
RECENT LITERATURE.

WALLACE'S GEOGRAPHICAL DISTRIBUTION OF ANIMALS.¹— Although a complete work on this subject by a single writer — and the one under consideration applies, as the author intended it should, almost exclusively to land animals of a comparatively few orders — would in the present state of our knowledge be an impossibility, we know of no one, next to Mr. Darwin, who is better fitted for the task, by training both in the field and in the study, than Mr. Wallace. The work is comprehensive in scope and apparently accurate in details, while the subject is presented in the attractive, clear style of the distinguished author of the Malay Archipelago and the Contributions to the Theory of Natural Selection. It is written, as it should mainly be, in the light of the recent uniformitarian views in geology and the theory of evolution, though with occasional disregard of zoögeographical laws laid down by Humboldt, Brown, Schouw, Schmarda, Decandolle, Agassiz, Dana, and others whose names are not even mentioned in the work before us, no historical sketch of the subject being presented, an omission of considerable importance.

The work is divided into four parts: I. The Principles and General Phenomena of Distribution. II. On the Distribution of Extinct Animals. III. Zoölogical Geography; a Review of the Chief Forms of Life in the Several Regions and Sub-Regions, with the Indications they afford

¹ *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. In two vols. With Maps and Illustrations. New York: Harper & Brothers. 1876. 8vo, pp. 503, 607. \$10.00.

of Geographical Mutations. IV. Geographical Zoölogy; a Systematic Sketch of the Chief Families of Land Animals in their Geographical Relations.

The grand merit of the work, and one which will give a substantial foundation to the author's fame as a biologist, aside from his authorship, simultaneous with Darwin, of the doctrine of natural selection, is the endeavor to account, from a more extended range of study than any previous author, for the present diversity of life on the different continents, by a study of the fossil forms and of past geological changes. He discards the older notions of certain authors, as Humboldt, Schouw, and others, that the distribution of life over the globe is due primarily to differences in temperature and to physical barriers. In how broad a way our author has treated this subject may be seen by the chapter entitled Summary of the Past Changes and General Relations of the Several Regions, reprinted in the last number of this journal. As long ago as 1847 Agassiz stated in his Introduction to the Study of Natural History that "modification of types [on different continents was] not caused by climate," though he proposed no scientific explanation as to how they did originate. Mr. Wallace supposes that all land animals originated in the northern portion of the Europe-Asiatic continent, and thence migrated south into India, Australasia, Africa, and to North America by means of a supposed former polar continent of which Arctic America, Greenland, Iceland, Spitzbergen, and Nova Zembla are the remnants. South America, he suggests, was peopled from North America. This view we suppose to be original with the author, and the hypothesis seems to be supported by known palæontological facts, and may serve as a working theory until a better one is offered. Mr. Wallace's view that the primitive centre of distribution was in the Old World is based on the fact that life is more abundant and the continental mass larger than that of North America. Mr. Wallace quite thoroughly disposes of the notion, advanced by Heer, Murray, and others, of continental bridges, and fully recognizes the facts strenuously maintained for years by Dana and others, and proven by the late deep sea explorations, that the present ocean beds have always been such,¹ oscillations of the original continental masses and the evident former existence of an arctic Americo-European continent being sufficient to account for the regular and normal interchange of life, which palæontology shows must actually have occurred.

The limits of the six primary regions into which the earth's surface is divided by our author have been marked out by geological agencies

¹ "The preliminary studies above enumerated will, it is believed, enable us to see the bearing of many facts in the distribution of animals, that would otherwise be insoluble problems, and, what is hardly less valuable, will teach us to estimate the comparative importance of the various groups of animals, and to avoid the common error of cutting the gordian knot of each difficulty by vast hypothetical changes in existing continents and oceans, probably the most permanent features of our globe." (Vol. i., p. 9.)

almost wholly. When, however, we come to the zoological subregions, temperature and mountain barriers, rivers and deserts are factors for the most part, though not always duly recognized in this work, for climatic causes are, we think, not given sufficient prominence, and the correspondence between zones of temperatures, and the distribution of faunæ are too lightly discussed. For example, he rejects the idea of an arctic region with a circumpolar fauna, contrary to the well-founded views of Agassiz, Dana, Huxley, and others, though he gives some good reason for his own opinion. Mr. Wallace's six regions are those originally proposed by Sclater, namely, the Palæarctic, Ethiopian, Indian, Australian, Neotropical, and Nearctic.

Mr. Wallace disbelieves in the existence of an antarctic region, and we should be inclined to agree with him, but we see no good reason, if we are to confine ourselves to existing facts of distribution, for ignoring a seventh arctic region embracing all of America, Europe, and Asia north of the isothermal of 32° . We should follow Agassiz (1847) and others, as well as Huxley (1868) and put the northern limits of the Palæarctic and Nearctic regions, or Europe, Asia, and North America, respectively, south of the isothermal of 32° . In this case, we think, Mr. Wallace treats too lightly the importance of temperature in limiting zoogeographical regions, and is disposed to rely too strongly on the fact that this arctic region had in former times a warm climate, and supported a flora and fauna like that of north temperate Europe, Asia, and America. But the Glacial epoch destroyed the continuity of climate, and at the present time temperature is the prime factor in limiting life as regards this region of the globe. When we turn to the distribution of marine invertebrate life, a subject almost wholly ignored by Mr. Wallace, the extension into the arctic zone of Mr. Sclater's Nearctic and Palæarctic regions is entirely arbitrary. All the facts brought out by deep-sea researches and Scandinavian, British, and American marine zoologists tend to prove most forcibly that there is a circumpolar fauna, no more European-Asiatic than American,¹ and that this fauna may, at great depths, where the temperature of the water is the same (as it actually is), extend to Cuba and underlie the tropical zone of life. In fact, the fauna of the sea is primarily polar or frigid, and tropical, and we believe that Messrs. Sclater and Wallace are quite wrong in ignoring the fact that even land animals share largely in this distribution. Indeed, in discussing the distribution of marine life, temperature is the main element in the limitation of zoological regions and subregions, as first shown by Professor J. D. Dana in 1853, in his essay on the geographical distribution of Crustacea, and again and again proved by marine zoologists and the results of the explorations by the United States Coast Survey, by Scan-

¹ Since the publication of Mr. Wallace's work, in the Reports of the Valorous Expedition to Greenland, Mr. Jeffreys argues against and Mr. Norman in favor of the Greenland marine fauna being American rather than European.



(FIG. 28.) A SCENE IN CUBA, WITH CHARACTERISTIC ANIMALS.

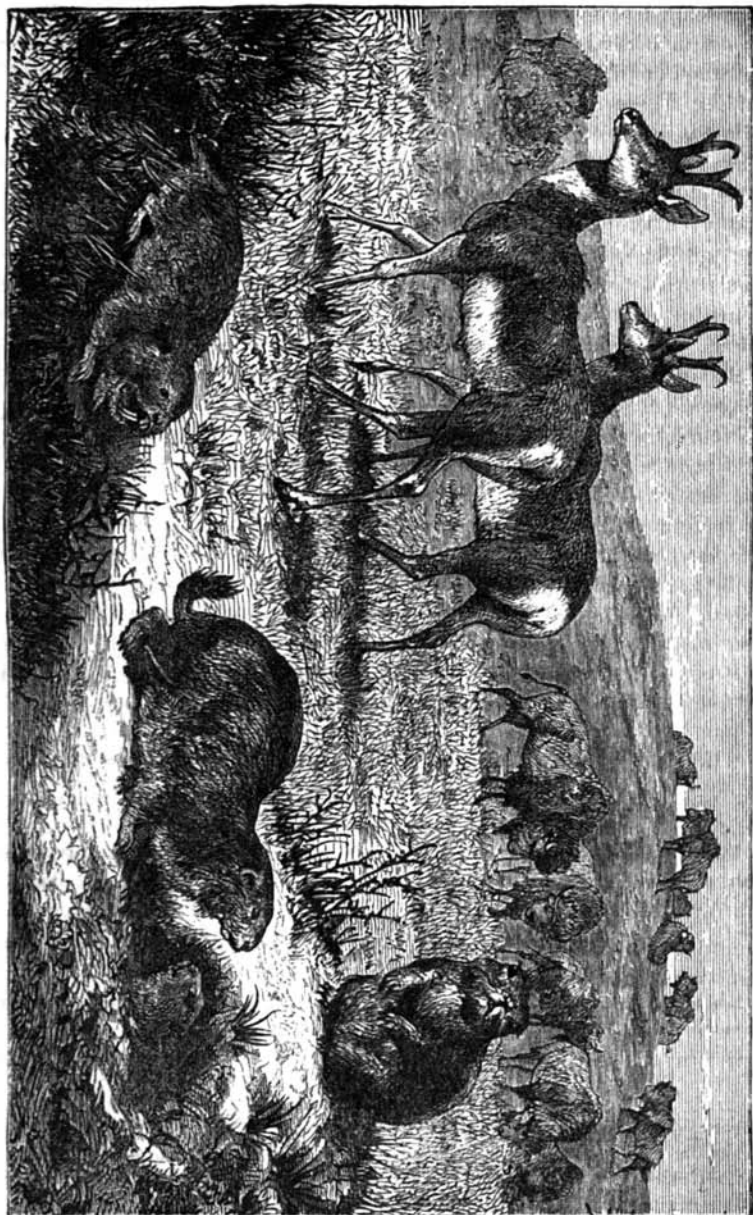
dinavian, and the Porcupine and Challenger, and other English expeditions. We are disposed to find some fault with the present work in not considering the subject from a stand-point so important as this.

To return to the theory as to the origin of the present distribution of life on the great continents by means of a migration from lands to the north. While the idea is evidently original with Mr. Wallace, he seems to have overlooked some suggestions made by writers in the United States previous to the publication of his work. More than twenty years ago Professor Asa Gray¹ proposed the hypothesis that the present vegetation of North America "or its proximate ancestry must have occupied the arctic and subarctic regions in Pliocene times, and that it had been gradually pushed southward as the temperature lowered and the glaciation advanced even beyond its present habitation." He also attempted to show that certain forms might survive in Japan and the Atlantic United States, "but not in intermediate regions of different distribution of heat and moisture." . . . And it was thought that the occurrence of peculiarly North American genera in Europe in the Tertiary period (such as *Taxodium*, *Carya*, *Liquidamber*, *Sassafras*, *Negundo*, etc.) might be best explained on the assumption of early interchange and diffusion through North Asia rather than by that of the fabled Atlantis." These views were confirmed by Lesquereux. In 1873 the reviewer applied this hypothesis to the origin of the distribution of animals, particularly insects.² We then, in discussing the origin of our North American fauna, drew the inference that "cospecific or congeneric forms occurring in California and Europe and Asia are the remnants of a southward migration from polar Tertiary lands during Tertiary and even perhaps Cretaceous times, and in proportion to the high antiquity of the migrations there have been changes and extinctions causing the present anomalies in the distribution of organized beings, which are now so difficult to account for on any other hypothesis."

As Mr. Wallace could not in such a work enter into details of distribution beyond briefly describing his subregions, in which temperature and natural barriers need to be studied with care, he may have been led into the error of underestimating the influence of zones or temperature in determining the limits of distribution within the subregions. Much excellent work that has been done in this direction by American naturalists, who have had much better opportunities than European students, has been too hastily discussed either from want of space or from lack of information, since the great extent of North America as compared with that of Europe is exceedingly favorable to the formation of correct opinions regarding the influence of climate on species, an influence of greater

¹ Memoirs of the American Academy of Arts and Sciences. Boston. Vol. 6. See Sequoia and its History, *American Naturalist*, October, 1872, pp. 589, 590.

² On the Distribution of Californian Moths. By A. S. Packard, Jr. *American Naturalist*, August, 1873, and Proceedings of the Boston Society for May, 1873.



(FIG. 29.) THE NORTH AMERICAN PLAINS, WITH CHARACTERISTIC MAMMALS.

importance in the origin of species than Darwinians as such seem willing to admit.

The errors of detail in the chapters we have read seem very few, and the wonder is that there should not be more. We notice that *Phrynosomæ*, or horned toads, are stated on one page to exist in New York and on another in Florida. We are not aware that the genus occurs east of the Mississippi River. *Siredon* is referred to the family *Proteidæ*, when it has been shown by Dumeril and Marsh to be simply a larval *Amblystoma*. An attractive feature of the work are the twenty full-page illustrations, showing the chief forms of land vertebrates characterizing the subregions. They are drawn with skill and evident fidelity, though the skunk on Plate XX. is not well sketched. Through the courtesy of the American publishers our readers can judge of the excellence of the plates by a glance at the two accompanying illustrations (Figs. 28 and 29). The colored hypsometrical maps add greatly to the value of the work. In that of North America the author colors yellow supposed desert tracts east of the Rocky Mountains, which farmers in Wyoming and Colorado would consider as reflecting on their possessions, and over which herds of buffalo a few years ago must have grazed with satisfaction.

In conclusion it may be said that while our author has shown that life has probably originated in northern lands, the question still remains to be answered, and the problem will probably not be solved for generations. What caused the radical differences in the life of the several continents? The united efforts of future palæontologists and biologists will be concentrated on this task, and centuries hence, if we mistake not, Alfred R. Wallace will be regarded as the pioneer in the work.