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Drude's Text-Book of Plant Ecology

Die Ökologie der Pflanzen. by O. Drude

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NOTICES OF PUBLICATIONS OF GENERAL BEARING

DRUDE'S TEXT-BOOK OF PLANT ECOLOGY

Drude, O. "Die Ökologie der Pflanzen." Mit 80 eingedruckten Abbildungen. Pp. x + 308. *Die Wissenschaft*, Band 50. Braunschweig (Vieweg und Sohn), 1913. Preis geheftet M. 10, gebunden M. 11.

The publishers prefix to Professor Drude's book an excellent note defining the field of ecology for the benefit of wider scientific circles to which the conception of ecology is still little known or obscure. In this note the JOURNAL OF ECOLOGY is alluded to as a sign of the lively interest now taken in the subject.

Professor Drude divides his work into four sections, dealing respectively with "The Physiognomic Life-forms of Plants"; "Climatic Influences, Periodicity and Leaf-character"; "Physiographic Ecology"; and "Ecological Epharmony and Phylogeny."

In the first section the author critically traces the development of the conceptions of physiognomy of vegetation and life-forms, up to Raunkiaer's work. The author himself gives 55 groups of life-forms, arranged under the three primary headings of Aerophytes (vascular plants), Water-plants and "Cellular" plants (bryophytes and thallophytes). This part of the book is specially fully illustrated by excellent, well-selected and well-reproduced, mostly photographic, figures. Here as elsewhere the author lays special stress on power of colonisation, and in this connexion deals with such topics as vegetative propagation, fixity of location and power of wandering, level in the soil of underground parts, effective distribution of plants by seeds.

In the second section the author points out that the influence of climate is seen very largely in the *leaf* (so far as vascular plants are concerned), in its organisation, form and duration. He deals with different duration periods of leaves, with the position taken up in regard to light, and with the relations to water. Under the last head he suggests 4 types, hydromorphic, hygromorphic, mesohygromorphic and xeromorphic, which, as he points out, correspond in a general way with the divisions commonly used by ecological writers in classifying formations. The mesohygromorphic type corresponds with Warming's "mesophytes," but this class is too vague and loosely constituted, and Professor Drude's view is that the conception is useful rather as he applies it, under the name "mesohygromorphic," than as the name of a group of formations. Finally the author calls attention to the general climatic zonal arrangement of leaf-form, both in the major climatic zones of the earth and in the altitudinal zones of high mountain ranges.

In dealing with climatic periodicity of vegetation the author points out that not only is this the rule as regards by far the greater part of the earth's surface, but that even in the tropics the vegetation processes are not so uniform throughout the year as is often supposed. He lays great stress on the necessity of considering all the important factors—heat, distribution of light throughout the year, humidity of the air, and supply of water in the soil—together; and cites with special approval as applicable to ecological purposes de Martonne's division of the earth's surface into 8 climatic types. Prof. Drude, using a combination of de Martonne's and de Candolle's principles of classification, makes 18 climatic types, arranged under 4 groups with the prefixes iso-, tropo-, etesial- and helio-. The first has uniformity of light, temperature and rainfall throughout the year, the second alternation of rainy and dry hot periods bringing about a resting phase, the third has a summer like the second, but a winter more like the fourth, with frequent but not very intense cloudiness. The fourth has a winter with little light, causing a resting period even if it is mild. The types falling under each group allow for different combinations of other factors, such as are found for instance on tropical mountains, in subtropical deserts, in dry regions with hot summers and cold winters, and so on. This classification, the author claims, represents the most important combinations of climatic factors as they affect the economy

of the vegetation through regulation of the active vegetative and colonising period. Individually various habitats within the climatic type of course modify the rigidity of incidence of the typical combinations of climatic factors.

In the last chapter of this section the author discusses at some length the general phenomenon of periodicity in relation to climate, and concludes with Schimper and Volkens, in opposition to Klebs, that periodicity or rhythm is inherent in plant life, and is only regulated by climatic periodicity to which it has to be adapted. Prof. Drude's view is that this inherent periodicity has been acquired by plants as a result of exposure to millions of years of climatic periodicity. He does not consider the view that it may be rooted in an automatic internal periodicity dependent on the sequence of internal physico-chemical processes, and thus in origin independent of climatic periodicity.

The third section of the book, dealing with physiographic ecology, begins with a chapter on the formation of plant-communities (*Pflanzenvereine*) or synecological units and takes Schimper's view that the soil differentiates the units formed by the social plants and their synecological associates within a given climatic region. In the second chapter the author discusses the familiar problems of the effective edaphic factors—water supply, lime, humus, bacterial flora and so on, calling special attention to the detailed studies of Kraus¹. The third chapter deals with Jaccard's work² on the distribution of species in the alpine flora, and concludes that Jaccard's results on the great variety of floristic composition shown by different small areas of the same association, even when in close proximity, offer no hindrance to the conception of the "elementary" association, the unit with which physiographic ecology has to reckon, since this variety is the expression of the space required by an association to develop its full floristic character. The conception of physiographic ecology—a term due to Professor Cowles—is shown to depend on the life-history of plant-communities in relation to their environment, and this study is a necessary starting-point in the inductive establishment of formations from which we can progress to larger and larger units ending with the largest units of climatic-physiognomic character which had been largely recognised before ecology in the modern sense had begun to develop.

The scheme of nomenclature of vegetation-units adopted by the author (pp. 214–216, 287) is as follows. (1) *Elementary associations*, i.e. the association as developed in a given region of uniform climatic and edaphic character. These are also regarded as "facies," characterised by different "Leitpflanzen" and developed in different floristic districts. (2) *Associations*, which have "Nebentypen" (? *Subassociations*) according to local edaphic variations of the habitat. An association cannot be conceived as without a definite floristic character. If it loses this it ceases to be the same association. (3) *Formations*, which are the expression of a definite physiognomic type. Definite instances of the extent and limits of formations are not given, but it is suggested that the deciduous forests of eastern North America and of Europe, for instance, belong to one formation. (4) *Formation-groups*, which are not defined or illustrated by examples. (5) *Vegetation-types*—the highest groups. The author is not satisfied with the four vegetation-types of Brockmann-Jerosch and Rübél³, and himself gives 12 such types, as follows:—(i) Evergreen tropical forest; (ii) Deciduous tropical forest green at the rainy season; (iii) Subtropical evergreen sclerophyll forest; (iv) Deciduous (summergreen) forest and coniferous forest resistant to frost; (v) Evergreen and deciduous scrub; (vi) Grass-steppe, bush-steppe, tree-steppe and savanna; (vii) Evergreen grass-land and grass-moor; (viii) Xerophyte-steppe and desert-steppe; (ix) Chamaephytes, mosses and lichens on acid soil; (x) Freshwater associations and limnaeid marginal formations; (xi) Halophytic sea-coast formations; (xii) Submerged halophyte formations.

In the fourth section the author discusses such topics as the phylogenetic value of ecological characters (life-forms); eurychory and stenochory; the monotypic and polytypic origin of species; homalochoric, allochoric and heterochoric species. It may, the author holds, be laid down as a general rule, that closely allied races of a species (or, as others would say, closely allied species)

¹ **Kraus, G.** "Boden und Klima auf kleinstem Raum." Jena (G. Fischer), 1911.

² **Jaccard, P.** "The distribution of the flora in the Alpine zone." *New Phytologist*, **11**, 1912, pp. 37–50.

³ See review in this JOURNAL, **1**, 1913, pp. 27–42.

either inhabit separate areas or are heterochoric, i.e. occupy different ecological habitats within the same area. This he considers a necessary extension of Moritz Wagner's migration hypothesis—genera rich in species colonise different formations with different species. The author concludes the third chapter with some interesting data on the separate habitats of certain pairs of closely allied species of Central Germany. The next chapter deals with “representative” species of eurychoric genera—species, that is, which are ecologically equivalent and inhabit different geographical areas. An example is taken from the genus *Asarum*: *A. europaeum*, *A. canadense* (Saskatchewan and Ontario southward to the mountains of North Carolina) and *A. caudatum* (Cascade Mountains of Washington and Oregon) show ecological equivalence in cultivation. On the other hand, *A. virginicum* and *A. arifolium* in the Southern Atlantic States are ecologically different. In the following chapter the author calls attention to the striking confirmation of the principle that under ecologically uniform conditions one species of each genera alone succeeds, by Jaccard's results (*loc. cit.*), with his generic coefficient, i.e. the ratio of the number of genera to the number of species in a given area. Under uniform conditions this ratio is high, and the greater the diversity the lower it becomes. Jaccard's interpretation of his results is however open to criticism on statistical grounds into which we cannot here enter. The field opened up by the Swiss botanist is certain, nevertheless, to afford rich results in the future.

In the concluding chapters Professor Drude states his philosophy of evolution—a combination of neo-Lamarckism and Darwinism; and he concludes with a very judicious characterisation of the scope of ecology, which he regards as finding “its strength, its commanding significance for modern science, in the material which streams into it” from all sides (p. 278).

The work under review, with its statement of the conclusions of the veteran plant-geographer, who never closes his mind to new ideas and new lines of research in the still young science of ecology, will be turned to with interest and with profit by all ecologists.

The book is nicely got up, and the illustrations, though small in size, are exceedingly good. The price is, perhaps, rather high.

A. G. T.

THE SOIL SOLUTION

Hall, A. D., Brenchley, W. E. and Underwood, L. M. “The soil solution and the mineral constituents of the soil.” *Phil. Trans. Roy. Soc. Lond.*, **B. 204**, 1913, pp. 179–200.

In an earlier number of this JOURNAL (**1**, 1913, pp. 293–5) an account was given of the views held regarding soil problems by the Bureau of Soils of the U.S. Department of Agriculture. It was there pointed out that the main object of Dr Cameron and his colleagues is the rejection of the “Plant Food Theory of Fertilisers” and its replacement by a very different theory of his own construction. The workers at Rothamsted have now come to the support of the earlier theory in the paper whose title is given above.

Mr Hall and his collaborators attack the conclusions of the Bureau of Soils along several lines. In the first place, they attempt to show that the soil solution is not constant in composition as regards potash and phosphoric acid as Dr Cameron and his colleagues suppose. Their soils were obtained from plots at Rothamsted on which wheat or barley are grown permanently and whose history as regards manuring has been known for the last 60 years. Soil extracts were made by working up the soil with water in a definite proportion and syphoning off and filtering the supernatant liquid. Water cultures of both wheat and barley were then grown in the soil extracts from the variously manured wheat and barley plots. By analysis of the soil extracts it was shown that their composition as regards phosphoric acid and potash was not constant, but varied as one would expect from past manurial treatment. Moreover the growth of the cultures was closely parallel with the quantity of potash and phosphoric acid present, and also with the crop-yield of the plots from which the soils were taken.

It should be mentioned here that the workers at the U.S. Bureau of Soils prepared and analysed many soil extracts, and although the results of their analyses are expressed somewhat differently from those of the Rothamsted experiments, yet they record differences in the quantities