Review: Primary Survey of the Peak District of Derbyshire

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REVIEW

PRIMARY SURVEY OF THE PEAK DISTRICT OF DERBYSHIRE¹

Moss, C. E. "Vegetation of the Peak District." Pp. x + 235, with 36 figures and 2 coloured vegetation maps. London (Cambridge University Press), 1913. Price 12s. net.

The latest (tenth) contribution to the primary survey of the vegetation of the British Isles appears in the form of a handsome volume published by the Cambridge University Press. The financial difficulties which have now in spite of much persistent effort to overcome them brought to a standstill (one may hope a temporary standstill) this important and indeed fundamental work on British vegetation are alluded to by the author in his Preface; and it is only owing to the timely generosity of the Royal Society and of the Royal Geographical Society that Dr Moss's present excellent contribution has been enabled to obtain publication. We cannot reasonably expect such help to be forthcoming in the future, at any rate with the regularity necessary to secure the frequent publication of memoirs which is essential if primary survey work is to be carried out systematically and to aim at covering the whole country within a reasonable time. The only possible means of placing the work on a sound financial basis is to obtain Government recognition and support. The Government Department concerned is indeed most anxious to give such recognition and to undertake publication of the memoirs, but it has hitherto most unfortunately been quite unable to obtain the ridiculously small funds necessary for securing regular publication.

After an introduction treating of certain general topics, the author deals with his subject in seven chapters, occupied respectively with Woodland associations, Scrub associations, Grassland associations, associations of rocks and scree, Marsh and Aquatic associations, Moorland associations, and the Culture associations of cultivated land.

The Peak District is taken, for the purposes of the present memoir, as coextensive with the accompanying vegetation maps, which represent an area of 432 square miles, comprise parts of Sheets 86, 99 and 111 of the new series of one-inch-to-a-mile (1:63360) ordnance survey maps, and include the western part of north Derbyshire together with adjoining parts of Yorkshire, Cheshire and Staffordshire. This district includes the greater part of the southern portion of the uplands produced by the great north and south Pennine anticline and composed of rocks of Carboniferous age. In the southern half the core of Carboniferous Limestone is exposed, while to the north the limestone is covered by a great mass of Millstone Grit (coarse sandstone) with the overlying rocks of Coal Measure age on its eastern and western flanks.

The distinction between the vegetation of these two great regions of sandstones and shales on the one hand and limestone on the other is at once seen by a glance at the two maps. The northern map is mainly occupied by an extensive uncultivated

¹ By kind permission of the author, the photographers, and the Cambridge University Press, we are enabled to reproduce (Plates 16—20) some of the illustrations in this work.

upland clothed with moor, cottongrass¹ moor on the higher plateaux, heather² moor on the slopes, and bilberry³ moor on the rocky summits and edges. The southern map is occupied by a plateau whose surface is mostly covered with upland cultivation, of which oats are the characteristic cereal, but which in fact is mainly permanent pasture. Both plateaux are more or less dissected by streams, the sides of whose valleys bear oakwoods in the case of the sandstones and shales and ashwoods in the case of the limestone. Between and above the woods on the valley slopes are areas of grassland, again of different types according to the kind of rock on which they are based. No area in England could be better adapted for bringing clearly into view the fundamental contrast between the edaphic effect on vegetation of these two great categories of rock—a contrast which is repeated wherever the two rock types are developed in contiguous areas.

Towards the edges of the maps the “wheat zone” appears in the larger valleys at lower altitudes. Though the characteristic cereal of the lowland cultivation is wheat, most of the cultivated land, as in the case of the “oats zone,” is under permanent pasture.

After pointing out the general geographical features and types of scenery produced by the different geological formations, the author calls attention to the fact that “solid” geological maps do not in all cases represent the soils actually found at the surface and on which the vegetation actually depends, and that no “drift” maps of the district are available. The cases in which the surface soil has characteristics different from those of the underlying rock are however, with the exception of the great areas of peat on the northern plateau, and of small areas of “chert” on the southern (limestone) plateau, comparatively few and unimportant.

The author concludes that the soils of the region may be divided into three great classes—calcareous, siliceous and peaty—and that the last two “are more closely related to each other than either is to the calcareous soils, not only by the acidity but also by their low soluble mineral content and by their floristic composition.” He then gives, in parallel columns, lists of the characteristic species of the three types of soil, from which it appears that the calcareous soils are much the richest in species and have no “characteristic” species in common with the siliceous or with the peaty soils; and that the siliceous soils are richer than the peaty soils and have several species in common with them.

Following sections on Flora and Vegetation and on Vegetation maps the author sets forth the terminology of units of vegetation used in the present work. These follow the general lines laid down in the author's *Fundamental Units of Vegetation* (*New Phyt.*, **9**, 1910, pp. 18—53), and adopted in *Types of British Vegetation* (1911). The conception of the life-history of a plant-formation, and the related conceptions of progressive and retrogressive associations, are emphasised. The author also states that from his point of view “climatic factors and geographical position are regarded as part of the habitat; and it follows that any particular plant-formation is confined to a single climatic or geographical region.”

The introductory chapter concludes with some meteorological data (from which it appears that the mean annual rainfall on the Southern Pennine Uplands varies

¹ *Eriophorum vaginatum*.

² *Calluna vulgaris*.

³ *Vaccinium Myrtillus*.

from 40 to 50 inches or a little more) including some interesting data collected by the meteorological department of the University of Manchester on the meteorology of the upper air. In the absence of meteorological stations on the higher Pennine Uplands themselves, the author uses these upper air statistics in order to gain some idea of the atmospheric conditions of plant life at the higher altitudes. The station itself is situated near Glossop at 335 metres alt., and readings at 500 metres and 750 metres alt. are utilised. These three altitudes, as the author points out, represent approximately the conditions (1) at the upper limit of woodland, in scrub, grassland and heather moor, (2) in cottongrass moor, and (3) a little above the highest plant-communities of the district, i.e. bilberry and retrogressive moor. The statistics are based on single daily readings, taken in the afternoons, and thus roughly representing daily maxima. Single records of several degrees below zero Centigrade are met with but none of the monthly averages falls to zero at the two lower altitudes, while those of January, February and March are in the near neighbourhood of zero at 750 metres. The temperature did not fall to zero from May to November inclusive in 1908, nor from April to October inclusive during 1909, but from November to April there were (with two exceptions) always some days when the temperature failed to rise above zero at 335 m. alt. These figures correspond with the author's statement that very little growth is discernible in the district before the month of May above 335 m. During the six months which may be regarded as winter months on the Pennine Uplands severe weather alternates with "moderately mild intervals," and this state of things, considerably more severe than in the lowlands at the same latitude, is perhaps related to the meagre flora of the Pennine Uplands. It may however be suggested that the low summer temperatures—the July mean for 1908 at 750 m. is 11.6° and for 1909 10° C.—are likely to be even more important in this respect. Westerly and southerly winds prevail on approximately two days out of three and there is little change of direction at the different altitudes. The velocity of the wind however increases very much at the higher altitudes. Thus in 1909 the averages of the monthly means were 5.1, 8.5 and 11.6 metres per second at the three altitudes. On comparatively few days does the wind velocity exceed 15 metres per second at 335 m., but the number of days on which such a velocity is exceeded increases considerably and progressively even in summer at the two higher altitudes. The mean monthly humidity of the two years is high (about 85 per cent.), remarkably constant from month to month, and remarkably constant at the different altitudes. The daily records however show very considerable variations, and the lowest percentages are recorded on the whole at the higher altitudes. The absolute minima during the two years are single records of 25 per cent. in October 1908 and January 1909. In May 1909 records below 60 per cent. were made at 335 m. on more than one-third of the days, and on nearly half the days at 500 and 750 metres. Records below 60 per cent. are however in general rare.

The chapters dealing with the different groups of associations attain that excellence of lucid description and unambiguous statement which we expect from the author, and the reviewer's remarks will be confined mainly to points which appear to call for criticism.

The chapter dealing with woodland associations is prefaced by a list of the plant associations of British woodlands somewhat more extended than that given in *The Woodlands of England* (Moss, Rankin and Tansley, 1910). It may be suggested that an association of *Quercus sessiliflora* and *Carpinus Betulus* on sandy loam might be added to the list under E to correspond with that of *Q. Robur* and *Carpinus Betulus* under D, but the reviewer doubts whether either of these oak-hornbeam woods should find a place in the list since there is no evidence that the presence of the hornbeam modifies the associated vegetation. The pinewoods of the south of England with *Pinus sylvestris* dominant are generally regarded as subspontaneous only, and a note to this effect might with advantage have been added, even though the author's opinion be different. With regard to the native Scottish pinewoods, two of the finest and most extensive, viz. the Black Wood of Rannoch and the lower, i.e. the thickly wooded, part of Rothiemurchus Forest are developed, not on the shallow soils of the older siliceous rocks, but on deep sand and gravel. An association of ashwoods might be added after the beechwoods of the chalk; and this is actually referred to on pp. 43 and 67. The necessity of stating the habitat of ashwoods (H 16) as *fissured* limestones is not however obvious; and if the word "fissured" were omitted the ashwoods on chalk would naturally find a place under the same head as the ashwoods on other limestones. The words "and calcareous oolite" should be added after the habitat of beechwoods; and the words "and calcareous sandstones" after the habitat of ash-oak woods (G 15).

The accounts of the two contrasted types of woodland characterised by the dominance of *Quercus sessiliflora* and *Fraxinus excelsior* respectively are exceedingly good, and their dependence on edaphic factors other than amount of soil water is clearly demonstrated. The comparative list of species occurring in the two types of woodland is very useful and clearly shows the considerable difference of floristic composition, though even this is not nearly so striking as the differences in the dominant and very abundant ground species. A numerical analysis of the lists would have been worth making, but this the reader can do for himself. It is however rather surprising to see such plants as *Calamintha Clinopodium*, *Vicia sepium* and *Tamus communis* printed as "confined or almost confined to the more shady parts of the woods."

In Chapter III, dealing with scrub associations, the author discusses the depression of the upper limit of forest. While admitting that the indiscriminate felling of trees and the "browsing of quadrupeds" have played their part in depressing the forest limit, he believes that a wood may fail to rejuvenate if the seeds of the trees fall into closed plant communities of ground vegetation; "and as the more upland ash, oak, and birch woods of this district are, on the whole, characterised by such closed ground societies, it would seem that here is an additional reason which helps to explain the gradual degeneration of the forests of the Pennines" (pp. 92—3). The author quotes Krassnoff (cited in Warming's *Ecology of Plants*, p. 316) to similar effect, and states that some foresters keep the ground of their woods and plantations free of woodland "weeds" in order to permit of rejuvenation of the trees. Assuming the correctness of these statements, which the reviewer has no reason to doubt, an interesting question is raised. If

the woods in question once rejuvenated regularly, as presumably they did, then *ex hypothesi* they were at that time carpeted by open and not by closed ground communities. What has led to the replacement of these open communities by closed ground vegetation? Such a change cannot be conceived of as a spontaneous biotic succession—for there is no evidence that such successions are actually occurring in natural woods so long as the trees retain complete dominance. Presumably the change in ground vegetation is a *consequence* of a change in the forest canopy, in the direction of a thinning of the canopy admitting more light to the ground and thus favouring a closed and more heliophilous ground vegetation at the expense of shade forms. But, unless a natural factor progressively unfavourable to tree growth can be postulated, it would seem that this thinning of the tree canopy can only have been brought about by “indiscriminate felling” together with the destruction of seedlings by the “browsing of quadrupeds.” Thus we are to all appearance driven back on the causes supposed to be insufficient. A possible alternative explanation involves the assumption that plants capable of altering the soil in a direction unfavourable to the growth of tree seedlings or even of the trees themselves are able to enter the untouched woods. For instance such species as *Deschampsia flexuosa* or *Vaccinium Myrtillus* with accompanying bryophytes might be conceived of as able to do this and to produce a more “acidic” peaty soil in such a cool damp climate as that of the southern Pennines. This would be a somewhat similar process to that obtaining in the invasion of woods on a sandy soil by the heath association. Something of the kind seems indeed to be contemplated by the author in his remarks on pp. 97—8; and the reality of such a process would be well worth testing by careful observation. In the reviewer’s judgment it is at any rate necessary to go behind the replacement of open by closed ground vegetation and enquire as to its causes. Such a replacement would seem to be only one link in the chain of causation.

That the scrub of the southern Pennines and indeed most (though not all) of the British scrub are plant communities retrogressive from forest may be taken as amply demonstrated, but it is possible to disagree with the author in his characterisation of their exact status as that of “subordinate associations.”

It may be doubted in fact whether such scrub really deserves the rank of an association at all. An association should have, we think, a definite and distinctive plant population, but it does not appear that this retrogressive scrub has any such thing. The fact that “if the localities are not very carefully chosen, one finds, in the case of scrub, for example, that one takes a list of species almost characteristic of a wood or a list almost characteristic of grassland” (p. 99) in itself raises the suspicion that we are dealing, not with an ecological and floristic entity, but with a mixture of two. The author states that “it will be seen there are very few species of the scrub which do not occur either in the woodland or grassland associations.” But in fact a comparison of all the relevant lists given shows that there is *no single species* of which this may be said¹. Now if this

¹ If, as is probable, we may take *Thalictrum collinum* to be a segregate of *T. minus*, and *Alchemilla filicaulis* to be a segregate of *A. vulgaris*. These segregates we presume are not in any way characteristic of scrub as such, but are, like their corresponding aggregates, grassland forms.

scrub has no separate habitat and no separate flora, it seems to forfeit all claim to be considered a separate association. In reality it is a mixture of the shrub layer of the woodland association (modified by freedom from competition with the trees and still sheltering, though in reduced numbers, a woodland flora) with a grassland association pure and simple.

There are two parallel scrub communities on the Pennine uplands, corresponding with the two woodland associations—a “siliceous scrub” originating by degeneration of oak-wood and a “calcareous scrub” similarly derived from ashwood. These two types of scrub, like their antecedent woodland associations, possess floras and especially vegetations, as may be seen from the lists given and especially from the frequency letters, which are essentially distinct, though there are many species, as in the case of the woodlands, that are common to both. Among the woody species this distinction is scarcely so well-marked as in the case of south English woods, owing to the comparative floristic poverty of the Pennine woods as regards these species.

Chapter IV deals with the grassland associations, occupying the hill slopes below about 1500 feet (457 m.) where these are not cultivated and not occupied by woodland or scrub. Grassland is “rather rare at altitudes above the limit of scrub,” and “it is highly probable that almost all the present grassland—both natural and cultivated—was once wooded” (p. 103). The existence of grassland rather than moorland on steep slopes is related by the author to the “slow but continuous exposing of new soils.” This relation is not, however, perfectly clear. Surely new soil cannot be exposed on slopes covered with turf without destroying the turf. It seems more likely that the persistence of a grass vegetation on such slopes should be attributed rather to the maintenance of aeration in the soil as opposed to the stagnation of the water in soils on flatter places and the consequent lack of aeration and encouragement of moor plants. As in the case of scrub and woodland there are two types of natural grassland, developed on siliceous and calcareous soils respectively. In the Pennine siliceous grassland two main associations are recognised, one dominated by *Nardus stricta* and the other by *Molinia caerulea*. Various “facies” of the Nardetum characterised by the abundant presence or local dominance of *Agrostis vulgaris*, *Ulex Gallii*, *Pteris aquilina*, *Deschampsia flexuosa*, and *Juncus effusus* respectively are recognised. These “facies,” by the way, are called subordinate associations on p. 215. Further, a mixed siliceous grassland is described, “much richer in associated species than the Nardetum.” This is presumably to be regarded as only a semi-natural type, since it occurs “on the upper limits of the cultivated land,” “is frequently fenced, and to some extent grazed over by cattle,” though it has probably “never been ploughed or drained.” It is regarded by the author as representing the remains of a primitive flora which flourished in the open spaces of the aboriginal woods at comparatively low altitudes.

The wetter type of siliceous grassland is the Molinietum. This association contains many moorland species, and “there can be little doubt that it sometimes develops into moorland.” In the diagram on p. 115 such a derivation is shewn; and a development of Nardetum into moor through a transitional type of “Nardus pasture with much *Calluna*” is also indicated. Nothing however is said of this latter succession in the text.

Photo.

W. B. Crump

Oak Wood of *Quercus sessiliflora*.

The ground vegetation consists chiefly of the Bracken (*Pteris aquilina*) and the wood Soft-grass (*Holcus mollis*).

Photo.

W. B. Crump

Oak Wood of *Quercus sessiliflora*.

The ground vegetation consists largely of the Bracken (*Pteris aquilina*), the Bilberry (*Vaccinium Myrtillus*), and the Silver Hair-grass (*Deschampsia flexuosa*).

MOSS—VEGETATION OF THE PEAK DISTRICT (pp. 275—285).

Photo

W. B. Crump

Siliceous Grassland.
Facies of the common Rush (*Juncus effusus*).
Harvesting the rushes.

Photo.

W. B. Crump

Calcareous Scrub and Grassland.
Rocky hill slope of Carboniferous Limestone.

MOSS—VEGETATION OF THE PEAK DISTRICT (pp. 275—285).

Photo.

Heather Moor.

W. B. Crump

Thin peat over Chert on the Limestone Plateau. Associated with the Heather (*Calluna vulgaris*) are Hawthorn (*Crataegus Oxyacantha* = *C. monogyna*) and dwarf Furze (*Ulex Gallii*). In the background is High Rake and a slope of upland calcareous grassland.

Photo.

Cotton-grass Moor.

W. B. Crump

Cotton-grass (*Eriophorum vaginatum*) in fruit in June.

MOSS—VEGETATION OF THE PEAK DISTRICT (pp. 275—285).

Photo.

Retrogressive Moor.

A. Wilson

A later stage of retrogression of the Cotton-grass Moor. Deep peat, capped with Cotton-grass (*Eriophorum vaginatum*), etc. Broken Millstone Grit in the bed of the stream.

MOSS—VEGETATION OF THE PEAK DISTRICT (pp. 275—285).

Photo.

Retrogressive Moor.

A. Wilson

A still later stage of retrogression of the Cotton-grass Moor. Peat hags with much bare peat, capped here and there with Bilberry (*Vaccinium Myrtillus*).

MOSS—VEGETATION OF THE PEAK DISTRICT (pp. 275—285).

"Calcareous" grassland, developed on limestone slopes, is clearly shown to have a very different composition from siliceous grassland, and to bear the same kind of relation to ashwood that siliceous grassland bears to oakwood. In discussing the difference in floristic composition between siliceous and calcareous grassland, the author (p. 119) gives two lists, one of plants in rocky places and one of plants found where the soil is loose, which hardly seem relevant to the particular distinction under discussion, though they undoubtedly help to show the difference of the flora of calcareous soils as a whole from that of siliceous soils. On p. 120 the author cites Gradmann's convincing argument on the unity of the "Hochmoor" formation in support of his contention that the whole vegetation of calcareous soils should be considered as one formation. But the cases are not quite parallel. It cannot be said of the different associations of calcareous soils, as it can of the different parts of a Hochmoor, that "the floristic composition is almost exactly the same." The flora of an ashwood is by no means almost exactly the same as that of calcareous grassland. And the fact that "it is impossible to draw any hard-and-fast boundary line between woods, scrub, and grassland" is certainly no proof of formational identity on *any* existing conception of the plant-formation.

Calcareous grassland does not, according to the author, show distinct associations related to habitat as in the case of siliceous grassland. *Festuca ovina* is, in general, dominant; but "mixed" calcareous grassland, analogous to mixed siliceous grassland, occurs and also a type transitional to siliceous grassland. "Calcareous heath" is defined as a transitional association between calcareous grassland and heath, and owes its origin to the lime-content of the superficial layer of soil being low, so that such plants as *Calluna* and *Vaccinium Myrtillus*, rooted in this surface layer, occur side by side with typical species of calcareous grassland rooted in the deeper calcareous layers. An interesting difference between Derbyshire and Somerset calcareous heaths is this, that while the former contain numerous heath species and few but individually abundant limestone species, the latter contain numerous limestone species and few but abundant heath species.

Under the heading "Pseudo-calcareous heath" the author points out that heath developed on small patches of non-calcareous detritus or drift alternating with limestone must not be confused with true calcareous heath.

In Chapter V, dealing with the associations of rocks and screes (talus), the author gives a list of species "more partial to the [limestone] cliffs than to any other kind of habitat." In this list however many typical woodland and grassland plants are included, an inclusion which is rather confusing to the reader. The author shows indeed that comparatively few species are confined to rocks in this district, and in the case of sandstone rocks there are no vascular plants in this category. The author concludes that no formation of rock plants can be recognised in the Peak District and that the vegetation of limestone rocks and screes must be included in the formation of calcareous soils, and that of sandstone rocks and screes in the formation of siliceous soils.

Chapter VI deals with marsh and aquatic associations, which are but meagrely represented in the district. Reedswamps in particular are rare and not very typical. The author distinguishes swamps (or marshes) on the sandstones and

shales, often dominated by the common rush (*Juncus effusus*) and with quite a long list of species, from swamps (or marshes) on the limestone which are much less numerous, have a different floristic composition and many fewer species. On these grounds the two types of swamp are placed in separate plant-formations and assigned to the silicion and calcarion respectively. In the author's view in fact the contrast between lime and absence of lime is more important than the contrast between the marsh habitat and the "dry land" habitat. Both types of marsh habitat are considered to be characterised by well-aerated water as opposed to the stagnant water of the typical "bog." The aquatic communities are described under the heading of the vegetation of quickly flowing streams which is regarded (p. 218) as a subformation of the formation of fresh waters. The distinction of calcareous and non-calcareous waters is here used to divide associations of this subformation.

The concluding section of Chapter VI is devoted to a brief consideration of "The relation of mineral salts to the flora and vegetation," and the author concludes that the "chemical theory" of soil differences as largely determining vegetation is "far from being effete." He very rightly says that this theory "requires close investigation by modern plant physiologists; and a restatement of the whole position is urgently needed."

Chapter VII is devoted to the moorland associations, which are decidedly the most important group in this district, covering as they do a far larger extent of country than any other group of associations. The moors are characteristic of the plateaux and higher slopes of the Millstone grit area depicted on the northern map. The heather moor generally occupies the slopes and leads up to the cotton-grass moor covering the plateaux, except those at the highest altitudes which are occupied by a retrogressive moorland association dominated by *Vaccinium Myrtillus*. The high rocky summits and ridges are also occupied by *Vaccinium Myrtilli*, but this type is much more extensively developed in the Scottish Highlands. Besides these three main moorland associations, there are various transitional areas leading from one to another, and others connecting the moorland types with siliceous grassland. The author also gives a conspectus of all the known types of British moorland. We note however that he passes over the grass-moor described by W. G. Smith in *Types of British Vegetation* without any mention at all, while he includes *Rhacomitrium* moor, whose claim to rank as a distinct moor association, coordinate with the others, is very doubtful.

After pointing out that the distinctions between "Hochmoor" and "Flachmoor" made by continental plant-geographers do not exactly correspond with the British distinction between "moor" and "fen," the author considers the distinctions between "Hochmoor" and "Flachmoor" enumerated by Warming, and concludes that the Pennine moors belong to the "Hochmoor" type, though some of the tests "require re-stating." The author regards "the amount of soluble mineral matter in the peat" as the only distinction between fen-peat and moor-peat which is "really fundamental."

In discussing the factors related to the distribution of moorland associations the author points out that the possession of large aeration canals in plants such as *Eriophorum*, as opposed to their absence in *Calluna* and *Vaccinium Myrtillus*, is

probably related to the dominance of the first-named plant on wet, badly aerated peat, and of the latter on drier peat. In the transitional regions where *Calluna* and *Eriophorum* live side by side, the heather root system occupies the more superficial and therefore presumably better aerated peat layers, while the root system of the cottongrass penetrates to deeper levels. Similarly on the retrogressive moors in which *Vaccinium Myrtillus* succeeds *Eriophorum*, the surface peat is progressively drying owing to increased drainage.

Space does not permit of extended reference to the many interesting points brought out in the author's excellent account of the different moorland associations and their relationships. This is indeed in most ways the best contribution to the ecology of the British moorlands that has yet appeared. Special attention may however be called to the full description of the retrogression of cottongrass moor marked by the increase of *Empetrum*, *Rubus Chamaemorus* and *Vaccinium Myrtillus*. This is brought about by the cutting back of streams into the cottongrass moor peat (Plate 19), and the consequent increased drainage; and results in the reduction of the uniform covering of peat to a collection of isolated "peat hags" (Plate 20). Eventually the whole of the peat is removed, the underlying rock laid bare and finally colonised by siliceous grassland. The extensive plateau of "the Peak" itself is an excellent example of such a retrogressive moor. The existing vegetation is *Vaccinietum Myrtilli*, but the peat is composed exclusively of the remains of *Eriophorum*.

The arrows in the diagram on p. 196, showing the relations of the "silicion" and "oxodion" of the district, indicate a genetic succession from oak wood at the one end through scrub, siliceous grassland, heather moor, cottongrass moor, retrogressive moor and bare peat to subalpine pasture; but the text does not suggest that such a long succession has actually occurred. The conclusion to be drawn from the author's discussions is rather that the slopes of the valleys find siliceous grassland or heather moor their natural term, while the higher plateaux have never been forest-covered but have presumably been occupied by wet peat associations, such as the cottongrass moor, since the glacial period.

The final chapter deals with the culture associations of the cultivated land occupying the bottoms and sides of the larger valleys and most of the limestone plateau. The cultivated land of the district falls into the wheat zone below six or seven hundred feet and the no-wheat (oats) zone above that level. The upper limits of wheat cultivation vary however a good deal on the different soils; and on the limestone "not a single case of wheat cultivation has been observed." As is usual in the west and northwest of England the cultivated area both above and below the wheat limit is very largely under permanent pasture. There is no evidence of any great reduction or increase of cultivation nor that the cereal crops of the district ever had any but a domestic importance.

The artificial associations of trees or plantations occur usually on the site of former grassland. *Pinus sylvestris*, *Larix decidua* and *Fagus sylvatica* are the species most commonly planted. Many of the higher plantations have not succeeded and some are quite derelict, having been made on entirely unsuitable soil. The author points out that while the calcareous grassland and much of the siliceous grassland is quite suitable for planting at once, the moorland areas covered with

deep peat are entirely unsuitable, unless the peat is first removed. Even then it may be doubted whether trees would flourish on the high wind-swept plateaux with their very cool moist climate. The peat of these plateaux could however, as the author suggests, undoubtedly be utilised in various ways.

The book closes with two appendices, one setting forth the author's view of the relationship of the various kinds of vegetation dealt with, and the other giving a conspectus of the British plant communities that have hitherto been recognised.

The natural terrestrial vegetation of the district is divided into the formation of calcareous soils (calcarion), the formation of siliceous soils (silicion) and the formation of acidic peat (oxodion). There can be no doubt that these correspond with the broad phenomena of the vegetation of the district, but whether the first and second will eventually be found capable of forming part of a universal system of nomenclature of vegetation we think may be open to some question.

It is impossible to discuss the formation concept at large in the course of a review, but there are two points about the author's concept of formation which raise doubts in the reviewer's mind. The first is whether the habitats of the "calcarion" and of the "silicion" respectively are really so essentially constant as is supposed, in view of the wide differences between the plant populations of the woodland and of the grassland that occur on each of these soils. Till the habitats have been far more accurately analysed than has yet been done the plant populations are the only exact tests we have, and a widely different plant population in the same region is in general indicative of a distinctly different habitat. It is not of course for a moment denied by the reviewer that grassland has followed woodland in succession, but in the course of the succession it may be that the habitat has been more modified than is suspected. The author's conception—an admirable one—that a plant-formation has a life-history, that it is born, reaches maturity and decays, its maturity being marked by its "chief association" (p. 21), does not square with the existence of *two* chief associations at different stages of the succession—one of woodland and the other of grassland. This would rather suggest the rise of a new formation of grassland displacing woodland, like that which is admitted to occur when heathland or moorland replaces woodland.

The second point is connected with the well-known fact that the effect of edaphic factors on vegetation is greatly altered by climate. This is admitted of course by the author, who meets the difficulty by dividing the world into separate climatic and geographical regions, within each of which he would recognise his plant-formations. But here we shall probably encounter serious difficulties if we are not to erect artificial barriers separating entities essentially alike. An instance may be found in Skene's recent suggestion (*Journal of Ecology*, **1**, p. 94) that the beechwood of southern France is essentially the same thing as the typical chalk beechwood of southern England, though the former may be developed on siliceous soils while the latter is confined to calcareous soils. Much more comparative investigation must be undertaken before we can reach a sound result on such questions, but if the type of beechwood in question should be found to be essentially a unity, from the Mediterranean to the British Isles, to say that part is developed in one climatic region and part in another will be no valid justification for artificially splitting up a natural plant community.

Meanwhile we may admit that Dr Moss's conception has done great service in

making possible an orderly and intelligible classification and recognition of the relationships of British plant communities, even if it cannot be regarded as final.

The photographs illustrating the text appear to be without exception excellent, and the majority of them are well reproduced; but in some cases too coarse a screen has been used for the half-tone blocks, and in several cases the whole scale of tones of the block is much too light and badly deficient in contrast.

The two coloured vegetation maps which accompany the book are beautiful examples of cartography, and the colours employed are clear and for the most part well contrasted, though the pale greens, blues and yellows are very difficult to distinguish by artificial light.

The book contains a larger number of typographical errors and of minor inconsistencies (to some of the more important of which attention has already been called) than is quite permissible, suggesting haste in revision and proof correcting. One of the most striking of these minor blemishes is to be found in the two footnotes on pp. 146 and 151, in one of which we are told that 0.22 gallons = 1 litre, while in the other it appears that 1.76 gallons = 1 litre! The nomenclature of the species of plants is not always uniform, e.g. on p. 84 a certain plant is called *Calamintha vulgare* [sic] (= *C. Clinopodium*), on p. 74 *Satureia vulgaris* (= *Calamintha Clinopodium*), while on p. 130 it is called *Satureia Clinopodium*. We all know that the names of plants nowadays undergo rapid changes which are often startling and disconcerting to those of us who are not systematists, but it may be respectfully suggested that the author should make up his mind what he wants to call a plant at the moment before he actually publishes his book.

On p. 206 mention is made of a plan of drawing a distinction on coloured vegetation maps between cultivated land with a high and with a low proportion of permanent pasture; and it is stated "that the maps which accompany the present volume are coloured on this plan." But on turning to the maps we find that this is not so.

Such matters as these are of course comparatively trivial and they are only mentioned because we have learned to expect from the author a very high standard of scholarly accuracy and precision.

This contribution to our knowledge of British vegetation is indeed an exceedingly valuable one, partly because of the author's masterly grip of his subject-matter, and partly because the limitations of space not being so closely drawn as in previous primary survey memoirs, there has been room for a broader and more leisurely discussion of the whole subject and especially of many of the wider questions involved. Whatever the points on which we may disagree with or feel impelled to question the conclusions of the author, he has laid all ecological plant-geographers under a real debt of gratitude. British ecology will we fear be very much the poorer through the withdrawal of the author's logical and incisive mind from vegetation survey to the domain of floristic and taxonomic studies. Floristics and taxonomy, however, will be so much the richer, and the floristic side of ecology and plant geography has gained a much needed accession of strength from one who has trained himself to such very good purpose not only in the discrimination of critical forms but in the practical study of vegetation.

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