to feel joy and ecstacy." This, our author, with much reason, holds, is due to the ancient prevalent belief in metamorphosis, through which the Roman thought of his birds not simply as birds, but also as human beings in changed form. Another observation worthy of mention, to which our author is led by his study of the writings of American poets, is that in the latter is found much more traditional Greek and Latin bird lore than the ordinary reader realizes.

It is unfortunate, though perhaps unavoidable, that of a number of the birds treated, identifications more specific were not made. Moreover, while we do not forget that the purpose of the book is primarily not scientific, but literary, we are of the opinion that its literary flavor would not have suffered from the use of proper modern scientific names instead of the antiquated terms that appear under many of the species. Any well-informed ornithologist could have furnished these. Less excusable is the statement (page 242) that the nightingale is not a thrush, but a member of the "silvidæ." A good index of bird names would have aided much in finding references scattered through the text.

Few of us, however, can fully appreciate the great amount of research involved in the task that the author has set for himself; and we owe him a debt of gratitude for having put before us in such readable form the results of his industry; and for having produced a treatise that will be interesting and profitable alike to classicist, litterateur, and ornithologist. It furthermore impresses us anew with the thought that in all phases of ornithological study there are the same endless possibilities that these lines of the poet suggest:

Quis volucrum species numeret, quis nomina discat?
Mille avium cantus, vocum discrimina mille.

HARRY C. OBERHOLSER

A Montane Rain Forest. A Contribution to the Physiological Plant Geography of Jamaica. By FORREST SHREVE. Carnegie Institution of Washington, Publication No. 199.

This admirable presentation of the results of eleven months' study of the forests of the Jamaican mountains should demonstrate the value to American botany of a laboratory in the primeval forest of the western tropics. It ought also to prove the pioneer of a whole series of exact distributional and experimental studies of American tropical vegetation.

The main ridge of the Blue Mountains, which varies from 5,000 to 7,428 feet in height, lies directly across the path of the northeast trade winds. In consequence of this the climate of the northern, or windward side is fog-drenched and constantly humid, with a rainfall of 160 inches. Two miles south of the ridge, however, the precipitation is but 105 inches, the percentage of sunshine is far higher and hence the climate is decidedly warmer and less humid. The whole region is frostless. The annual range of temperature is about 42° Fahrenheit, and the daily range close to 12°.

The flora of the rain forest is less varied than that of the neighboring tropical lowlands. The composition of the flora is rather less like that of these lowlands than that of a temperate forest. A list is given of the higher plants, which is not intended to be complete, but does embrace the more characteristic species. It includes 93 pteridophytes and 187 seed-plants.

The vegetation of the untouched rain-forest is dominated by a nearly continuous covering of trees, very few of which get to be more than 50 feet high and 2½ feet in diameter before being undermined by the rapid erosion characteristic of the region. On the ridges and higher slopes the trees are reduced to 15 or 20 feet in height. The floor of the forest, especially of the windward slopes and ravines, supports many shrubs and has an abundant carpet of herbaceous mosses, ferns and seed-plants, while numerous epiphytic mosses, ferns, orchids and bromeliads stick to the branches of the trees and lianes often overspread their tops. On the leeward slopes, and on the ridges of both sides trees are more scattered, the herbaceous ground vegetation is sparse, but thickets of shrubs or of climbing ferns and

grasses cover the soil between the trees. This difference in the types of plant covering on the windward and leeward sides is the most striking feature of the distribution of the vegetation of these mountains. A comparison of the vegetation of a valley bottom with that of its own higher bounding slopes, even on the beclouded windward side, shows a difference of the same sort as that just mentioned, though somewhat less marked.

Detailed instrumental measurements of the physical characteristics of several selected habitats were made by Shreve, between October, 1905, and June, 1906. These studies of the climate, in the valleys and on the ridges and at the top of the forest canopy as well as on its floor, together with his inquiry into the transpiration capacity of typical rain-forest plants, are perhaps the most unique features of his contribution. The habitat in which the climatic peculiarities of the rain-forest are most accentuated, as was demonstrated by the aid of the air and soil thermographs, the hygrometer and atmometer, is the floor of the windward ravines. Here soil moisture is abundant, the leaves are dripping wet with rain or fog for weeks together. The humidity is constantly high; the rate of transpiration is very low and the light filtering through the screen of foliage and of cloud is faint even at midday. On the slopes, and especially on the ridges, of both windward and leeward sides of the mountains, where air currents and sunlight have freer access, the soil is still moist, but the leaves are less often covered with water drops, and measurement shows that the humidity of the air is less, the rate of transpiration is higher and there is a somewhat greater daily range of temperature. These climatic differences, taken together with the characteristic differences in the vegetation of the two sides of the range, make it clear that the general distribution of the vegetation here is controlled primarily by the moisture content of the air rather than by that of the soil. The latter is probably adequate in all but a few restricted locations.

One very interesting feature of the seasonal activity of the rain-forest trees is that while certain of them vegetate actively throughout the year, others growing right beside them show a well-marked winter rest. Most of the former species are allied with the lowland tropical forms, while the latter are allied rather with north temperate genera.

Most plants of this montane region grow quite slowly, probably in consequence of the moderate temperatures, a low transpiration rate and the often weak light. The uncoiling leaves of certain ferns show the most rapid growth observed.

The rate of transpiration was studied in 8 or 10 species. One rather unlooked for result was that the rate of transpiration for these plants, *under the conditions prevailing in the rain-forest,* is not *very* unlike that found for many Arizona plants *when growing under desert conditions.* As a matter of fact the desert plant, in spite of its highly protected surface, loses more water per square centimeter of surface, in its native habitat, than the plant of the rain-forest when growing in its home.

One other interesting conclusion of the author from this comparison of rain-forest plants and desert plants is that the continuous extreme humidity, the low temperature and weak illumination give conditions approximately as unfavorable to plant growth as are the opposite extreme conditions of arid regions. The tropical lowlands and the moist temperate regions are regarded as the homes of the most luxuriant and most varied floras of the earth, and the places of origin of new structures and new species.

DUNCAN S. JOHNSON

Engineering Geology. By HEINRICH RIES and THOMAS L. WATSON. New York, John Wiley & Sons. Octavo, bound in cloth. 672 pages.

This volume fills a special field in which it has no rival. It is arranged particularly for the use of the student of civil engineering, but the full treatment of many subjects and the extensive lists of standard papers will make it also a valuable reference work for engineering libraries. In many engineering