SOIL EROSION*

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THE subject of this short talk is soil erosion: that wearing-away process which goes on all the time on some part of the earth's surface. Erosion, like most of nature's processes, works in two directions, causing a breaking-down of existing rock and soil, and a building-up of future soils.

Under natural conditions, this building-up process is a very, very slow one; so slow that from a practical point of view it is rarely of any immediate value. The breaking-down process, however, is very rapid, extremely so under the conditions of cultivation of short-aged crops, and its rate is not constant but is often accelerative. Through the effects of soil erosion, a smiling country-side can be converted into a barren desert in a comparatively short space of time.

Because of these facts, it is imperative that everything possible should be done to reduce the rate at which soil erosion takes place, since all of us are dependent upon the soil for our food.

Soil erosion is a manifestation of the actions of one or more of that group of forces which, collectively, form such a general topic of conservation: in common parlance—the weather. The most important of these causative agents of erosion are water, wind, and changes of temperature.

Water causes erosion because it is a liquid and because it is often so unequally distributed. We seem to receive either too much or too little of it at a time, and because it is not always supported on all sides it is usually moving about.

The chief cause of soil erosion in Ceylon is water in the form of intensive falls of rain, and the flow of many of the aggregated raindrops over the surface of the soil. In its latter form, this water is technically known as surface run-off. The beating of rain on the earth disturbs the soil, and the surface run-off water carries away the loose soil particles and makes the flow of our streams and rivers irregular and uneven.

* The text of a broadcast talk given from the Colombo Broadcasting Studio on the 23rd February, 1938

Irregularity of stream flow, due to variations in the intensity and distribution of the rainfall, is mainly caused by surface run-off water which is excessive in quantity and insufficiently controlled in its rate of movement. The alternation of torrential rushes and tiny trickles of water in streams and rivers leads to bank erosion which is one of the contributory causes of floods.

For the surface soil, as for human beings, there is only one really effective defence against heavy rain, and that is a sufficient degree of shelter and protection. Under natural conditions, the necessary protection of the soil is provided by vegetation, and Nature, in her beneficent way, seems to provide this almost automatically, since the higher the rainfall, the more luxuriant is plant growth.

The first way in which rain causes erosion is by its direct beating action on the surface of the soil; and in this respect the raindrop is a big bully to the soil particle, being about fifty times its size. How much this is the case may be appreciated better if we compare the size of a small raindrop (1 mm. in diameter) with that of an ordinary particle of soil or fine sand (0·02 mm.). If each were enlarged to only about a hundred times its normal size, they would compare approximately with large oranges falling upon a number of small grape seeds. This, however, does not complete the story, for we also have to consider the fact that the soil particles are normally at rest, while the raindrop is falling and has a definite rate of movement. The rate at which a raindrop falls depends upon its size, and when it falls through the air, its velocity increases until the resistance of the air is equal to its weight. After that moment, it continues to fall at a constant speed, which is called its terminal velocity. The largest raindrops reach a size of nearly a quarter of an inch in diameter, and they attain a terminal velocity of almost eighteen miles per hour.

As may well be imagined, the continual beating of large raindrops on the surface of the soil, even for an hour or so, constitutes a fairly heavy bombardment; and the actual disturbance and movement of soil particles caused by rain, is therefore considerable. This is particularly so after the soil has been loosened by cultivation; and also when the soil is dry, since the soil particles are then lighter in weight.

The more a soil is exposed to the elements, and the less it is protected by vegetation, the more it will be eroded and its fertility destroyed. This, in itself, is a strong argument in favour of a ' plant more trees ' campaign.

The shade and protection which trees afford the soil are of great value, especially in the case of those trees which are either evergreen or do not shed all their leaves at the same time. The

soil surface cover or litter which many trees provide by their leaf-fall, reduces the degree of soil erosion which can take place; since not only does it cover and protect the surface soil, but it helps to keep it moist and to make it more absorptive.

The best protection for the soil from surface run-off water is provided by a close cover of low-growing vegetation, since this impedes the movement of the water and reduces its rate of flow.

Normal erosion, such as takes place under natural conditions, is not nearly such a serious form of erosion as that induced by man and his domestic animals. The latter form, *induced erosion*, is caused primarily by changes, even if only temporary, which reduce the density of the vegetative growth which covers the soil. Such changes, however, are often a necessary accompaniment of man's labours, not only in agriculture, but in industry and all other forms of work which involve any disturbance of the soil or its natural cover. In all such cases adequate measures should be taken to reduce and control surface run-off, so that it neither causes nor leads to erosion.

The extent to which soil erosion affects the whole population of a country, urban as well as rural, is often insufficiently appreciated. It has two main trends, each with its own particular train of effects. The first of these is the direct loss of water, as run-off from higher areas, due to insufficient vegetative density and poor soil absorptive capacity. Both lead to a rapid rate of run-off and to an excessive volume of water, causing a deepening of the main lines of water flow due to its erosion and scour of stream beds. This, in turn, lowers the height of the water table in the land on each side, causing crop failures and shortage of water for man and beast. In other words, drought effects supervene, particularly in areas of low or badly distributed rainfall. Rapid and excessive run-off causes the supply of water to lower levels at a rate greater than its discharge, with the result that the water accumulates and flooding takes place.

The second main trend is the transport of soil from higher areas by the run-off water. This leads to an increasing reduction in the fertility of the land: at higher levels from the actual loss of soil, and at lower levels as a result of its deposit on cultivated areas. Fertility is further reduced by the silting of streams, channels, &c., causing inadequate drainage.

All these effects, which have their origin in soil erosion, cause a considerable and increasing drain on public funds. Money is required for flood relief and control works, and for repairing flood damage, the costs of which have to be met by the taxpayer.

Serious as these effects are, it is doubtful if they are so far reaching as the disastrous effects of the constant reduction in soil fertility. This results, not only in poorer yields and decreasing supplies of food, but possibly in lowering the nutritional value of the foods produced, with its natural reaction on the health and well-being of the population as a whole.

Induced erosion must be retarded and reduced till its degree is negligible. The fertility of the soil must be built up and raised to a high level. The main basis of soil fertility, humus or organic matter, which erosive forces so readily remove and destroy, must be restored and maintained so that the food of the people may be plentiful and nutritious.

Everyone has a contribution to make towards the protection of the soil and the prevention of erosion. The agricultural population have to see that full use for plant growth is made of the water which they receive, and that the surplus is passed on under control. The urban population have to see that this surplus is utilized to the full, is regulated and controlled. Both sections of the population have to see that it is properly divided and efficiently ruled, and this can be effected only if all do their part.

The gift of rain requires to be profitably utilized in each of its stages: before it reaches the earth, when it reaches it, and before it rejoins mother ocean. If we do not make full use of this gift we run grave risk of its being taken from us.