Nearly forty years ago Ed Imbeaux, a distinguished French hydrologist, published in Zeitschrift für Gewasserkunde (1), "Essai-programme d'Hydrologie," in which he outlined outstanding problems of hydrology and, by implication, the need for further research. He pointed to the problem of runoff as the keystone of the hydrologic cycle. Much has since been accomplished. The object of this paper is to outline surface runoff phenomena and thereby bring to light what seems to the author to be the most outstanding needs for research and extension of knowledge regarding the interrelations of water and soil. The relations between water and soil have been much studied. Previous studies, as reviewed, for example, in the excellent books by Maximov (2) and Keen (3), have mostly been predicated on the assumption that the water is already in the soil. How it got there has received altogether too little attention.

The present paper is devoted primarily to the relation of rainfall and soil, that is, to the ground surface phase of the hydrologic cycle. The behavior of water after it enters the soil, evaporation, transpiration by vegetation and the phenomena of ground-water storage and flow are considered only incidentally, since for the most part this discussion centers around the phenomena of infiltration. Infiltration capacity ($f$) may be defined as the rate at which a soil surface when in a given condition can absorb rainfall.

Interception and Ground Rainfall. On an area covered with vegetation, a part of the rain is intercepted as interception storage on the leaves, twigs and stems of vegetation (4), (5). An amount equal to the interception storage is lost by evaporation after rain ends. During rain, the interception storage remains nearly constant but evaporation takes place. The rate of evaporation per unit area during rain is commonly very small, but due to the enormous extent of leaf surface, the volume of evaporation during rain becomes appreciable. If the rain starts at low intensity, most of the interception storage is derived from what is subsequently described as the "initial rain," which produce no runoff in any event. Evaporation when runoff is taking place has much the same effect on runoff as increasing the infiltration by an equal amount, so that in determining surface runoff it is not necessary to distinguish between total rainfall and the rain which reaches the ground. In dealing with subsequent phenomena and the amount which actually is added to the storage within the soil, the distinction between total and ground rainfall becomes important. In the present discussion in relation to infiltration and phenomena dependent thereon, the word "rainfall" will be used in the sense of "ground rainfall."