

ECOLOGICAL NOTES ON WISTMAN'S WOOD AND BLACK TOR COPSE, DARTMOOR.

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IN February of this year (1921) a paper dealing with the physical features of Wistman's Wood, Dartmoor, was read before the Linnean Society of London by Mr. Miller Christy, F.L.S., and the present paper arises out of a remark made during the discussion that followed, that it was to be hoped some local society would study the Flora of Wistman's Wood from an ecological point of view. The remark suggested to me that I might embody some observations of my own on Wistman's Wood and Black Tor Copse, and offer them in the form of a paper to the Devonshire Association.

Wistman's Wood has so long been the happy hunting-ground on Dartmoor of wondermongers and romantic writers that one almost feels some apology is desirable for making an effort to account on scientific lines for its existence and abnormal growth. The two woods dealt with in this paper have much in common, and are advantageously studied together, as the edaphic conditions are practically identical. Wistman's Wood, as is well known, is a narrow strip of scrub oak extending for about half a mile along the bank of the West Dart, under Longaford Tor, facing roughly S.W. Black Tor Copse is a similar strip of scrub oak on the right bank of the West Oke-ment, also facing about S.W. Both assemblages of trees occur amongst accumulations of huge granite boulders, the debris of Longaford Tor in the one case and of Black Tor in the other, and both are situated at about the same altitude, Wistman's Wood ranging from a little below 1250 to a little below 1350, and Black Tor Copse from 1220 to about 1400 feet, O.D. In both cases the continuity of the woodland strip is broken by bare patches

of moorland strewn with granite blocks of unimportant dimensions, and not comparable in size with those amongst which the trees are situated. Above both woods the ground slopes at a moderate angle, which is succeeded by a rather precipitous slope upon which the woods are situated, so that they have somewhat the feature of "hanging" woods; though perhaps they come nearest in character to the "scar" woods of the Pennines. Between the wood and the river in each case is a comparatively flat portion, covered with bogs and marshy ground. Both woods are composed of oak and occasional mountain ash. Mr. Miller Christy, in his paper, stated that the oaks were all *Quercus pedunculata*, and my opinion at first was that they were this species (or sub-species of *Q. Robur*, as some authors consider it). A further examination of the trees, however, lead me to doubt if the woods were composed entirely of this species. One tree I came across in Black Tor Copse was certainly *Quercus sessiliflora*, as old acorns not fully developed were on the tree to aid determination; but the characters of some of the trees suggest that hybrids may occur, and at the present time I hesitate to state definitely that the woods are composed entirely of *Quercus pedunculata*. It would, of course, be of interest to find that a wood like Wistman's was composed of *Q. sessiliflora*, that is, if this oak is the original native oak of England, as some botanical authorities state, and as was pointed out by Dr. E. J. Salisbury at the reading of Mr. Christy's paper. Furthermore, Messrs. Moss, Rankin, and Tansley state (*The Woodlands of England*) that *Q. sessiliflora* is the dominant oak on shallow siliceous soils. It has been said that the trees in these woods do not bear acorns, but Mr. Miller Christy states that acorns are produced, though few in number. I have never visited the woods late enough in the season to speak definitely on this point, but I saw on several trees half-grown acorns that apparently had not come to maturity, and several seedling oaks of a few inches in height that I carefully dug up were certainly independent plants and not suckers from the roots of older oaks. In both woods young oaks are numerous and healthy; in fact, trees of all ages are present, so that it becomes obvious that a constant succession of generations has been maintained. Wistman's Wood has so often been referred to as a wood of ancient trees that this statement appears necessary.

The average height of the trees is, as near as can be ascertained, the same in both woods, 15 to 20 feet, some less, very few more; the trees in Wistman's Wood being perhaps of somewhat less stature than those of Black Tor Copse (Mr. Christy gives 10 to 15 feet). The foliage of the trees in both woods is normal and vigorous, the leaves giving measurements approximating those of normal oaks (4 inches long by 2 inches wide being a measurement generally obtained), but internodal growth showed a reduction of 50 per cent compared with that of oaks growing around Bridestowe. This one would look for, but the large size of the leaves in both woods is somewhat puzzling, as a reduction in leaf size is usually associated with xerophytic conditions.

WISTMAN'S WOOD.

It may be stated at once that the aged trees in Wistman's Wood far surpass those in Black Tor Copse in their circumference and in their fantastic branching. At the same time allowance must be made for the truly astonishing growth that covers their trunks and branches, which gives them a fictitious appearance of size only recognized when some trunk has been cleared to permit of the measuring tape being used. Mr. Miller Christy gives the average circumference of the trunks as being 40 to 60 inches, the largest he measured being 70 inches. My own measurements of the circumference of twelve selected trees in various parts of the wood are, in inches, 72, 75, 77, 78, 60, 93, 60, 72, 82, 72, 77, 64; the largest measured having a circumference of 102 inches. These measurements were made about 12 inches above the ground, when all adventitious growth had been removed. Measuring these trees is not quite the simple matter it seems. When all adventitious growth has been removed it is often difficult to determine which of perhaps half a dozen stems should be regarded as the main one, and how far one is correct in judging that the base has been reached. One of the most arresting features of these woods is the close intimacy of trees and boulders. They are dovetailed together in such extraordinary closeness, and are masked so completely by the growth upon and around them, that it is often difficult to determine where the tree ends and the rock commences. In one case where a small oak appeared

to be growing altogether upon the flat surface of an enormous boulder I was able to lift the entire tree with its growth of bilberry bushes, wood-sedge, and moss clear of the granite surface. Only the most careful examination revealed a single root creeping down the side of the boulder and entering the ground. For my own part I am far more impressed by the extraordinary way in which these trees sprawl over the granite boulders and grip them in every direction by their stems and roots than by any other feature of the woods. It probably is due to this anchorage that the trees withstand so successfully the fierce winds that sweep across Dartmoor. In one instance the stems covering the upper flat surface of a granite boulder were roughly interlaced in the manner of wicker-work, the whole being covered with a dense growth of *Vaccinium Myrtillus* and mosses.

The wood is divided into three portions, the intermediate portions being open moorland strewn with small boulders, quite unlike the huge granite blocks that exist within the wood. The association between the large masses of granite boulders and the oak scrub is one of the features that first strikes the investigator. Even outside the wood proper if a pile of these large boulders exists an oak is almost invariably found growing amongst them, so that the open spaces of moorland found between the woods may be seen dotted with trees occupying these aggregations of granite boulders. This applies both to the woods on the West Dart and those on the West Okement. In explanation of the association, Mr. Christy suggests that the boulders protected the seedling oak from being destroyed by grazing cattle, and such was my own opinion when first investigating these woods. In the New Forest the close companionship that exists between hollies and oaks in many parts of the Forest naturally suggested the protection afforded by the holly from grazing cattle, which permitted the seedling oak to grow up in security. A like reasoning applied to the association of the boulders and oaks on Dartmoor may, however, be fallacious, and better acquaintance with the woods dealt with in this paper leads me to doubt the correctness of my former conclusion, principally from the appearance of a small patch of woodland on the West Okement. This portion of Black Tor Copse is towards the upper part of the wood, and is growing on a space almost free from boulders, large

or small, the few present being of negligible size. The soil is a rich humus, and the trees are straight stemmed and of good height (probably 25 feet). It is quite easy to walk about upright amongst the trees, and cattle seem to use it for its shade. Such a wood could not have come into existence if it had required a "clatter" of granite boulders to protect its seedlings, as none whatever are present. Furthermore, above the woods constituting Black Tor Copse, in suitable spots, many young seedlings, 6 or more inches in height, are at present growing on the open moorland unprotected by any boulders although cattle are freely grazing over the moor where they grow. In looking for an explanation of this association between boulders and trees it occurred to me that the protection afforded by the blocks to the young seedlings was not from grazing cattle, but from the fierce and cold winds that sweep across the moor. In support of this explanation I would point to the fact that both woods are exposed to the full force of winds blowing from the N.W., and if a careful examination be made of those trees in Wistman's Wood situated at the extreme end, facing Crow Tor, the effects of wind-pruning are very obvious. One conspicuous example is an isolated oak at the edge of the wood, consisting of stem and a single bough, the bough leaving the stem at right angles in the direction N.W.-S.E. The majority of the trees on the N.W. extremity of the wood show severe wind-pruning from the N.W. winds and growth along an axis N.W.-S.E. It may be objected, that if oak seedlings are to be found growing at the present time undefended by granite boulders this explanation is not sufficient, but the young seedlings mentioned above as growing on the open moorland are on the immediate fringe of the parent wood, whose trees form an effective wind-screen. Moreover, they are screened by *Calluna* and *Vaccinium* bushes in the immediate vicinity. In the early stages of Wistman's Wood and Black Tor Copse no woods existed to act as a wind-screen, and the shelter of these granite boulders would be essential. My present opinion, therefore, is that the original wood commenced within the shelter of the huge granite blocks and gradually extended its boundaries by the shelter afforded to seedlings by the parent trees. Anyone who has spent an early spring day in Wistman's Wood, with a piercing wind from the N.W., will, I think, be quite

prepared to credit such a wind with unlimited powers of destruction.

Reference has been made to the vegetation covering the trees and rocks in Wistman's Wood. This contributes quite as much to the unique character of the wood as does the fantastic branching of the trees. The most obvious feature is the luxurious growth of *Juncoides sylvaticum*, which occurs in very large tussocks, and even supports itself on the branches of the trees where sufficient humus has accumulated. The Bilberry (*Vaccinium Myrtillus*) is the next predominant plant, this also having invaded humus-laden branches. The dominant Flora of the trees and boulders is: *Vaccinium Myrtillus*, *Sedum acre*, *Oxalis acetosella*, *Potentilla Tomentilla*, *Anthoxanthum odoratum*, *Blechnum spicant*, *Polypodium vulgare*, *Juncoides sylvaticum*, *Digitalis purpurea* (one exuberant writer on Wistman's Wood speaks of "the groves of foxgloves that rise even above the tops of the oaks themselves"!), *Eurhynchium myurum*, *Dicranum scoparium*, *Hylocomium loreum* (fruit plentiful), *Ulota crispa*, *Antitrichia curtipendula* (in fruit). With regard to the last-named moss, Mr. H. N. Dixon, in *The Student's Handbook of British Mosses*, says: "This plant grows nowhere, perhaps, more finely in our islands than in Wistman's Wood, Dartmoor, where it clothes the limbs of the old and stunted oaks with large masses, hanging down to the length of a foot or more, and producing fruit in abundance." In addition to the plants named many species of Lichens and Hepatics occur. On the ground amongst the boulders are *Rubus* (sp.) and *Lonicera Periclymenum*, which in some places form thick growths. *Stellaria Holostea* is frequent; *Endymion nutans* and *Geranium Robertianum* are occasional. The principal ferns on the ground are: *Lastrea Filix-mas*, *Athyrium Filix-fœmina*, and *Pteris aquilina*. The amount of humus gradually accumulated on the rocks and tree branches is really remarkable, and, of course, accounts for the masses of vegetation (which is naturally of a xerophytic type); one boulder had a depth of 2 inches of rich humus, and some branches had similar depths. On one tree branch sufficient humus had accumulated to allow of the growth of quite a sizeable mountain ash, and small beds of *Oxalis acetosella* were observed also on the branches. As the edge of the wood is reached the typically sub-alpine woodland moss, *Hylocomium loreum*, is replaced

on the boulder tops by *Racomitrium lanuginosum*, which flourishes so luxuriantly on the open moor. The species mentioned are, of course, the dominant species only of a very considerable flora, principally Cryptogamic, peculiar to the wood when compared with its surroundings.

In dealing with the trees themselves one notices two types. The one type (Standard) has an upright stem rising straight from the ground for about $4\frac{1}{2}$ feet before commencing to branch; the other type (Coppice) commences to branch at the surface of the rock. This latter is the more frequent type, and is probably the one that gives to the wood its distinctive features. Although these trees appear to branch immediately from the surface of the rocks there may be a short stem hidden in the crevices of the group of boulders, but only laborious and extensive clearing away of humus and vegetable growth could definitely decide this matter. As the branches grow and increase in age they apply themselves more closely to the rock surfaces, in some instances even deflecting themselves, growing down the side of the boulder and eventually resting upon the surface of the ground. They are, in fact, trees that have been compelled to abandon the upright mode of growth by force of xerophytic conditions, and have in consequence assumed a prostrate habit. Here and there seedlings rooted in a greater depth of soil, and screened from fierce winds by the older trees, have maintained in some degree the upright habit. That some of these trees are of great age cannot be doubted, and the oldest and most contorted trees seem more or less confined to the largest group of boulders. Emphasis is needed upon the fact that Wistman's Wood is an assemblage of trees of all ages, from seedlings to old, fantastically distorted trees of, perhaps, 300 years of age; 500 years has been suggested. Mr. Miller Christy says: "Probably well over 500 years, as has been proved by cutting sections in order to count the annual rings." (It was, however, pointed out by Dr. D. H. Scott in the discussion that followed, that in some years two rings might be formed.) In sheltered parts of the wood healthy young oaks are growing with perfectly straight stems 5 feet in height and 12 inches in circumference. Some of the older trees are badly galled with *Cynips Kollari*, which appears to delay their foliation and cause a reduction in the size of the leaves.

Mingled with the oak trees are occasional mountain ash trees, which deserve a passing notice on account of their extremely close companionship with the oaks. Often they grow from the centre of the radiating oak stems, which is easily accounted for, as a considerable depth of humus nearly always accumulates in such situations, which would form a sufficient bed for the germination of any seed dropped therein. The most remarkable instance of oak and mountain ash association occurs on the northern fringe of the wood. Viewed from the outside of the clump, the mountain ash covers an area about equal to that of the oak. The main stem, 23 inches in circumference, appears to grow directly from the main stem of the oak, and after clearing away the considerable growth of vegetation which loaded the stem at its junction with the oak, I was able to satisfy myself that it did actually enter the oak stem, which had closed completely around it. On the under part were the scanty and decayed remains of the original oak branch. The branch had probably been in a decayed condition when the seed of the mountain ash was dropped upon it, the vigorous young plant eventually grafting itself upon the oak; unless (which is a matter that I could not ascertain in spite of considerable work), it passes completely through the oak stem and its roots have reached the soil on the other side. It now, however, forms a bush equal in dimensions with the oak it consorts with.

BLACK TOR COPSE.

Black Tor Copse on the right-hand bank of the West Okement is about three-quarters of a mile in length and of varying breadth, averaging perhaps 500 yards. Towards the western extremity of the wood the ground slopes at a comparatively low angle; but near the eastern end the trees occupy a very precipitous position of the valley, amounting almost to a rocky wall. Here the wood is literally a "hanging" wood, and viewed from the moorland above is very striking. The wood here, as at Wistman's Wood, is associated with huge granite boulders, the debris of Black Tor. The soil is a rich humus, inhabited by occasional earth-worms (*Lumbricus*, sp.); towards the eastern extremity, however, where the wood gradually thins out to scattered scrub, the soil becomes more peaty and no worms were seen. It has already been said that the

trees here are inferior to those of Wistman's Wood in their fantastic branching and appearance of extreme age, nor do they reach the girth of the Wistman's Wood oaks. The circumference of twelve average-sized trees measured were, in inches : 26, 21, 21, 35, 26, 40, 20, 19, 29, 33, 21, at 12 inches from the ground. Here, as at Wistman's Wood, are two types : the "Standard" type, with stem branching at about 24 inches from the ground, having a basal circumference of 26 inches ; and the "Coppice" type, branching at or close to the surface of the ground ; this type being extremely well represented at Black Tor Copse. One specimen at the eastern end of the copse is as fine in its way as any tree in Wistman's Wood, though it lacks the obvious indications of age that attracts the general public. The stems radiate from the ground in a complete circle, being decumbent at their bases, then gradually curving upwards until they reach a height of about 7 feet ; here is formed a flat or slightly dome-shaped leafy canopy of, perhaps, 20 feet in diameter. The branches near the tops of the stems exhibit an amazing wealth of small interlaced twigs. It is possible to crawl into the centre of this exceedingly interesting example of scrub oak, the centre being occupied by considerable blocks of granite from which the stems roughly radiate. Another notable tree about the middle of the copse is a perfect miniature oak tree, with "trunk" rising 24 inches from the ground to the commencement of the branches, and having a circumference at the base of 26 inches. The carefully measured diameter of its slightly dome-shaped leafy canopy was 18 feet. The two specimens just described may be regarded as types of the trees met with in Black Tor Copse and Wistman's Wood, though such perfect specimens were rarely seen.

Old oaks in these woods give off "suckers," as in the case of the elm, and this fact is rather puzzling when attempting to decide which stems belong to the original tree. To assure myself of the fact I carefully uncovered one of these suckers until its connection with the parent stem could be observed. It is difficult to determine without actual examination between seedling and vegetative stems.

High above the copse on the open moor, at an altitude of about 1500 feet, one encounters a very interesting growth of oak in the form of low, matted bushes, 12 to 18 inches high, densely branched, and, which is striking,

with leaves of normal size. This growth, of course, corresponds with the nanism exhibited by *Pinus sylvestris* and other trees growing at alpine heights.

The boulders in Black Tor Copse have a varied xerophytic association similar to that of Wistman's Wood; but the sub-alpine moss, *Hylocomium loreum*, is here certainly in greater profusion, and on some flat-topped rocks is wonderfully profuse and covered with capsules. *Antitrichia curtipendula* is as plentiful on trees here as it is at Wistman's Wood. *Hypnum Schreberi* is dominant on the ground between the boulders. *Juncoides sylvaticum* here seems not to form the considerable tussocks it forms at Wistman's Wood. *Rhinanthus Crista-galli* occurs sparingly. The floral association is almost identical with that described for Wistman's Wood.

In connection with Black Tor Copse reference should be made to the spot in the West Okement Valley known as The Island of Rocks. This occupies a narrow ravine further down the valley, where the river descends by a series of cascades from the upper valley in which Black Tor Copse is situated. The valley at the Island of Rocks is very narrow, with precipitous sides, upon which grows a wood composed of birch, mountain ash, hazel, willow, thorn, and oak (two oaks being quite large, well-formed trees of lowland type). An examination of the soil showed it to be a rich, fairly deep, sandy humus, very different from the soil higher up the valley whereon the dwarfed woods occur. The wood in this ravine exhibits none of the xerophytic characters of Black Tor Copse; it is lowland woodland in its normal growth, although situated less than a mile from the stunted trees above it. The reason is obvious. Sheltered from the fierce winds by the deep, narrow ravine, its roots in a comparatively deep, rich, and well-aerated soil, it is immune from the xerophytic conditions that interfere with normal growth. It is very interesting to the ecologist to work up the West Okement Valley from The Island of Rocks to the extreme limit of the trees approaching Lints Tor. From the rich, well-developed trees of the Island of Rocks he passes to the lower extremity of Black Tor Copse, with trees exhibiting xerophytic characters. As the valley is ascended the xerophytic conditions become more severe and the woodland becomes thinner and more intermittent, until it eventually ceases with, here and there, an occasional

dwarf scrub. Returning down the valley high up under Fordsland Ledge and Black Tor at, say, an altitude of 1500 feet, he comes upon patches of low, densely-branched oak, rarely more than 15 inches above the ground, and occasionally meets with a small stem, 3 or 4 feet high, dead and rotten, but with a cushion-like growth of branches and leaves close to the ground, where sheltered by stones and ling from the desiccating effects of the strong winds. The impression created upon my mind by a study of Black Tor Copse was, that it is a more recent assemblage of trees than Wistman's Wood, but of identical character and requiring only age to make it a similar wood.

ECOLOGICAL SUMMARY.

We are not concerned here with the many romantic descriptions, indulged in by various writers, even of modern times, of the two strips of woodland with which this paper deals. To the ecological student Wistman's Wood is more interesting than wonderful, and its counterpart may be found in all countries, from Arctic to Equatorial, wherever xerophytic conditions are dominant. In Arctic countries are dwarf bushland of birch and willow, and in Central Europe dwarf rhododendron bushland. In Lapland the spruce is a creeping shrub; the Scots pine at high altitudes, even in our own country, is a dwarf shrub; and the Mediterranean oak forest is composed of a species of oak which forms low, shrubby bushes. In some instances Wistman's Wood appears to be cast quite into the shade, for it is said that, "Whole mountain slopes or ridges may be clothed with dark green interlacing masses of elfin-wood so densely as to be impenetrable, or often more easily to be passed over than through" (Warming, *Ecology of Plants*). And in all this elfin-woodland the feature that makes Wistman's Wood so conspicuous is predominant, short-stature, and distorted branching. Indeed, Warming's description of this type of woodland might have been written of Wistman's Wood and Black Tor Copse, for he says: "An erect stem is not developed, the stems creep under the ground, descend slopes, and are clothed with moss and other plants." "This elfin-scrub is a xerophytic type of vegetation which is well able to withstand, on the one hand, rapid transpiration, intense sunlight, and cutting cold winds; and on

the other hand, the exceeding moisture of a wet soil, frequent and dense mists, falls of rain and of snow" (Warming, *loc. cit.*). Hence it will be seen that Wistman's Wood conforms both in character and conditions to a type well known and widespread. Two instances may be given illustrating the influence of edaphic conditions. On Dartmoor *Salix repens* forms low, creeping plants closely pressed to the ground and scarcely observable unless the fluffy catkins are present, yet on Woodbury Common in the same county this species is a bush of some size; and, within a short distance of Cranmere Pool, on the sour humus of the extensive peat beds, is a small mountain ash, a few inches in height, leading a solitary and very precarious existence, while only three miles away, in the sheltered ravine through which the Rattlebrook flows, on a small patch of sandy loam, is probably the finest individual on Dartmoor of the same species, with a stem 54 inches in circumference.

Both Wistman's Wood and Black Tor Copse occupy strips of moorland bounded on the higher and lower sides by ground that is unfavourable to their extension. On the higher side is open moorland with extremely xerophytic conditions, colonized by *Nardus stricta* (in some places forming a pure Nardetum), *Calluna vulgaris*, *Vaccinium Myrtillus*, *Festuca ovina*, and *Agrostis vulgaris*; while on the lower, between the wood and the river, is a strip of ground covered with bogs and marsh. It will be seen, therefore, that the woods lie between ground that is physically dry on the one hand, and physiologically dry on the other, and that the strip the wood occupies, though one of the contributory causes of the wood's xeromorphy, is sufficiently fertile to support its existence. Mr. W. Crossing, in writing of Black Tor Copse (*Guide to Dartmoor*), remarks that there is documentary evidence to show that this copse was at one time much more extensive, and that it may possibly have been continuous with The Island of Rocks. Now, between The Island of Rocks and Black Tor Copse at the present time is a stretch (about three-quarters of a mile) of more or less boggy ground upon which no oaks would grow, and it scarcely seems possible that in the comparatively short space of a few hundred years the character of the moor would alter so much as to allow of the extermination of a strip of woodland by successfully competing bog conditions; in fact,

my own impression is that Black Tor Copse at the present time shows indications of extension rather than reduction ; young trees are numerous and vigorous, and where seedlings grow on the screened immediate fringe of the wood they seem capable of holding their own against the fierce cold winds that sweep across the wood from the N.W. This wind has undoubtedly had much to do with the stunted and fantastic shapes shown by the woodlands. Though screened from the cold easterly and north-easterly winds by Longaford Tor in the one case, and Black Tor in the other, they are both open to the N.W. wind, and it is easy to see the effect of this in those trees so severely wind-pruned by winds from this direction. A strong wind increases transpiration, and this would further contribute to a stunted growth and xerophytic condition. Further, one has to recognize the fact that in some years the growth of the trees would be little or none by reason of these N.W. winds. A striking example of their influence may be seen at Black Tor Copse, on the upper fringe of the wood, where the trees are fully exposed to the sweep of the N.W. winds ; it is a small oak tree that, in some recent year, has had all its annual shoots killed soon after their production, so that the surface of the present leafy canopy is well below these dead shoots, which remain projecting above, all over the surface of the tree, as dead and leafless twigs. Subsequent branching would take place laterally, below these dead twigs, and so eventually contribute to the fantastic branching of the tree.

It is well known that in accounting for the presence of these patches of scrub oak on Dartmoor a good many writers, and most "moor-men," assume the existence of former extensive woodland of which these patches are the surviving remnants. As far as the Dartmoor of the present is concerned such an explanation is altogether inadmissible on ecological grounds. The same belief in former extensive woodland is held with regard to the Yorkshire moors by the older inhabitants, and they account for the present absence of woodland by assuming that the iron-smelters of the past exterminated the woods in smelting the ore. On Dartmoor it is assumed to have been the tanners who exterminated the woods. One has to admit, however, that in the geological past Dartmoor may have been more extensively wooded than it is at the present time ; but it would almost certainly have been

with birch and willow, and before the great deposits of peat took place. Although the birch is an accommodating plant with regard to the soil it lives in, a time would come when it would be unable to hold its own against the advancing conditions of bog and swamp; with the continuous increase of peat and sour humus its extinction would ensue. But with respect to the Dartmoor of the historical period, and, indeed, long before this period, no extensive woodland could have covered its upper portions. The numerous remains of prehistoric man's occupancy support the ecological argument that Dartmoor has not been a wooded area since the accumulation of the great deposits of peat.

The presence on Dartmoor of the woodland dealt with in this paper is not difficult to account for, without relying on the problematical existence of former extensive woodland. In North America occur strips of what have been named "fringing forest," which are strips of woodland confined to river banks, and which have invaded upland districts where xerophytic conditions prevail. These have gradually pushed their way from the lowland woods and acquired xerophytic characters where the edaphic conditions were unfavourable to their normal development. This, I think, is the explanation of the presence of woodland in such elevated and exposed parts of Dartmoor as those occupied by Wistman's Wood and Black Tor Copse. The woodland in the West Okement Valley, from The Island of Rocks to the last scrub oak under Fordsland Ledge, is a story of invasion against hostile forces, of a pioneer who sets his face to the wilderness and arrives at his destination with the marks of the journey upon him.