

THE ANCIENT DWARFED OAK WOODS OF DARTMOOR.

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SYNOPSIS.

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I and II by MILLER CHRISTY.

III, IV, V, VI, and VII by HANSFORD WORTH.

I. INTRODUCTORY.

ONE does not usually associate the wild open wastes of Dartmoor with woodlands of any kind. Yet the fact remains that two of the most remarkable woods known to exist lie within its bounds. These are Wistman's Wood, near the centre of the moor, and Black Tor Beare (or Copse), near its northern boundary. Piles Wood, in the southern part of the moor, is of somewhat similar type.

All these woods are so exceptional in their main characteristics as to be unique, not only in Britain, but also probably in the whole world. They are remarkable, not for luxuriant tree-growth or great extent, but for their very diminutive trees and extremely limited areas; while the excessive humidity of the region in which they exist and other extraordinary conditions amid which they grow add characteristics which can only be described as weird.

Wistman's Wood, the smallest but most remarkable of the three, has long been known, and not a few writers have given more or less casual descriptions of it. The earliest is that by Tristram Risdon, of Winscott, in North Devon, who wrote a description of his county about 1620, just over

three centuries ago, and this has been printed in at least three editions. He describes the wood as one of the "three remarkable things" to be seen on Dartmoor (26, p. 76, and 27, p. 223). The Rev. Samuel Rowe declared (28, p. 175), a trifle fulsomely, that "The whole world cannot boast, probably, a greater curiosity in sylvan archæology than this solitary grove in the Devonshire wilderness. . . . The ancient storm-stricken oaks of Wistman are without recorded parallel. . . . There is something almost unearthly in their aspect." The late Canon Ellacombe described it as "certainly the most weird and curious wood in England, if not in Europe" (13, p. 193). The latest and best general description of it is that by Mr. William Crossing (6, pp. 19-23). An excellent account of it from the point of view of its plant ecology, by Mr. G. T. Harris, has appeared since most of the present article was written (10, LIII, pp. 232-45). Others who have written on the wood are noticed hereafter.

Yet the fact remains that all descriptions of the wood hitherto published are either inadequate, misleading, or otherwise unsatisfactory. Some of them are so pervaded by poetic fancies that they are ridiculous as serious accounts of the wood and its peculiarities. Such is the case, for instance, with N. T. Carrington's sketch of it (5, pp. 55-6), which shows him to have been a very fully-licensed poet. It is still more the case with the remarks of Mrs. Bray (1, pp. 85-102), the friend and correspondent of Southey. This lady's mind was obsessed by ideas of Druids, who (she imagined) dwelt in the wood, there offering up sacrifices and gathering mistletoe from the easily-reachable branches of the dwarf oaks. She adds an ode "To Wistman's Wood"!

Black Tor Beare, though the larger of these two woods, is far less known and has received little more than passing mention from local guide-book writers and topographers. The same is true to an even greater extent of Piles Wood.

All three woods lie, curiously enough, in an almost straight line across the moor, and each about nine miles from its nearest neighbour. Only Wistman's Wood lies within the bounds of the ancient "Royal Forest of Dartmoor."

It may very well be that these woods are the last remaining examples of a limited number of similar groves which

flourished formerly in some of the more sheltered combes on the moor and very likely were destroyed by the early "tanners" in the course of their smelting operations, just as the ancient oak woods of Sussex were destroyed by the iron smelters in the sixteenth century. The Members of the Geological Survey have expressed the opinion (17, p. 60) that the tanners refrained from destroying Wistman's Wood chiefly because they realised that, even if they felled the trees, they possessed no means of transporting the logs across the surrounding "clatter." In any case, there is no reason to regard the woods as remnants of a primæval forest which once covered the whole of Dartmoor, as is commonly supposed locally (3, pp. 160-3); for there is no evidence that such a forest ever existed. Indeed, the conditions on the moor—especially as regards exposure to storm and exposure to grazing animals, and in a less degree as regards soil.

Of all these woods, it may be said that no competent writer, either Devon man or stranger, has yet published anything like an adequate account of them and their unique features, especially those of scientific interest.

As to our respective shares in the work, each of us, while admitting general responsibility for the whole, accepts special responsibility only for those particular portions to which his name is attached.

II. WISTMAN'S WOOD.

BY MILLER CHRISTY.

Briefly described, this is a very small wood of very ancient, but very stunted, oak trees growing, at a considerable elevation and without any visible soil, out of a pile of huge granite blocks which rests upon the steep side of the valley of the West Dart.

Most of those who take interest in the things of nature—even those dwelling in counties remote from Devon—have at least heard of this extraordinary piece of woodland. Yet those who have actually seen it are comparatively few; for it lies as nearly as possible in the very centre of what Devon folk generally call "the Moor," and in a part thereof so remote, desolate, and elevated that, unlike the rest, it has never been fully mapped by the Ordnance Survey, inasmuch as it has upon it neither houses, nor

mines, nor any trees other than those in the wood. It "enjoys," moreover, a particularly vile climate; for its normal weather consists mainly of excessive and continuous rain, with intervals of dense fog, and fine day now and then for contrast.

Yet one may approach by rail to within four or five miles of this secluded wood. By far the easiest means of access to it is by the line from Plymouth to Yelverton, where one changes on to the moorland railroad—one of the very strangest lines in Britain. By it, one has to travel eleven miles and a half, constantly rising and always winding round deep peat-bogs and high rocky tors, before one reaches its terminus at Princetown, only six miles from its starting-point, but some nine hundred feet higher, and in the very heart of the moor. So sinuous is the line that, at one point, as the train proceeds, one sees above one, a few hundred yards further up a steep hill-side, what looks like another railway altogether; and one has to proceed fully two miles further round the hill before one discovers that this is, in reality, the same line upon which one is travelling. Each train consists of two (or, at most, three) coaches only, and has to be provided with a small engine of exceptionally powerful type; for an ordinary locomotive has been found unequal to the task.

Leaving Princetown railway station (said to be the most elevated in Britain, standing at 1372 ft. above sea-level), one follows for about two miles an excellent road—the main highway across the moor—to Two Bridges, a village in the valley of the West Dart and consisting mainly of one good hotel, largely frequented by anglers. From here, one may actually see the wood, some two miles further up the river valley; but at this distance (and even nearer) it forms a very inconspicuous feature in the landscape and looks so like a patch of withered bracken that the stranger requires to have it pointed out.

From Two Bridges, one may proceed on wheels, if one has permission, a mile still further up the valley, as far as Crockern Farm, under Crockern Tor; but the road thither is rough and not to be recommended for wheeled traffic. Crockern Tor is the moot-hill of the early "tinnerns"; and on it is still the amphitheatre in which, anciently, the Stannary Court held its open-air meetings.

Crockern Farm is the last outpost of civilisation in this direction. Here there is a cow-shed—smelly, but convenient—in which the sanguine can take shelter (as I have done) on the chance that in time the rain may stop. Here, too, there is a gate in a rude stone wall; and whosoever has passed this emerges at once upon the open moor. For the remaining mile, one's own feet are to be preferred before those of even the most sure-footed moorland pony.

Once on the open moor, one should keep well above the narrow flat strip of boggy bottom land beside the river, and about half-way up the steep left shoulder of the valley. For the trip, one should select, if possible, a day during a spell of settled fine weather, so as to avoid both the dreaded moorland fog and an excess of moisture, both overhead and underfoot. At the time of my recent visit (6th October, 1920), immediately after exceptionally heavy rain, masses of fog hung menacingly around all the surrounding hill-tops and (though actual rain held off) I had to wade much of the way through water half-way up to my ankles, as it trickled down among the grass on the steep slope of the valley.

Arrived at Wistman's Wood, one finds it hung (so to speak) on the steep (eastern) bank of the roaring river, about three miles below its source among the higher tors and about six miles above its junction with the East Dart at Dartmeet.

The first thing which strikes anyone seeing the wood for the first time is its extreme smallness. It is, in fact, nothing more than a mere strip of woodland, of irregular shape, something less than one hundred yards wide, stretching along the side of the river valley for perhaps four hundred yards, parallel with the river, but about two hundred yards from it and one hundred yards above it. The wood is divided, more or less completely, into three portions, but only the small northern portion is entirely separated from the rest by an actual gap.

Hitherto it has not been possible to state the exact area of the wood; for no large-scale Ordnance Maps of the district have been published.¹ Through the courtesy of the Director-General of the Ordnance Survey, however,

¹ Former estimates of the area of the wood have varied greatly. Risdon, about 1620, described it (27, p. 223) as "some acres of wood and trees"; Polwhele, in 1796, declared (24, I, p. 94) that it covered "a space of about half an acre"; Archdeacon Froude, about 1827, estimated it (19, p. 1786) at "about two acres."

I am now able to state that its area is just four acres, as follows :

Northern portion	0·700 acre
Central portion	2·200 acres
Southern portion	1·100 acre
	—
Total	4·000 acres

—a queer little toy Noah's Ark kind of a wood, notwithstanding its wide fame and its many points of interest!

The accompanying panoramic view of the wood (Fig. 1) taken from high up on Beardown, on the opposite slope of the river valley, shows its extent, its slope, and in some degree the gaps dividing it into three portions.

The elevation of the wood above sea-level has already been mentioned as remarkable. As in the case of the area, however, it has not been possible hitherto to state its elevation with exactitude, though this might be guessed approximately at something over 1,000 feet, which is about the normal limit of oak woods in this country. Through the kindness of Mr. R. Hansford Worth, however, I am now able to state, on his authority, that its elevation ranges from just below 1250 feet O.D. up to 1390 feet in the North Wood, 1370–80 feet in the Middle Wood, and 1340 feet in the South Wood.

The wood grows out of what is known locally as a "clatter"—a vast heap of large, loose, angular masses of the characteristic Dartmoor granite—not a tor in any sense, but clearly the result of the disintegration of a tor in some long-past geologic age. Many of these rock masses are as large as an elephant's body or a taxi-cab.¹ They are piled together in the wildest confusion, and between them are numberless crevasse-like spaces—some large enough for one to fall into bodily: most large enough and deep enough to receive one's leg at full length. The whole "clatter" must have been, in early times, a favourite haunt of wolves and other wild beasts. To-day it swarms with adders in summer and affords at all times a safe refuge for foxes.

One of the strangest features of the wood is the fact that,

¹ They are often spoken of as "boulders," but are not such in the strictest sense of that term, being neither rounded nor transported.

FIG. 1.



By the courtesy of the Proprietors of "Country Life."

PANORAMIC VIEW OF WISTMAN'S WOOD.

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practically speaking, no firm soil whatever is discoverable within it. If, as the result of a slip, one's foot goes to the bottom of one of the crevasses, one feels there, not soil, but only other great rocks, such as one sees upon the surface. Probably, indeed, the huge blocks of granite extend many feet down. Yet soil there must be below, within reach of the roots of the trees. There are, however, in crevices beneath and between the granite blocks, accumulations of vegetable humus, and these, though very small in total amount, suffice to maintain a limited herbaceous ground-flora.

Naturally, in the circumstances described, crossing the "clatter" is not easy. It is, indeed (quite apart from the steep slope of the surface), more in the nature of a climb or scramble from rock to rock than of a walk, and nasty slips into the crevasses between the titanic sharp-edged blocks of granite are hardly to be avoided.

Having crossed the "clatter" and entered the wood, one finds progress even more difficult; for here the light is bad and the gaping spaces between the masses of granite are largely concealed by the ground-flora, consisting mainly of bramble (*Rubus*), bilberry (*Vaccinium myrtillus*), the large wood-rush (*Luzula sylvatica*), the common polypody (*Polypodium vulgare*), the broad-leaved fern (*Nephrodium dilatatum*), ivy (*Hedera helix*), and a very abundant crop of mosses, which thickly covers, not only the rock masses, but also the recumbent stems and branches of the trees. Bracken (*Pteris aquilina*), which is abundant among the rocks of the "clatter," also passes within the margin of the wood, but it does not enjoy the gloom of the interior. Perhaps the most prominent of all these plants is the wood-rush, which produces tussocks of immense size, right in the centre, under the shade of the trees. The bilberry is also very abundant.

The foregoing were the chief ground plants which were prominent at the time of my visit, apart from certain epiphytes, to be noticed hereafter; but, earlier in the year, there are others, and the late Mr. T. R. Archer Briggs, of Plymouth, collected in or immediately adjacent to the wood some forty species of plants, including the above (29, ed. 1902, p. 203 n.). In spring, the foxglove (*Digitalis purpurea*) grows sparingly among the dwarf oaks and is said almost to rival them in height. Other species, chiefly early-flowering, which were not to be

seen at the time of my visit, but the occurrence of which is recorded by Mr. Harris (10, LIII, p. 237), are: *Sedum acre*, *Oxalis acetosella*, *Potentilla tormentilla*, *Anthoxanthum odoratum*, *Stellaria holostea*, *Geranium robertianum*, *Scilla (Endymion) nutans*, *Lonicera periclymenum*, *Blechnum spicant*, and *Lastræa filix-mas*.¹ *Corydalis claviculata* also occurs, as Mr. Hansford Worth informs me. All these plants grow, of course, in the small accumulations of humus mentioned above, some of these being actually upon the low-lying stems and branches of the trees, as Mr. Harris has pointed out.

The mountain ash (*Pyrus aucuparia*) also occurs, but in limited number, and Mr. Hansford Worth informs me that there is at least one bush of holly (*Ilex aquifolium*). Both these species bear, it will be noted, brightly coloured berries which attract birds, especially members of the Turdidæ. These, eating the berries, distribute their seeds widely, and this fact is more than sufficient to account for the appearance of these two species of tree in the wood.

The foregoing list of species and the list of Cryptogams which follows represent, with practical completeness, the flora of Wistman's Wood. This flora is of highly unusual type and of much interest from the point of view of the student of plant ecology. It may almost be described as an *insular flora inland*; for, the wood being surrounded on all sides by a great extent of open elevated moorland, there can be and are no other habitats suitable for woodland plants within a considerable distance. Probably, indeed, most of the species enumerated are growing at least five or six miles from any others of their kind. Further, in view of facts already set forth, there can be no doubt that the flora of the wood is one of considerable antiquity.

The existence of this ground-flora is largely accountable for the fact that, while progress across the clatter surrounding the wood is a matter of some difficulty, even for the agile, progress through the wood itself is actually dangerous, unless care be exercised. Here, too, progress is rendered slower, owing to the necessity of crawling under or scrambling over the low-lying branches of the trees. Some of the guide-books, indeed, warn visitors not to venture into the wood, solely because of the risk of injury through slipping into the many deep openings half

¹ *Athyrium filix-fœmina*, recorded in error by Mr. Harris, does not, I believe, occur in the wood.

concealed by herbage ; while the Members of the Geological Survey admit (17, p. 61) that their "attempts to cross the wood, from end to end, had to be given up, after three hours scrambling and some bad falls." Nor are such warnings by any means to be despised, especially by the townsman or tripper ; and ladies who think it necessary to wear on all occasions the ordinary conventional skirt will be well advised not to enter the wood ; but the ardent naturalist, accustomed to scrambling about in the waste places of the earth, may neglect such warnings.

Immediately on entering the wood, one sees that it is essentially an oak wood. The oak is, in fact, not merely dominant, but constitutes practically a pure formation. No other tree exists in the wood in sufficient abundance to be spoken of as even sub-dominant. I saw, indeed, no other trees whatever, except three or four small bushes of the mountain ash (*Pyrus aucuparia*).¹ At a rough estimate, one may guess that the individual oak trees number between three and four hundred, all very uniform in type and crowded very closely together. The statement by Messrs. Elwes and Henry (14, p. 326, 1907) that the wood "contains a number, perhaps a thousand, of the most stunted and dwarf oaks in existence," certainly exaggerates the number.

But these Wistman's Wood oaks present an appearance very widely different from that of the tall, spreading, stately trees one usually sees in woods, parks, and hedge-rows. Though obviously of great age (even as the age of oak trees goes) and apparently quite healthy, they are all dwarfed, stunted, and gnarled almost beyond belief, reminding one inevitably of the diminutive trees, of Japanese origin, one now often sees grown in pots indoors for decorative purposes. Mr. Harris says (10, LIII, p. 234) that, while the leaves of these dwarf trees remain vigorous and of normal size (about 4 inches by 2 inches), the internodes are about half the length only of those of certain other oaks elsewhere ; but this appears to be an error of observation (see *post*, p. 332).

Yet some writers have exaggerated the diminutiveness (so to speak) of these trees. Thus, there is a local saying (8a, p. 147, and 18a, p. 306) that the wood "consists of five hundred trees five hundred feet high"—a statement which

¹ From what Mr. Harris says (10, LIII, p. 239), however, there must be more than I observed.

(as Mr. Crossing says (6, p. 21)) "is at least entitled to that latitude usually accorded to humour"; for it is intended to imply, in whimsical fashion, that each tree is no more than one foot high!

Turning to serious writers, we find that Risdon, writing almost exactly three centuries ago, spoke of them as "trees that are a fathom about and yet no taller than a man may touch to top with his hand (27, p. 223). The statement by Mr. W. Burt, of Plymouth (3, p. 166), that "none of these venerable foresters exceed 7 feet in height, but their circumference is great in proportion, being nearly the same," is incomprehensible.¹ The Rev. Samuel Rowe gives the average height as 10 feet (28, p. 177). Mr. J. Ll. Warden Page says (23, p. 134) that "the tallest cannot be more than a dozen feet in height"; also (22, p. 161) that "the average cannot exceed 9 feet"—both figures which are, I believe, under the mark. The Members of the Geological Survey assert that "none of the trees exceeds 15 feet in height" (17, p. 60). Mr. Harris gives the average height as from 15 to 20 feet (10, LIII, p. 234).

I myself estimated that, in height, most of the larger trees ranged from 10 to 15 feet, few or none being taller—an estimate which Mr. Hansford Worth regards as approximately correct, though he has measured one individual tree which, though it girths no more than 41 inches, stands over 26 feet in height.

Further, I ascertained by actual measurement that, in girth, most of the adult trees ranged between 40 and 60 inches, though one of the largest ran to 78 inches (about 26 inches diameter), thus slightly exceeding Risdon's "fathom about." Mr. Harris has measured thirteen selected trees, which he found to have (at 12 inches above the ground) the following circumferences: 72, 75, 77, 78, 60, 93, 60, 72, 82, 72, 77, 64, and 102 inches (an average of nearly 76 inches) (10, LIII, p. 234.) But many of the larger trees are of bushy or scrubby growth and present no measurable stem at all. In many, the lower branches rest on (and, in some cases, actually coil round) the moss-covered masses of granite. Thus, as Mr. Crossing has observed (6, p. 21), "one may very

¹ The statement by Mr. W. Borrer (19, p. 1757) that "none of them are now above 7 ft. high, though their trunks are more than 10 ft. in circumference," is also incomprehensible, probably through some misprint.

comfortably sit on the bough of an aged oak with one's feet touching the ground." One may use, too, whilst so doing, a natural footstool, soft as eider-down, provided by the thick moss which covers the rocks. Few, if any, even of the largest trees, possess a clear bole as much as 4 feet high. Further, in practically all the trees, the lateral spread of their branches is considerably greater than their height.

The procumbency of the lower branches of many of the trees is a feature admirably sketched by Mr. Harris, who writes (10, LIII, p. 234): "One of the most arresting features . . . 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."

A still more remarkable feature is presented by the trees in their fantastically-gnarled and twisted branches. Mr. Burt wrote of them long since (3, p. 165) as "scrubbed, decrepit trees . . . which, by various causes, have been reduced to uncouth misshapen dwarfs." These phenomena are due undoubtedly to the extremely unfavourable conditions of their existence generally, and especially to the very open and elevated position they occupy, in which they are exposed to the full force of terrific winds, especially those blowing from the north-west. Mr. Harris, who has studied carefully the effect of these winds upon the trees, doubts if the wood could ever have come into existence at all without the shelter given to the original seedlings by the huge granite rock masses amid which the trees grow. In support of this view, he points out (10, LIII, p. 236) that: "if a careful examination be made of those trees in Wistman's Wood situated at the extreme [N.W.] 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 of 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. . . . My present opinion, therefore, is that the original wood commenced with the shelter of the huge granite blocks. . . ."

Another extremely-noticeable feature of these curious trees is that their stems and branches are overgrown, often almost to their tops, by an extremely profuse epiphytic growth of long shaggy moss, lichens, and the common polypody fern. These plants form huge masses and give to the branches an enormously bulky appearance, swelling many a branch no thicker than one's wrist to the size of one's waist. As long ago as 1828, H. E. Carrington, a son of the poet, wrote of their branches (4, p. 209) that: "what chiefly attracts the notice of the beholder is the profusion of moss with which they are overgrown. This moss, indeed, exists in such astonishing abundance that some of the boughs though not in reality more than 3 or 4 inches in diameter, are made to appear five or six times that thickness."

Such a growth could occur only on trees of very great age, growing very slowly, in a region of extreme humidity, and it gives the interior of the wood a weird unearthly aspect.¹ The accompanying view (Figs. 2 and 3) was taken actually in the interior of the wood, where the light is very bad. (See also Figs. 9 and 10.)

At the time of my visit I collected no specimens of the plants forming this very remarkable epiphytic growth; but, from the observations of Mr. Harris (10, LIII, p. 237) it appears to consist mainly of the mosses *Anomodon* [*Antitrichium*] *curtipendulum*, *Eurynchium myurum*, *Dicranum scoparium* and *Ulota crispa*. William Borrer, who botanised in the wood nearly ninety years ago, noted (19, p. 1757) that *Anomodon curtipendulum*, "bearing its very rare capsules in profusion," formed a large part of the cryptogamic flora. Mr. H. N. Dixon says (11, p. 408) that it "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

¹ Polwhele (24, I, p. 94) quotes a correspondent who says of the trees that "on their decayed tops, thorns, brambles, etc., are shooting forth, forming altogether a most grotesque appearance," and Martyn soon after solemnly repeated this nonsense (see his ed. of Miller's *Gardener's and Botanist's Dict.*, art. "Woods," 1809).

FIG. 2.



WISTMAN'S WOOD, INTERIOR.

FIG. 3.



YOUNG OAKS, WISTMAN'S WOOD.

Miller Christy, phot.

ANCIENT OAK WOODS OF DARTMOOR.—To face page 302.

length of a foot or more and producing fruit in abundance." Mr. Harris also mentions, as occurring in the wood, *Hylocomium loreum* (a typical sub-alpine woodland species) and *Rhacomitrium lanuginosum* (on boulder tops round the edges of the wood). In addition to the mosses, the principal epiphytic plants are *Oxalis acetosella* and the polypody fern (*Polypodium vulgare*), with a certain number of lichens.

Since my visit, I have been favoured with specimens of twenty species of lichen, gathered in the wood by two different collectors. On 17th September, 1921, Dr. A. B. Rendell, of Postbridge, collected seven species, which were identified by Miss A. Lorraine Smith, of the British Museum, as follows :

- Cetraria glauca* Ach.
- Lecanora intumescens* Kærst.
- Karmelia fuliginosa* var. *læteirrens* Nyl.
- Evernia prunastre* Ach.
- Usnea florida* var. *hirta* Ach.
- Parmelia saxatilis* Ach.
- Parmelia physodes* Ach.

In June, 1922, Mr. W. Dallamore, of Kew, collected seventeen species (thirteen of them not gathered by Dr. Rendell), which were identified by Mr. Robert Paulson as follows :

- Sphærophorus globosus* Wain.
- Parmelia perlata* Ach.
- Parmelia saxatilis* Tayl.
- Parmelia omphaloides* Ach.
- Parmelia caperata* Ach.
- Cetraria glauca* Ach.
- Evernia prunastri* Ach.
- Ramalina siliquosa* A. L. Sm.
- Usnea florida* Web.
- Cladonia fimbriata* Fr.
- Cladonia squamosa* Hoffm.
- Cladonia furcata* Schrad.
- Cladonia cervicornis* Schær.
- Cladonia sylvatica* Hoffm.
- Cladonia rangiformis* Hoffm.
- Opegrapha herpetica* Ach.
- Graphis elegans* Ach.

Mr. Worth reports *Cladonia coccifera* Willd. in addition to the foregoing.

All this remarkable epiphytic growth would be impossible were it not for the extremely moist atmospheric conditions which prevail in the wood. Without these, scarcely any kind of vegetative growth could take place therein.

What the average rainfall in the wood may be, no one knows exactly; for, on Dartmoor, owing to the widely varying conditions, the precipitation varies so greatly, even in places immediately adjacent to one another, that nothing but a rain-gauge actually on any particular spot suffices to show the amount of the rainfall there. The nearest rain-gauge to the wood is that of Mr. T. C. Bridges, about two miles to the south, at Two Bridges (elevation 1170 ft.), where the average yearly fall is slightly over 80 inches and rain falls on about 220 days out of the 365.¹ At the prison at Princetown (elevation 1359 feet), two miles further south-west and probably the wettest spot on the moor, the fall averages 81.46 inches (20, p. 66). This enormous precipitation, which obtains over limited areas only, is due to the proximity of high tors, which, by cooling the moisture-laden breezes coming straight off the Atlantic, cause them to shed their excessive moisture in the shape of prodigiously heavy rains.

It is certain, however, that the rainfall at the wood does not reach the figures indicated above. Mr. Hansford Worth, whose knowledge of the amount of precipitation which takes place over the whole of Dartmoor is unrivalled, has pointed out to me that the amount of rainfall decreases very rapidly to the north of Princetown, in which direction Wistman's Wood lies. For instance, 42 years' average in the Cowsic Valley (1352 ft.) is 71.69 in.; 20 years' average at Cowsic Head (1580 ft.) is 64.94 in.; 20 years' average at Beardown Tor (1550 ft.) is 48.95 in.; 20 years' average at Devil's Tor (1785 ft.) is 52.21 in.; 20 years' average at White Tor (1640 ft.) is 51.15 in.; and 30 years' average at Hessary Tor (1625 ft.) is 56.82 in. This shows a *falling off* as elevation increases, the *amount* of such falling off depending, however, largely on various other factors. On the whole, in the absence of actual observations taken on the spot, Mr. Hansford Worth is of opinion that the

¹ Information kindly supplied by Mr. Bridges (see also recent volumes of *British Rainfall*).

average rainfall at the wood is probably between 67 and 70 inches.

I have seen elevated forests, up to the extreme limits of tree growth, on the Rocky Mountains, the Alps, and the high Norwegian *fjelt*. Yet nowhere have I seen features at all similar to those seen in Wistman's Wood; for none of the localities indicated possesses, like it, the same remarkable combination of special natural conditions. Even the far-northern woods which exist in the deep *fjords* on the west coast of Greenland show a vegetative growth which is, by comparison, quite luxuriant, as is proved by the views of it published recently by Daniel Bruun (2, LVII, pp. 27-32). My belief is, indeed, that these Dartmoor woods have no near parallel anywhere in the whole world.¹

Returning now to the trees in the wood: It is noticeable that, notwithstanding the excessive epiphytic growth upon them, they appear to be in good health generally. Some show signs of decay, but I saw none which were actually dead. Such statements as those of Mr. T. A. Falcon, who refers (15, p. 47) to "this wood of decay"; of Mr. J. Ll. Warden Page, who says (23, p. 135) that the trees are "all more or less apparently dying"; and of Mr. W. Burt, who says (3, p. 166) that "in spring and summer a little green may betray itself in foliage," are all due to careless observation and are quite misleading. Still less correct is the statement of H. E. Carrington (4, p. 209) that "in summer the eye is cheered by a little green, but even this is formed by the foliage of the brambles, fern, ivy, and other parasitical plants which have fixed themselves on the trunks and branches of the decaying trees. . . . The general appearance of the spot is, notwithstanding, cheerless in the extreme. The trees are little other than lifeless heaps of yellow moss. Scarcely a leaf trembles in the breeze. . . .—a scene chosen by Desolation as her own peculiar dwelling-place."

More in accord with the true facts is the statement of the Rev. Samuel Rowe, who says (28, p. 176) that "although it is probable that the trees have not increased in height for many an age, yet these dwarf Patriarchs of the Forest produce bud, leaf, and acorn in their season." Indeed, one may say of the trees that, hard as are the conditions of their existence, they are all "going on as well as can be expected."

¹ See postscript, p. 341.

Desiring to ascertain to which of the two closely-allied British species of oak the trees belong, I searched them carefully for acorns. It has been stated (18, V, p. 422) that the trees in the wood are too decrepit to produce fruit; but this was proved long since to be wrong. For instance, Mr. J. Brooking Rowe says (29, p. 499) that, in September, 1895, a lady, after long search, discovered two acorns, which, on being sown, duly germinated.¹ Probably the crop varies greatly in different years, as is commonly the case with the oak everywhere; for William Borrer, an excellent botanist, who visited the wood in the "thirties" of last century, says (19, p. 1757) he found on the trees "a tolerably vigorous crop of leaves and acorns," and Mr. R. Hansford Worth informs me that in 1922 the oaks in the wood fruited very freely, as did most trees everywhere, a result of the hot summer of 1921 having thoroughly ripened the young wood. At first, I myself was unable to find any acorns; but, after considerable search, I found a few small ones on some of the younger trees,² and these sufficed to show that the trees bearing them belonged to the common oak (*Quercus pedunculata* = *Q. robur*): not to the sessile-flowered oak (*Q. sessiliflora*).³ Of the latter species I saw no examples, but Mr. H. Vendelmans, who is familiar with the wood, informs me that this latter tree does occur therein, though sparingly. Mr. Harris is also of opinion (10, LIII, p. 233) that some of the trees are of this species and others possibly hybrids between the two.⁴

Further, my observations showed conclusively that, notwithstanding all statements to the contrary, the trees are reproducing themselves satisfactorily; for there are, in the lower part of the wood, a number of quite young trees (Fig. 3)—some with stems no thicker than a walking-stick and a height of two or three feet only: others with a stem-diameter of three or four inches. Mr. Harris' evidence on this point is conclusive. He says (10, LIII, p. 233), "Several seedling oaks of a few inches in height that I carefully dug up were certainly independent plants

¹ See *post*, p. 310.

² These acorns are now in the herbarium of the British Museum.

³ Mr. Borrer also found the trees to be of this species (see 19, p. 1757).

⁴ That the trees in the wood should be of the pedunculate species is somewhat surprising; for, as a rule, that species is met with on rich alluvial and other good soils, while the sessile-flowered species is usually met with on poorer soils and in hilly districts.

and not suckers from the roots of older oaks. . . . In fact, trees of all ages are present."

Yet, that the wood is not extending its area is certain. Indeed, fires, the terrific winds, and the animals which graze upon the moor would effectually prevent it from extending, in any case, beyond the protection afforded by the tumbled rock masses of the "clatter."

The general features of the wood, as noticed above, have been sketched with greater regard to picturesqueness than scientific accuracy, by Carrington in his alleged poem, *Dartmoor* (1826) :

. Thy guardian oaks,
My country, are thy boast—a giant race
And undegenerate still ; but, of this grove—
This pigmy grove—not one has climbed the air
So emulously that its loftiest branch
May brush the traveller's brow. Their twisted roots
Have clasp'd, in search of nourishment, the rocks,
And straggled wide, and pierced the stony soil
In vain. Denied maternal succour, here
A dwarfish race has risen. Round the boughs,
Hoary and feeble, and around the trunks,
With grasp destructive, feeding on the life
That lingers yet, the ivy winds, and moss
Of growth enormous. E'en the dull vile weed
Has fix'd itself upon the very crown
Of many an ancient oak. And thus—refused
By Nature kindly aid, dishonour'd, old,
Dreary in aspect—silently decays
The lonely wood of Wistman !

As to the age of Wistman's Wood, it is extremely difficult, even for one accustomed to judge the ages of trees, to form even an estimate, owing to its exceptional nature and surroundings. At the same time, there can be no doubt whatever that it is very ancient. Probably it is, as a wood, very much older than the thousand years traditionally assigned to it locally, though one may doubt if any of the existing trees are of that age. Local people sometimes tell the stranger that the wood "dates from something B.C.," and even this is far from impossible. Mr. H. Evershed, an able writer on such subjects, thought (16, p. 387) that the older trees must

have been "in their prime at the time of the Norman Conquest," whilst Lady Shelley in 1852 supposed (30, p. 304) them to have been "flourishing during the period of the Roman occupation"; but these are probably overestimates of their age. More certain light on the age of the wood appears to be afforded by the statements of Risdon, made just three hundred years ago, which prove that the area of the wood was then much the same as it is now and that the trees were then very similar, both in height and characteristics, to what they are to-day.

Several attempts have been made to ascertain the exact age of the trees by cutting sections of their stems and counting the number of annual concentric rings—an easy matter in the case of most trees, but very difficult in the case of these Wistman's Wood oaks, owing to their excessively slow growth having produced a very hard close-grained wood, with exceedingly narrow rings. Moreover, the records left us by those who have made these attempts are all more or less unintelligible, chiefly because the observers were inexpert in such work. Nevertheless, their records enable one to estimate the approximate age of the trees.

The first attempt to count the rings appears to have been made in 1827 by Archdeacon Froude, of Dartington, near Totnes (a brother of Prof. Froude, the historian). He says (19, p. 1786) that, on a section of a tree¹ "cut down partly for the purpose, I counted [beginning from the centre] upwards of 250 concentric rings, when the further evidence of annual formations in [? extending to] the exterior circumference was too indistinct to be noticed," even with the aid of a microscope (1, p. 96). Another section is said to have shown "seven hundred rings," but this is of doubtful authenticity, and possibly "seven" is a misprint for "several" (21, p. 199 and 30, p. 304). Another section, cut by Mr. John Divett, of Bovey Tracey, is said (10, XII, p. 279) to have shown 120 rings only; but, as the diameter is not given, this record also is valueless. Yet another section, said to have been 9 inches in diameter, cut on 16th September, 1866, by Mr. Wentworth W. Buller, by permission of the Prince of Wales, as Duke of Cornwall, showed 163 annual rings. These facts are recorded in an inscription cut on the face of a large triangular

¹ Unfortunately he neglects to record its diameter.

granite block near the centre of the wood.¹ Duplicate sections were sent, by order of the Duchy Authorities, to Kew and to the Royal Albert Memorial Museum at Exeter, while another passed into the possession of Mr. P. F. S. Amery, of Druid, Ashburton. This latter section is said (14, p. 326) to measure "9 inches by 7 in diameter"; to show "163 years' growth"; and to represent "no less than forty years to the inch."

Through the kindness of Mr. F. R. Rowley, Curator of the Exeter Museum, I have been enabled to examine the section in his charge, which appears to have come from a tree with a twelve-inch diameter (not 9 inches as recorded). It presents, apparently, at least the number of annual rings stated, but has been dealt with, unfortunately, in such a way that it is not now possible to check the number exactly.

In the Timber Museum at Kew, there is a portion of the stem of a tree said to have been cut in 1887.² Its top section (which is about 19½ inches in diameter) shows about 90 annual concentric rings in the innermost 5 inches, but the outer 5 inches of the wood is diseased (having, perhaps, been affected by the epiphytic growth), and in this portion the rings are not distinguishable.

The Members of the Geological Survey observe (17, p. 60) that the trees "are very old, and a branch only a little over an inch in diameter showed 40 rings of annual growth."

These records, though extremely vague and unsatisfactory, seem, nevertheless, to afford a basis for a rough estimate as to the ages of the larger trees. Thus, if a tree with a 4½ inch radius is proved to be 163 years old (thus showing 38 years' growth to the inch), one with a 13 inch radius (as the largest measured by me had) is probably about 471 years old. Again, if one allows 40 rings to the inch (which two other trees are said to have shown), this same tree may be assumed to have been about 520 years old.

Such conclusions are, as stated, far from sound; but, taking all considerations into account, I personally am

¹ It reads: "By permission of H.R.H. the Prince of Wales, Wentworth Buller, on September 16th, 1866, cut down a tree near this spot. It measured 9 inches in diameter and appeared to be about 163 years old."

² Apparently, therefore, it is not the section cut and sent there in 1866.

prepared to believe that some of the larger trees in the wood are well over five hundred years old.

But whatever the age of the existing trees, Mr. Hansford Worth is of opinion that some, at least, of them, though apparently complete trees, are in reality no more than shoots coming from much more ancient roots or stumps concealed beneath the huge rock masses—a surmise which, though probable, is difficult to prove conclusively.

Moreover, as bearing on the age of the trees, it may be stated that Mr. J. S. Amery, of Ashburton, has now growing in his grounds a young oak, twenty-seven years old, raised from an acorn gathered in Wistman's Wood in September, 1895.¹ It was found by the late Mr. J. Brooking Rowe and his niece, and being sown in a pot it germinated at once (29, p. 499). He gave the young tree to Mr. Amery in 1902, when it was still in the pot. It was at once planted out on the spot where it now stands, the soil in which it grows being loam on clay slate. It has now attained a height of 14 feet, its stem being 15 inches in girth at 2 feet above the ground and 10 inches at 4 feet. It produces fruit, which shows that it belongs to *Quercus pedunculata*. For this information I am indebted to Mr. Amery, who has been kind enough to supply a photograph of it (Fig. 4). That the tree has not inherited the dwarfed characters of its progenitors is clear from the foregoing—indeed, growing in good soil and in normal circumstances, it was hardly likely to do so. Apparently, however (judging from the photograph), the tree certainly does present, in some degree, the gnarled characteristics of its ancestors. The twist in the main stem just where the branches begin to spread is probably a result of some injury received while it was still growing in the pot. The unusual gnarling of the upper branches (which, though slight, is obvious) is, however, less likely to be attributable to the same cause; and it is hard to regard it as due to any cause other than actual inheritance. That acquired characters of the kind are not usually inherited is, of course, well known; and if, in this case, this particular character has been inherited, one is driven to the conclusion that, in the course of the many generations through which we may assume these ancient Wistman's Wood trees to have gone, the character has become more or less fixed and permanent.

¹ See *ante*, p. 306.

FIG. 4.



J. S. Amery, phot.

SEEDLING FROM WISTMAN'S WOOD GROWING AT "DRUID," ASHBURTON.
(REF. D). (TREE REFERRED TO MARKED "W").

ANCIENT OAK WOODS OF DARTMOOR.—*To face page 310.*

It will have been gathered from the foregoing that Wistman's Wood is in no danger of disappearance, provided it is protected from destruction by accidental fires. Such fires are usually a result of farmers firing the gorse and heather to improve their pasturage. They often get loose upon the moor and run, like prairie fires, for long distances; but the existence of the rocky "clatter" surrounding the wood suffices, as a rule, to protect it from these. In July, 1886, however, its area was reduced considerably by a fire, thought to have been started by a party of excursionists boiling their kettle. Its smoke was seen from Princetown by Mr. Barrington, Steward of the Duchy, who, hurrying to the spot on horseback, was able, with help, to extinguish it before very serious damage was done.

The moraine of tumbled rock masses forming the "clatter" serves also to protect the wood, naturally and effectively, from injury due to the browsing of the moorland cattle, sheep, and ponies. These abound all round; but it is hard to imagine them (or, indeed, any other ungulate animals) crossing the "clatter" to browse on the foliage of the trees, with the exception of the nimble goat; and of these creatures fortunately there are none in the vicinity.¹

The Duchy Authorities (to whom the wood belongs) have always done their best to preserve and protect it in every possible way. Nevertheless, however safe it appears to be at present, its points of interest are so many, so varied, and so unique, that I venture to suggest it ought to be scheduled under the Ancient Monuments Act or placed under the protection of the National Trust. In any case, it ought to be surrounded by a stout stone wall, to protect it from further risk of injury.

That such legendary lore should have grown up around so strange a spot is natural enough. Old writers have stated that the wood is mentioned in a Perambulation made soon after the Conquest, but the Rev. Samuel Rowe asserts (28, p. 176) that no such document exists. Again, it has been stated that the wood was planted in the thirteenth century by a certain noble lady who owned it; but, for this also, there is (according to the same writer) no authority. Moreover, the wood is clearly of natural growth: not a plantation.

¹ Mr. Vendelmans informs me, however, that he has more than once seen evidence that ponies succeed occasionally in getting into the wood.

Other, and still more fanciful, writers have regarded the wood (as noted already) as a sacred grove of the "Druids." According to local belief, too, it is inhabited by "pixies" or "little people." It may be, but I saw none and I can find no definite record. The modern scientific mind is apt to overlook this species when investigating any local fauna. All residents in the district know the wood as the headquarters of the "Black Huntsman" and his pack of spectral "wish-hounds," whose cries may be heard on dark nights as they hunt over the moor at unearthly speed; but the same huntsman and pack may be heard by night elsewhere at those seasons of the year when waders and wild-fowl are migrating.

The wood has figured in the local stories of Mr. Eden Philpotts. Less romantic is the fact that on more than one occasion a convict who has contrived to escape from the great prison so close at hand has sought concealment among the great rocks in the wood. Such might very well succeed for a time in escaping detection by warders alone, but could hardly hope to escape discovery if tracked by means of hounds.

Who Wistman was, if anyone, is hard to say. He may have been anybody, from some pagan deity who dwelt in the wood to some escaped convict who hid in it. Captain S. P. Oliver has suggested (16, p. 711) that "Wistman" is probably a corruption of the Celtic *uisg-mœn-coed*, meaning "the rocky wood by the water," and this view has been accepted by Mr. R. N. Worth (31, p. 333). More probable is the idea, held by Mr. Crossing (6, p. 23) and others, that the name is a corruption of Welshman's Wood, a name which was actually in use a century ago, *welshman* having been anciently an epithet applied to a foreigner or a stranger. In all probability, however, the correct name is *Wistman's Wood*, which was not only that used by Risdon three centuries ago, but is the form in common use to-day. There is an old Devon word "wish" or "wisht," meaning anything supernatural, spookish, or uncanny; and the wood is spoken of locally as "a wisht old place." Mr. Warden Page has suggested (23, p. 134) that the wood gets its name from some ancient "wistman" or "wiseman"—a sort of fakir, medicine-man, druid, hermit, or other holy man—who lived in the grove; and there can hardly be a doubt that in this he is correct.

III. SOME COMPARATIVE DATA OF THE THREE WOODS.

BY R. H. WORTH.

In past years much, mainly inaccurate, has been written as to Wistman's Wood; it is perhaps an advantage that it has also been contradictory. The other woods have none but a recent literature.

Although not neglected, the subject had found no adequate place in recent scientific publication, when Mr. Miller Christy, in a communication to the Linnean Society, challenged the silence of local botanists. The challenge was accepted by our member, Mr. G. T. Harris, in the last volume of our *Transactions*. I had before me last year the offer of a paper from Mr. Miller Christy, which, however, could not be completed in time for the meeting. At his invitation I have now joined him in the present communication; it should, I think, be regarded as a symposium rather than a joint paper. If I may venture to add Mr. Harris as in effect an associated worker, then there will now be available the observations and conclusions of three independent witnesses, who are mutually pledged to nothing, save an effort toward accurate statement of fact.

In all observations, and in the collection of all data, the personal equation of the observer is an hindrance to precision. Complete honesty of purpose will not, for instance, prevent a leaning toward selected trees of either a greater or a less height or girth than would make them fair representatives of the whole number. Against this the only safeguard in statistical evidence; which I, as having the best opportunity, have undertaken. It is possible for me to visit either of the woods, spend several hours therein, and return within the day.

In each wood I have selected an area of 100 feet by 65 feet (6500 square feet), and have counted the trees, measuring the girth and height of each. It remains that my selection may not have been fairly and fully representative. This others may judge; at Wistman's Wood I took the south-east corner of the South Wood, an area where the special characteristics of the oaks are well developed; at Piles Wood I took the north-east corner of the main wood, where the trees attain their best growth; and at Black Tor Copse I selected the north part, as

containing the largest trees. Hereafter I shall refer to these areas as "the selected areas."

The statistics have been tabulated below. The following are the general results. The numbers of oaks in the selected areas are respectively: *Wistman's Wood*, 26; *Piles Wood*, 45; *Black Tor Copse*, 65; practically an arithmetic progression with a common difference of 20.

In *Wistman's Wood* the mean girth of these trees is 49 in., the least girth is 23 in. and the greatest 99 in. (It is to be noted that where a tree grows coppice fashion, with two or more trunks from one root, and no main trunk, then the girth of the largest of the sister trunks is taken as that of the tree.) Plotted as a curve, the girths as abscissae and the number of trees of each girth as ordinates, the curve for *Wistman's Wood* presents no true maximum, but about 84½ per cent of the total number of trees have girths ranging between 23 in. and 64 in., and the distribution over that range is remarkably uniform. Outside the selected area the largest girth noted was 106 in.

The mean height of the trees in the selected area of *Wistman's Wood* is 14 ft. 7 in.; the least being 9 ft. and the greatest 20 ft. The curve shows a maximum at 16 ft. and a lesser peak at 11 ft., but from 11 to 18 ft. is the range within which 81 per cent of the trees fall, and 42 per cent are accounted for by the heights of 15 ft. and 16 ft., taken together. Outside the selected area the greatest height noted was 26 ft. 6 in.

In *Piles Wood*, in the selected area, the mean girth of the trees is 25 in., the least girth is 12 in. and the greatest 64 in. The curve of girths shows a marked maximum between 19 in. and 24 in., 42 per cent of the total number falling within these limits. The greatest girth measured outside the selected area was 67 in., but larger trees probably occur. The mean height is 26 ft. 1 in., the least being 16 ft., and the greatest 38 ft. The curve of heights shows a marked maximum at 24 ft., 23 per cent of the whole number having this height. Outside the selected area the tallest trees stood 44 ft. 6 in.

Within the selected area at *Black Tor Copse* the trees, excluding five seedlings or saplings, have a mean girth of 27 in., the greatest being 46 in. The curve shows a marked maximum between 25 in. and 30 in., 45 per cent of the trees having girths between these limits. The

greatest girth measured outside the selected area was 50 in., but there may be larger trees.

The mean height (again excluding the saplings) is 25 ft. 6 in. The curve of heights shows a marked maximum at 24 ft., 25 ft., 48 per cent of the total number of trees falling within these limits. No greater height than 32 ft., the maximum within the selected area, was anywhere found.

Table of girths and heights of every oak (except seedlings) within areas 100 ft. by 65 ft. in Wistman's Wood, Piles Wood, and Black Tor Copse, respectively.

GIRTH.				HEIGHT.			
	I	II	III		I	II	III
	Number of Trees.				Number of Trees.		
Under 1' 0"	—	—	5	7' 0"	—	—	5
1' 0" to 1' 6"	—	12	8	Under 9' 0"	1	—	—
1' 7" to 2' 0"	3	19	14	10' 0"	2	—	—
2' 1" to 2' 6"	3	5	27	11' 0"	5	—	—
2' 7" to 3' 0"	3	2	5	12' 0"	—	—	—
3' 1" to 3' 6"	3	3	4	13' 0"	—	—	—
3' 7" to 4' 0"	2	2	2	14' 0"	1	—	—
4' 1" to 4' 6"	3	—	—	15' 0"	5	—	—
4' 7" to 5' 0"	3	1	—	16' 0"	6	1	—
5' 1" to 5' 6"	2	1	—	17' 0"	—	—	—
5' 7" to 6' 0"	—	—	—	18' 0"	4	—	—
6' 1" to 6' 6"	1	—	—	19' 0"	1	1	1
6' 7" to 7' 0"	1	—	—	20' 0"	1	1	1
7' 1" to 7' 6"	1	—	—	21' 0"	—	2	—
7' 7" to 8' 0"	—	—	—	22' 0"	—	1	3
8' 1" to 8' 6"	1	—	—	23' 0"	—	4	5
				24' 0"	—	10	14
				25' 0"	—	3	15
				26' 0"	—	5	3
				27' 0"	—	3	5
				28' 0"	—	2	1
				29' 0"	—	2	5
				30' 0"	—	1	4
				31' 0"	—	2	2
				32' 0"	—	2	1
				33' 0"	—	2	—
				34' 0"	—	—	—
				35' 0"	—	—	—
				36' 0"	—	—	—
				37' 0"	—	1	—
				38' 0"	—	1	—
		Inches					
Average	49	25	27		14' 7"	26' 1"	25' 6"

I. WISTMAN'S WOOD, 26 trees, distance apart 13' 6".

II. PILES WOOD, 45 trees, distant apart 10' 6".

III. BLACK TOR COPSE, 65 trees, distance apart 8' 9".

The "distance apart" given above is a mean, arrived at in the following manner. Assume the ground divided into squares by two sets of equidistant parallel lines,

chess-board fashion. Then if the trees were rearranged so that one tree stood in the centre of each square, the sides of such squares would have the following approximate lengths: at Wistman's Wood, 13 ft. 6 in.; at Piles Wood, 10 ft. 6 in.; and at Black Tor Copse, 8 ft. 9 in.

The following notes may here be added, although this involves some repetition. In each wood specific trees have been measured either by Mr. Harris, Mr. Miller Christy, or myself; in my own measurements I was guided by some special feature to the selection of the particular tree.

Wistman's Wood. Mr. Harris ascertained girths of 72, 75, 77, 78, 60, 93, 60, 72, 82, 72, 72, 77, 64, and 102 inches. Mr. Miller Christy obtained measurements chiefly between 40 and 60 inches, with one of 78 inches. Neither of these observers measured any trees for their height, except a few saplings.

The highest tree known to me in Wistman's Wood has a height of 26 ft. 6 in., and a girth of 41 in. The tree, which I believe to have the stoutest trunk, girths 106 in., is 21 ft. in height, and has a radial spread of 26 ft.

A good example of the deformed trees, I do not say the most deformed of all, for that would be difficult to determine, has a girth of 41 in., its height is 7 ft. 3 in., and its radial spread, wholly before the wind, is 19 ft. (B).¹ On the other hand, the oak, quite certainly the most symmetrical, is young, its height is 14 ft. and its girth 16 in. (c).

Other measurements were: Girth, 69 in.; height, 10 ft.; radial spread, 19 ft. Girth, 58 in.; height, 11 ft.; radial spread, 21 ft. Girth, 20 in.; height, 12 ft.; radial spread, down the dominant wind, 10 ft., against the wind, 3 ft. Girth, 39 in.; height, 13 ft.

Piles Wood. Here I have only my own measurements. The highest trees grow coppice fashion, many trunks from one root; they are situate in a little valley running up from near the river level; and, having the advantage of starting from lower ground than their neighbours, while reaching the same general level of the upper surface of the canopy of the wood, are necessarily taller than less favoured trees. I found one such tree having five trunks (possibly seven). The girths are 31 in., 25, 24, 21, and 24 in.; the height is 44 ft. 6 in.

¹ Certain trees are identified in this paper by reference letters.

An isolated tree, at the north-east corner of the wood, is of a type that might grow anywhere under normal conditions; its girth is 49 in., and its height 28 ft., its trunk is somewhat over 7 ft. to the first branch. Hard by is another type, the girth 67 in., but the trunk rises little more than a foot from the ground and then branches into four, the largest branch having a girth of 36 in. The height is 29 ft. and the radial spread 20 ft. 4 in. A young oak, near the river, well grown and symmetrical, measures, girth 19 in., height 17 ft. 6 in.

The procumbent type, so frequent in *Wistman's Wood*, is very rare in Piles Wood except in the outliers to the east of the main wood. Here an excellent specimen of the single trunk procumbent has a girth of 34 in., a height of 12 ft. 6 in., and a radial spread of 19 ft. 6 in. The many-trunked type, with no visible main trunk, is also represented, one tree has three trunks, 34 in., 21½ in., and 22½ in. in girth respectively; its height is 11 ft. 6 in. Some young isolated trees show the procumbent trunk in its origin, one such girths 8½ inches, is 4 ft. 8 in. in height, and trails away down wind for a length considerably greater than its height.

At *Piles Wood* a new feature appears, shrub oaks covering continuous areas and reaching no greater height than 8 ft. Isolated, or in twos and threes, such oaks occur at *Wistman's Wood*, but here they form little thickets on the high ground above and eastward from the main wood. The girths are always small, and the plants are rather shrubs than trees.

Black Tor Beare or Copse. Mr. Harris gives the following details: girths 26, 21, 21, 35, 26, 40, 20, 19, 29, 33, 21 in. Another tree is mentioned having a girth of 26 in. Twenty-five feet is given as the probable height of some trees, and 7 ft. as the height of a tree at the eastern end of the copse, which has decumbent branches. Small scrub oaks of 18 in. in height are also mentioned.

My own notes include the following: A tree having a girth of 49 in. with a comparatively long straight trunk, the height of this tree I have not yet measured. Another tree having a trunk of only some 2 to 3 ft. in height, the girth 44 in. and the height 16 ft. 6 in. Yet another, having but little over a foot of trunk, its girth 50 in., and its height 21 ft. 6 in. These three are in the north part of the wood, where also is a sapling of girth 4 in., and height 4 ft. 5 in.

By the river are some detached oaks, one, free standing, girths 12 in. and is 5 ft. high. Others hug boulders as creepers might, as tightly pressed to the rock surface as ivy; one such girths 16 in., climbs a rock 4 ft. 6 in. in height, sprawls over its upper surface, and rises 4 ft. 6 in. above it.

In the south parts of the wood, as to which I shall write later, I measured two straight-stemmed trees, 17 in. girth by 15 ft. 6 in. height; and 18 in. girth by 16 ft. height; also shrubs from 10 ft. to 8 ft. in height, and 14 in. to 3½ in. in girth; I noted scrub oaks of about 18 in. in height.

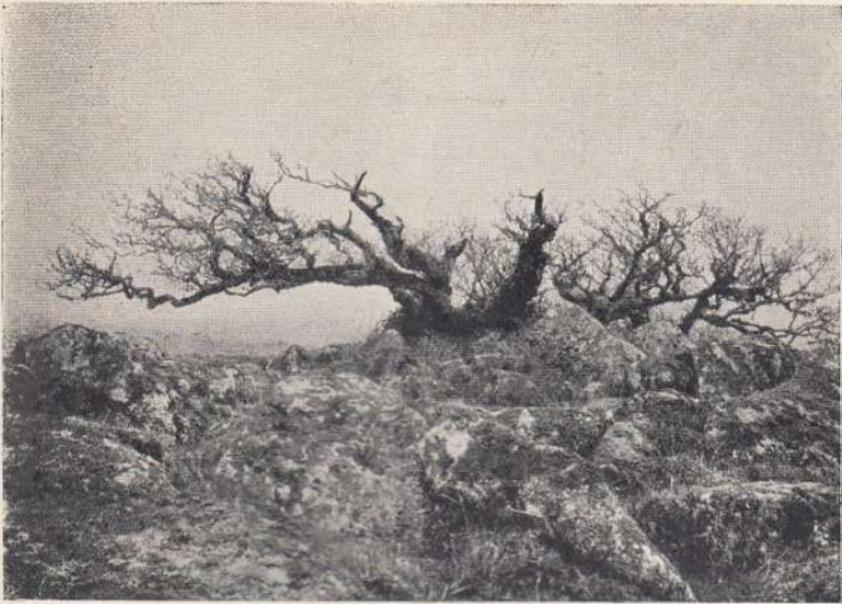
An isolated tree at the south (or eastern) end of the wood (y) is probably that referred to by Mr. Harris. It has no true trunk, but three main branches spring from one root, and girth 24, 28, and 37 in. respectively, the height is 7 ft. 4 in., and the greatest radial spread is 20 ft. The actual diameter of the canopy is, however, less than double this, being 33 ft., and, on plan, the canopy covers a wellnigh perfect circle.

I have placed these comparative data here because I believe it important to present them to a single view, rather than scattered over many pages. Since they include details of importance to the further discussion of the features of these woods, I shall not hesitate to repeat them when occasion needs.

IV. WISTMAN'S WOOD.

I venture a few notes on this wood, additional to the full treatment which Mr. Miller Christy has accorded to it. The evidence is essential to the argument which I have to present.

In common with Mr. Harris, I have been much impressed by the importance of certain features of trees in the north wood. One oak which is at the south-east corner of the north wood, is situate on the highest ground of all, at an elevation of 1390 ft. above Ordnance datum. It has three sister branches (I do not call them "trunks" for reasons which will appear later). All three branches are, in their lower parts, at least one half stripped of bark. Two have slight vitality left, yet one of these has thrown out a branch which, in 1921, made shoots 2¼ in. in length. Two of the branches to which I refer unite in a "trunk" before joining the root; this "trunk" girths 69 in., and



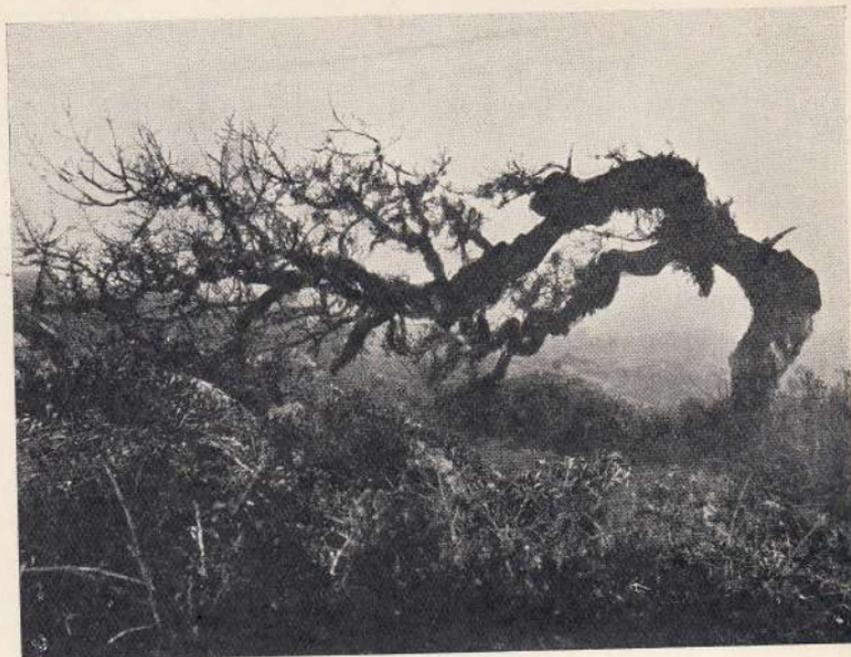
S.E. TREE, WISTMAN'S (NORTH) WOOD.

FIG. 6.



R. H. Worth, phot.

YOUNG TREE, WISTMAN'S (MIDDLE) WOOD (REF. C).



PROCUMBENT OAK, WISTMAN'S (NORTH) WOOD (REF. B).

FIG. 8.



YOUNG PROCUMBENT OAK, PILES.

R. H. Worth, phot.

the branches 41 in. and 30 in. respectively. The height is 10 ft., and the radial spread is 19 ft., all before the prevailing wind (Fig. 5).

A little distance down the hill is situate a more remarkable oak (B), which springs erect from the ground to a height of a little over a foot, then leans toward the wind, but before it has reached 5 ft. in height has turned away from the wind and become horizontal; at this point it divides into two branches, which dip at an angle of 34 degrees with the horizontal, then slightly recover, but the secondary branches from which rest upon the ground. The girth, near the ground, is 41 in., and on either side of the trunk the wood is bare of bark for 6 in. in width, and is decaying. Yet from a branch on this deformed and decaying tree there springs a secondary, of vigorous, growth. In 1920 this bore shoots of $5\frac{1}{2}$ in. in length, and in 1921 it made shoots $8\frac{3}{4}$ in. in length. The same tree shows in some parts very restricted growth, say $\frac{3}{4}$ in. in the year. The radial spread of this oak is 19 ft., all away from the wind, the height of its topmost twig is 7 ft. 3 in. above the base of the trunk (Fig. 7).

Both the oaks above described bore acorns in 1921, and this year also, and both belong to the species, or variety, *Quercus pedunculata*.

As indicators of the direction of the most crippling wind the oaks in this north wood are almost unanimous in their evidence, differing only 12 degrees as to its direction, the mean trend pointing to the W.N.W. as the most destructive quarter.

The older trees present evidence of frustrated effort to send out branches against the wind, the younger trees accomplish some temporary success. Thus one which I measured girths 20 in., its trunk rises 2 ft. 6 in. to the first branch, the total height of the tree is 12 ft., its radial spread before the wind is 10 ft., and against the wind it is 3 ft. From my observations it is only a question of time when the growth against the wind will be suppressed; the height materially reduced; and the branch, which springs at a height of 2 ft. 6 in. may, if it survives, take on the duty of the trunk. I give the qualification as to its survival, since a branch, the girth of which is 9 in., has been split in halves, both halves being as yet living.

On this evidence I most cordially agree with Mr. Harris as to the effective wind pruning to which these oaks are

liable. But I would also point to the extraordinary recuperative power shown by aged and decayed trees.

As to decay, this is rather marked throughout the whole of Wistman's Wood ; in my selected area eleven oaks out of twenty-six showed clear signs of its ravages.

Turning to the other end of the scale, it has been suggested that the soil conditions, and the difficulty as to the supply of water, whether arising from drought, undue transpiration, or sourness of the soil, in themselves prevent normal growth and partly induce the unusual habit of the trees. I think the recuperative power of the old trunks negatives this suggestion, but we have further evidence against it. In contrast with the abnormalities which I have described, there must be set instances of normal and well-proportioned growth. Probably the most striking of these is a young oak in the Middle Wood (c). This has a girth of 16 in. and a height of 14 ft. So straight is the trunk that from the topmost twig a line drawn to the centre of the base for two-thirds of the height lies within the thickness of the trunk, and nowhere falls more than 2 in. outside the trunk. The tree is in no way especially favoured as to soil ; some of the most contorted of the oaks are its immediate neighbours ; it is on the lee side of these and thus had some shelter in its youth ; it now overtops them. Merely it is not old enough to have gathered full experience of the trials which await it ; granted time and I have little doubt the wind will work its will with this tree also. Such an example proves that there is nothing in the stock, no inherited tendency, nor anything in the soil or climate (if we except the devastating wind and occasional unusually severe frost) which produces abnormal forms of growth (Fig. 6).

At first I had written that I had *no doubt* as to the future effect of the wind upon this young oak. I have since substituted the words *little doubt*, and this in view of the next example, also to be found in the Middle Wood. A tree having a girth of 41 in., and a height of 26 ft. 6 in. The trunk springs straight and erect for the first 10 ft. ; then it parts into branches which all have a strong upward tendency. It is true that the trunk has some branches at a lower level also (the lowest at 3 ft. from the ground), but so has the young oak, and in each these rise in a normal manner. There is a curious feature in this tree ; side by side with the upright trunk, and appar-



WISTMAN'S (SOUTH) WOOD, INTERIOR.

FIG. 10.



WISTMAN'S (SOUTH) WOOD, INTERIOR.

R. H. Worth, phot.

ently from the same root, is a smaller trunk, the girth of which is 33 in., and this is procumbent.

Here then is the tallest tree observed in the wood, preserving in respectable age the qualities which mark the vigorous youth of its neighbour. A companion selected for comparison, has two trunks or branches from one root, both so badly decayed that little more than half the circumference of either is left, the present girths are 39 in. and 31 in. ; they rise but a short distance from the ground, and then branch away almost horizontally ; the total height to the topmost twig is 13 ft. Another tree forms a bow, rising from the ground and again entering it like a pegged-down rose shoot, and, like it, having a close growth of twigs and shoots from its upper surface.

The north part of *Wistman's Wood* presents a very good example of a phenomenon which I have named "*the boulder break.*" A place where the boulders are of such a size, and so deeply piled the one upon the other, that never through the ages has sufficient humus gathered to fill the interstices and present a surface upon which vegetation could seize. There is growth of whortleberry and wood rush on the larger boulders, but between them cavities only. Such spaces are necessarily breaks in the wood, devoid of trees. Throughout the wood these conditions occur sporadically, and they account for the greater distance apart of the trees in *Wistman's Wood* as compared with *Piles Wood* or *Black Tor Copse*. Trees further apart receive less mutual shelter, and hence there are more deformed trees in *Wistman's Wood* ; but deformity is not absent from either of the other woods, in which there are similar and even larger boulder breaks, but where the condition is not so uniformly present.

I would add that I have seen no oak of the sessile variety (*Quercus sessiliflora*) in *Wistman's Wood*, and that the climbing *Corydalis* (*C. claviculata*) is plentiful in places and should be added to the flora given by Mr. Harris. Kingston and Jones name this locality. I found a few small hollies, one in the selected area, where also were three mountain ash trees. The "coral moss" (*Cladonia coccifera* Willd.) grows upon some of the oaks.

V. PILES WOOD.

Piles Wood lies on the Erme, in enclosed land, a mile and a half above Harford Bridge. Situate on the east

bank of the river, on a slope facing west, it has sheltering it the steep slope of Sharp Tor, rising 300 ft. above the highest ground of the main wood. Facing it, on the west, is the even steeper Staldon, of similar height.

From north to south the wood is some 530 yards in length; its width varies between 150 yds. and 83 yds. At its north end it extends almost to the river bank, elsewhere a strip of rough pasture or meadow, from 30 to 70 yds. in width, lies between the wood and the river; on the bank of which there are, however, a number of trees. This meadow is very gently sloping ground, but the hill-side in the wood itself has, for the most part, a gradient of about 1 in $2\frac{1}{2}$.

The ground within the copse is thickly strewn with boulders; there is certainly more granite than soil on the surface. At places boulder breaks occur; one of these deeply indents the western margin of the wood, the others are relatively small and the canopy of the trees is almost continuous above them.

The area of the wood, as shown upon the Ordnance Survey, is $13\frac{1}{3}$ acres. There are outliers on the higher ground to the east, which the Ordnance Survey does not indicate. The highest ground in the main wood is 1040 ft. above Ordnance datum, the lowest point is at an elevation of 860 ft., or thereabout. The highest outlier stands at about 1080 ft.

A notable feature of the wood is the very regular surface of the canopy as a whole, unbroken by any of the trees, the upper surface of which is indeed more regular than that of the ground in which they grow. The existence of one little valley is thus hidden; the trees within it rise to the same general level as their neighbours, and the valley becomes the nursery of the tallest trees, which attain a height of 44 ft. 6 in.

Taken as a whole the growth is much nearer the normal than in *Wistman's Wood*. As against a mean height in the latter of 14 ft. 7 in., there is here 26 ft. 1 in.; and, compared with a greatest height at *Wistman's Wood* of 26 ft. 6 in., at *Piles Wood* some trees reach 44 ft. 6 in. But to some extent this arises from the fact that in the main wood at *Piles* the trees spend their energy largely in upward growth, at *Wistman's Wood* largely in horizontal, or even decumbent, spread. A tree at *Wistman's Wood* may have a total height of 7 ft. 3 in., but what serves it as trunk and

the topmost twigs of that trunk may rise, perhaps, 4 ft. in an approximation to the vertical and extend 18 or 19 ft. horizontally; straighten the tree out and place it erect and it would stand some 22 or 23 ft. I have checked this by an actual example, and it somewhat understates the facts.

At *Piles* the trees are closer set than at *Wistman's Wood*, in the proportion of 110 sq. ft. to each tree in the former to 182 sq. ft. in the latter; in my note on *Wistman's Wood* I have suggested the relative distributions of soil and boulders as the reason. This is in accord with my observation of the local variations in this respect within *Piles Wood* itself.

In patches of very rough, bouldery ground to the east of the main wood there are outliers; here the growth is strictly comparable with that prevalent at *Wistman's Wood*, the same restricted vertical and dominant horizontal extension prevail, the same relatively large area is allotted to each tree.

Between these outliers and the main wood are patches of oak shrubs, close set, tangled, and no more than 8 ft. in height; boulders standing much above the surface are rare in these shrubberies.

At about the same level there are certain small trees in the open, which obviously live a very hard life. These are of great interest as exhibiting the nature of the education which has trained the procumbent trees in their life habit. The plants are small, two which I measured were 8 in. and 8½ in. in girth, and 5 ft. and 4 ft. 8 in. in height respectively; each had a radial spread greater than its height. That the trees are young is undoubted, but that tree, the girth of which was 8½ in. and the height 4 ft. 8 in., was crowded with flowers this spring. I judge this to involve that its least age is twenty-four years, since at or about that age Mr. J. S. Amery's seedling from *Wistman's Wood* (D) first flowered (in, it must be noted, a much more favourable situation). If my surmise as to its minimum age is correct, then the stem of this tree (trunk is too great a name) would show about eighteen annual rings to the inch. Much more important, because demonstrable, is the manner in which these trees have attained their present procumbent form; this has not been by any bending of the trunk. At a very early stage the leading, upward, shoot was suppressed, its place was taken by a side shoot, still upward

in direction. This, at less than 18 in. from the ground, was also suppressed, its place also being taken by a side shoot of upward direction. At less than 2 ft. 6 in. from the ground the last-named shoot suffered the same fate; this time none but an approximately horizontal growth was allowed to retain life. The history of subsequent mutilations has been the same, growth upward is inhibited, growth against the wind may not survive, only horizontal or decumbent growth before the wind is possible (Fig. 8).

In older trees all trace of the suppressed efforts toward upward extension is of necessity lost, except in rare instances; but, in fact, the apparent trunks of these procumbent trees are really branches, borne by a trunk which rarely rises more than a very few feet from the ground.

Wistman's Wood is a specialist in deformity, except for a few striking instances of strictly normal growth. *Piles Wood*, with its more varied conditions, is far more informative. *Piles Wood* has its own examples of normal growth. There is the young tree near the river, girth 19 in., height 17 ft. 6 in., whose trunk from the topmost twig to the centre of the base does not deviate from the straight line by more than six inches. There is the much older tree at the N.E. angle of the main wood, whose girth is 49 in. and height 28 ft., while others can easily be found. It has its procumbent trees in the outliers; one, for instance, with girth 34 in., height 12 ft. 6 in., and radial spread 19 ft. 6 in.; and the two small plants described above. It has its shrubby oaks, and all these can be studied and compared in the surroundings which have imposed upon them their peculiar form.

Decay is not as marked at *Piles Wood* as at *Wistman's Wood*. In both selected areas there are the same number, 11, of decayed trees, but in the former this is 24 per cent of the total, and in the latter it is 42 per cent.

In the selected area at *Piles Wood* there are, in addition, 8 oaks which are quite dead. A dead trunk here has some chance of standing awhile.

In *Piles Wood* I saw no oak of the sessile-flowered species, all which I noted belonged to *Quercus pedunculata*.

I feel certain, although I can produce no proof, that *Piles Wood* has been felled, in part at least. It is situate where the trees could be removed—not easily it is true!

and probably it has been resorted to for timber and fire-wood, but this must have been very many years ago.

VI. BLACK TORS BEARE.

I have adopted the old name, which was in use at least as late as the early part of the seventeenth century. "Beare," as meaning a wood or copse, is frequent in place names around Dartmoor. (It may even be ventured that "Beardown," opposite *Wistman's Wood*, takes its name from the proximity of the latter.)

This wood is situate on the left bank of the West Ockment, on a slope which faces the south-west. It occupies the lower part of the hill-side and trespasses upon the relatively level ground by the river. The lowest point of the wood is 1200 ft. above Ordnance datum, the highest part is at an elevation of 1530 ft., and the ridge of the Black Tors, as far as it is an effective shelter, rises to about 1650 ft. at its highest. The other side of the valley is formed by the slope on which are the "Slipper Stones." These are bare, smooth surfaces of granite, coincident in their dip and strike with the general slope of the hill-side. Some of these surfaces extend at least 60 ft. up the hill, the average dip is about 30 degrees, or approximately 1 in 1.7. Smooth and regular, and standing at so steep an angle, it is no wonder that these rock faces should have been called "slipper," as the true Devonshire equivalent for "slippery." It is rather surprising that Crossing should, by implication, suggest the name to have been derived from a block wearing "the form of a huge slipper." Be this as it may, the hill of which they form a part is steep and high and affords shelter to the wood opposite to it.

The length of the wood from N.W. to S.E. is about 1000 yds., its width varies from under 50 yds. to over 100 yds. The Ordnance Survey shows it as a long, irregular strip, touching the river at two points, but elsewhere at a varying distance from the bank, averaging about 50 yds.; its area $14\frac{1}{2}$ acres. This last is too large, the south-eastern part, in place of being continuous woodland, as shown in the Survey, is much interrupted by boulder breaks; 10 to 11 acres would probably be nearer the truth.

According to Crossing (7, p. 196) there is documentary

evidence that *Black Tor Beare* once occupied a larger area. He says that "it probably extended from the Island of Rocks into the forest" of Dartmoor. There is no evidence, known to myself, which points to any former extension toward the Island of Rocks, but at a Court of Survey, holden at Okehampton on the 15th August, 1608, the jurors made the following presentment (8, p. 55):

"Item further also they do present that William Chastie (by his owne confessyon) kild a stagge with a pece or gun nere a month since about Blacktorrebeare (which is part in the forest of Dartmoor and part in venvill) and that he did it for Sir Thomas Wys . . . and delivered the same to the said Sir Thomas at his house at Sidnham, at which tyme he told him that he had kild the same dere in the fforest."

The statement, if made, that Blacktorrebeare lay part in the forest would involve, if accurate, a former considerable south-easterly extension, the present forest boundary being more than half a mile distant, at Sandy Ford; and the same jury had found (8, p. 54) the boundary to run "unto Steinegtor and from thence linyallie to Langaford, alias Sandyford, and so from thence linyallie to the ford which lyeth in the east syde of the chapple of Halstoche," essentially the line now recognised as the limit of the forest. Notwithstanding which, saving the possibility of an occasional tree on the river bank, I find it impossible to believe that there was any material extension beyond the present south-eastern limit of the wood, the exposure is prohibitive. On the other hand, the name of Black Tor Beare may have attached to an area larger than the copse itself; the phrase used is "*about Black Torrebeare,*" and "*about*" the copse may well be a description which would extend to cover land as far as the forest.

This is not the only reference to Black Tor Beare being within the forest. At the manor and forest court of Lydford north, held 21st September, 1587, the jury upon their oaths presented (8, p. 139) that a certain William Bowden had cut certain oaks in "*Blacktors Beare infra Fores̃ pd,*" and it was ordered that he be summoned to answer at the next court. He duly obeyed the summons and was fined three pence. But one must be careful not to accept the literal rendering of "Forest" in these presentments. The word was loosely used, as such instances as the following will show. It was presented that a certain

wall between the lands of Richard Ellacot, called Sowtherley, and the Forest of Dartmoor, and a certain gate called Sowtherley gate were ruinous and fallen ; and, at another court, that a hedge of John Ryetche between a tenement of the said John called Sowtherley and the lands of Dartmoor of our Lady the Queen was ruinous. Now no part of Southerly adjoins the forest, and it is evident that in the first instance the words "*Forest of Dartmoor*" are loosely used, where "*solũ Dñe Rñe de Dartmore*" was correctly written in the latter ; and, even more correctly, at times the term was "*solũ Dñe R^{no} iuxta Forest.*" We need not accept the entry as evidence of any larger copse than that at present existing.

But it is evidence that, notwithstanding the great difficulty of removing timber, trees were cut, probably for firewood, and equally probably the wood was removed by pack-horses. In addition to unauthorised wood-cutters there were those who acquired their timber in a more regular fashion. There is in existence a document, without date, but early seventeenth century, entitled "*Review of Woods,*" which contains the following entry (8, p. 59) : "*Forest of Dartmoor and of 44^l for the price of 2^a of wood growing within the Chase of Dartmoor so sold to Bartholomew Gidley. And of 40^s for 8^a underwood growing within the Forest of Dartmoor in a certain place there called Black Tores Beare.*" The two acres sold at £44 must evidently have comprised well-grown timber, and were certainly not within the boundary of the true forest ; they would probably have been either in the parish of Gidleigh, or of Chagford. The relative value of 8 acres at Black Tor, 5 shillings an acre as compared with 22 pounds, gives a very fair indication that, then as now, little real timber grew there. It seems probable that 8 acres was the computed total area of the copse at Black Tor at that time, if so it was certainly no larger than at present. It will be noted that it is described as underwood.

This gives us a date, at or about 1618-20, when the copse was probably cut, and hence few of the present trees could be more than 300 years old.

There follows a long gap in the available written record ; then, on the 27th May, 1830, we find Miss Dixon viewing the wood. This lady, the authoress of certain poems entitled "*Castalian Hours,*" was active in body as in mind ; the opening words of her *Journal* (12, p. 3) are

“ Wednesday, May 19th, 1830, left Princetown at half-past four o'clock—a pleasant mild morning; the larks soaring up and singing at every step.” It may be added that at nine o'clock she breakfasted at Tavistock. She concludes the day's notes, “ Our direction was now taken through several pleasant fields and shady lanes towards Horsa Bridge, over the Tamar, about three miles distant, where we terminated the day's excursion, having travelled, from the time of our leaving the Prisons, twenty-five or thirty miles, and continued walking, with slight interruption, during a period of fifteen hours.”

On Thursday, May 27th, she visited Black Tor. She had no adventures, apart from the fact that “ the clouds suddenly collapsed ” (a rather frequent incident on and about Yes Tor). Her description of the copse and its neighbourhood is worth quoting. She writes (12, pp. 29-30): “ The ground from Eastor [Yestor] to Blackator is a peat bog, whence most probably the name of this latter hill. The descent of the river is very steep, and entirely covered with blocks of stone, similar to those which strew the sides of Eastor. Among these stones, and growing in their very crevices, are many mountain ashes or rowan trees, some old and moss grown. All along the side of the hill overlooking the course of the West Ockment, is a growth of dwarf oak, mostly quite young, and now appearing in the red leaf common to such bushes. This place, which is known by the name of Blackator Copse, bears the strongest resemblance to Wistman's Wood, near Two-bridges, in every particular, except that the trees are of much more recent date than those in the valley of the Dart, the antiquity of which gives rise to so many varying conjectures. Blackator Copse is certainly a remarkable place, and well deserving a visit from the explorers of the moorland districts, both on account of the singular disposition of the bushes and trees, which extend over a space of, perhaps, upwards of ten acres; and also for the sake of several grand views on the West Ockment, especially where it contracts its course between the descent of two craggy hills, and rushes among the stones below with great violence.”

Miss Dixon's estimate of the area is interesting. We now have (a) my own estimate, in 1922, of 10 to 11 acres; (b) Miss Dixon's figure, 92 years ago, of 10 acres; (c) the sale, in or about 1620, say 300 years ago, the area being set



S.E. TREE, BLACK TOR BEARE (REF. Y).

FIG. 12.



BUSH OAKS AND OAK SCRUB, BLACK TOR.

R. H. Worth, phot.

at 8 acres. The probability is that, for the past three centuries, the area has been practically constant. In connection with this constancy it is curious how clearly defined is the boundary of the wood, more especially along its higher side.

It is strange that the Rev. Samuel Rowe, in his *Perambulation of Dartmoor*, omits all reference to Black Tor Copse. He writes (28, p. 242): "The scenery on the West Ockment, in the deep glen at the foot of Black Tor, is grand and impressive, but will not long detain us from tracing the course of the river onwards."

The lowest and best-sheltered ground in *Black Tor Beare* lies at the north-west end. Here, in my selected area, are trees up to 32 ft. in height and 46 in. in girth. Here, if anywhere, the wood was cut in or about 1620; the ground is very bouldery, but is the easiest of access in the whole copse. If we take this largest tree as being 300 years old, its diameter is very nearly 15 in., its radius $7\frac{1}{2}$ in., and there should be 40 annual rings to the inch. Buller's tree at *Wistman's Wood* had a radius of trunk of $4\frac{1}{2}$ in., and there were 163 annual rings, which gives 36 rings to the inch. Remembering that the earlier rings are frequently obscured, this is further evidence in favour of the possibility of 40 years to each inch of radius of trunk.

On the average, each tree occupies an area of $76\frac{1}{2}$ sq. ft. Even at this north-western end, as the growth climbs the hill-side, its form changes, and the oaks degenerate to mere bushes of 7 or 8 ft. in height (Fig. 12). Such bushes form the higher margin of the copse throughout its length. Toward the south-eastern end they form the greater part of the whole growth, standing but 4 or 5 ft. apart, and having girths up to about 15 in. None the less, where the wood is at its widest, and also on some of the lower slopes, larger trees occur, even in the south-eastern part. These are from 7 to 8 ft. apart, some are as high as 16 ft. and girth 18 in.; such trees are frequently of symmetrical growth.

Near the south-eastern extreme the mountain ash becomes a prominent member of the tree community. I believe that, even at the centre of length of the wood, a mountain ash there growing is one of the largest trees in the wood, but I have not yet measured it. This species is much hardier than the oak, and outlying specimens are to be found at least 1590 ft. above Ordnance datum. As to the oaks, their relative size clearly depends upon the exposure, until we take the next downward step, from the

bushes 8 ft. in height to scrub oaks 18 in. high. Above the main wood at the south-east is a belt of such scrub oaks, extending about 20 ft. from the wood, the little plants being from 4 to 5 ft. apart. They are actually sheltered by the adjacent copse, and hence no question of exposure can be entertained; the nearest to the main wood are on ground but a foot or two above it, so that elevation is not the cause of their dwarf growth. I have assured myself that they are kept down by grazing animals. If this be so, the question at once arises how the main wood itself has ever reached this point. I think the answer is clear, there is here an abrupt change in both the surface of the soil and the fall of the ground. Within the wood boulders are very numerous and form much of the surface; without the wood boulders are either absent or more widely apart. Within the wood the ground slopes 10 ft. down in 17 ft. horizontal; without the wood it slopes at a little more than half this angle. The change in this latter respect is not quite so marked at all points; indeed, where the scrub oaks are best developed the change in gradient is not great. I conclude that, although the cattle sometimes enter the wood for shelter, there was nothing to tempt them there before the trees grew. This steep and bouldery hill-side was not everywhere and as a whole impassable to animals, it was merely devoid of grazing and hence free from their attentions. Where the change to soil without boulders (or with less boulders) coincides with the change to a flatter gradient, there sheep and cattle constantly feed, and even the scrub oaks get little chance. Where the change takes place without a marked alteration of gradient, there, on the steep slope, the animals feed less frequently and the scrub oaks can just maintain themselves. It must also be remembered that the leaf mould from the trees has levelled up the ground between the boulders, so that it is now much less rough within the wood than when the trees first established themselves. The scrub oaks are also hampered by the entry of disease into the plants, through the surfaces broken by the animals.

Alone of all the trees in the wood the little oaks, so suppressed, produce abnormally small leaves. An occasional shoot is normal in leaf area, but the general matted growth is very different; although it may be matched in much-trimmed hedgerows in lower ground, the trimming at Black Tor being done by grazing animals.

I take two twigs as fair examples; on the one the first six leaves from the apex aggregated 57.0 sq. cm. in area, the largest leaf having an area of 13.1 sq. cm.; on the other the first six leaves from the apex aggregated 60.2 sq. cm., the largest leaf being 16.4 sq. cm. I compare with them a shoot from a bush oak at Black Tor, having the least leaf area which I measured in any of the "bushes," the combined area of six leaves was 126.75 sq. cm., the largest leaf was 38.0 sq. cm. The length of the internodes of the scrub oak was not as markedly deficient, the length above the seventh leaf on one twig was 30 mm., and on the other 22 mm.; on the bush oak the corresponding length was 44 mm. (See also scrub oak from hedgerow in Bickleigh Vale, the first entry in table, page 333.)

Before further pursuing the question of leaf area and internode length, I add a note on the extreme south-eastern tree of Black Tor (γ), already referred to as being on the highest ground, at 1530 ft. above Ordnance datum (Fig. 11.) This isolated tree grows in a patch of large boulders, a slight hollow in which affords its lower growth some shelter. When or how it found the soil necessary to its seedling life would appear an insoluble problem, were there not at the present a last year's seedling growing under its shelter on the moss and other vegetation which covers a part of the surface of a boulder. The tree has never accomplished a trunk, its three main branches crawl over the boulders, from which they but slightly lift themselves; their girths are 24, 28, and 37 in. respectively. From a tangle of secondary branches springs a matted confusion of twigs, to form the canopy of the tree. In effect the canopy is a mere superficies, slightly domed in form, and 33 ft. in diameter, almost a true circle on plan. This, the highest situate oak in Devonshire, is vigorous and healthy, neither the soil nor the exposure has affected its vegetative power. Pruned remorselessly by the wind, restricted to a canopy wholly out of proportion to its root and branch system, rising no more than 7 ft. 4 in. from the boulders around its base, it makes good each year its loss of leaf-bearing twig, with generous shoots bearing leaves of more than average area. This year, 1922, on the 17th of June, it had already put forth new twigs, many of which were 9 in. (229 mm.) in length, and bore 18 leaves apiece; a larger number were 6 in.

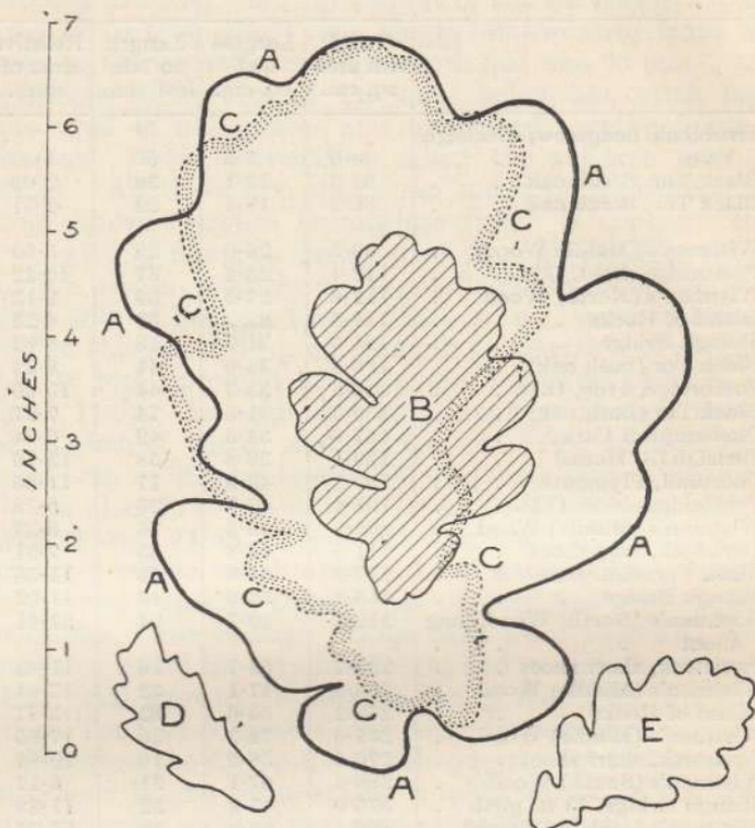
(152 mm.) in length and bore 12 leaves apiece. Taking the top six leaves of a representative shoot, their area totalled 213.3 sq. cm., the largest of the six leaves had an area of 54.6 sq. cm.; the length of the twig from the apex to the insertion of the seventh leaf was 69 mm.; the conjugate diameters of the twig below the sixth leaf, measured in millimetres and multiplied together gave a product, 11.58 (hereinafter called the relative area of stem). All these are above the mean of measurements from fifteen selected Devonshire trees. I compare this tree with a fine oak growing at Shaugh Bridge, whose girth is 152 in., and the corresponding data for which are: total area of first six leaves 215.1 sq. cm., area of largest leaf of the six 54.6 sq. cm., length to insertion of seventh leaf 46 mm., product of conjugate diameters of stem (in mm.) 11.02. Another, and larger, oak at Shaugh Bridge has a girth of 156 in. and a height of 58 ft.; its data are: total area of first six leaves 375.9 sq. cm., largest leaf 67.3 sq. cm., length to insertion of seventh leaf 32 mm., relative area of stem 11.88. The Black Tor oak may be the most amazing tangle which ever had the name of tree, but its vegetative capacity equals that of very fine and shapely examples. The Shaugh Bridge oaks were measured later in the year and the terminal leaves had more fully acquired their final growth; allowance being made for this, the Black Tor tree compares even more favourably.

I shorten the discussion of this question of leaf area and internode length by inserting a table, in which the trees are entered in order of sum of the areas of the first six leaves on the twigs. It will be seen that, if we except the scrub oaks, the Black Tor trees take place quite regularly among examples from the most favourable localities for growth. The relative areas of stem vary with so many circumstances which it is impossible to insert here that no general comparisons can safely be made. The meaning of the term "relative area of stem" is explained above, the approximate actual area in square millimetres can be obtained by multiplying the tabular numbers by .7854, treating the section as an ellipse. I may note that in *Black Tor Beare* all the trees which I have examined have been of the *pedunculata* variety, but the two trees examined near the Island of Rocks were both *sessiliflora*, the only specimens of this variety which I have seen in the course of the inquiry.

TABLE OF TWIGS CARRYING SIX LEAVES.

	Total leaf area sq. cm.	Largest leaf sq. cm.	Length to 7th leaf mm.	Relative area of stem.
Scrub oak, hedgerow, Bickleigh Vale	34.0	7.5	56	1.82
Black Tor, Scrub oak	57.0	13.1	30	2.09
Black Tor, Scrub oak	60.2	16.4	22	2.31
A Wistman's (Middle Wood)	99.2	26.0	28	5.50
Postbridge, 1040, O.D.	112.4	25.2	37	10.22
B Wistman's (North) Wood	112.6	27.5	59	9.13
Island of Rocks	114.5	28.2	61	4.25
M Shaugh Bridge	124.5	31.7	18	5.02
X Black Tor (bush oak)	126.8	38.0	44	8.28
Postbridge, 1160, O.D.	146.3	33.3	44	13.90
X Black Tor (bush oak)	150.3	31.6	74	7.27
Okehampton Park	157.6	34.5	49	6.84
Farleigh (S. Hams)	169.1	39.8	58	13.76
Thornhill, Plymouth	193.2	42.9	17	11.66
Postbridge, 1050, O.D.	193.4	40.0	25	5.78
A Wistman's (Middle) Wood	202.5	40.6	74	8.33
L Tavistock, long shoot	211.5	49.8	65	7.51
Y Black Tor, S.E. tree	213.3	54.6	69	11.58
M Shaugh Bridge	215.1	54.6	46	11.02
B Wistman's (North) Wood, long shoot	219.7	40.7	94	22.41
L Tavistock, short shoot	225.7	53.7	16	11.83
Wistman's (Middle) Wood	255.9	47.1	32	17.64
Island of Rocks	258.2	54.6	82	13.87
C Wistman's (Middle) Wood	268.9	74.3	36	17.65
L Tavistock, short shoot	270.6	58.2	16	10.84
Wistman's (South) Wood	289.4	67.1	31	6.17
Shaugh Bridge, 13 ft. girth	375.9	67.3	32	11.88
Wistman's (Middle) Wood ¹	def.	97.8	18	25.77
L Tavistock, long shoot	411.5	104.7	96	10.49
E Wotter (very exceptional) ²	608.6	156.5	37	26.31
Mean (29)	208.6	50.3	45	11.01
Mean, excluding scrub oak and "E" (26)	204.7	49.0	47	11.10
Mean, excluding Wistman's, Black Tor and "E" (15)	212.0	47.9	44	9.92
Mean of Wistman's Wood (8).	206.9	52.6	46.5	14.07
Mean of Black Tor, excluding scrub (3)	163.5	41.4	62	9.04
D "Druid" Seedling (Wistman's Wood stock)	332.7	85.9	33	18.62

¹ Seventh leaf 118.0 sq. cm.; some leaves defective.² Excluded from all means.



Comparison of largest leaves from shoots bearing six leaves each.

- A. (Full line), from tree at Wotter, Lee Moor, area of leaf 150.5 \square . cms.
- B. (Hatched), from tree at Shaugh Bridge, girth of tree 152 inches, area of leaf 31.7 \square . cms.
- C. (Dotted), from deformed tree in Wistman's (middle) Wood, area of leaf 97.8 \square . cms.
- D. From hedgerow near Bickleigh Bridge, scrub oak, owing its characteristic scrubby growth to hedge-pruning, area of leaf 7.5 \square . cms.
- E. Black Tor Beare, scrub oak, grazed down by animals, area of leaf 13.1 \square . cms.

NOTE.—The above reference letters do not correspond to those given in printed table, and elsewhere in paper.

In the selected area in *Black Tor Beare* twelve trees out of sixty-three living oaks are in part decayed; this is a proportion of 19 per cent, as compared with 24 per cent at *Piles Wood*, and 42 per cent at *Wistman's Wood*. There are also fourteen oaks which are dead. Two small saplings are to be seen springing from the roots of trees, otherwise apparently dead, and on one root the three main branches are quite dead, but a shoot 4 in. in girth and 4 ft. in height is growing healthily.

I noted two mountain ash trees in the selected area, both small, from 5 to 6 in. in girth and 8 ft. in height; but just outside that area is a mountain ash of 44 in. girth and 28 ft. in height. Ivy is frequent, and at places is growing strongly. *Corydalis claviculata* grows in quantity on the boulders around the isolated tree at the south-eastern end, at an elevation of 1530 ft. O.D. Ferns are plentiful, the following list of species is incomplete: *Polypodium vulgare*, *Lastrea dilatata*, *L. filix-mas*, *Blechnum spicant*, *Pteris aquilina*.

VII. SUMMARY AND CONCLUSIONS.

The three woods have much in common. As regards site, each stands on a steep slope of westerly aspect in a deep valley. It is obvious that east winds are good for neither man, beast, nor oaks. Notwithstanding the extraordinary effect that winds from the W.N.W. have had upon the oaks at *Wistman's Wood*, and upon some of the highest situate oaks at *Piles Wood* and *Black Tor*, we may be in some danger of overestimating the inclemency of the climate. At *Wistman's Wood* there are many hut circles along the side of the hill above the Middle and North Woods and above the ground between them; at *Piles Wood* there are hut circles on the hill-side well beyond the trees; and our predecessors of the early Bronze Age had a very good idea of desirable sites for their habitations; especially they liked dry ground with a warm exposure. I yield *Black Tor* to the pessimistic critic; there no early man had the hardihood to build his dwelling.

Each of the three woods springs from soil which chiefly consists of boulders; in fact, the association of boulder and tree is so marked that evidently the presence of the former is necessary to the origin of the wood. Several reasons suggest themselves. It has been held, by Mr. Harris among others, that the shelter of the boulders was

essential to the first seedlings as protection from the storms. It has been held, by Mr. Miller Christy among others, that the boulders protected the seedlings from grazing cattle; certainly at parts of each wood no cattle could penetrate in consequence of the roughness of the ground. I myself have above suggested that the cattle, where not of necessity excluded, found nothing to tempt them into the area, in consequence of the absence of herbage among the boulders; and this although I have seen a Kerry cow walk a quarter of a mile over its native hills to crop a square yard of green stuff; our Dartmoor cattle are not as hard pressed. These arguments do not exhaust the benefits which the trees derive from the boulders; I believe there is truth, partial at least, in all the above. But there is another advantage which must be allowed considerable weight. In shallow and yielding soil no oak, exposed as on these hill-sides, could find an abiding place for its roots; once beyond the sapling stage it must become a windfall. But, wedged in the crevices between the granite blocks, and wandering far in search of the sparse soil, the roots find such anchorage as must be necessary to sustain the eccentric load of procumbent trees; as a foundation therefore the boulders are an essential. And I would repeat that you must not too closely judge the past by the present, the ground was rougher in all these woods when the trees first colonised them; in the course of ages the accumulation of leaf mould has smoothed away many of the irregularities which formerly existed.

It was long ago noted by De la Beche (9, p. 476) that oaks grew well on "growan" soil, growan being the decomposed granite surface which forms the subsoil of so many acres of Dartmoor. I have given instances of the recuperative power and vegetative capacity shown by certain trees; in so doing I may not have specifically stated that in each of the three woods which we are considering there is ample evidence that each season's growth is healthy and normal, being fully up to the standard of lowland oaks. The difference is that in these woods such growth is not additive in successive seasons, it is largely expended in making good the losses which are brought by most winters. There may perhaps be a little disadvantage caused by the shorter growing season enjoyed by the trees on the Dartmoor highlands, but this is certainly not very marked.

Among the boulders the oaks have widespreading root systems ; the soil is merely a filling of the interstices of the "clatter" of rock, and a considerable length of root is necessary to place the tree in contact with a sufficiency of humus. It is notable that, in each of the woods, even the older trees show a strong tendency to the continued formation of adventitious roots, which spring from the base of such trunk as the tree may possess. It is, I think, from these more recent and shallow-seated roots that suckers arise at some distance from the parent tree. The root system not infrequently retains its vitality after the sub-ærial growth has been destroyed, and fresh saplings then spring to replace the lost tree. There seems to be an opinion among foresters that the regenerative capacity of the oak largely fails at the age of ninety years or thereabouts, and trees coppiced after that age will doubtfully make fresh growth. This certainly is not true of the ancient woods of Dartmoor. I think that it would be difficult to fix an age limit at which the roots, deprived of their trunk and branches, cannot replace them ; there may well be root systems in full life at *Wistman's Wood* which are older than any of the trees. The circumstances are in part like those of plants which propagate by runners or by other vegetative processes, one cannot say that the plant ever dies until it has been extirpated as a species from a given area of ground. But, more than that, there is here the great vitality exhibited by the original root, apart from its adventitious extensions.

If, then, the growth and vitality of the trees is such as I claim for them, how are we to account, first for their small absolute size, and secondly for their small size relative to their age ? The answer is that the trunk and branch system of any tree, until decay sets in, is directly proportioned to the leaf area which it has borne and the period of time over which it has borne it. If each winter, or most winters, a proportion of the leaf-bearing twig is killed off, if even whole branches suffer breakage, then the tree as a whole can never attain the full canopy which the vigorous growth during the successive summers of its existence would represent, could such growth be preserved. Trunk area for trunk area, these stunted trees carry certainly less than one-quarter, in some instances less than one-sixth of the leaf area which trees having similar girths would carry in sheltered situations. I am sorry that I

have not found time to make exact comparisons. It follows that the increase in diameter of the trunk will each year be only from one-fourth to one-sixth (or such other proportion as precise measurement may disclose) of the increase of a lowland oak. After a time the canopy of leaf becomes practically a constant, destruction and reconstruction balancing, but the trunk and branches continue their slow increase in diameter. We can make one, approximate, comparison if we ignore the possibility of the small procumbent tree at *Piles Wood* being older than the *Wistman's Wood* seedling now growing, at the age of twenty-six years, in Mr. J. S. Amery's grounds at *Druid* (D). The little oak at *Piles Wood* has a girth of $8\frac{1}{2}$ in., Mr. Amery's oak, at the same height above the ground, girths over 15 in., and this latter tree spent the first seven years of its existence in a pot. In diameter of trunk the more favourably situated tree has come near a ratio of 2 to 1 as against the exposed plant, and this in a little over a quarter of a century. The *Piles Wood* oak is 4 ft. 8 in. in height, the *Druid* tree reaches 14 ft., a ratio of 1 to 3. The *Piles Wood* oak branches away from the wind and in that direction only; the *Druid* tree branches toward all quarters of the horizon; the leaf area borne by the *Druid* tree must be at least eight times that of the tree at *Piles Wood*. So great a divergence, attained at such an early age, is excellent evidence of the possibility of extreme divergences in later years.

I have already pointed out that the young procumbent oak at *Piles Wood* must have 18 annual rings to the radial inch, more probably 20; the *Druid* oak has 11 rings only in the same distance.

Laslett counted the number of annual rings in 21 different specimens of English oak; his first ten trees were of relatively slow growth; at 9 in. diameter they gave a mean of 28 annual rings, or just over three to the inch; at 6 in. diameter they gave $3\frac{2}{3}$ rings to the inch. The *Druid* oak has three times this number, but its early life in the pot probably cramped it somewhat, and it must also be remembered that *Druid* is practically 600 ft. above sea-level. Comparing Laslett's figure of 28 years age for 9 in. diameter, with Buller's oak from *Wistman's Wood*, showing an age of 163 years for the same diameter, we have actual figures for the difference between normally grown timber and that of our Dartmoor woods. Had I taken Laslett's

second ten trees, which gave a mean of 16 years age at 9 in. diameter (admittedly magnificent specimens) the comparison would have been more striking. Now all Laslett's trees were such as yielded marketable timber, and the length of trunk has also to be considered; on the other hand, the Dartmoor oaks must be credited with the immense amount of wasted effort which they have had to put forth in the shape of growth destroyed soon after its formation. I have no doubt that the leaf area borne by the trees measured by Laslett was greater than the leaf area of the *Wistman's Wood* oaks of similar girth, in at least the inverse ratio of their respective ages. This would give from six to ten times, as the proportion of the leaf canopy of the well-grown oaks to that of the dwarfed trees, figures which certainly are not unreasonable.

There is a small collection of trees of varied species at *Shavercombe*, in the Plym Valley. Here the little *Shavercombe* brook, passing, in its course, from the granite to the altered sedimentaries, has carved out, for a short distance, a steep-sided valley; the head of the depression being formed by a waterfall. From the moorland above, the existence of this gully cannot be detected until one is almost upon its verge. Here, in the shelter of the steep sides of the depression, grow fifteen trees, comprising nine mountain ashes, two sycamores, two willows, one hawthorn, and one oak. Not one of these trees show a twig above the crest of the valley side. The oak is of the *pedunculate* variety, its girth is 34 in., and its height 24 ft; it twists its trunk so as to almost hug the cliff from which it springs; its next neighbour of the same species is two miles distant, which raises the question of how the acorn reached this remote spot, and by what chance it fell in this one sheltered valley of such small area, rather than upon the unfriendly moor. From time to time I have found the remains of acorns upon the open moorland at least a mile to two miles or more from the nearest oak trees. Another problem is the arrival of the seed of the first of the two sycamores, the nearest possible parent being also two miles distant, but I do not doubt the capacity of a high wind to effect the transport of a sycamore seed over this distance.

Isolated thorn and mountain ash trees occur in various parts of the moor; their distribution is not hard to explain, and in hardiness these species far surpass the oak. Or

the slope of Yes Tor, at an elevation of 1420 ft., is a hawthorn tree, wholly unsheltered from any quarter. It girths 10 in. and stands 9 ft. high, and this year it has been covered with blossom.

Four hundred yards north-east from Black Tor, at an elevation of 1570 ft., are two mountain ash trees, which as seedlings had shelter from boulders, but have now outgrown it; both stand 12 ft. 10 in. in height, the girth of one is 17 in. and of the other 11 in.; both are strong and healthy. Another, somewhat unhappy-looking, mountain ash occupies an even more elevated position in another cluster of boulders not far distant. It is a peculiarity of the mountain ash that, unlike the oak, it bends before the blast, the trunk and branches taking a permanent set; even so, it never assumes the pro-cumbent form which is forced upon the oak by successive amputations.

This, however, is trespassing beyond the subject, and long as this paper may be it leaves sufficient of interest untouched to make unpardonable its expansion with foreign matter.

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POSTSCRIPT.—In the foregoing, I have expressed my belief (see p. 305) that the Dartmoor oak woods described are without parallel elsewhere in the world, and I desire to add a few words as to this.

First, I venture to dissent from the views on this point expressed by Mr. Harris (*ante*, LIII, pp. 242-243) to the effect that similar woods exist. Mr. Harris cites as similar "dwarf brushland of birch and willow" in Arctic regions, the spruce as "a creeping shrub" in Lapland, and the Scots pine as "a dwarf shrub" at high altitudes in Britain. These are, however, not oak woods, as are the Dartmoor woods; nor do they even form woods at all in any ordinary sense. More to the point is Mr. Harris' reference to "the Mediterranean oak forests, composed . . . of low shrubby bushes"; but, if he refers to woods of stunted cork oaks (*Quercus suber*), such as those I have seen on the dry and sterile lower slopes of the Estérel Mountains, I am able to state that these have no resemblance whatever to the oak woods of Dartmoor. Mr. Harris is thinking, apparently, of the character of *dwarfness alone*. If so, he is correct; for some of the trees he mentions are even more diminutive than any in the Dartmoor woods. But these woods have other and more striking characteristics than the mere dwarfness of their trees; and these characters are scarcely even suggested by anything in the woods (if one may so call them) mentioned by Mr. Harris.

Further, I suggest that woods similar to those on Dartmoor do not and cannot exist elsewhere, inasmuch as the unique combination of climatic, geological, and other natural conditions which has given these woods their special characteristics does not occur elsewhere in the world. Those natural conditions comprise a very elevated site (for an oak wood), a soil (if one may use

the term) consisting of practically nothing but huge blocks of granite, occupying a position exposed to terrific wind-blasts, situate near a west coast directly facing a huge ocean, from which come moisture-laden breezes yielding a prodigious rainfall, and all in the Temperate Region in about lat. 50°. If one searches a map of the world, one quickly perceives that such conditions could occur in combination in very few regions—only, in fact, on the west coasts of southern Norway, Scotland, Ireland, British Columbia, and Patagonia. Now enough is known of all these coasts (except, perhaps, that of Patagonia) to enable one to say, with practical certainty, that no oak woods of the Dartmoor type occur on or near any of them.

The natural conditions which obtain on certain elevated portions of the west coast of Ireland seem to approach more closely those met with on Dartmoor than do any which obtain on the other coasts mentioned. I have, therefore, made special enquiry as to weather any oak woods of the Dartmoor type exist there. None such are mentioned in Dr. R. Lloyd Praeger's excellent *Flora of the West of Ireland* (1908), though various isolated trees, oak and other, of stunted growth (due to the rocky soil) and much distorted by the force of high winds from the west, are referred to. Prof. A. Henry, of Dublin, than whom there is no higher authority on British and Irish trees, kindly writes me, in response to an enquiry: "I know of no such woods in the West of Ireland. . . . There are bits of oak woods in Clare, with small trees; but these are of no great size and occur only in one or two ravines." Further, Mr. R. A. Phillips, of Cork, whose acquaintance with the botany of the West of Ireland is exceptional, writes me: "I do not think I have ever seen oaks so deformed as those shown in your photo (certainly no woods or groves of such), and I feel sure that you are correct in saying that such do not exist in Ireland."

I maintain, therefore, that I am fully justified in the belief I have expressed as to these remarkable Dartmoor woods being of a type which is unique in the whole world.—M.C.