

VEGETATION, CLIMATE, AND SOIL AND WATER CONSERVATION

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THE subject of afforesting areas of low rainfall is very closely connected with the problem of soil and water conservation. The once popular belief that forests affected the climate of a country generally, has not yet proved to be strictly correct. The change from fertility to aridity which has occurred in certain areas has been due chiefly to deforestation; but this, in any cases known, has not greatly affected the climate either as regards temperature or rainfall.

In the main, it is not so much a question of vegetation affecting climate as climate affecting vegetation, and the chief climatic factor in this connexion is undoubtedly rainfall. Climate, or the average state of the weather, is chiefly determined by temperature, topography, and rainfall. Temperature is governed mainly by altitude and latitude: topography by the forces of erosion, geologic and induced: and rainfall by changes in the temperature and humidity of the air. The vegetation of any area is mainly determined by rainfall, and this explains why the characteristic natural vegetation, in both tropical and temperate regions, with an abundant rainfall is forest, with a moderate rainfall is grass savannah or steppe, and why there is no vegetation in desert areas.

To attempt to create forests in the unirrigated areas of Ceylon which have only a moderate rainfall would be working against nature, with little or no likelihood of success; while to irrigate and afforest such areas would not appear to be an economic proposition.

It is certainly true that forests occasionally do increase rainfall to a slight extent, particularly in the neighbourhood of the trees, but they cannot alter its seasonal periodicity. In comparison with unforested land, however, forests tend to conserve rain water and to modify extremes of both moisture and temperature. The quantity of surface run-off water is reduced and its rate of flow retarded when a litter of fallen leaves covers the surface of the soil, which is thus kept in a moister and more absorptive condition.

In connexion with forest vegetation, the factor of plant transpiration has also to be considered. It is well known that the transpiration of water by plants is much greater in dry, hot areas than in moister and cooler ones, but to what extent and to what elevations this applies has never been very clearly defined. In 1937, some investigations were recorded by Coster on the transpiration of different types of vegetation in Java. The results of these investigations indicate that, at altitudes of over 3,000 feet receiving more than 140 inches of rain in the year, 60 per cent. or more of the rainfall becomes surface run-off and nearly 25 per cent. is used up in transpiration. At lower elevations where rainfall is less and transpiration is greater, many types of vegetation use up in transpiration all the water which percolates into the soil, even during the wet season. In view of this fact it is concluded that the afforestation of the plains is inexpedient in cases where stream-flow and water conservation are desirable. Low-growing vegetation, however, can still provide a necessary protection to the soil from erosion and can materially assist in reducing the percentage of surface run-off water, but the types selected should have low transpirational tendencies. Short grass is considered to be one of the types which best fulfils both these requirements, and it is now well established that a good grass cover is the most effective natural means of controlling surface run-off and preventing erosion. In up-country areas where evaporation from tropical vegetation is much less, and where an abundant undergrowth provides the best possible conditions for the prevention of erosion and for the percolation of water into the soil, water conservation and control of soil erosion are best secured under a mixed forest.

Ceylon happens to be situated in that part of the world in which a tropical monsoon climate prevails. The monsoon itself is not a rain but a wind, which characteristically blows one way during one part of the year and the opposite way during another. In between these two main seasons are periods of change-over, when unsettled weather prevails. The winds during these two monsoon periods often bring with them cool, moisture-laden air which, according to the greater or lesser amounts of heated-up air or land surface that they encounter or pass over, precipitate less or more of this moisture in the form of rain. Thus, the south-west of Ceylon generally receives more rain during the south-west monsoon than it does during the north-east monsoon, and the north-east of Ceylon usually receives more rain during the north-east monsoon than it does during the south-west. We cannot, however, control or regulate these natural phenomena, so we cannot in any material way affect either the amount or duration of the rainfall. Areas which receive an excess of rain, over and above the actual

requirements of the vegetation they support, even if this rain falls only during a few months in the year, have to provide for the removal of this excess by drainage, natural or artificial. On the other hand, areas subject to a deficiency of rainfall have to meet the requirements of such vegetation as it is desired to establish by means of irrigation.

Now it happens to be one of the unchangeable characteristics of those tropical monsoon climate areas, which normally receive only a moderate rainfall, that the monsoon rains, as during the 1938-39 north-east season, occasionally fall below the limit essential for successful cultivation; thus the importance of irrigation, and of water storage and conservation, in these areas.

In dry areas, such as the Jaffna and Hambantota Districts, in which the amount and distribution of the rainfall is only sufficient to maintain a very meagre cover of vegetation, soil erosion is liable to be more widespread since less of the rainfall percolates into the soil and a greater amount becomes surface run-off water. It is in such areas, therefore, that there is a greater need for the conservation of as much of this surface run-off as possible. The afforestation of such areas, even if feasible, is unlikely adequately to effect this, since the greater part of the moisture absorbed by the soil will be lost to wells and springs through transpiration.

The one method of reducing soil erosion and of conserving surface run-off water in the drier parts of Ceylon would appear to lie in the establishment and maintenance of low-growing vegetation, such as drought-resistant grasses and ground-cover plants. These would reduce the rate of movement of surface run-off water, giving it more time to sink into the soil, and increase the absorptive capacity of the surface soil by keeping it in a moister and more open condition.

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