4.3 THE MENS FIVE YEARS AFTER THE STORM

The effect of storm damage on growth increments

Growth of beech, oak and holly over the period 1988/9 to 1992/3 was compared between six quadrats which had been severely storm damaged and seven which had not. The two categories were subdivided into beech dominated, oak dominated and mixed categories, as in previous studies. The comparison was made on the girths of individual stems, only stems which were still living and standing at the time of the later survey were included. Although most stems had grown, several showed no change and a few appeared to have decreased in girth; it is not known whether such decreases are genuine or whether they were due to experimental error. Therefore only those stems showing increase were used in the analysis. The results are shown in table 4.

In both oak dominated and beech dominated quadrats trees appear to have grown more slowly in the storm damaged areas. Both oak and beech grew more in oak dominated quadrats, but these differences may be too slight to regard as definite. In the mixed quadrats, however, beech appears to have shown significantly more growth in storm damaged quadrats.

Table 4 **Growth of trees in storm damaged and undamaged stands (increases are shown as mean increment in girth at breast height in cm.)**

		Storm Damaged	Undamaged
Beech Dominated Quadrats	Beech	5.4	6.3
	Oak	2.0	-
Oak Dominated Quadrats	Beech	6.0	8.5
	Oak	3.4	6.0
Mixed Quadrats	Beech	6.6	2.7
	Oak	3.0	2.6

An examination of changes taking place over a five year period in an example stand.

One example stand has been selected so that the details of vegetation change can be closely examined in order to address what actually happens on the ground.

Quadrat 84 was chosen as it represented a good example of "mixed" woodland (ie no single species dominated the stand) which had received considerable storm damage. Three diagrams have been drawn to show the composition of the stand:

a) just before the storm
b) One year after the storm
c) five years after the storm.

On each diagram the location, size and species of each tree is detailed along with further information like locations of fallen trees and presence of root pits.

The 1988 survey collected data for the Mens one year after the storm thus diagram b) was compiled directly from the data. Diagram a) was compiled by reconstructing the state of the stand before the storm - it was known which trees were windthrown by the storm so it was a simple matter to stand them up again in the imagination. Diagram c) was drawn using data from the 1992 re-survey which followed the fate of all individual trees.

Detailed statistical calculations for this stand are perhaps less meaningful than a verbal description because the situation was confused by trees falling into and out of the quadrat. However, the stand started as a mixed oak/beech wood prior to the storm. Following the storm similar proportions of oak and beech blew over but remained alive until the 1988 survey. Several standing trees were also damaged either by having main branches removed, or were tipped and leaning because of fallen trees pushing on them. Some shrubs were also crushed by fallen trees.

By 1992 all of the trees which fell and were alive in 1988, had died. One leaning tree in 1988 had fallen to the ground and had died by 1992. All were in an advanced state of decay. One standing oak and one standing beech were badly damaged but alive in 1988. By 1992 these too had died. The two crushed hawthorn shrubs, however, were still alive in 1992.

These observations contrast greatly with more anecdotal observations elsewhere. It has often been reported that trees survived uprooting and continued to grow. The situation in The Mens may be different in that many of the canopy gaps here were quite small. Thus a tree which fell would be receiving greatly reduced light levels so would eventually die. This may also be the case for severely damaged but standing trees which would be at a competitive disadvantage to their neighbours.

Many of the remaining trees, however, had put on significant growth. Beech, it seems, was achieving a higher growth rate than oak, though one of the oaks had sprouted a mass of epicormic

growth (see the appendix for details). Many of the shrubs, including one which had been crushed by a falling tree, had put on significant growth. Some shrubs had more than doubled in size.

Many additional shrubs and seedlings had appeared between 1988 and 1992. Much of this regeneration was holly and hawthorn, some of which had grown into significant multi-stemmed shrubs. A large group of regenerating ash seedlings, some of which were deer browsed, had also appeared. Ash is fairly infrequent within The Mens generally so the regeneration of ash in association with canopy gaps is an interesting feature.

Figure 13

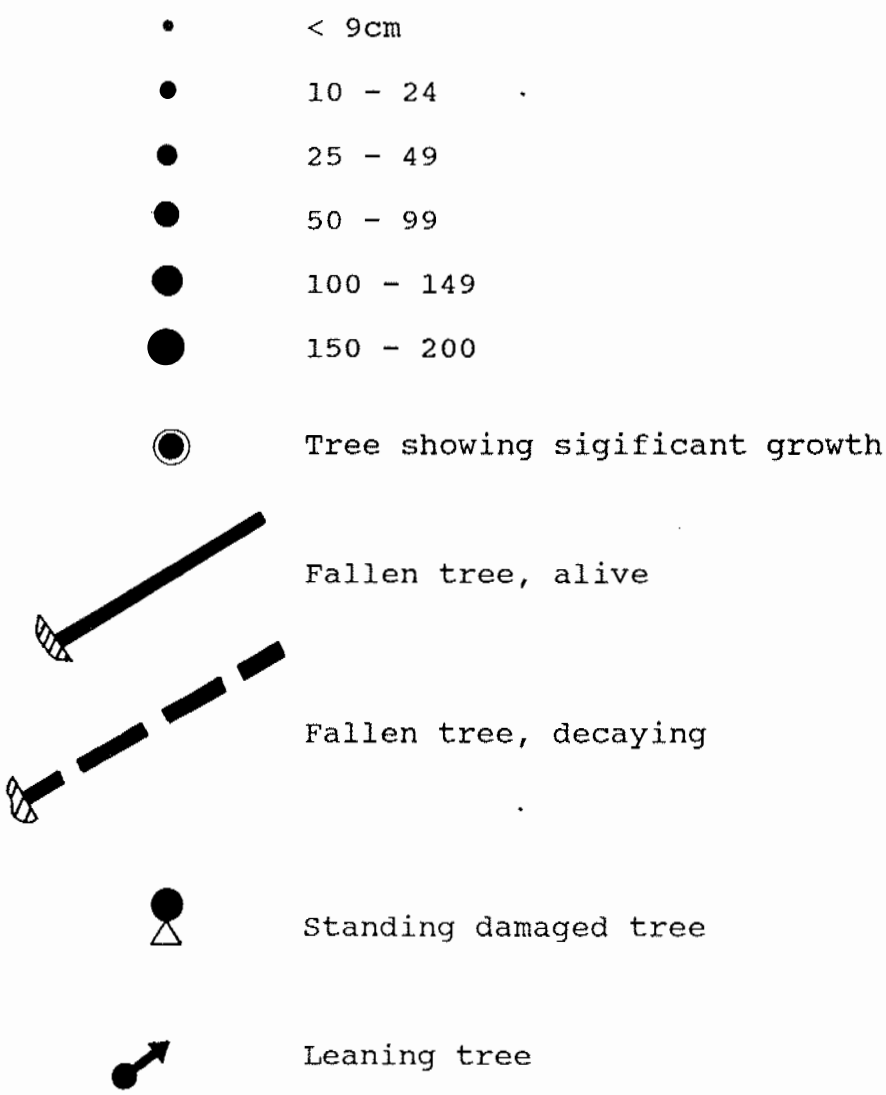
An examination of one stand (quadrat 84)

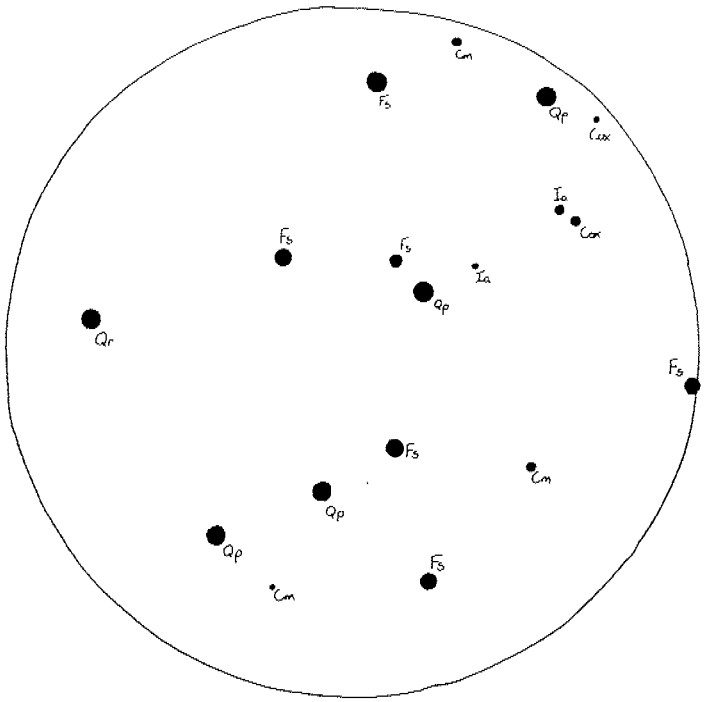
from just before the storm to five years after.

KEY

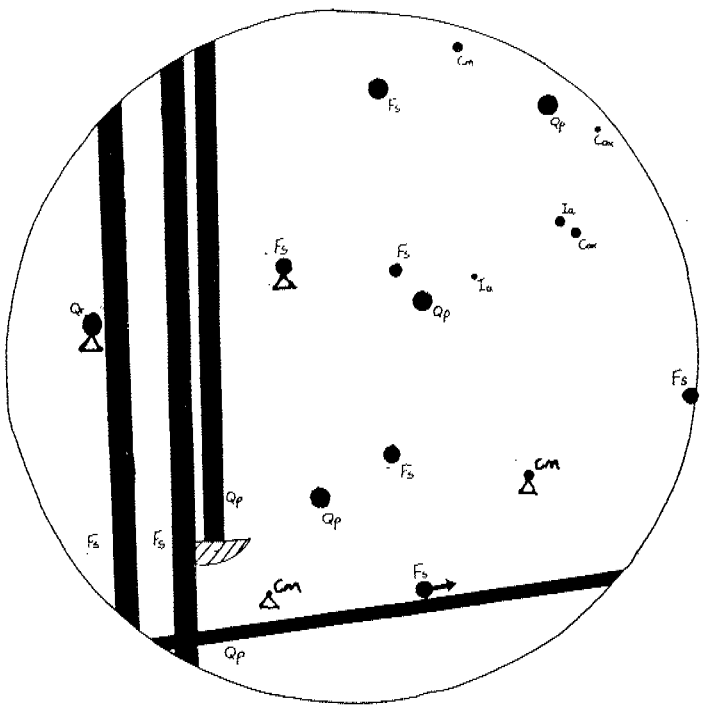
Cm = Crataegus monogyna
Cox = C. oxyacanthoides
Fe = Fraxinus excelsior
Fs = Fagus sylvatica
Ia = Ilex aquifolium
Qp = Quercus petraea
Qr = Q. robur

Girth size categories

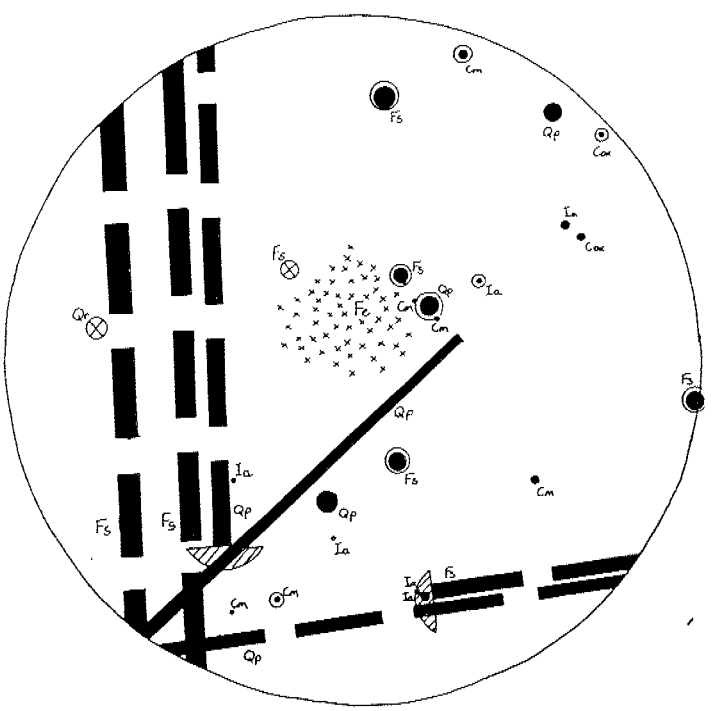




a) Reconstruction of the stand before the storm.



b) The stand in winter 1988/89



c) The stand in winter 1992

5 GENERAL DISCUSSION

This collection of studies is beginning to unravel the nature of the natural vegetation changes that are taking place in The Mens. However, further study is needed in order to be more confident of the apparent patterns that are emerging. More work could be done on the existing data set by carrying out different forms of analysis, but ongoing monitoring is also required in order to follow vegetation change into the future.

The analysis of The Mens before the storm has served two main purposes. Firstly it has given an accurate picture of the structure and principal species composition of the site at one point in time, secondly the analysis of size distributions provides information on possible changes underway prior to the survey.

The site is predominantly a beech/oak mixture, with varying amounts of other species. Beech is more frequent on the sandy soils to the south, pedunculate oak more frequent on clayey soils to the north and sessile oak predominates in between. A further brief discussion of species distribution is given in section 4.1.

The dynamic relationship of the oak species and beech is interesting and the study of size distribution has started to address this. This study may imply some degree of cyclic change between woodland types. In oak dominated woodland beech seems to regenerate freely, as there are many small beech trees, oak, however, does not. Following from this there would be a development towards a mixed wood in which beech and oak are more mixed. In mixed woods, however, oak still is not present in the smaller size classes so again beech appears to increase in abundance at the expense of oak. Beech dominated woodland may therefore appear to be a later successional stage than oak or mixed woods. Thus there appears to be a transition of:

oak wood - mixed wood - beech wood

However, in beech dominated woods oaks become more frequent in the smaller size classes. So oak does remain within the mixture and it may even imply some cycling back to mixed or oak woodland.

Incorporating the effects of the storm may add to the picture. Both mixed stands and beech dominated stands experienced more damage than oak stands, and in all categories beech suffered more than oak. Thus any progression towards beech dominated woodland is interrupted by disturbance which affects beech more than oak.

It is also interesting to note how the site responded after the storm. In spite of being susceptible to wind damage, it was generally beech which grew most after the storm. However, the rate of growth in a storm damaged area was lower than in an undamaged stand. This is surprising as other studies (Merrens & Peart, 1992) have shown that trees in disturbed stands respond by growing faster than those in an unaffected area. It may be that the 5 year period of this is too short. Individuals may take some time to respond to the increased resources available, whilst in the short term they may be suffering from the immediate physical effects of disturbance. Furthermore a loss of branches

will have caused a short term loss of photosynthetic area and consequently a reduction in productivity from the tree.

There may therefore be several conflicting processes affecting the proportions of oak and beech. In the absence of disturbance there may be a progression towards beech woodland, but as oak still regenerates under beech wood there would be some tendency back to mixed woodland. When a disturbance occurs mixed and beech woodland types are affected most, and beech trees generally are affected more than oak. But beech responds by putting on more growth after disturbance than does oak.

The details that are picked up by looking at an individual stand are also informative. The first effect that is noticed is that the storm created a great deal more variety in the stands structure. A closed canopy beech wood was changed to a canopy gap with standing and fallen trees, suffering varying degrees of damage, and with other features like exposed root pits not previously found in the stand. Five years later dead wood had increased considerably, more trees had fallen - some still alive - many saplings had regenerated and trees had put on significant growth. Many shrubs, previously a more minor component of the stand, had increased in number and grown considerably. Of further interest is a large pulse of regenerating ash seedlings which had appeared in the stand. The apparently random distribution of ash in The Mens may therefore be the result of ash regeneration in canopy gaps following disturbance.

These details confirm the general picture that disturbance creates variety within previously more uniform stands, and that this variety results in the presence of many more species on a site than would be the case in the absence of disturbance.

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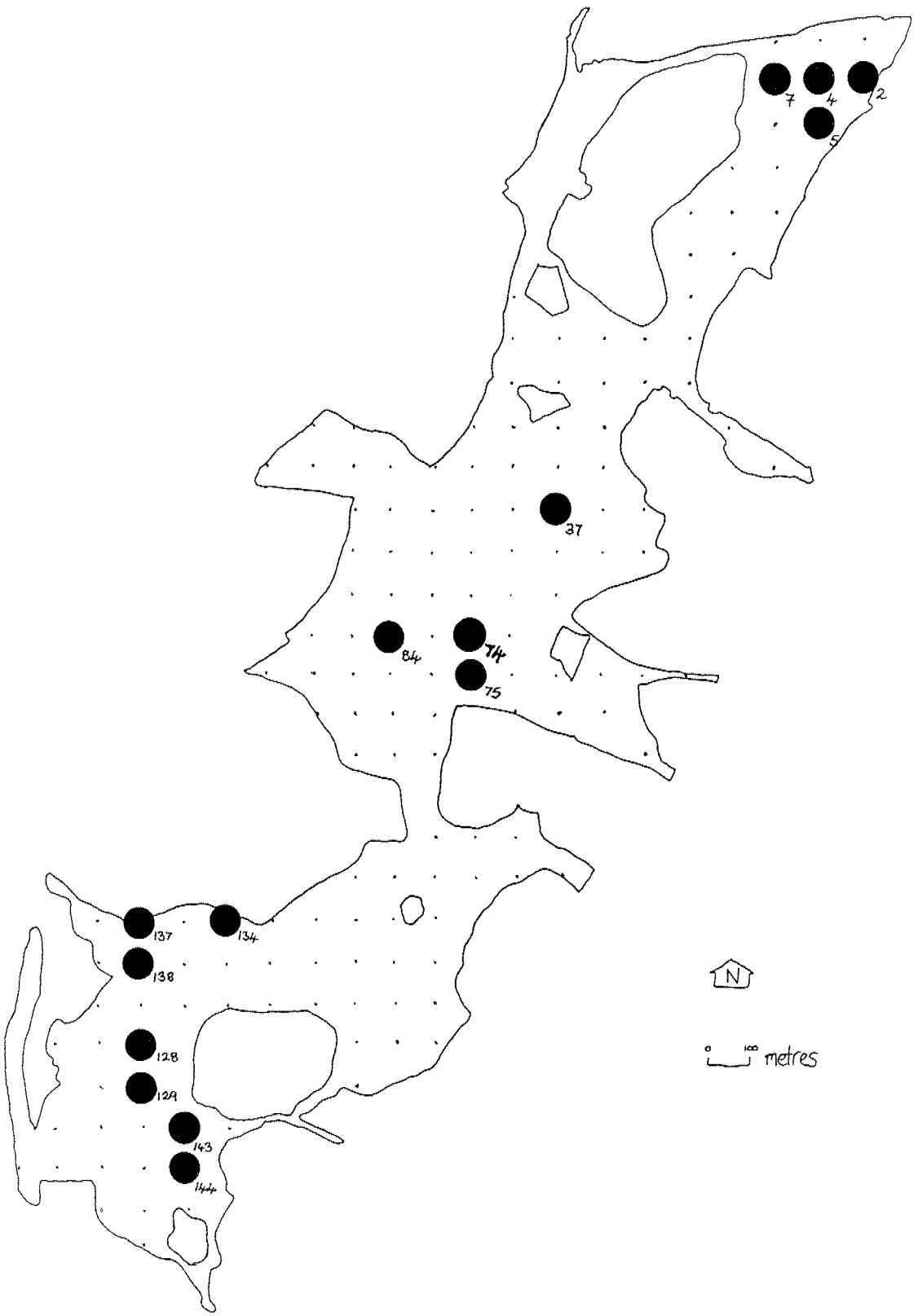
APPENDIX

Raw data from the 1992 resurvey including a map showing locations of sample plots resurveyed.


7
4
2
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metres

VEGETATION SURVEY OF THE MENS – 1992/93.

PLOT No : 2 DATE : 30/10/92 SURVEYOR: FRANK DOUGHARTY

Tree Code No	Species	Girth at breast height (cm)	NOTES
1	HOLLY	15 cm	Shrub. Multi-stemmed.
2	HOLLY	20 cm	Shrub entwined with honeysuckle.
3	BEECH	30 cm	Sub-canopy but growing fast.
10	OAK	1 m	Canopy. A little honeysuckle to halfway.
11	HOLLY	25 cm	Shrub.
12	BEECH	(34 / 15)	Sub-canopy. Deeply entwined with honeysuckle and not doing well.
13	HOLLY	32 cm	Sub-canopy. Branches up to 2 m high are drooping to and running along the ground The higher branches are going upwards.
16	HOLLY	5 cm	Shrub. Looks like one of the branches from number 13 has taken root here.
14	OAK	1·35 m	Canopy. Lowest branch almost dead.
17	BEECH	1·27 m	Canopy. Hollow centre showing at intervals up to half its height, some holding water. Leaning to get the light. Item 2 has rotted away
15	BEECH	47 cm	Stump of fallen tree. 1m high and hollow, as is the fallen trunk. Rotting well
18	HOLLY	42 cm	Sub-canopy. With berries.
19	HOLLY	25 cm	Shrub. Sprawling with multi-stems.
21	OAK	1·6 m	Canopy. Lost a few branches in hurricane
22	HOLLY	17 cm	Sub-canopy. Top 4 has died. Several smaller stems.
20	HOLLY	14 cm	Sub-canopy. Leaning but with slight change of direction every metre or so. Presumably the light source shifted every few years.
6	OAK	1·75 m	Canopy. A superb tree. About 12 m to the first branch. A few thin 'heart of oak' remains of earlier branches still showing.

VEGETATION SURVEY OF THE MENS – 1992/93.

PLOT No : 2 CONT. DATE : _____ SURVEYOR: _____

Tree Code No	Species	Girth at breast height (cm)	NOTES
8	BEECH	1·85m	Canopy. This tree has a spread of branches 20 m wide
9	HOLLY	13 cm	Shrub.
7	OAK	1·56m	Canopy. Superb tree.
5	HOLLY	(67 46)	Just canopy. Two branches, one going straight up.
25	OAK	2·25 m	Canopy. Four branches from 6 m going almost straight up and all to the canopy. The top of one big branch was broken off in the hurricane.
4	MISSING		
24	HOLLY	6 cm	Shrub. Mostly held down by fallen oak branch but starting to grow up out of it.
23	OAK	1·30m	Canopy. A mass of small branches to about half its height are beginning to die off as the canopy closes after the hurricane. Honeysuckle up to halfwa
26	Holly	5 cm	New shrub replacing # 14.4

VEGETATION SURVEY OF THE MENS – 1992/93.

PLOT No : 4 DATE : 3/11/92 SURVEYOR: F. DOUGHARTY

Tree Code No	Species	Girth at breast height (cm)	NOTES
1	Holly	6	Shrub
2	Holly	(13 10)	Shrub – multi-stemmed
3	Holly	60	Sub-canopy
4	Holly	50	Sub-canopy, possibly same root as No. 3.
5	Oak	180	Canopy. Main trunk broken off in hurricane and is No. 51. Lowest branch has a long split.
19	Holly	11	Shrub, trailing and rooting.
9	Holly	9	Shrub, trailing and rooting
10	Holly	8	Shrub.
11	Holly	28	Shrub, multi-stemmed, with berries.
12	Oak	175	Canopy, first branch at 9m.
14	Birch	23	Dead, standing but decaying rapidly.
52	Holly	15	Shrub, multi-stemmed. NEW shrub not recorded in 1988
13	Birch	45	Canopy, at least 18m tall
23	Sallow	30	Dead, leaning on to No 25.
25	Sallow	41	Sub-canopy, Struggling to survive
24	Hazel	(24 18)	Horizontal, Struggling to survive.
15	Holly	32	Sub-canopy, many minor stems.
16	Holly +2 stumps	(38 16)	Sub-canopy (wrongly shown as beech in 1988)
17	Holly	34	Sub-canopy – could be same root as No 16.
18	Beech	76	Canopy, angular, Several awkward branches,
28	Birch		Almost rotted away, stump 70cm high.
27	Oak	120	Canopy, nearly all the branches lie to the north
51	Oak		Fallen from No 5, little decay some fungi.
8	Oak		
7	Oak		Fallen branch, little decay, holding down No 47
22	Birch	35	Sub-canopy
20	Beech	31	Sub-canopy, many low branches.

VEGETATION SURVEY OF THE MENS – 1992/93.

PLOT No : 4 (cont) DATE : _____ SURVEYOR: _____

Tree Code No	Species	Girth at breast height (cm)	NOTES
21	Holly	9	Shrub, multi-stemmed.
29	Birch	31	Sub-canopy
26	Holly	10	Shrub, mult-stemmed
30	Holly	10	Shrub, mult-stemmed with berries
32	Birch		Fallen, rotting rapidly, stump almost gone.
31	Birch	29	Dead, leaning, (sub canopy).
33	Birch	23	Sub canopy
34	Birch	30	Dead, still standing, with honeysuckle
35	Hazel	(9 30 20 / 18 20 (23))	Shrub, multi-stemmed. (23) dead stem
36	Holly		} Possibly same root stock
37	Holly	(39 / 23)	Sub canopy, berries }
38	Holly	(13 / 8) (15)	(15) dead stem Shrub, mult-stemmed.
39	Holly	(16 / 13)	Shrub, multi-stemmed
40	Oak	170	Canopy, branches mostly lying to the south
41	Holly	13	Shrub, multi-stemmed.
42	Holly	15	Shrub, multi-stemmed.
43	Holly	17	Sub-canopy, multi-stemmed.
44	Holly	(55 45 / 33 25)	
6	Holly	9	Shrub, multi-stemmed.
45	Holly	(19 / 43)	Canopy.
46	Holly	27	Sub canopy, many minor stems
47	Holly	27	Sub canopy but held down by branches.
48	Holly	22	Root alive, with minor stems, but main stem dead, standing with top broken off. Very little decay.
49	Beech	(32 / 22)	Sub-canopy, multi-stemmed, main branch broken by fallen branches but still alive.
50	Oak	125	Canopy.

VEGETATION SURVEY OF THE MENS – 1992/93

PLOT NO : 5 DATE : 3/12/92 SURVEYOR : FRANK DOUGHARTY

Tree code number	Species	Girth at breast height (cm)	Notes
1	Holly	19 cm	Shrub. Multi-stemmed. Berries.
2	Oak	1·41m	Canopy. Several small young branches, the lowest only 1m from ground level.
3	Oak	–	Fallen branch. Decaying rapidly.
4	Holly	7 cm	Shrub. Stems have bent over, many have layered.
5	Holly	15 cm	Shrub. 3 stems.
6	Beech	28 cm	Shrub. Many angled stem, the top is cracked and held down by a large fallen oak trunk.
7	Holly	10 cm	Shrub. Multi-stemmed.
8	Oak	—	Fallen branch. Decaying slowly.
9	Oak	–	Fallen. Dead. This is the trunk of a small tree which has been down many years. Still solid.
10	Oak	90 cm	Canopy. From 2m there are many small branches of not more then 3m long all the way up to the large branches at canopy height.
11	Oak	—	Fallen branch. Masses of fungi.
12	Oak	–	Fallen top of N°15. Shown on map as from N°18. The small branches are decaying rapidly with lots of fungi. The trunk shows a little fungi on the torn parts, otherwise only moss.
13	Oak	—	Fallen branch from top of N° 18. Much fungi.
14	Oak	–	Fallen top of tree outside quadrat. Little decay.
15	Oak	(1·30m	Possibly dead standing? The trunk has been snapped off at 12m with only a few tiny branches which look dead.
16	Holly	4cm	Shrub. Multi-stemmed.
17	Holly	21 cm	Shrub. Multi-stemmed. Entwined by honeysuckle.
18	Oak	1·61m	Canopy. Several top branches broken off.
19	Beech	79 cm	Sub-canopy. Growing out from base of N° 18.
20	Holly	25cm	Shrub. Multi-stemmed. Main stem dead at tip.
21	Beech	88cm	Just into canopy now that 18 has lost branches.
22	Holly	8 cm	Shrub. Multi-stemmed.
23	Beech	–	Fallen branch. Many fungi on smaller branches.