AMERICAN DESERT VEGETATION.[1]

THE popular impression of a desert as an endless plain of tawny sand, rainless, and utterly devoid of vegetation, or perhaps showing a distant oasis, bears but slight resemblance to the desert overlooked by the botanical laboratory near Tucson. Here considerable variety of vegetation prevails; in the streams and river aquatic plants flourish; along the river banks rise poplars and willows; on the alluvium of the "flood-plain" is mesquite-forest, in which acacias and another leguminous species, *Prosopis velutina*, live side by side with elder-trees and ash-trees; approaching the hills other types of vegetation appear in the dried water-courses, and on the gravelly and sandy slopes, in both of which sites grows the notorious creosote-bush (Larrea); while on the hills are found yet other plant-communities, including giant cacti and Fouquieria. In the winter and summer seasons of rainfall—scanty though this be—the scene changes like magic, for thousands of short-lived annual (ephemeral) herbs spring up and clothe the ground with fresh verdure that contrasts with the ashen or bluish-green tints of the bushes or bizarre succulents.

Variety of water-supply, of slope, and of soil (clay, gravel, sand, alluvium, hard pan, saline spots) evoke corresponding variety in the vegetation of this patch of desert, and render the site eminently suitable for a botanical laboratory and for the solution of ecological and physiological problems by observations and experiments on desert plants in their natural surroundings.

Desert plants are exposed to the danger of death from desiccation by reason, first, of the various intense climatic factors tending to cause excessive evaporation, and, secondly, by the scantiness of the water available for absorption by the roots. Hence even where water is abundant in the soil, as is the case near rivers, atmospheric factors militate against luxuriance of growth or multiplicity of species. In less moist soil desert-plants evade or withstand the danger of desiccation by their possession of peculiar characters that may be physiological or morphological and anatomical.

As regards physiological peculiarities, the desert plants that are capable of reviving after thorough desiccation are few in number and are limited to lowly organised types, such as lichens (yet these by no means lack protective arrangements, as is indicated in Dr. Fink's article on lichens in the volume under review). On the other hand, many flowering plants exhibit in their life-history a rhythm that enables them to thrive in the desert without the aid of any adaptive structural features. For instance, in deserts there are many ephemerals that spring up in the rainy season, and within a few weeks produce leaves, flower and fruit, and die. They evade the true desert conditions, and survive in virtue of their rapid completion of the life-cycle at a definite season.

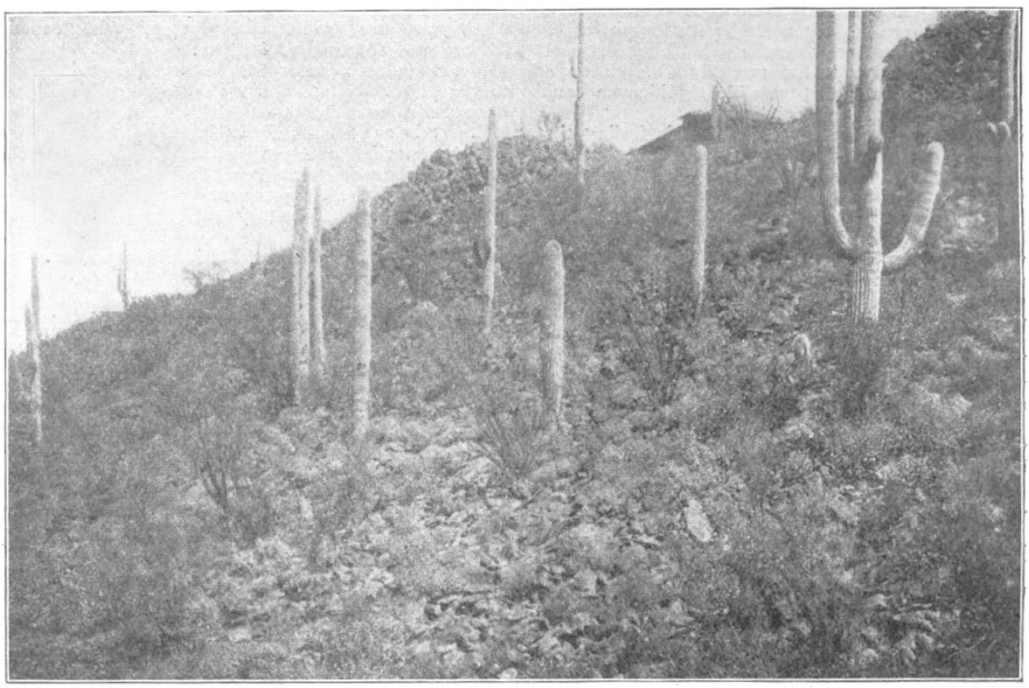

FIG. 1.—Right side of gulch near Laboratory, with generally south exposure.

In the Egypto-Arabian desert there is but one annual rainy season, namely, in winter, and consequently only one annual crop of winter-ephemerals. Near Tucson, however, there are two rainy seasons—in winter and summer respectively—and corresponding crops of winter-ephemerals and summer-ephemerals. These two plant-communities consist of entirely different sets of plants, the seeds of which (according to the information in this volume) will not germinate at the particular rainy season during which they are wont to be inactive.

The structural characters enabling desert plants to exist have been dealt with by Volkens and other investigators, and additional details have more recently been supplied by workers at the Tucson laboratory. But the main value and novelty of the work conducted in connection with this laboratory lies in the investigation of the behaviour and physiological activity of representative species, also in the thorough

[1] "Distribution and Movements of Desert Plants." By V. M. Spalding. Pp. v+144. (Washington: Carnegie Institution, 1909.)

analysis of the conditions prevailing and determining the precise local distribution of species and communities, including the changes taking place in the arrangement of the vegetation by colonisation and invasion.

In the various sections of the volume under review, interspersed in the discussion of general principles, we find many interesting details regarding certain species that we can piece together. For instance, we learn that the giant cactus, *Cereus giganteus*, which raises its fluted columnar stem up to a height of fifty feet, was shown by Mrs. E. S. Spalding to act as a vast expanding and contracting reservoir, as its ribs and furrows permit of bellows-like action. This plant, like some other desert-plants, possesses extensive shallow roots, which are very efficient collectors of water derived from feeble showers; for Mrs. Spalding found that after a rainfall of 0·5 inch "the stems expanded steadily for three weeks." Such a slight fall of rain would cause an appreciable increase in moisture only to a depth of less than four inches, so that the utility of shallow roots is clearly demonstrated, although so many desert plants have extraordinarily deep, relatively unbranched roots. In connection with the question of water supply, Dr. Livingston, in his valuable article on the soils, shows by means of curves that the effects of atmospheric precipitation on moisture in the soil regularly "lag" behind the actual falls of rain, so that, with certain depths of root, the plant does not immediately profit by showers, nor does it suffer, *pari passu* with absence of rain, from lack of supply of water. To return to the consideration of *Cereus giganteus*, Mr. J. C. Blumer clearly shows that individuals of this species, as of certain others, are more numerous on the southern slopes of hills. Inasmuch as other species show a preference for the more favourable northern slopes, there is a difference in the vegetation of the different sides of hills or gulches; and it is shown that on the northern side of the latter the difference tends to become accentuated with time, because the more numerous individuals and species present tend to cause an accumulation of humus and a consequent amelioration of the soil.

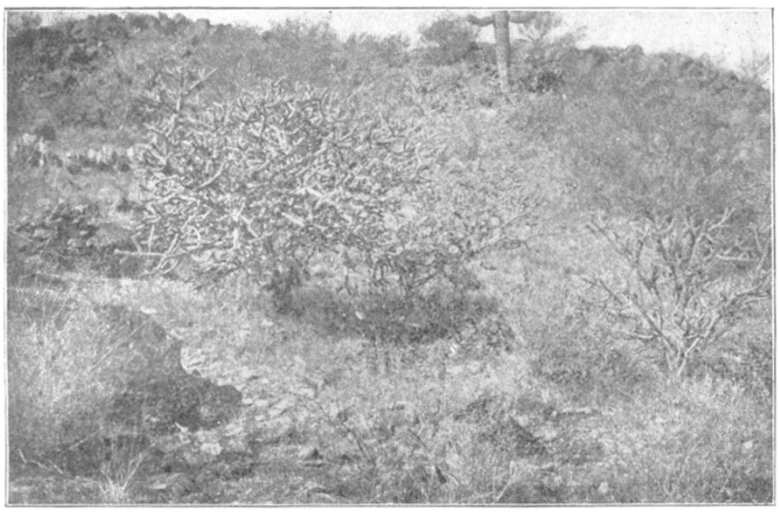

FIG. 2.—Left side of gulch near Laboratory, with generally north exposure.

The section of the volume dealing with the geology of the desert, written by a geologist, Prof. Tolman, seems in subject-matter rather out of place, as it abounds in diffuse and irrelevant generalities. Among these the statement that "Europe is behind America in the study of these newer phases of geology" would perhaps have been nearer correctness a dozen years ago.

One chapter differing from the others in being not particularly applied to Tucson desert is that on the origin of desert floras, written by Dr. D. T. MacDougal, who deals rather with the possible mode of evolution of biologic types than with the origin of the desert flora. He affirms that consideration of the known facts "leads to the inevitable conclusion that the form-characters, moisture-conserving capacities and resistance to desiccation, distinction of xerophytic species, must have made their appearance within comparatively recent geologic time." In the light of the geological evidence suggesting the former existence of deserts, and in view of the difficulty of geological preservation of the remains of desert-plants (except in oases or by rivers), such a conclusion seems open to the gravest doubt; and scepticism as to its correctness will be heightened by our knowledge, not only of the existence of xerophytic Cryptogamia and Phanerogamia of all ranks, but also of the distribution of such remarkably isolated types of desert plants as Welwitschia and Acanthosicyos. An additional consideration militating against Dr. MacDougal's conclusion is that xerophytic characters are evolved with considerable facility, as is demonstrated by the fact that various xerophytic communities (in deserts, for instance) in different parts of the world generally include a relatively large number of endemic forms that are definitely allied to and derived from the adjacent non-xerophytic flora.

In congratulating Mr. V. H. Spalding and his collaborators on this valuable contribution to our knowledge of the ecology of desert-plants, and on supplying ample justification for the foundation of a desert laboratory, we may perhaps be forgiven for adding a prayer to American botanists that when they use local or popular names of plants, they will, at least on first mention of these, also give the botanical names. The omission of this precaution causes botanists of other countries to lose more than time in the endeavour to learn what plant is being referred to. For instance, early in the volume under review, reference is made without any explanation to the "sahuaro," the "creosote-bush," "cotton-woods," the "ocotillo"; yet few, if any, European botanists would know the identity of all these, or that these names represent respectively *Cereus giganteus*, and species of Larrea, Populus, and of—the reviewer imagined that he remembered the generic name of the last, but has been compelled to interrupt this sentence and waste ten minutes in fruitless search.

PERCY GROOM.

NUBIAN ARCHÆOLOGY.[1]

THE first publication of the Egyptian Department of the Pennsylvania University Museum, under the direction of Prof. Randall Maciver, is one that shows great promise for the future. Thanks to the enlightened financial support of Mr. Eckley B. Coxe,

1 "Areika." By R. Randall Maciver and C. Leonard Woolley. With a chapter on Meroitic Inscriptions, by F. Ll. Griffith. Pp. 56+plates (Oxford: Letterpress and Plates printed by Horace Hart at the University. Press, 1909.) Price 1*l.* 1*s.* net.