

SOME ASPECTS OF SOIL EROSION*

THE question of soil erosion has, during the last few months, figured fairly largely before the general public but it is no new problem.

Erosion and loss or wastage of soil have gone on in this country ever since human occupation or cultivation became at all fixed. In the early times the damage appeared small and the new land available almost endless, but with the increase of population and activity the available new areas soon became limited and the losses were forced on notice. There is no doubt that at the present time erosion and loss of soil have reached the stage of becoming a serious menace in the Union. It is a menace that the Government has decided to tackle seriously. A comprehensive scheme has been put forth for collecting information, education of the public, combating the evil by assisting land owners with loans for reclamation and finally, by assisting research in the fundamental aspects. It is not at all necessary to go into any details of this national scheme. The press has already contained accounts. It is enough to emphasise that the very existence of such activity on the part of the Government is evidence that the problem is a serious one.

The erosion of soil, except in exceptional cases, only occurs when the vegetation covering the surface is destroyed or interfered with. In uninhabited regions the surface is remarkably stable. Soil erosion is thus basically a botanical problem.

The soil is the source of water and food materials for plants and also their foothold. The plants which build up the vegetation form the basis on which ultimately the whole continuance of the human race depends.

The soil consists of broken rock material and is penetrated by roots. These roots keep the soil mass together and increase its mass by penetrating deeper, working into cracks, and so on. In the soil physical and chemical changes go on and organic matter derived mainly from plants, is added, till finally the surface layers become very different both in structure and content from the rocks or rock material from which the soil was originally formed. While the vegetation is untouched and active the formation of soil continues, sometimes rapidly, at others very slowly; but as soon as the plants are removed or destroyed the loose soil material is exposed to easy removal by wind, water or other agents.

In a country such as South Africa, where practically the whole is liable to extended periods of drought and where so much of the rain when it does come falls in heavy storms, erosion is especially liable to occur. The heavy rain falling on dry soil wets and loosens the surface and runs downhill. Unless the soil is held firmly by roots the sudden downhill movement of large quantities of water is liable to remove whole sheets from the surface. In other cases where the water runs off in channels, dongas, which

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may attain considerable depth, are cut out. These dongas cause great wastage of soil and themselves are a source of drying out of surrounding soil that often results in the death of plants and hence further wastage.

It is not proposed in the present note to attempt any sort of general account of the position in regard to soil erosion in the country but rather to treat very shortly some of the special aspects present in the South-Western Cape region. This region differs in many ways from the remainder of the Union and in any scheme covering the whole country is apt to have its own problems treated as of minor importance in accordance with its proportion of area to the whole. For this reason these local problems are brought forward.

The South-Western Cape is characterised by the rainfall being wholly or in very large part confined to winter months and the summer dry. Correlated with this climate the vegetation is very characteristic, being typically bush, not very tall, and generally with hard evergreen leaves predominantly of small size. Grasses and any turf-forming plants are infrequent or absent and hence grazing is not carried on to any large extent. The main agricultural value of the region is in fruit growing and grain production. The country is mountainous and the land of agricultural value is confined to the lower slopes and valleys and the coastal plain. In this region the losses due to soil erosion are less obvious than in many other parts but are none the less severe.

Erosion is worst on the mountains and as these are of little agricultural value, the loss has, up to the present, been either totally neglected or treated as of no serious account. It is true that the mountain vegetation, which is composed of bushes and reeds, is of little value as food for animals, and the soils too steep, too shallow and often too poor to justify cultivation. In an attempt to create pasturage the practice of burning the vegetation has gone on for centuries. Burning was carried out even before the advent of the white man, who has continued the habit. Several reasons are brought forward in support of the practice. The untouched bush is thick and most of the plants hard and woody. Animals find little to feed on and in the old days were liable to attack from easily concealed leopards or natives. When the bush is burned a certain number of the plants sprout up from underground portions that survive and the young soft shoots are much more palatable than the old hard ones. The apparent improvement is, however, of short duration. After two to four years, depending on local conditions, a dry bush cover, generally of low stature, is established. Not at all infrequently this re-established bush is again burnt in the hope of getting further improvement. But such recurrent fires, especially when combined with grazing, soon eliminate all but tough resistant plants of no economic value at all.

Fire destruction has other effects as well, effects that may mean serious ultimate loss. Fires most commonly occur in summer and especially towards the end of the dry season when both bush and soil are dry. After the fire the soil, which may have been much heated, is exposed to the full drying effect of the sun and wind. This alone causes rapid alteration and often total disappearance of the organic matter in the soil which seriously reduces its nutritive value for plants and its capacity to

hold water. The pale colour of the soils of recently burnt areas must be familiar. Under thick bush the surface layers of the soil are dark, often black, while after a fire the colour changes to white or very pale. This impoverishment of the soil by loss of organic matter renders the reappearance of the plants slower and more difficult.

The unprotected soil of a burnt area is exposed to erosion by wind or water. In the dry season winds remove the loose dry soil, especially in the upper portions of the mountains. When soil in large quantity becomes open to movement by wind action the establishment of plants may become very slow or even impossible.

Water in the form of rain is still more potent as an agent for erosion. The soil, no longer held by roots is washed down the slopes which may become so denuded that the solid rock alone remains; a condition too often seen on our mountains and especially in those with the heaviest rainfall.

After burning the vegetation is regenerated but the vigour of the new growth, its character, and the time taken for it to be formed, depend on the local conditions and the amount of erosion. Even under favourable conditions, when little soil removal occurs, the destruction has an adverse effect. One example must suffice, taken from an area that has been under observation for a number of years. This was on a granite soil on the slopes of Table Mountain. The angle of slope was not sufficient to allow of serious erosion. Before the fire the soil was covered by a dense growth of bushes beneath which were a number of shade tolerant species. Ninety-three different species were recorded of which fifty-one were woody plants. After the fire thirteen of these sprouted from still living underground portions; the remainder either restarted from seed or were totally destroyed. The area was kept under observation for seven years, during which time no further fire took place. At the end of the period the vegetation, as compared with the original, was lower and less dense. It contained a larger proportion of low growing woody plants with small leaves. The shade enduring plants, which have relatively large leaves, had mostly disappeared. The whole aspect was drier and less luxuriant: from the point of view of pasturage it was certainly less desirable.

This example was under favourable conditions. When these are less good the changes towards increased dryness are more pronounced and the time that elapses before regrowth is complete is extended. Very frequently fires occur before re-establishment and each fire has an increasingly deleterious effect, so that after very frequent fires the vegetation become sparse and largely made up of reeds, low bushes or bulbous plants which have no feeding value for animals and very little holding power on the soil and which produce very little soil improvement. The whole upper portions of many of our mountains are now in this condition though the general type of climate and moisture lead one to expect an especially vigorous vegetation. Fires followed by erosion by rain and wind have resulted in so great a removal of soil that only the most resistant plants which make little demand are able to survive.

People can and do say in this connection,—“Why bother about the mountains which are of no value as land; let us concentrate on the fertile low grounds.” This is a very short-sighted view. The condition on the

mountains has a decided influence on the slopes and valleys at the base; an influence shown in more than one way. The most important is on the water supplies, especially on springs and streams. When the vegetation is undisturbed and the soil well penetrated by roots and containing organic matter, the rain water penetrates. In part it is held, in part it percolates down and escapes in springs and streams. The percolation is gradual and the soil protected from loss of evaporation and hence the streams continue to flow evenly. On the other hand, when the vegetation is destroyed by fire the rains either remove the unheld soil or compact it. In either case the water runs off at once and little or none is held. The streams come down in flood but continue flowing for a short time only. Floods are very liable to occur in the low lands and the rush of water from above in addition to the ordinary rainfall causes dongas or other forms of erosion. Also in the sparse vegetation following fire such water as is kept in the soil is liable to be lost by evaporation.

Destruction of the vegetation has another serious effect on water supplies. The mountains here are frequently covered by mists brought up by the South-East winds in summer. These clouds condense on the plants but only to a negligible extent on the soil itself or on rocks. The late Dr. Marloth demonstrated some years ago that the condensation by bushes and reeds might reach an amount corresponding to several inches of rain. In unburned vegetation this reaches the soil and helps to keep streams running. When the vegetation is burnt it is wholly lost. As the whole country is dependent on the mountains for its water supply it would seem obvious that a preservation of the vegetation on them is both urgent and essential.