

seeds without a certain intensity of summer heat and a certain quantity of light ; others cannot endure a similar intensity either of heat or cold.

It is now established that many of the existing species of animals have survived great changes in the physical geography of the globe. If such species be termed modern, in comparison to races which preceded them, their remains, nevertheless, enter into submarine deposits many hundred miles in length, and which have since been raised from the deep to no inconsiderable altitude. When, therefore, it is shown that changes in the temperature of the atmosphere may be the consequence of such physical revolutions of the surface, we ought no longer to wonder that we find the distribution of existing species to be *local*, in regard to *longitude* as well as latitude. If all species were now, by an exertion of creative power, to be diffused uniformly throughout those zones where there is an equal degree of heat, and in all respects a similarity of climate, they would begin from this moment to depart more and more from their original distribution. Aquatic and terrestrial species would be displaced, as Hooke long ago observed, so often as land and water exchanged places ; and there would also, by the formation of new mountains and other changes, be transpositions of climate, contributing, in the manner before alluded to, to the local extermination of species.*

If we now proceed to consider the circumstances required for a *general* change of temperature, it will appear, from the facts and principles already laid down, that whenever a greater extent of high land is collected in the polar regions, the cold will augment ; and the same result will be produced when there is more sea between or near the tropics ; while, on the contrary, so often as the above conditions are reversed, the heat will be greater. (See Map, Pl. 2.) If this be admitted, it will follow, that unless the superficial inequalities of the earth be fixed and permanent, there must be never-ending fluctuations in the mean temperature of every zone ; and that the climate of one era can no more be a type of every other, than is one of our four seasons, of all the rest.

It has been well said, that the earth is covered by an ocean, in the midst of which are two great islands, and many smaller ones ; for the whole of the continents and islands occupy an area scarcely exceeding one-fourth of the whole superficies of the spheroid. Now, according to this analogy, we may fairly speculate on the probability that there would not be usually, at any given epoch of the past, more than about one-fourth dry land in a particular region ; as, for example, near the poles, or between them and the 75th parallels of N. and S. latitude. If, therefore, at present there should happen to be, in both these quarters of the globe, much *more* than this average proportion of land, some of it in the arctic region being above five thousand feet in height, and if in antarctic latitudes a mountainous country has been found

* A full consideration of the effect of distribution and extinction of species is changes in physical geography on the given in book iii.