

Malay Archipelago and tropical America ; but there is a breadth of grasp of scientific questions and a distinctive precision of treatment, as well as sufficient fulness of detail in matters which have a philosophical bearing, to make this volume an important contribution to science, and an invaluable sequel to the author's record of travels. Some of the more important essays have already been printed, wholly or in part ; but they well find places in this work, giving it an entirety which would otherwise have been wanting. The book is arranged into eight chapters, which unfold the features of tropical climate, vegetation, animal life in the forests, and treat of humming birds, colors of animals and of plants ; the antiquity of man, and the distribution of animals as indicating geographical changes. In this wide survey is a whole magazine of well-ascertained facts, and many suggestive ideas which, even if not always adopted without reserve, at least boldly endeavour, often for the first time, to grapple with difficulties, and unveil the mystery, of natural phenomena. In the chapter on Climate we are impressed with the small range of variation in temperature from month to month, the heat of the day in the equatorial zone rarely exceeding  $90^{\circ}$  F., while the cold of night as seldom falls below  $74^{\circ}$  F., the daily range of temperature in the Dutch Government of Batavia being about  $12^{\circ}$  in September when greatest, and only  $8^{\circ}$  in January when least. The cause of this high and uniform equatorial temperature which so scorches the European is found to exist in the vast amount of heat received from the sun during the day, and radiated at night to an atmosphere too densely charged with vapour to allow it to escape. So that tropical heat is referred to the same causes as account for the warmth of cloudy evenings in our own country, and the increase of heat on the Continent as the earth becomes warmed in the autumn. Other causes raising the temperature are the winds, which have all passed over warm regions, and the condensation of aqueous vapour from the atmosphere, in dew and rain, liberates large amounts of heat. The distinctive features of tropical forests are the tall trunks of trees with a crown of foliage shutting out the light, and descending aerial roots like buttresses—almost every tree being of a different kind from that next it. Below this high canopy are lower forest trees rising to forty or fifty feet ; and yet below these, often a growth of herbaceous ferns, tree ferns and dwarf palms, some six to ten feet high. The surface of the ground below is frequently covered with decaying leaves and fallen fruits, and sometimes carpeted with club-mosses and small flowering plants. Some of the smaller trunks in the lower parts are covered with blossoms, or are hidden by the quantity of fruit. The author suggests that this remarkable condition results from the fertilising influence on the flowers of the thousands of butterflies which frequent the ground in the forests, and urges, that since the bees, which love the sun, abound at the tops of the lofty trees, the crowns of the lower

In "Tropical Nature" the general reader has brought before him not only a vivid survey of the characteristics of life in the equatorial zone, but an endeavour to account for many of its distinctive phenomena.<sup>15</sup> Mr. Wallace has drawn largely on his own recollections of twelve years' experience in the

<sup>15</sup> "Tropical Nature, and other Essays." By Alfred R. Wallace. London: Macmillan & Co. 1878.

forest trees escape the influence of both groups of insects. The list of exogenous tropical woods valued in the arts of civilised life, include such trees as mahogany, teak, ebony, lignum-vite, iron-wood, sandal-wood, and satin-wood; there are trees yielding dyes, such as log-wood, brazil-wood, and sappan-wood; others valued for gum, such as india-rubber, gutta-percha, tragacanth, copal, lac, and dammar; and a host which supply drugs, spices, and fruits. Next to the trees, in striking features, are the creepers and climbers of the tropical forests; twined like cables, or expanded like ribbons, they grow by indefinite longitudinal extension upward towards the light, leafless and without blossoms, till they reach the top of the great forest trees. The palms are often absent from large areas. Some, as at Para, in South America, have rigid leaves thirty feet long and five feet wide. Others are creepers like the *Calamus*, which grows to a length of 600 or 1000 feet, and yields the rattan cane of which cane chairs are made. In point of food, palms yield many of the necessities of life, supplying bread, oil, sugar, salt, fruit, and vegetables, besides palm wine. Many of the palms yield sugar, and it is strongly urged that the *Arenga saccharifera* of the Malay countries should be cultivated for sugar in preference to the sugar cane, since it grows on ground that is almost waste, and yields several quarts of sap a day for weeks together, which only needs to be boiled and evaporated, to produce the sugar. The great points in favour of this source of sugar supply, are that the soil is not impoverished, and that neither manure nor cultivation are required. Ferns, ginger-worts, wild bananas, arams, screw-pines, orchids, bamboos, and mangroves, all contribute striking elements to the vegetation of the tropics; and the account given of the practical utility of the bamboo is more than usually full. The sensitive plants of South America, species of *Mimosa*, are the last group noticed. At each step over them, the plants on each side, to a width of several feet, close their leaflets, droop, and lie prostrate, as though simulating death. In the department of animal life, the wealth of the tropics is most conspicuous in butterflies and birds, especially parrots, to which may be added apes and monkeys, bats, lizards, and frogs; the snakes being less conspicuous. The number of butterflies is amazing, not only in individuals, but in species. In our own country there are 64 species of butterflies; around the city of Para there are more than 700 species, brilliant with every variety of rich colour in contrast, and often as large as small birds. The account of ants, wasps, bees, beetles, and other insects, abounds in the interest of personal recollection. The parrots are chiefly characteristic of tropical America and the Australian region, which together contain nearly 840 species, while Asia and the Malay Islands have but thirty, and Africa hardly more than twenty. Pigeons abound in the tropics, especially in regions where there are no monkeys; since the monkeys devour their

eggs. And it is remarked that the most conspicuous pigeons in all countries, exist where they have fewest enemies. The cuckoos, trogons, barbets, toucans, and passerine birds, are all interesting. One remarkable feature of tropical birds being the prevalence of crests, long feathers in the tails, and ornamental plumage. Lizards swarm everywhere, iguanas in South America, chameleons in Africa, and dragons in India and the larger Malay Islands. The serpents in Borneo reach a length of twenty-six feet, and in South America one which had devoured a horse was nearly forty feet long. The most abundant of the amphibia are the green tree-frogs. The monkeys are eminently tropical, and abound in the forests of Borneo, West Africa, and the Amazons. The gibbons pass through the forests of Asia at a height of one hundred feet, as rapidly as a deer could cover the ground beneath. Altogether this picturesque survey gives a more definite conception of tropical life than has been offered hitherto, but it would, we suggest, have been even more valuable if the geographical limitations of the plants and animals referred to had been given more frequently and with more precision. The fourth chapter deals with humming birds, of which there are 400 different species, classed in 100 genera; and treats of their structure, ornaments, food, geographical distribution, and affinities with the swifts, and difference from the sun-birds. The most thoughtful chapters are those devoted to the origin of the colours of animals and plants, and constitute an admirable exposition of the principles of Natural Selection as explaining the origin in nature of ornament, and the reasons for its absence. It is not a little curious to notice how nearly parallel to the old interpretation on the hypothesis of design, are the views urged by Mr. Wallace, in which he endeavours to demonstrate that the minutest details of structure and colour have been acquired, because they better fitted the organism for the conditions under which it had to exist. The last chapter on the distribution of animals, as indicating geographical changes, is the least satisfactory in the book, since it neither gives a full summary of the distribution of life in the several provinces, nor demonstrates that the provinces exist, or shows how they came to acquire their distinctive groups of animals, or even discusses the method by which researches of this kind are made; and, least of all, does it attempt to show, from the present distribution of life, what the former configuration of land has been in later geological times. Granting the value of the author's survey of "tropical nature," in which natural history provinces are treated as though they were accidents, owing to the separation of tropical lands, it might have been expected that the same principle would have been recognised to the end; and that "temperate nature," and "circumpolar nature," would have been found to be worth at least a passing thought, especially when the present distribution of plants has to be kept in mind, in order to avoid being mis-

led into unstable generalisation from a single division of the animal kingdom. We offer this criticism not to detract from the value of this part of the work, but only to express a conviction that in dealing with a problem of such magnitude, a larger method of treatment was required than the author has felt himself at liberty to attempt.