

species. Thus, though hybrids are incapable of propagating themselves beyond a very limited period, the pollen of the parent species may be made to fertilize them, or their pollen to fertilize the parent; but in either case the new offspring gradually merges into the original species. Thus nature has wisely set a limit to the intermingling of species, by which they are preserved from ultimately running into confusion and disorder. The cause of sterility in hybrids is unknown; for, in general, there is no perceptible difference between the perfection and healthiness of their organs and those of the parent species.

282. *In an economical point of view*, hybridism is of great value to man. By a knowledge of its principles, he has been enabled to modify the characters of natural species, so as to adapt them to his special purposes, and thus have arisen most of those beautiful sorts and varieties of blossom which now adorn the flower-garden. So, also, by crossing varieties of the same species, our grains, fruits, and kitchen vegetables have been brought to a high state of perfection. The size of one species has been assiduously amalgamated with the durability of another, the beauty of a third with the flavour or odour of a fourth, and so on with other qualities, till we have now as many perfect vegetables as it seems possible to produce. The principles of hybridism will yet be more extensively applied; and it is not too much to expect that the perfection of our field and forest produce will yet rival that of our orchards and gardens.

#### GEOGRAPHICAL DISTRIBUTION OF PLANTS.

283. *The geographical distribution of plants* is influenced by conditions of soil, heat, moisture, light, altitude of situation, and various other causes; for, did they flourish independently of these conditions, then there were no reason why the vegetation of one part of the globe should differ from that of another. We know, however, that the flow-

299. Value to horticulturalists.

300. Examples of hybridism.

301. What of the geographical distribution of plants?

ers, shrubs, and trees which adorn the plains of India are not the same with those which clothe the valleys of Britain; and that these, again, are totally different from the scanty vegetation of Iceland or Spitzbergen. Each order is, nevertheless, perfectly adapted to the conditions under which it exists, and finds in its *habitat*, or native situation, all the elements which administer to its growth and perfection. A knowledge of these conditions, and of the various vegetable tribes which flourish under them, constitutes the subject of botanical geography.

284. *The influence of soil, climate, &c. upon vegetable life* is very obvious; but the manner in which it operates is but imperfectly known. The same elements enter into the composition of the vegetation of the tropics as those which form the vegetation of temperate regions; the same organs, tissues, modes of growth, and inflorescence, are observable; and yet, without the external conditions above enumerated, a plant which has been transferred from the one region to the other will speedily languish and die. Even one which flourishes under the influence of the sea-breeze, if removed far inland, will perish; and no art can retain in healthy perfection a native of the mountain which has been transplanted to the warm and humid valley.

285. *Certain plants, like animals, may, however, be acclimatized*; that is, may be made to grow and propagate their kind in a region in which they do not naturally occur. Many of our cultivated and most useful plants are of this kind; as, for example, the potato. This plant, which is a native of tropical America, flourishes luxuriously, and is of the highest utility, in northern Europe; but this it does by a special adaptation. In South America, the warm climate enables it to propagate by the seed; hence in that region its tubers are small and insignificant; but in Europe, where the climate is unfavourable to the production of the plant from seed, it propagates by the tubers, which are consequently enlarged, so as to contain a store of nutriment for

302. Influence of climate upon vegetable life.

303. What of acclimation?

304. Illustrations of acclimation.



the young plant before the stem and leaves be sufficiently developed. The acclimatizing of plants does not permanently change their character, for, in being restored to their native habitats, they assume their original forms and qualities.

286. *The habitats of plants*—that is, the situations in which they naturally thrive best—depend upon the conditions of soil, climate, &c., already alluded to, and are generally distinguished as follows:—*Marine* when the plants float upon or are immersed in salt-water, such as sea-weeds; and *maritime* when they grow by the sea-shore, or in places exposed to the influence of the sea-breeze. *Aquatic* is the general term for fresh water habitats; and these may be either *lacustrine* when growing in lakes, *fluvial* when in rivers, or *palustrine* when in marshes or wet meadow-lands. Plants growing in open pastures are said to be *pratensine*, in cultivated lands *arvensine*, in woods *sylvan*, in mountainous parts *alpine*, and in caves, mines, and other underground excavations, *subterranean*. The station of a plant is said to be *epiphyte* when it grows upon others, living or dead, without deriving from them the elements of nutrition; and *parasitic* when it adheres to their surface, and directly extracts its nourishment.

287. *The range of habitat* is that extent of the earth's surface over which a plant is distributed by nature. The terms maritime and alpine, for example, are general in their application, and refer to all plants which grow by the sea-side or on mountains; but the plants which flourish on the sea-shores of Great Britain are not the same with those on the coast of Africa; nor are these, again, allied to the maritime vegetation of Chili. The geographical range of any plant conveys a more specific idea, and embraces only that particular spot in which the plant rejoices. This range is circumscribed by conditions of temperature, light, and elevation above the sea, and does not, as might be supposed depend very closely upon belts of longitude, by which temperature is generally indicated. Thus, nearly all the beauti-

305. Classification of plants according to their habitats.

306. The range or limit of habitat.

ful pelargoniums and mesembryanthemums which adorn our greenhouses are natives of a limited space near the Cape of Good Hope, as are also many of our most beautiful bulbs. The curious stapelias, that smell so much like carrion, are found wild only in South Africa. The different kinds of eucalyptus and epæris are only found in Australia; and the trees bearing balsam grow principally in Arabia and on the banks of the Red Sea. The umbelliferous and cruciferous plants spread across Europe and Asia; the cacti are found in tropical America; and the labiatæ and cario-phyllacæ are seldom discovered but in Europe. The peculiar ranges and centres of vegetation, as they are termed, cannot be well understood without a knowledge of the different tribes and classes of plants, the consideration of which forms the subject of SYSTEMATIC BOTANY.

288. *The soil exercises less influence on the distribution of plants* than is usually ascribed to it, though there can be no doubt that on its power of absorbing and retaining heat and moisture much of the luxurious growth of vegetables depends. They will grow to some degree in almost any soil, as the bulkier ingredients (clay, lime, and sand) always predominate (par. 23); but a proper proportion of these earths is necessary to perfect vegetation; and many plants will not continue healthy and propagate, unless supplied with other elements, such as potash, soda, and various metallic salts. For this reason the natural vegetation of a limestone country differs from that of a retentive clay; while the plants which cover all sandy downs are totally different in kind and character from those of the alluvial valley. For this reason, also, it is that some soils become exhausted of the elements necessary to the perfect growth of a certain race of plants, and that these plants are succeeded by a new tribe, which still find in the soil all the constituents of their growth and perfection (par. 25, 26).

289. *Moisture*, which is indispensable to the existence of vegetation, also exercises some influence in its natural

307. Illustrations named.

308. Effects of soil, and its changes.

309. What of moisture?



distribution. The plant which roots in the parched sand is furnished with leaf-organs to absorb moisture from the atmosphere, and retain it, while in a wet situation these organs would become diseased, and rot away; so, in like manner, a marsh plant, whose spongioles are its main organs of sustenance, would perish were it removed to an arid soil. The organic structure of such plants forms a limit to their distribution; and the same may be said of the *salicorniæ*, *arenaria peploides*, &c., which live only when exposed to the salt spray of the ocean.

290. *Heat and light* are perhaps the most manifest agents in the distribution of vegetable life. The luxurious growth of the tropical jungle is the direct result of warmth and moisture, just as the barrenness of Nova Zembla is the effect of piercing cold; yet both situations are inhabited by plants which enjoy the conditions peculiar to their existence. No conditions of mere soil, or light, or moisture, could make the palms, tree-ferns, and jungle-flowers of India flourish in Great Britain; so neither would our oaks or pines flourish in Iceland, unless we could provide for them that temperature and seasonal influence necessary to their existence. Light, though it acts most powerfully on the colours and blossoms of plants, is also an essential element in their geographical arrangement. The southern slopes of our hills and mountain ranges are always clothed with a more elaborated and more fully developed race of plants than the northern slopes, and this depends wholly upon the greater degree of light which the former enjoy. The northern side may sometimes be as green, but it will never be so flowery as the southern exposure; and the attentive observer may detect new tribes on either side almost as soon as he has passed the summit.

291. *Altitude, or elevation above the ordinary sea-level*, also exerts an obvious influence on the distribution of vegetable life; it is equivalent to removal from a tropical to a temperate region, or from temperate latitudes to the arctic circle. For every hundred feet of ascent, there is a pro-

310. What of heat and light? their effects.

311. Examples of altitude, and its influence

portional fall of the thermometer; so that at the height of 5000 feet in Britain, and 16,000 at the equator, we arrive at the region of perpetual snow; in other words, to heights as destitute of vegetation as the frozen zone. This intimate relation between altitude and decrease of temperature accounts for the fact, why the base of a mountain may be clothed with the vegetation of tropical India, the sides with that of temperate England, and the summit with the mosses and lichens of icy Labrador. Many mountains exhibit such belts of vegetation; the most familiar instances being Mount *Ætna*, *Teneriffe*, and the *Andes*.

292. *The circumstances which facilitate the dispersion or migration of plants* are unconnected with the causes which limit their geographical distribution. Many seeds drop from the parent stalk, spring up into new series of stems, which in turn give birth to another race of seeds, and these, again, to another circle of vegetation. Thus, any tribe of plants would spread from a common centre till arrested by the influences which limit its range of habitation; and this mode of dispersion no doubt occasionally occurs. In most plants, however, the seeds are small and light, and easily borne about by the winds; some are downy, and furnished with wings; others have tufts and filaments; and many are ejected from their carpels with considerable force. All these appendages and peculiarities are evidently intended to facilitate their dispersion, which is further assisted by rivers, lakes, and tidal currents, by the wool of animals, the droppings of birds, and the economical pursuits of man, whether accidental or intentional. The seeds are arrested in their progression by various causes; some are furnished with barbs and hooks, which lay hold of objects, others become entangled amid herbage, the mud of rivers, or the softened soil of winter, while many towards spring are acted upon so as to emit an adhesive substance, or their fleshy pericarps melt down into the soil, carrying the embryo along with them. In all, the appendages which aid their migration begin to decay at the proper season, and so are unfitted any longer to transport them.

312. Wonderful dispersion and migration of plants.



293. *Botanical geography* is thus both an interesting and intricate subject. To enter fully upon the influences of temperature, altitude, &c. would require a pretty extensive knowledge of physical geography; and even then, without an acquaintance with the various classes of plants, the special effect of these influences could be but imperfectly understood. A general idea of the subject, however, has been given in the present section, from which the student will perceive that every plant is perfectly adapted to the situation it is created to fill; and that there is no portion of the globe—the regions of perpetual snow and the moving sands of the desert scarcely excepted—which does not administer to the growth of some plant, which has not some form of vegetation to adorn its surface.

### 313. Define botanical geography.

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