Federal Government paved the way for this by educating the farmers in project areas to look after their own land, and the logical outcome is this delegation of authority to a local democratic body with powers to follow and enforce the experts' advice.

The authors frequently mention Java and the Dutch East Indies as having been saved from the erosion danger by the timely action of the Dutch Government, but from information gleaned during a visit last summer to their admirable Colonial Institute in Amsterdam, I gathered that the Dutch foresters and erosion experts were far from satisfied themselves over the rate of progress in counter-erosion work, particularly in the poorer soils of the more remote uplands. The fact remains, however, that the Dutch colonial organisation is fully alive to the danger, though it has not been mastered yet, except in the most intensively cultivated plantations which are under skilled European management.

A phase of soil conservation work which has not been sufficiently discussed in India, but to which the authors devote much space, is that of tree shelterbelts. The results of early tree belts planted in Russia are so satisfactory that the Soviet Government adopted a programme for establishing 865,000 acres of shelterbelts in their second Five-Year Plan. This compares in magnitude with the U.S.A. maximum of 1¼ million acres in 10 years for the Great Plains Shelterbelt project which is now going forward. In the Californian fruit districts shelterbelts are a *sine qua non* of good farming, and for orchard land it is considered worth while to have 10 per cent. of the area 15 dollars (40 rupees) per orchard acre under wind-break trees, and to spend up to

upon wind-break maintenance. Considering the recent large developments in Malta orange planting in the irrigated Punjab plains, it seems strange that this essential point in the Californian fruit-growing technique should have been neglected.

Amongst the many ways of checking erosion and reducing run-off from sloping lands, emphasis is rightly placed on *contour ridging*. In fact the authors harp so much on the need for terracing, trenching, and ridging at right angles to the slope of the land that they have coined a new phrase "contour farming" to cover the many minor variations of this standard principle in run-off control.

The book attempts to assess the wider implications of soil conservation activities throughout the world. In spite of the publicity which has focussed attention on this work in the U.S.A., the authors have decided

that the African continent must now take the foreground for erosion "news value". In the U.S.A. a conservation economy is being developed on a vast scale and in an orderly manner, whereas in Africa the need for such work is even more urgent but the issue is much more complicated owing to the conflicting aims and interests of the several governments, the varying standards and needs of black and white populations, sometimes mixed, sometimes segregated, and the technical difficulties connected with the ecology of arid grass-lands and dry savannah forest. Due place is also given to the great effort now being made by Russia, for the Russian plan does not stop short with saving soil and stopping floods, but aims at a Utopia by harnessing all the rivers east and west of the Urals into a gigantic scheme for the conquest of the semi-arid steppes.

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Electricity in Chemistry*

ALMOST the first application of electricity to chemistry was the experiment of Nicholson and Carlisle in which water was decomposed into its elements by a current from the voltaic pile, which had just then been discovered. This was in 1800. In the immediately following decades, the new tool of electricity held the fascination of the leading chemists. In particular, the classical work of Faraday and the laws enunciated by him have remained to this time fundamental in all considerations dealing with the relationships between electricity and chemistry.

Studies on these relationships increased rapidly, and when Arrhenius promulgated his hypothesis of ionisation equilibria in solutions, a definite big impetus was given to the whole subject. The thermodynamic study of energy in chemical systems had just then been initiated and was in the full vigour of its youth. It was soon realised that the electrical energy connected with galvanic cells was of a reversible type and that rigorous methods of thermodynamics could be applied to many of the chemical changes involved in the galvanic cells. The relation-

ships between chemical and electrical energies, particularly in liquid systems, have since been developed by systematic work into a subject in itself, under the caption of "Electro-chemistry". This term 'electro-chemistry' can at the present day however comprehend a much wider range of topics, for, much of the recent investigations on the electrical nature of matter and of the chemical reactions between them, the investigations mostly carried out by physicists on the electrical conductivity in solids and gases, and several other aspects of molecular physics could all be included under this head. Indeed it will be difficult to draw any sharp line between "electro-chemistry" and other branches of physics and chemistry.

Still the old and somewhat arbitrarily defined 'electro-chemistry', which includes mostly studies of chemical reactions brought about by electrical energy and of chemical reactions giving rise to electrical energy, is itself a wide and steadily growing subject. Considerable progress has been made in this field after Debye and Huckel indicated how the then troublesome deviations of strong electrolytes from ideal behaviour in solutions, could be accounted for quantitatively by taking into consideration the interionic attractions and repulsions. As is well known the basic idea in this theory is that each ion is surrounded on the average by an

The Principles of Electrochemistry. By Duncan A. MacInnes. (Reinhold Publishing Corporation, New York, Chapman & Hall, Ltd., London), 1939. Pp. 478 with 148 illustrations. Price \$ 6.00.