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‘New Publications.’

*Island Life: Or, the Phenomena and Causes of Insular Faunas and Floras, Including a Revision of the Problem of Geological Climates.* By Alfred Russel Wallace. 8vo. pp. xvi: 522. New York: Harper & Brothers.

Whatever Mr. Wallace writes on the subject of natural history is always entitled to serious attention; but there is a special interest in this volume at the present time, which will be made more apparent if we first glance at the great movement of recent thought out of which it has grown, and of which in several aspects it is an able and opportune exposition. In the recent advance of science the problem of terrestrial life assumes a more profound significance than at any former period. At first the living world, like all the other phenomena of nature, had to be considered in its sensible aspects, and could be only superficially explained. The objects of natural history were observed, compared, described and classified as they presented themselves according to characters easily determined. But it is a necessary tendency of science to go behind appearances and get at the operation of causes. Material forms and structures first engage attention, and then the forces and dynamic conditions by which such forms and structures were determined. This tendency of scientific study, however, was long hindered in the field of life by a settled *a priori* theory of the origin of living things. It was believed that the numberless kinds of living creatures which inhabit the earth were specially created in their perfect forms, and exactly adapted to the condition in which they are found. This was a fundamental proposition in natural history, and was the more tenaciously held because reinforced by strong religious sanctions. The problem of origins and adaptations being authoritatively solved in advance, any inquiry into it was regarded as superfluous if not irreverent. The older natural history, therefore confined itself to the comparatively easy task of delineating the sensible characters of living creatures and the construction of such systems of relationship as were possible from this point of view. There was an avoidance and a neglect of those deeper inquiries into causes which were pursued in other scientific fields with the most fruitful results.

But the human mind cannot be contented with the endless accumulation of unexplained facts. The sterility of biological science was a palpable anomaly. The mere massing of observations at length corrected itself, and the factitious restraints upon inquiry gave way almost with the suddenness of a catastrophe. The old procedure is now essentially abandoned, and within the last twenty years the methods of natural history have been revolutionized. The work of critical observation, of course, continues, and must always go on, but it is now guided by new theories and the problems which were so long forbidden as useless have become first in interest and importance. Natural history from being a mere matter of the description of animals and plants and the tracing of their superficial connections, has passed into the new phase of philosophic biology which opens the profoundest questions that can occupy the human mind. It was inevitable that in this newly-opened field, which revealed the grandest interactions of nature as legitimate factors of inquiry, there should be great activity of speculation, and inevitable conflict of opinion over important questions. Stormy controversies quickly arose, so that it was difficult to determine what could be regarded as accepted and what must be still held as disputable. It was well, therefore, that Mr. Wallace saw fit to address himself at this time to a critical discussion of the general

subject. He was eminently the man for the task. Foremost among the pioneers of the revolution in biological method, the co-discoverer with Mr. Darwin of the principle of natural selection as a cause of diversity in species, an original thinker of sharp insight and wide grasp, and long familiar with the large elements of the investigation, no man was better prepared to sum up the case and to inform us as to what may be considered as now fairly established. His book will be welcomed not only by the scientific world but by many outside of it who desire to keep themselves informed as to what is going on in the active arena of scientific thought. And this class will be the more pleased with it because Mr. Wallace is one of the clearest and most attractive of our scientific writers. Four years ago he published an elaborate treatise, in two volumes, on the "Geographical distribution of animals," from the most modern point of view. The present book is, in a certain sense, supplementary to that, as it starts from a summary of its results, and then takes up the larger factors of biological influence and causation. The present book, moreover, appeals to a wider audience, and treats the subject in a more elementary and interesting way.

Mr. Wallace introduces his readers to some features in the distribution of animal life by the following illustrations. When an Englishman goes by the nearest sea-route from Great Britain to Northern Japan, he passes many countries of the most diverse aspects, and after travelling 13,000 miles and becoming separated from his home by the whole width of Europe and Northern Asia, he finds himself at Hakodadi, in Japan. But upon visiting the interior of the country he is surprised at the familiarity of its natural objects. He finds the woods and fields tenanted by tits, hedge-sparrows, wrens, wag-tails, larks, redbreasts, thrushes, buntings, and house-sparrows, some absolutely identical with his own feathered friends, others so closely resembling them that it requires a practised ornithologist to tell the difference. If he is fond of insects he notices many butterflies and a host of beetles which, though on close examination are found to be distinct from ours, are yet of the same general aspect and seem just what may be expected in any part of Europe. If now an Australian sails to New Zealand, a distance of less than 1,300 miles, he will find himself in a country whose productions are totally unlike those of his own. Kangaroos and wombats there are none, the birds are almost all entirely new, insects are very scarce, and quite unlike the handsome or strange Australian forms, while even the vegetation is all changed and no gum-tree, or wattle, or grass-tree meets his eye. Again, in the Malay Archipelago there are two islands named Bali and Lombok, each about as large as Corsica, and separated by a strait only fifteen miles wide at its narrowest part. Yet these islands differ far more from each other in their birds and quadrupeds than do England and Japan.

Mr. Wallace then points out that current explanations of these irregular diversities in distribution of life are wholly unsatisfactory. It is sufficiently obvious that mere distance is of very little importance. Nor can the effects be accounted for by difference of climate. Hot countries usually differ widely from cold ones in their organic forms, but the differences are neither constant nor do they bear any proportion to difference of temperature. Between frigid Canada and sub-tropical Florida there are less marked differences in the animal populations than between Florida and Cuba or Yucatan, so much more alike in climate and so much nearer together. Nor has similarity of climate and general conditions any tendency to produce similarity in the animal world. The equatorial parts of Brazil and of the west coast of Africa are almost identical in climate and in luxuriance of vegetation, but their animal life is totally diverse. The animal life of great islands is equally anomalous, for while some exactly resemble the nearest continents, others are widely different. The subject must be dealt with more thoroughly, and the full breadth of the problem is thus stated by Mr. Wallace:

These examples will illustrate the kind of questions it is the object of the present work to deal with. Every continent, every country, and every island on the globe offer similar problems of greater or less complexity and interest, and the time has now arrived when their solution can be attempted with some prospect of success. Many years' study of this class of subjects has convinced me that there is no short and easy method of dealing with them; because they are, in their very nature, the visible outcome and residual product of the whole past history of the earth. If we take the organic productions of a small island, or of any very limited tract of country, such as a moderate-sized country parish, we have in their relations and affinities—in the fact that they are *there* and others are *not* there, a problem which involves all the migrations of these species and their ancestral forms—all the vicissitudes of climate, and all the changes of sea and land which have affected those migrations—the whole series of actions and reactions which have determined the preservation of some forms and the extinction of others—in fact the whole history of the earth, inorganic and organic, throughout a large portion of geological time.

To understand the real magnitude and complexity of this inquiry, it must be remembered that we have to start with a new geography. Instead of the familiar and permanent outline of masses of land and water, we have to deal with vast tracts or spaces occupied by animals. Each kind has its territory or “area of distribution.” These vary in extent according to the groups defined. “Specific areas” are those occupied by any given species. Every species has an area of distribution to which within certain limits of fluctuation it is permanently confined; but while some of these areas are very extensive, others are remarkably restricted. It might be expected that birds, considering their powers of flight, would be the freest in their ranges, but it is a curious fact that some of them illustrate the extremest restriction. The beautiful sun-bird, a peculiar starling, is almost or quite confined to the warmer portions of the valley of the Jordan; and several species of laughing thrushes are to be found only on the summits of the Himalayas. The humming-birds of tropical America furnish striking examples of restricted habitats. The great volcanic peaks of Chimborazo and Pichincha have each a peculiar species of humming-bird confined to a belt just below the limits of perpetual snow; while the extinct volcano of Chiriqui has a species confined to its wooded crater. On the other hand, many species of birds are very widely distributed. The little northern willow-wren ranges from Norway across Asia to Alaska and southward to Ceylon, China, Borneo, and Timor. The fishing-hawk and barn-owl are also very extensively distributed over a great area, though some question arises as to the identity of the species in widely separated localities; but among the undisputed species of mammalia the leopard inhabits an enormous range and is probably the most extensively distributed of any known mammal. But very wide and very narrow ranges are exceptional. The great majority of species both of mammals and birds ranging only over moderately wide areas.

As genera consist of closely-allied groups of species, the “generic areas” differ widely from the specific areas and are of course more extensive. The number of species in a genus varies greatly from one up to several hundreds. The giraffe, the secretary-bird, and many others have no close allies, and each forms a genus by itself. The deer-genus has forty species, the mouse and rat genus more than a hundred species, there are more than 400 species of swallow-tail butterflies, while among the shells the genus *helix*, including the commonest snail, numbers 2,000 described species and ranges all over the world. As we pass to families and orders new systems of distribution arise, and we here find few cases of restriction and many of world-wide distribution. The distribution of families and orders gives rise to other and still more extensive areas. The matter is further complicated by overlaps and breaks in the areas of distribution. The species of a genus either occupy distinct areas which are sometimes widely separated, or they touch and overlay each other. The best example of separated but conterminous ranges is that of the beautiful South American wading-birds called trumpeters. There are five species all found in the Amazon

Valley, but each limited to a well-marked district bounded by large rivers. Overlapping areas are, however, the most common. Examples of discontinuous areas are often remarkable. The genus of blue magpies has two species which are separated from each other by 5,000 miles of continuous land. The same break of continuity is often seen in the distribution of a single species. Of the variable hare it is said that there is a gap of about 1,000 miles between its southern limits in Russia and its reappearance in the Alps.

The new geography has still further complications. The great natural divisions of the globe now serve only as landmarks for the construction of grand ideal divisions known as "zoological regions." The term "Europe," for example, will not give, with any approach to accuracy, the range of any one genus of mammals or birds, or perhaps not that of half a dozen species. Either they range into Siberia, Asia Minor, Palestine, or North Africa. Mr. Wallace takes the British mammals and land-birds and follows them over the whole area they inhabit, as an example of a zoological region. Others have been marked out as the "Ethiopian region," the "Australian region," and the "Oriental region."

We have illustrated these views of distribution with some detail, though they form but the starting point of Mr. Wallace's discussion. But in no other way can we get so clear a conception of the breadth of his task. All these manifold complications in the dispersion of animal life over the globe are required to be accounted for. It is needless to say that the author's treatment of the subject is based entirely upon the doctrine of evolution. The fourth chapter of his work is entitled: "Evolution the key to distribution," and it contains an admirable summary of the chief points of the doctrine. Mr. Wallace here speaks with the authority of an original discoverer, and the skill of a practical expositor. He shows that evolution is the only principle that is adequately applicable to the subject, and that the law of descent with variation, acting through vast periods, and influenced by changes of climate in geological times, is already competent to explain the main features in the distribution of terrestrial life. In fact, the law of evolution implies and compels the great results which we now observe. Upon this point the author remarks:

When writing on the subject of distribution, it usually seems to have been forgotten that the theory of evolution absolutely necessitates the former existence of a whole series of extinct genera filling up the gaps between the isolated genera which in many cases now alone exist; while it is almost an axiom of "natural selection" that such numerous forms of one type could only have been developed in a wide area and under varied conditions, implying a great lapse of time. In our succeeding chapters we shall show that the known and probable changes of sea and land, the known changes of climate and the actual powers of dispersal of the different groups of animals were such as would have enabled all the now disconnected groups to have once formed parts of a continuous series. Proofs of such former continuity are continually being obtained by the discovery of allied extinct forms in intervening lands, but the extreme imperfection of the geological record as regards land animals, renders it unlikely that this proof will be forthcoming in the majority of cases. The notion that if such animals ever existed their remains would certainly be found is a superstition which, notwithstanding the efforts of Lyell and Darwin, still largely prevails among naturalists, but until it is got rid of, no true notions of the former distribution of life upon the earth can be attained.

Mr. Wallace next passes in a series of chapters to the recondite changes involved in the distribution of organisms. He first investigates the means by which the various groups of animals are enabled to overcome the natural barriers by which they are restricted. Chapter V., on "The powers of dispersal of animals and plants," points out the numberless curious ways in which the various classes of animals and plants are enabled to extend their areas. In Chapter VI., he inquires how far those barriers are themselves liable to be altered or abolished, and what are the exact nature and amount of the changes of sea and land

which our earth has undergone in past times. The geographical and geological changes in past periods are here traced out and the question of the permanence of continents is considered. This is regarded as a fundamental question, but it is still in controversy. Mr. Wallace adduces several distinct classes of evidence to prove that the grand features of our globe—the position of the great oceans and the chief land areas—have remained on the whole unchanged throughout geological time. The general stability of continents has, however, been accompanied by constant changes of form, and insular conditions have prevailed over every part in succession. The geological changes of climate are next taken up. The glacial question is considered with the fullness which its importance demands. Mr. Croll's views connecting the glacial epochs with astronomical causes are partially adopted; but Mr. Wallace maintains that changes of climate from this cause require the cooperation of specific terrestrial conditions. He argues that without high land to begin with there can be no permanent snow and ice. The long continued mild climates of the Arctic regions are held to have been mainly influenced by geographical revolutions, while the local glaciations in the temperate zones have their main cause in astronomical revolutions. In regard to geological time, Mr. Wallace is satisfied with the period allowed by the physicists, and claims that organic changes have by no means been so slow as is generally supposed. In his tenth chapter, on "The earth's age and the rate of development of animals and plants," the various contested questions are very clearly presented.

In the second part of the work the principles developed in the chapters we have noticed are applied to insular faunas and floras or the general phenomena of "Island Life." This part of the work is extremely interesting, as affording a test of the views previously laid down. The islands are classified as "Oceanic," including the Azores, Bermuda, the Galapagos Islands, St. Helena, and the Sandwich Islands; and "Continental," as Great Britain, Borneo and Java, Japan and Formosa, and the Madagascar group. Celebes and New Zealand are ranked as anomalous islands. The peculiar faunas and floras of all these are passed in review together, with the indications of ancient connection with continental masses. Mr. Wallace closes his volume with the following remarks:

In concluding a work dealing with subjects which have occupied my attention for many years, I trust that the reader who has followed me throughout will be imbued with the conviction that ever presses upon myself, of the complete interdependence of organic and inorganic nature. Not only does the marvellous structure of each organized being involve the whole past history of the earth, but such apparently unimportant facts as the presence of certain types of plants or animals in one island rather than in another are now shown to be dependent on the long series of past geological changes; on those marvellous astronomical revolutions which cause a periodic variation of terrestrial climates; on the apparently fortuitous action of storms and currents in the conveyance of germs; and on the endlessly varied actions and reactions of organized beings on each other. And although these various causes are far too complex in their combined action to enable us to follow them out in the case of any one species, yet their broad results are clearly recognizable; and we are thus encouraged to study more completely every detail and every anomaly in the distribution of living things, in the firm conviction that by so doing we shall obtain a fuller and clearer insight into the course of nature, and with increased confidence that the "mighty maze" of Being we see everywhere around us is "not without a plan."

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*The Alfred Russel Wallace Page*, Charles H. Smith, 2015.