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[p. 3a]

### ‘Animal Life Upon the Earth.’

*The Geographical Distribution of Animals; With a Study of the Relations of Living and Extinct Faunas as Elucidating the Past Changes of the Earth's Surface.* By Alfred Russel Wallace, author of the “Malay Archipelago,” &c. In two volumes. With Maps and Illustrations. New-York: Harper and Brothers. 1876.

These full and handsome volumes tell at first sight how great a change has come in the relations of scientific men to the general public; for, rich in scientific learning as they are, they are evidently intended to attract and reward the attention of thoughtful readers in general by the union of literary and artistic merit with professional knowledge. The maps and illustrations, with important passages in the text, that define the methods and sum up the results of the investigation, interpret the bearing of the work to the reader's eye and understanding, while the tables of classification of families of animals and the minute comparisons of organization, and studies of origin and variation and migration require the careful regard of well-schooled naturalists. We best meet the needs of our readers and present the merit and purpose of the volume by stating the upshot of the author's observations and studies.

That he has a right to speak, and to be heard, upon this class of subjects, the author's record amply proves. He was born in Usk, Monmouthshire, England, Jan. 8, 1822, and his life has been devoted to the study of natural history. He has spent four years in South America, and nearly eight years in the Malay Archipelago, where he made valuable collections of specimens of the plants and animals of those regions, and his papers upon the *Origin of Species* and their tendency to form varieties have given him a name hardly second to that of Darwin, from whom he differs not so much in his method of recognizing the fact of natural selection as in insisting upon the limits of its power to produce the varieties of organization. St. George Mivart speaks of him as the opponent of the theory of the derivation of man from speechless, irrational, non-moral brutes thus: “No less a writer than Mr. Wallace, the independent originator, and by far the best expounder of the theory of natural selection, differs widely from Mr. Darwin as to the question of man's origin. He contends that some special agency was needed to produce the human frame.” According to him man is to be considered not only as placed “apart as the head and culminating point of the grand series of organic nature, but as in some degree a new and distinct order of being.” In the present book, however, the theory of selection is not discussed, nor is there any sustained argument as to the origin of life, but all the researches and studies are made to bear upon the facts of the present distribution of animal life upon the globe, and the connection of these facts with the past changes of the earth's surface.

Of the eleven hundred pages that are contained in the two volumes, about one hundred are given to the “Principles and General Phenomena of Distribution” that constitute Part I.; nearly seventy pages are given to Part II. on the “Distribution of Extinct Animals,” while Part III. devotes nearly five hundred pages to “Zoological Geography,” or a review of the chief forms of animal life in the several regions and sub-regions with the indications they afford of geographical mutations, and Part IV. devotes more than three hundred pages to “Geographical Zoology,” or a systematic sketch of the chief families of land

animals in their geographical relations. The indexes are very full and minute, occupying more than sixty pages in small type.

Every common-sense reader will be greatly interested in the author's principles of observation as stated in the first part. He remarks that in our travels we cannot but note two distinct kinds of changes in the forms of animal life. Immediately around us we observe that particular species appear or disappear, because the soil, the aspect, or the vegetation is opposed to them; this class of changes is that of *stations*. But as we get further away, we begin to find that the localities that are very much like these that we have left behind, are inhabited by a different set of species, and that the difference increases with the distance; this class of changes is that of *habitat*, which is a geographical phenomenon, as the former was a local phenomenon. Another distinction to be noted is that between representative species, as between different kinds of squirrels, moles, or warblers in different places, and distinct groups or types, or when we meet with wholly new forms, like the glutton and snowy owl in Northern Europe, the genet and the hoopoe in Southern, and the saiga antelope and collared pratincole in Eastern Europe. The one represents a very recent modification, while the other is the result of very ancient changes, both organic and inorganic, and it is connected with very curious and difficult problems.

In considering the geographical distribution of animals we must recognize the influence of climate and vegetation, yet must shun the error of trying to account for all changes by these causes, since countries very different in their plants and animals, such as the equatorial parts of South America and Africa, are much alike in temperature and in vegetation, and their animals differ widely; and elephants, apes, leopards, touracos, and guinea fowls abound in Africa, while South America presents in their place tapirs, prehensile-tailed monkeys, jaguars, curassows, and toucans. So, too, South Africa and Australia are much alike, yet the former has lions, antelopes, zebras, and giraffes, while the latter has only kangaroos, wombats, philangers, and mice. It is an odd fact that no crows exist in South America, while they inhabit every other part of the world, not excepting Australia. We find when we examine the distribution of animals in any wide region, that different though closely allied species are often on the opposite sides of any considerable barrier to their migration. Thus, on the two sides of the Andes and the Rocky Mountains in America almost all the mammalia, birds, and insects are of distinct species; the Alps and the Pyrenees form similar barriers, and so do great rivers like the Amazon and the Ganges. The author's conclusion is, that by some slow process of development or transmutation all animals have been produced from those which preceded them, and that the modification of animal forms took place very slowly, so that the historical period of three or four thousand years has hardly produced any marked change in any species. Even the time since the last glacial epoch, which he estimates at least from 50,000 to 100,000 years, has only served to modify the higher animals into very slightly varying species. If we remember the various causes of change, and that the forms and structure and habits of all living things are also slowly changing, while the earth, the continents, oceans, and the loftiest mountain chains change more slowly and after long intervals, we must see that the present distribution of animals upon the globe must be the final result of all these marvelous revolutions in organic and inorganic nature. The greatest and most radical differences in the productions of any region must depend upon the efficiency and extent of the isolation by permanent barriers.

In order to complete the observation of the distribution of animals we must study into the powers of multiplication and dispersal of the various groups, and the nature of the barriers that most surely limit their range. We are to investigate also the effects of changes in physical geography and in climate; to

examine into the changes that have occurred; to determine what other changes are possible or probable, and to ascertain the effect of such changes upon animal life. This research cannot be carried on successfully without studying carefully the characteristics of the continents and their main subdivisions and the chief islands, and comparing accurately the classes of animals that abound in each. We must also try to know enough of the past geological epochs in order to explain the changes that depend upon the transformations, and to read the history of the various extinct animals that have lived upon the earth during the tertiary period, which answers in geology to what we call modern times in history, and is called tertiary because it comes or came after the ancient or primary and the middle or secondary geological ages. By Dana, our American geologist, this tertiary age, with its post-tertiary appendix, is designated as the mammalian, although in the previous or middle age there appear traces of mammals of insignificant size, and chiefly marsupial, or of the opossum family. Curious facts are given to illustrate the means of disposal and migration of animals. The elephant is, strange to say, equally at home on plains and mountains, and it even climbs to the highest summit of Adams' Peak in Ceylon, which is so steep and rocky as to be hard for man to ascend it. It also crosses rivers with ease and pushes its way through the densest jungle. The tiger, too, is a famous ranger, and it can swim over rivers, and even over narrow straits of the sea, and it can bear the extreme cold of Northern China and Tartary as well as the burning heats of the plains of Bengal. Other animals are limited by the nature of their food and their organization, like the monkey, that must live among forests, or camels and giraffes, who can neither move nor feed among wooded regions. Some animals, such as goats and sheep, tend to the mountains, and others, such as beavers and otters, live among the rivers. Climate is a great power in deciding the range of animal life, but not to the extent generally supposed. The quadrumana seem to live only in the tropics, but specimens of this family of fruit-eaters range far north, and one variety has been seen in the Himalayan Mountains at the height of 11,000 feet, leaping among fir trees loaded with snow wreaths. The elephant and the rhinoceros, that are now found in tropical countries, once roamed over the whole of the northern continents to within the Arctic circle, when apparently the climate was as cold as it is now, because their bodies were preserved in ice. Some creatures that are thought to be very sluggish have shown good speed, and during the floods of Scotland in 1829 some pigs that were only six months old that were carried out to sea, swam five miles and reached the shore again. If the well-fed, substantial, tame pig can do this, what may we expect of thin, long-legged, wild pigs in the face of wide rivers or even considerable arms of the sea that are in the way of their feeding, or their fellowship. Squirrels and rats often migrate from northern countries in armies of thousands and hundreds of thousands, and pass over rivers, lakes and even arms of the sea, although salt water is generally fatal to them. Ice floes and drift-wood give great facilities of migration to animals, and sometimes a chance tree or a raft of drift-wood acts as a sail, and carries quite a large number of creatures down the great river, or out upon the sea, to a new home. Birds and fishes, of course, have peculiar means of travel, and the water and the air offer grand highways for their movements, where the main barriers seem to be the depth of the sea or vicinity to land, or the temperature of the air and the opportunity for providing food.

Curious facts are given in illustration of the migration of birds, whose travels to the north in Spring are ascribed not merely to the increasing warmth, but to the abounding growth of insects that afford food, and which have much to do with making the nests of the emigrants merry, and supplying the old birds with the spirit and strength for their music. The early bird eats the worm, and comes for him not only in early morning "but early Spring." The power of institutional or traditional habit is curiously illustrated by observations which seem to show that birds continue to move in the old paths of their ancestors long after

the causes that began the migrations have ceased to exist. Migrations of this type probably are to be traced back to the period when there was continuous land along the route that is now passed over water. Thus, Britain was connected with the Continent during and probably before the glacial epoch, and Gibraltar, as well as Sicily and Malta, were also recently united with Africa, as is proved by the fossil elephants and other large mammalia found in their caverns, as well as by the shallow water in that part of the Mediterranean, and the resemblances in the land animals on the opposite shores of that sea. In some cases the sea passage that is made after the ancient method is very dangerous to birds, and great numbers of quails are drowned as victims of their stubborn conservatism on their way over the Mediterranean. The nightingale is a great traveler, and this little minstrel keeps his Winter in North Africa, Asia Minor, or the Jordan Valley; early in April he passes into Europe by one of three main routes, and spreads over France, Britain, Denmark, and the South of Sweden, which he reaches by the middle of May. He does not enter Wales or the west of England, and he rarely goes further north than Yorkshire. This bird spreads over Central Europe, and it breeds in the Jordan Valley, all of the family who can, tending to return to their Winter quarters in the East in August and September.

After considering the changes and conditions of the earth's surface, as determined by land and water, continental areas and their recent changes, the glacial epoch as affecting the distribution of animals, the changes of vegetation and the influence of organic changes upon this distribution, the author states his division of the globe into six zoölogical regions, each with four subdivisions, in which he adopts essentially the idea of Mr. Sclater, as he brought them into public notice in 1857. Some of the facts which he adduces to illustrate the effect of organic changes in distribution are very curious—as, for instance, the destruction of a whole flora of forest trees with their dependent tribes of insects in St. Helena by the introduction of goats, the extinction of the dodo in Mauritius by the introduction of swine, the death of cattle in Paraguay under the sting of a certain fly, and the effect of cats in protecting clover by exterminating the field mice that destroy the nests of the bees who keep the clover growing by constant sowing. The six regions of the earth which represent its zoölogical variations are as follows:

1. The Palaearctic Region, including Europe, temperate Asia, and North Africa to the Atlas Mountains.
2. The Ethiopian Region: Africa south of the Atlas, Madagascar, and the Mascarene Islands, with Southern Arabia.
3. The Indian Region, including India south of the Himalayas, to South China and to Borneo and Java.
4. The Australian Region, including Celebes and Lumbock, eastward to Australia and the Pacific islands.
5. The Nearctic Region, including Greenland and North America to Northern Mexico.
6. The Neotropical Region, including South America, the Antilles, and Southern Mexico.

In dealing with the distribution of animals in these six regions, with twenty-four sub-regions, the author has in view chiefly one of the eight groups of animals—the vertebrates—and he considers the Annulosa and the Mollusca only partially, and in the most general way.

In Part II. there is nothing more memorable than the startling fact, which is brought out by the systematic review, that an almost universal change has recently (according to the geological measure of time) taken place in the character of the fauna of the Old and New Worlds. In Europe, the great Irish elk,

the machairodus and cave lion, the rhinoceros, hippopotamus, and elephant; in North America, equally large felines, horses and tapirs larger than any now living, a llama as large as a camel, great mastodons and elephants, and abundance of huge megatheroid animals of almost equal size; in South America these same megatheroid animals in greater variety—a mastodon, large horses, numerous bears and felines and a large monkey—have all become extinct since the deposition of the most recent of the fossil-bearing strata. Mr. Wallace thinks that this was not a great while ago geologically, and that it is almost certain that this great organic revolution, implying physical changes of such vast proportions that they must have been due to causes of adequate intensity and proportionate range, has taken place since man lived on the earth. Thus it appears that we are now in an altogether exceptional period of the world's history, and we are living in a world that has been stripped recently of its hugest, fiercest, and strangest forms of organic life. The chief cause of the change, the author finds in what is called the Glacial epoch, with the immense coating of ice on the north and the rise of land at the tropics, on account of the absorption of the ocean by the great freeze. The whole survey of the extinct animals of the globe in the second part is very suggestive, as well as instructive; and while it gives an abundance of facts, in order to indicate the forms of life that had preceded the present age of geology, and in order to show what forms may have survived the general wreck by reaching the new shore, it starts the fancy into a strange region of contemplation, in comparison with which the present forms of existence on our globe are quite tame and common-place. All of our menageries and zoölogical gardens are dove-cots and sheepfolds in contrast with the fields and forests of Europe and America in those times, when classic Greece was inhabited by a gigantic machairodus larger than any existing lion or tiger and with enormously-developed canine teeth; and our North America had two species of felines as large as lions; and Texas, in advance of her bowie-knives, had the *trucifelis*, an awful cat of equal size.

Part III. appears to contain the most characteristic and important results of Mr. Wallace's researches and conclusions in Zoölogical Geography, and to sum up his studies into the chief forms of animal life in the several regions and sub-regions as affected by geological mutations. He is convinced, and he is in a fair way to convince his readers, that the great land masses of the northern continents are of immense antiquity, and are the area in which the higher forms of life were developed. During the whole of the tertiary period, or the geological age preceding our period, the Northern Hemisphere appears to have been divided as now into an eastern and a western continent, always approximating and sometimes united toward the north, and then admitting of much exchange of their respective faunas, but on the whole keeping distinct, and each developing its own especial family and generic types of equally high grade, and generally belonging to the same orders. No mere binary division into north or south, or into east and west is sufficient to meet the facts of the case, since the six regions in their rudiments can be traced out in the tertiary period. The north and south division truly represents the fact that the great northern continents are the home and birthplace of the higher forms of life, while the southern continents have derived the greater part if not the whole of their vertebrate fauna from the north; yet it is not true that the chief southern lands—Australia and South America—are more closely related to each other than to the northern continent. The east and west division represents a more fundamental diversity, and the Eastern and Western Hemispheres are the two great branches of the tree of life on our globe, since each of them peopled its southern from its northern regions. The facts that appear to oppose this view, as for example the radical diversity of the Australian region from the rest of the Eastern Hemisphere, are explained by adequate causes, as by the isolation of the Australian region from the great northern continent at an early date (probably during the secondary period) after previously being united. Thus, in Australia a single type

of mammal exhibits its development apart from the incursions of a later and higher type. In this way the six geographical regions are so presented as to show each its own history, the main outlines of which are treated with considerable certainty.

The distribution of plants throughout these regions admits of similar treatment, and six great regions are as a whole very well characterized by their vegetable forms. The flora of tropical America, of Australia, of South Africa, and of Indo-Malaya stand out as distinctly as do the faunas; while the plants of the Palaearctic and Nearctic, or the northern divisions of the eastern and western hemispheres, present resemblances and differences much like those that are found among animals. These characteristics are forcibly presented in the illustration of the fauna and flora of these regions in the plates.

In Part IV. the author passes from the argumentative and theoretical portion of his work, and enters into a systematic review of each family of animals, and a study of their phenomena in the light of the principles already established. Before, he was busy with the geographical view of animals; now he takes up the zoological view of geography, and interprets their distribution by their organization, habits, and history. It is a curious book of voyages and travels, and one that rewards careful perusal, and especially merits illustration from such cabinets and collections as may be at hand. Some of the results are striking, and when we ask the naturalist to tell us what animals have best survived the changes of the earth, and range most widely over its surface, the answer is not flattering to our pride of race or of affinity. The beetles are a marvelously old family, and these plodding, plucky little folk, who for untold æons of geology have managed to keep on their feet and set the ball rolling, belong to the Guelphs and the Hapsburgs, the Howards and Courtenays of nature. Mr. Wallace reviews six groups of beetles, comprising 2,400 genera and more than twenty-one thousand species. He ascribes to them high geological antiquity, and believes that they have survived changes that have altogether extinguished many more highly organized animals. The cosmopolitan culture of our age may not be much flattered by fellowship with the animals that are ranked as cosmopolites, and while the dolphin has a romantic name, and the pigeon has a high place in poetry, the rats and frogs, the hawks and owls and kindred birds of prey that have universal range, or nearly so, do not favor the idea that such range implies generous disposition so much as it indicates an ability to get a home pretty much everywhere and to eat pretty much everything.

We leave our study of these rich volumes with gratitude to the author for the mine of new facts and instruction, and to the publishers for the excellence of the print, paper, and illustrations. They suggest many thoughts that cannot now have utterance, prominent among them the importance of preserving the geographical history and surroundings of the animals that we preserve, whether alive or dead. Why not go beyond the author's hints and try to keep parks or woods in every geographical district, where the forms of aboriginal plants and animals can be preserved in native freshness, and where the animals that may be too wild or noxious to leave free may be properly confined? How valuable a square mile of field or forest might thus be made in every characteristic region of our own land.

Let us say, in conclusion, that if the author is not very flattering to the pride of man, and if he assigns little if any place to our race in changes of animal life upon the globe, while he is very generous in the range of ages that he allows to our human progenitors on the globe, we do not find him indulging the habit of some men of science, who make light of the human prerogative of mind, and try to let down the rational faculty into physical force. He leaves the question of the origin and nature of mind to be settled in the high court of reason and faith, and is content with the record and the result of the facts of nature and

life. In this respect his silence is better than much speech, and it leaves the reason and conscience with the Supreme Word and Spirit to speak the lesson of the ages of being, the prophecy of time, and the meaning and destiny of moral and rational existence. Probably the monstrous races that have passed away may have transmitted a certain force that is needed to give backbone and fire to the dominant surviving race; and not in the rage and roar of war only, but dominant in the strength of industry, the rhythm of music, and the efflorescence of beautiful art, the blood and muscle of thousands of years of animal life are telling upon the new and better times, as the horse tells upon the rider.

[\[Return\]](#)

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