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NOTICES OF PUBLICATIONS ON FOREIGN VEGETATION

MONTANE RAIN-FOREST OF JAMAICA

Shreve, F. "A montane rain-forest. A contribution to the physiological plant geography of Jamaica." *Carnegie Inst. Publ.*, **199**. Washington, 1914, 110 pages, 29 plates, 18 text-figures.

A good deal has been written about tropical rain-forests, but this sumptuous publication represents the first serious attempt towards a solution, by quantitative determination of the factors of the environment, of various problems presented by their vegetation. From a broader point of view the work is of first-rate importance from the fact that it deals with a truly primitive type of vegetation, to which the author has applied the thorough methods of study characteristic of the Tucson Laboratory workers. His visits to Jamaica covered in all about a year's residence on the island, and his headquarters were the Cinchona Botanical Station, which has until recently been run by the New York Botanical Garden but is now under the control of the British Association with the co-operation of the Jamaican Government.

The forest dealt with occupies the Blue Mountains at an altitude of 4500 to 7420 feet. The ridge extends along the length of the island and is thus nearly at right angles to the direction of the trade winds. The annual mean temperature is 16° C., the maximum rarely exceeds 22° or the minimum 7°, and frosts are virtually unknown. The northern or windward side of the ridge, besides being fog-clad for 70 % of daylight hours during 9 months of the year and for 30 % during the remainder, has a rainfall of about 425 cm. annually; the southern slope is drier, with less than half as much fog and with annual rainfall of about 255 cm. Evaporation measurements on the leeward slope gave maximum and minimum daily average losses of 18 and 1·8 c.c. in the open, with about half as much for the ravine forests; while the amounts in corresponding positions on the much more humid northern side were only a fourth or a fifth as great. The soil is liable to much erosion, the resulting instability, besides accounting in part for the absence of large trees, being reflected in the vegetation of the ravines and ridges—that of the former is strongly hygrophilous and that of the latter almost xerophilous. The forest though remarkably continuous over ravines and ridges alike is best developed in the ravines, where there are trees about 20 m. high, e.g. *Solanum punctulatum* and *Gilbertia arborea*. On the whole the floristic composition is simple, the forest in this respect resembling temperate forests rather than those of tropical lowlands; for instance, three species (*Clethra occidentalis*, *Vaccinium meridionale* and *Podocarpus urbanii*) form about half of the forest, and a further 35 % is made up of 10 other species. As further, rather unexpected, variations from other tropical rain-forests there may be cited the relatively small number of lianas, the somewhat poor floral display, the slow rate of growth and the absence of such features as plank-buttresses and cauliflory. Ferns are abundant (93 of the 270 vascular plants listed are pteridophytes), especially the filmy ferns (Hymenophyllaceae); epiphytes are very abundant but limited to a few species of orchids and bromeliads in addition to bryophytes and pteridophytes. The rich forests of the ravines on the windward slopes show distinct

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stratification more or less continuous, the canopy of the larger trees grading down through under-trees and shrubs to the herbaceous ground flora or carpet; the larger branches and leaning trunks are crowded with epiphytic orchids and ferns, the lower parts with mosses. On the steeper slopes the trees are smaller, the stories less distinct, and epiphytes less abundant, these changes being more marked on the ridges where there is a low open canopy, thickets of ferns and bamboo being here common. The author points out that no one of the types can be fixed upon as representing the climax, for the simple reason that by no conceivable physiographical change could any one of the habitats come to occupy all or the greater part of the area.

Besides the careful description of the various types of forest occupying the different habitats, the author gives observational data on temperature and humidity, soil temperature records, and above all the results of detailed experiments on transpiration rates. For the latter a number of plants was selected, including two of the commonest trees, a common shrub, a thick-leaved herb, two forest-floor herbs and two very hygrophilous ferns. The rates of relative transpiration of these rain-forest species and those of certain xerophytes of the Arizona desert were found on comparison to be of the same order of magnitude; that is, the rates of transpiration in the two regions are proportional to the rates of evaporation. While the rain-forest plants are capable of losing much more water per unit area than those of the desert under equal conditions, yet as each set exists in its habitat the desert plant loses far more per unit area than the rain-forest plant. The foliage of the rain-forest shows great diversity of structure, corresponding to the different vegetation strata and ranging from the sclerophyllous leaves of the trees and the leathery fleshy leaves of the epiphytes, through the mesophytic shade leaves of the herbs to the filmy ferns with leaves consisting of a single layer of cells. The effects of rainfall on the foliage was dealt with by the author in this JOURNAL (**2**, 1914, pp. 82–98), his experiments showing that although the adult leaves of practically all the rain-forest plants are wettable hardly any have functioning hydathodes, while drip-tips are neither abundant nor conspicuous.

The importance of the work under notice, together with the paper referred to as having appearered in this JOURNAL, can hardly be overestimated as contributions to the knowledge of the physiology and ecology of tropical rain-forest vegetation, based on accurate experimental work and in particular on quantitative as well as qualitative observational data. At almost every point one realises that the author's work marks a new era in the investigation of tropical vegetation, clearing away various false conceptions and generalisations drawn by earlier writers from too general and casual observations. For instance, the demonstration that the relative transpiration rates of rain-forest and desert plants are proportional to evaporation is quite contrary to the hitherto generally accepted opinion based not on experiment but merely on consideration of the reduced transpiring surface of desert plants. Again, the author shows that rain-forest is far from being a purely hygrophilous community in which xerophytes have no place, and points out that in no type of vegetation can there be found a wider diversity of life forms. "Together with the structural diversities discoverable in the field or at the microscope, are diversities of physiological behaviour, discoverable by observation or experiment, and sometimes correlated with the structural features. There are quite as high degrees of specialization to be found in the rain-forest as may be sought in the desert."

Finally, some interesting points in the seasonal behaviour of the species may be mentioned. Although the months from October to January have the maximum rainfall this is a season of relative rest during which some tree species, such as those belonging to the genera *Clethra*, *Rhamnus* and *Viburnum* and allied to north temperature forms, shed all or part of their leaves, while others make little growth. This may be accounted

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for by the comparative lack of sunlight. Other trees, though evergreen, flower in spring and complete their growth by October; others again show continuous growth and leaf formation but periodical flowering, while some show continuous growth and flowering. The behaviour of introduced species is interesting; for instance, *Quercus robur* and *Liquidambar styraciflua* become evergreen, while *Liriodendron tulipifera* and *Taxodium distichum* retain their deciduous habit.

VEGETATION OF THE PHILIPPINE ISLANDS

(I) **Brown, W. H.,** and **Mathews, D. M.** "Philippine Dipterocarp forests." *Philippine Journ. Sci.*, **9**, Sect. A, 1914, pp. 413–561, 1 map, 13 plates, 12 text-figures.

(II) **Gates, F. C.** "The pioneer vegetation of Taal Volcano." *Ibid.*, **9**, Sect. C, 1914, pp. 391–434, 8 plates.

(III) **Gates, F. C.** "Swamp vegetation in hot springs areas at Los Banos, Laguna, P.I." *Ibid.*, **9**, Sect. C, 1914, pp. 495–516, 5 plates.

(IV) **Gates, F. C.** "Notes from the tropical strand: *Ipomaea pes-caprae* and *Canavalia lineata*." *Torreya*, **15**, 1915, pp. 27–28, 2 text-figures.

(I) Although the dipterocarp forests are the most extensive and important forests of the Indo-Malayan region, the present paper appears to be the first account of their ecology, in which a botanist and a forester have cooperated with very interesting and valuable results. The dipterocarp forest is a tall tropical lowland forest in which species of the family Dipterocarpaceae are the dominant trees. In some cases the forest may be composed almost wholly of a single dipterocarp species, as in some of the sal (*Shorea robusta*) forests of northern India and those of *Dipterocarpus tuberculatus* in Burma, or two or more different species may share dominance; while in other cases the numerical proportion of dipterocarps may be small but owing to their large size they may yet give a characteristic appearance to the vegetation and form a large proportion of the volume of timber. These forests, which extend from northern India through Ceylon, Burma, Indo-China, Malay Peninsula and Sumatra to Java, Borneo and the Philippines, usually occur below 1000 m. They cover 75 % of the virgin forest area of the Philippines, or about 30,000 square miles, occurring on all kinds of topography but usually growing best on well-watered plains or on the gentle lower slopes of the main mountain masses; they may extend practically to the sea where situations favourable to them occur, but do not grow on sandy beaches or muddy flats.

Most of the descriptions of tropical forests have been written by naturalists who were looking for new and curious forms of plants, hence their descriptions and pictures have given the impression that these forests are composed largely of bizarre plants and that their appearance is almost entirely different from that of temperate ones. The authors point out that this is not the case, and that although the low mossy type of high mountains is certainly very different from anything seen in temperate countries, the tall dipterocarp type presents an appearance strikingly similar to a deciduous forest of the temperate zones, differing from the latter mainly in having the trees arranged in stories with an accompanying greater density of foliage and especially in containing a much larger number of different species. In the best developed forests the top story forms a very even canopy,

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