

**Specialist survey of all old pollards at
Burnham Beeches
&
work programme for 2007/8 to 2015/06**

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Survey of all old pollards at Burnham Beeches and future management proposals

CONTENTS

BACKGROUND INFORMATION	5
METHODS	6
Trees surveyed	6
Features recorded	6
SSM	6
Stubs	6
Repeats of 1990 survey	7
Tree health	7
Management issues	7
RESULTS	9
Dead pollards	9
Oak	9
Beech	9
Implications for management	10
Death rate of beech trees	10
Information about live trees gathered during the SSM	11
Species	11
Form of tree	11
Trunk dimensions	12
Hollowing & trunk condition	14
Wildlife value	15
Canopy & foliage features	16
Management impacts	17
MANAGEMENT CARRIED OUT TO DATE	19
FUTURE MANAGEMENT	21
Aim of the management work prescribed	21
The work programme	21
Techniques needed for cutting the pollards	23
Time of year to do the work	23
Recording future work	24
Future checks on old pollards	24
DISCUSSION OR ISSUES RAISED DURING SURVEY	25
Impact of different restoration cutting techniques	25
Type of cutting and amount to remove	26
Habitat issues	27
Shade and surrounding vegetation	27
Other tree management techniques	28
Consequences of a staged reduction	28
FUTURE WORK	30

Recommendations for Burnham Beeches	30
The survey method – recommendations for the future	31
Questions requiring study	31
REFERENCES	32
APPENDICES	
1. Example of recording sheet	33
2. Basic data (SSM)	See attached disk
3. Management programme	See attached disk
4. Action plan for working on each tree in the future	35
5. Guidelines for cutting trees	37
6. Glossary	41
MAPS	
1. Current status of old pollards at Burnham Beeches (dead or alive) ..	44
2. Distribution of beech and oak pollards at Burnham Beeches	45

BACKGROUND INFORMATION

The ancient pollards at Burnham Beeches are the most important features of the site. They are the reason for the high biodiversity of the area and the reason why it is designated as a site of European Importance. Previous reports and articles have described the history of the pollards (as far as can be deduced) and their recent management (Le Sueur, 1931, Read et al. 1991, Read et al. 1996, Read 2000, Read 2006).

The first comprehensive survey of the pollards was started by Keith Stevenson in 1989. He devised simple recording forms for each tree and started tagging them with individual numbers and plotting their location on maps. This work was continued by Helen Read and various students between 1990 and 1992. During this period photographs were taken of each tree, for some several times. All the pollards were visited again by Helen Read in 1999 to check their status as preparation work for the report setting out the work programme completed in 2000. At this time more photographs were taken but a detailed resurvey was not carried out. In 2001 the pollards were plotted accurately using a GPS system operated by John Smith and the original aluminium tags replaced by more secure stainless steel ones. In 2005 Jeremy Young visited most of the pollards to check for any urgent work required. In addition to these formal surveys, any major changes (a pollard falling or losing a large limb) have been noted when seen for any pollards by all staff. During the last 20 years inventories have been made of a variety of different organisms. Any rare or interesting species associated with particular pollards have been noted (for example the moss *Zygodon forsteri*, the lichen *Pyrenula nitida* and various species of fungi).

Since 1998/99 forms have been completed for each tree when restoration cutting was carried out. These include information about who did the work as well as what was carried out. An oversight however was not to complete a form for trees where clearance for light was carried out but no actual cutting of the tree. For some years photographs have been taken before and after restoration cutting but there are not complete sets of these.

All previous information about each tree is now stored in clear plastic folders under the tree number in the office, this includes prints of earlier photographs.

The photographs are now a mixture of prints and digital. The older prints are stored with the paper information about the trees. The negatives are stored in the office and a reference to the exact negative is listed on the paper sheets and also in Excel spreadsheets holding all the information regarding older surveys. Recent digital photographs are stored in the pollard folder on the H drive.

The work programme drawn up in 1999 is now almost completed. The current survey was initiated in 2006 to review the status and condition of the trees and draw up a work programme for future years. An opportunity was also taken to review some of the methods used and evaluate their use for the future.

METHODS

Trees surveyed

The trees included in the present survey were all those considered to be old pollards. This does not include all the veteran or even ancient trees on the site. Young pollards, i.e. those created in the last 20 years were also not included (they are covered by a separate plan which will need reviewing in the near future. Nearly 540 pollards had been identified during the initial survey and tagging exercise in 1989/90, further trees have been added since then and two more trees were added as a result of the present work. In most cases distinguishing a pollarded tree from a non pollarded tree at Burnham Beeches is straight forward. However, there are trees, especially on the west side of Halse Drive and just to the north of Hawthorn Lane, where the distinction is not clear. Since one of the main aims of the present work was to produce a work programme, those trees included here are generally those where a decision has been taken that they are pollards in order that they will be managed. Some of the decisions may be disputed in the future and the distinction is not always clear cut. There are many other old trees at Burnham Beeches which are undoubtedly good for wildlife and some of which might benefit from some management but they should be the subject of a different future survey.

Features recorded

The field work was carried out between December 2006 and May 2007. Due to the early bud burst in spring 2007 the trees surveyed in May were in full leaf. This was only a relatively small number (56), and for some features such as holes and deadwood in the crown the figures given for these trees are almost certainly an under estimate.

SSM

The features recorded on each tree were essentially those of the SSM (Fay & De Berker 1996) with some additions and minor changes. A recording sheet is given in Appendix 1. Additional features or those needing further clarification are listed below:

Squirrel damage: Any damage was recorded regardless of whether it was old or new. An asterisk indicates heavy squirrel damage. This was not recorded for oak trees.

Bats/birds, fungi, lower plants, higher plants: No attempt was made to make a full assessment of species present but anything obvious was noted. In addition wood ant nests in or at the base of pollards were recorded. (Information on rare species associated with a particular pollard at any point in the past was added to the spreadsheet from previous surveys and notes.)

Stubs

Those recorded were only those over 15cm in diameter, thus some trees will have many more cut stubs but these are smaller. Stubs were divided into 'cut stubs' i.e. those created recently as a result of the restoration pruning work and old/live i.e. those created in the distant past by pruning and those that are presumably naturally created.

Note that for the trees surveyed in May the figures for some trees will be an under estimate because of the difficulty in seeing stubs with the full foliage on the trees.

Repeats of 1990 survey

These features were recorded to compare with the previous detailed survey of the trees, prior to the development of the SSM.

Stem Condition: Hollow, rotten or solid – a simple assessment based on what was visible from the outside of the tree

Stem condition 1-10: 1 being a poor looking and small remnant of the former trunk, 10 being completely intact and in very good condition.

Canopy: Good, fair, poor, very poor – This is an assessment of the amount of canopy/branches the tree has in relation to a complete canopy (some degree of compensation is made for the fact that these trees are pollards and thus a complete full canopy is not to be expected).

Canopy % live growth 1-10: This indicates the amount of live growth on the branches that remain. It should be the same as the SSM ‘current live growth’ but is a fine scale.

Tree health

Initially the two scores found to be the most useful from the 2006 Beech tree health study were estimated for both old growth and young growth following cutting. However in the first trees there was no discernable difference between them, thus twig structure alone was used. In reality these scores record the health of the poorest branches and the best branches on the trees. This was not recorded for oak trees. Categories recorded also included: Too early to tell (trees cut too recently for any growth), none (i.e. no new growth seen), not cut and unable to distinguish (old and new growth).

Management issues

Response to cutting: recorded on a scale of 0-4 with 0 being a decline in health since cutting and 4 being exceptionally good growth. Note that response may be as a result of more light reaching the tree not actually cutting. Features looked at in making this assessment were: Growth of new branches from or close to the cut surface, re-iterative growth (i.e. from retained branches), adventitious growth from lower down on the branches, callous growth of cuts. Note was also taken of the response of the tree to cuts in the 1950s and as a result of any accidental damage.

Estimated end point: This is the height above the bolling (in metres) that it might be realistic to expect that the tree could be brought down to. In almost all cases it was not considered that in the future it will be possible to cut the tree again actually at the original bolling. Some trees have already reached their end point, most have not. For some the end point may be high above the bolling. The end point is the best estimate at the present time, future technology may enable lower end points to be reached in the future.

Estimated number of operations to achieve this: The number of times the tree is likely to require reduction work in order to reach the end point specified above. When this

is reached it can then be considered to be 'in cycle' and needing only maintenance work.

How much in the first operation: This can be specified in several different ways, as a % crown reduction or as length in metres. It describes the next operation that the tree requires. It may also include any other work, for example clearance of neighbouring trees for light.

Length of time to reach end point: This is the number of years estimated (roughly) to achieve the end point. This may vary between 0 and 40 or more.

When to do the next work: The first cutting operation and any other work required (clearance, mulching, removal of path) are written into the appropriate year span.

Climbing/platform: Possible methods for cutting the pollard are indicated.

New pollard potential: This refers to neighbouring trees and could refer to beech, oak or other tree species.

Notes

This field was left for anything else that was worthy of recording. Frequent entries included comments about old or new cable bracing, whether the tree was cut previously in the 1950s etc.

RESULTS

Map 1 illustrates the status of the old pollards at Burnham Beeches, indicating which are dead and which alive. Map 2 illustrates the distribution of beech and oak pollards.

Appendix 2 presents the data obtained from the SSM with additions as outlined in the methods section.

Appendix 3 consists of the management programme for each tree, shown for all trees and then broken down per year.

Dead pollards

Of the total 572 pollards that have been tagged 151 are now dead. (Of the 538 tagged and recorded in 1990 the figure is 146). 10 are oaks (5 *Q. robur*, 3 *Q. petraea* and 2 unknown species) and 141 are beech.

Oak

All the dead oaks died standing except one that was knocked down by another falling tree. Five were considered to have died from lack of light and 2 from too much light and heat following rapid clearance of surrounding vegetation. None had been cut recently although one had old cuts from previous work (and then suffered from lack of light).

Implications for management

The main cause of death for oaks is not enough light, but opening up too quickly can cause death by drying out.

Beech

Causes of dead in beech were noted where possible and these were put into broad categories, (it should be noted however that if trees are not seen soon after death they can be put into the wrong category – for example a tree dying standing can then fall over)

Cause of death	Number of trees
Loss of branches (either entire top at one time or more gradual loss of branches)	41
Fallen whole	35
Standing more or less whole	32
Died standing after major limb loss	29
Felled (inadvertently)	1
Unknown	3

This table does indicate that the heavy nature of the branches causing the trees to fall completely or to lose enough of the branches that the tree is unsustainable is the major cause of death.

The table below illustrates cause of death in relation to management activities. The results are shown below:

Cause of death	Number of trees
Death after cutting work	13*
Fallen or death following major branch loss after clearance but before any cutting work	10
Other trees falling into them	5
Surrounded by Rhododendrons (lack of water?)	3
Flooded by stream blockage	1
Compaction by cars	1
Felled	1
Cleared round and then signs of drought stress	1

*Of the trees dying following cutting:

7 were cut after major limb loss (largely in order to stabilise the tree)

3 suffered lack of light after cutting

1 fell, it was a very tall tree with heavy branches and no easy lower cutting point

1 was also a very tall tree that had already lost almost half the branches and may have suffered from lack of light

1 was generally looking in poor health

Thus only three pollards died from a situation that should have been preventable.

Implications for management:

- Trees in poor health and those that have suffered major limb loss may not respond to cutting even if it appears to make them more stable
- Clearing round trees without carrying out reduction work is not beneficial (10 trees died for this reason)
- Sufficient light after cutting is important
- Regrowth of surrounding vegetation after initial clearance may compete for water causing additional stress
- People issues (compaction etc.) should not be forgotten
- Keeping the area around the pollards free from major trees also reduces the risk to them from other falling trees
- The programme of reduction work is not itself causing rapid death of the majority of trees

Death rate of beech trees

The previous recording sheets for the pollards have been used in the past to note when a tree died, at best this could be the day after it fell over but frequently tree death was only noted during a major survey (1999 for the previous pollard work plan, 2003 for the stump survey and 2007 for the current survey), thus death appears to occur in a series of steps, however this is not generally the case. Excluding the pollards that were undiscovered at the time of the 19989/90 initial survey the following table indicates deaths and the year noted.

Year	No. of trees
1989	1
1990	8
1991	5

1992	10
1993	2
1994	2
1995	2
1996	1
1997	2
1998	1
1999	51
2000	5
2001	1
2002	3
2003	22
2004	0
2005	2
2006	2
2007	17

The two major surveys of the pollards were carried out in 1999 (when a total of 85 dead trees had been recorded) and 2007 (when a further 51 trees were noted). This approximates to a death rate of 8.5 trees per year in 1999 and 6.4 trees per year in 2007.

These figures imply that the death rate has been slowed as a result of the management work (at least it is reassuring that it has not increased) however there is no room for complacency. There were 12 beech trees scoring 3 for live growth in the current survey (i.e. they have less than 25% live growth) and 41 scoring 'very poor' for amount of canopy from the original. These trees are those that might be expected to fail to respond to any work.

The stump survey in 2003 listed 355 stumps, as a rough guide this indicates that there were 200 pollards dying prior to 1989 which have decaying remnants still identifiable. Rate of decay is not known for the site and is probably very variable at least for beech. Note that this figure includes oak as well as beech.

Information about live trees recorded during the SSM

Species

There are 426 old pollards still alive (one of which is a single young looking beech tree growing from the remnants of an old stump). Of these 348 are beech, 78 oak (18%) of which 46 are *Q. petraea* and 32 *Q. robur*. The proportion of oak is slightly higher than the 15% recorded during a previous survey. This is due to the fact that proportionally more beech have died than oak.

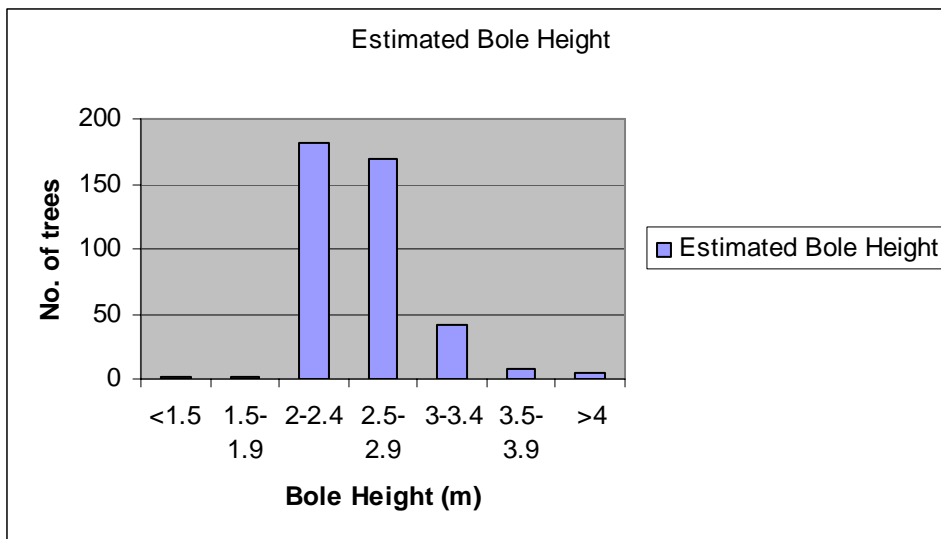
Form of tree

All of the trees surveyed were of course pollards. Most of the trees are standing and reasonably upright, one has fallen but is still alive, 3 are leaning. At least 8 trees have 'mini-mes', stems arising from the base of the trunk, the number may be higher because these were not necessarily recorded at the beginning of the survey.

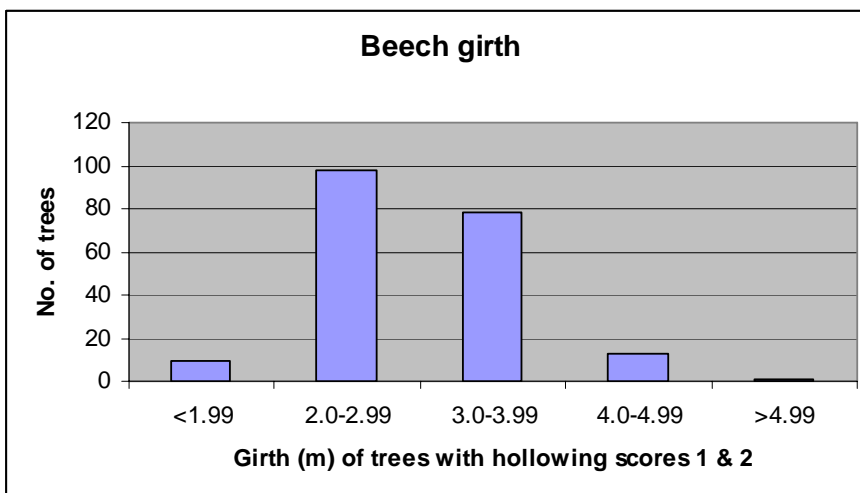
Number of mini-mes	Number of trees
1	2
2	2
3	2
4	1
Present but number not recorded	1

Trunk dimensions

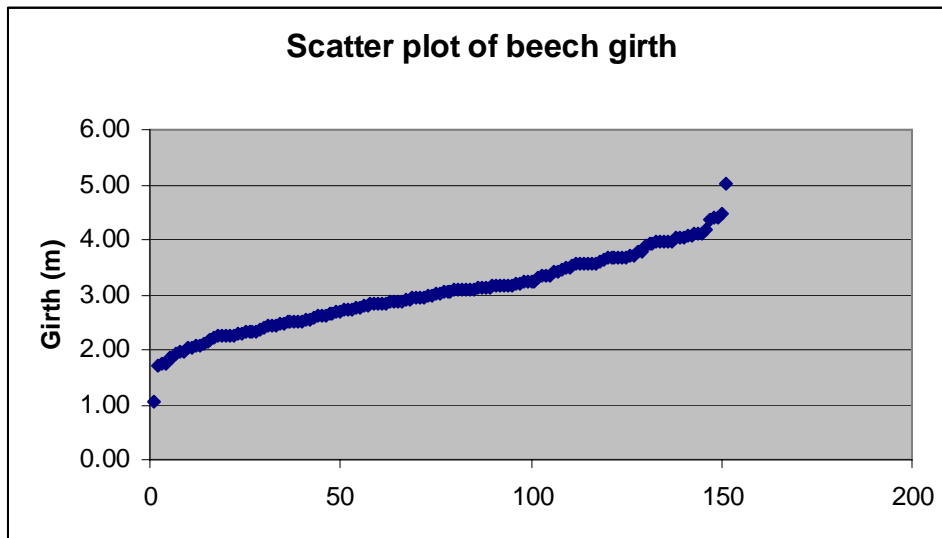
The height of the bolling was estimated; for some trees it was difficult to determine exactly where the bolling was as it either extended over a large area or the tree appeared to have more than one. The following graph illustrates the distribution of the heights recorded.



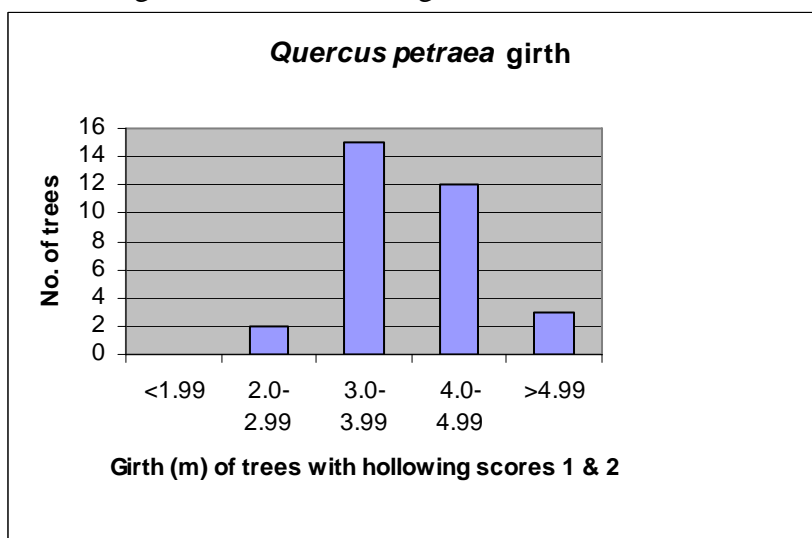
The girth was measured for all trees; clearly a remnant trunk will be recorded as a smaller girth than the maximum size for that tree when intact so the graphs below show the results for trees with hollowing scores at mid trunk of 1 and 2 (i.e. the most complete trees).



The scatter plot below shows the beech girth data in a different format and illustrated that there the majority of the trees form a continuum from small to larger girth with no evidence of particular cohorts. One tree is much smaller than the others, this is probably an accidental pollard, the result of a single decapitating action caused by wind or squirrel damage. One is substantially larger with a girth of 5.02m (tree 1056), the largest live beech (1271) has a girth of 5.11m but it is completely hollow. The largest beech tree for many years was His Majesty, which fell in 1987 but was reported in 1931 to have a girth of 28 feet (8.5m), the largest ever recorded stood near the junction of Park Lane and Morton's Drive and was 30 feet (9.1m) in 1878. It seems that the occasional tree may reach an exceptional size.

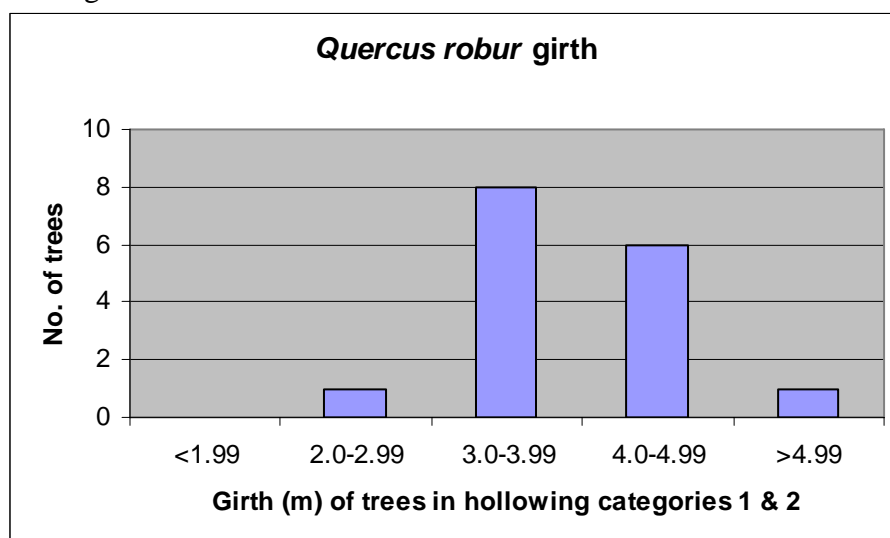


For *Quercus petraea* girth sizes of more or less intact trees are shown below. Three trees have girths over 5m, the largest of which is tree 1510 with a girth of 5.9m.



For *Q. robur* there are also three trees with girths over 5m, the largest of which, Druid's Oak with a girth of 9.18 is substantially bigger than the next nearest (5.56m). It appears that Druid's Oak may have a rather different history to the other trees in the beeches, perhaps dating from a previous era. It does not appear to be on a boundary

bank or in a location that would suggest a much older tree although it is close to the Iron Age Hill Fort.



Hollowing and trunk condition

Trunk hollowing was recorded for the top, middle and base of each tree, where 1 is an apparently solid trunk, and 5 a remnant trunk with more than 30% of the outer circumference missing. The table below shows the results for all trees:

Top		Middle		Base	
Hollow score	No. trees	Hollow score	No. trees	Hollow score	No. trees
1	9	1	27	1	27
2	129	2	222	2	232
3	111	3	74	3	69
4	109	4	50	4	48
5	65	5	50	5	235

Scores from 3 onwards indicate a trunk with major cavities, large openings or merging apertures. A large proportion of trees therefore have a fair degree of hollowing.

A total of 394 trees had 1322 crown hollows, these are cavities over 15cm in diameter.

Stem condition was also assessed on a simple scale to allow comparison with previous surveys. The results are as follows:

Stem condition	Number of trees 2007 (%)	Number of trees 1989 (%)
Apparently sound	230 (55%)	252 (47%)
Rotten	77 (18%)	125 (23%)
Hollow	108 (26%)	157 (30%)
Tiny remnant	4 (1%)	Recorded as hollow

Proportionally the trees appear to have a higher proportion of sound stems and a lower proportion of rotten stems now than in 1989. This could be due to the loss of trees

with poorer stem condition. Clearly around one third of the trees have obviously hollow trunks and this probably means that most of the decayed wood has gone from them. This has been suggested in the past as a potential problem, as the population of old trees all become hollow there may be a significant reduction in saproxylic habitat.

A score of 1-10 was also given for the same reason, where 1 is very poor and 10 very good. The results are shown below:

Stem condition	Number of trees 2007	Number of trees 1989
1	10 (3%)	19 (4%)
2	21 (5%)	25 (5%)
3	25 (6%)	38 (7%)
4	26 (7%)	52 (10%)
5	22 (6%)	44 (8%)
6	63 (16%)	77 (15%)
7	80 (21%)	86 (16%)
8	89 (23%)	133 (25%)
9	48 (13%)	52 (10%)
10	0	1 (0.2%)

The distribution of this more accurate measure of stem condition shows very little difference between the current survey and the earlier one.

Wildlife value

The survey has confirmed the wildlife value of the trees. 414 trees have holes between 5 and 15cm in diameter (larger holes were recorded as hollows). The total number of holes was at least 2166 and only 8 trees lacked any holes.

61 trees had water pockets, which numbered 73 in total. 74 trees had at least one split limb and two trees had two. 14 trees had at least one sap run, a total of 192 sap runs being recorded. These were broken down into categories as follows:

Type of sap run	Number of trees
Dry	97
Wet	42
Sticky	52
Bubbly	1

Despite a large number of trees having been worked, there is still a substantial quantity of attached dead wood in the crowns of the trees. 315 trees in total had some dead wood over 15cm in diameter and the total length of this came to 1790m.

Areas of dead, loosely attached, missing or flaking bark larger than 30x30cm were recorded for the base, trunk or crown of the tree. The results are given below:

Location of bark	Number of trees
Base	68
Trunk	141
Crown	192

A total of 318 trees had predominant major rots in the trunk or main limbs (areas up to 30x15cm). 55 had extensive areas, defined as being larger than 30x15cm. Rots were described as white, red, black or wood mould. The latter being the end product of various different rot types. The following table lists the results (numbers add up to more than the total as some trees had more than one rot type):

Rot type	Number of trees
White	266
Red	36
Black	34
Wood mould	61

Canopy and foliage features

Amount of canopy was recorded as a very simple score to allow comparison with a previous survey. This describes the amount of canopy the tree has (regardless of how much is still alive), taking into account that these trees are pollards and therefore a complete full canopy is not likely to be present on any of them. The results are below with those for the earlier survey:

Canopy amount	Number of trees 2007 (%)	Number of trees 1989 (%)
Very good	7 (2%)	Recorded as good
Good	125 (29%)	209 (40%)
Fair	123 (29%)	198 (37%)
Poor	119 (28%)	92 (17%)
Very poor	49 (12%)	32 (6%)

There does seem a clear trend for a decline in canopy amount since the previous survey. At least some of this is probably due to the fact that so many trees have been worked on, reducing their canopy size, in comparison to 1989. However, some may be due to a general decline in canopy which is more of a concern.

A different score was given for the canopy to describe the quantity of leaves on the branches. Thus a tree could have a good canopy as recorded above but if this had a very sparse covering of leaves it could have a low condition score. Conversely it is possible for a tree to have a very poor canopy but score highly on condition because what small amount it has is covered with leaves. Canopy condition is given below for both surveys:

Canopy condition (quantity of leaves on existing branches)	Number of trees 2007 (%)	Number of trees 1987 (%)
1	4 (1%)	3 (1%)
2	12 (3%)	8 (2%)
3	16 (4%)	18 (4%)
4	20 (5%)	15 (3%)
5	31 (8%)	31 (6%)
6	42 (10%)	66 (14%)
7	113 (28%)	85 (17%)
8	127 (32%)	137 (28%)
9	36 (9%)	122 (25%)

The proportion of trees scoring different amounts of canopy has not changed a great deal. Although there is a decrease in those scoring 9 there are increases in both 7 and 8. This hopefully means that the quantity of leaves on the existing canopies has not declined.

The health of the beech trees was measured using twig architecture scores where 0 is very good and 3 very poor. Because of the frequent huge difference in scores between the old branches on the pollards and any produced as a consequence of cutting two scores were given for each tree. In reality they correspond to the health of the healthiest branches and that of the worst branches. It has been stated that trees reaching a score of 2 (check this) are unlikely to recover. This work (and the report by Read 2006) has shown that cutting often results in a significantly lower health score (i.e. healthier growth).

Twig architecture			
Old branch score	Number of trees	New branch score	Number of trees
0-0.5	6	0-0.5	110
1-1.5	21	1-1.5	77
2-2.5	74	2-2.5	30
3	226	3	7

Trees with abundant epicormic growth often respond better to cutting. The presence of epicormic growth was recorded for the base, trunk and canopy of the tree. The results are given below for all trees and for beech. For a species not renowned for epicormic growth it seems that Burnham Beeches has a relatively large number of trees with at least some. One theory could be that the damage by grey squirrels has promoted epicormic growth, another that the genetic composition of the trees is different to those seen elsewhere in Britain.

Location of epicormic growth	All trees	Beech
Base	73	48
Trunk	53	37
Crown	243	153

The impact of grey squirrels may have a negative impact on the trees by killing branches that have grown as a response to cutting. Squirrel damage was only recorded for beech trees and 231 trees had obvious signs of squirrel damage, with 58 having extensive damage. A total of 61 squirrel dreys were seen in 51 pollards (beech and oak).

Management impacts

The trees were scored with respect to their response to cutting where 0 is a decline after cutting, 0.5 and above a positive response and 4 being the best. The results shown below:

Response to cutting	Number of trees
0	19
0.5	17
1	72
1.5	39
2	49
2.5	13
3	51
4	17

Regarding the future work, the end point has already been reached in 87 trees. The number of operations needed to reach the end point varies between none and 6.

MANAGEMENT CARRIED OUT TO DATE

The work programme drawn up from 2000-2006 recorded the number of trees cut at this time and proposed which trees should be worked on in each of the future years of the plan. The majority of the old pollards have now had the first stage of work carried out. For many this has involved cutting but for some just clearance for light was deemed sufficient for the first stage. One error of the previous recording system was that trees that were assessed not to need any cutting work were not recorded as having been looked at. The table below indicates how many trees were cut for the first time in each of the years. Since the majority of the work has been carried out in the winter the years are shown as, for example '2000/01', often the clearance was in the autumn and the restoration cutting in January/February but in the early years cutting may have been in the autumn too. A small number of trees have been cut in the summer.

Trees cut for the first time

Year of first cut	Number of trees
1986	1
1988	1
1989/90	20
1990/91	1
1991/92	3
Summer 1992	3
1994/95	1
1996/97	6
1997/98	45
Summer 1998	2
1998/99	53*
Summer 1999	1
1999/00	41
2000/01	31
2001/02	41**
2002/03	56
2003/04	5
2004/05	26
2005/06	19
2006/07	19
TOTAL	375

* Plus two trees cut for the second time to complete earlier work

**Plus four trees cut for the second time to complete earlier work

The numbers of trees do not match exactly with those listed in the 2000 report for the earlier years. This is partly due to poor recording in the first few years of cutting, making it difficult to be sure of exact years and partly because this table only shows trees that have been cut. Earlier lists may have included trees opened up but not cut (for example in 1991/92 when the Top paddock was cleared). The table above is also missing a small number of trees for which records were incomplete (i.e. the date was missing).

A very small number of trees were cut in winter 2003/04 due to the very hot dry summer preceding and concerns over tree health. Tip pruning was trialled this year as

a technique that did not require large scale removal of the canopy. For this reason the work programme was extended a year and the first stage completed in 2007.

From 1997/98 onwards (omitting the unusual year of 2003/4) an average of 37 trees have been cut each year. This indicates the typical work programme in recent years in is clearly manageable in terms of staff time and budget commitment.

Of the original total number of old pollards recorded since 1989 over 120 were not cut because they had died by the time they were due to be worked on. A further 65 were not cut for the following reasons:

Reason	Number of trees
Tree died before due to be cut	126
Cutting was not required (canopy very small or extra light was deemed sufficient initially)	42
Newly found trees	7
No obvious reason for no cutting (unable to locate tree, ran out of time etc.)	16

In addition some trees have been cut twice since 1989. The numbers of these are shown below:

Year of cutting	Number of trees
1998/99	5 (2 completing earlier work, 3 apparently cut only two years after first cuts)
2000/01	3
2001/02	4 (all completing earlier work)
Summer 03	2
Summer 04	1
2004/05	1
Summer 05	1

FUTURE MANAGEMENT

Aim of the management work prescribed

The general aim of the work prescribed in the plans is to:

1. Reduce the crown to the lowest sensible point and then,
2. Maintain at this point by removing larger branches close to the point of arising periodically while leaving the smaller ones.

This latter ‘maintenance’ can be seen as analogous to true pollarding as it seems likely that complete removal of all branches was probably never traditional for beech in the UK. Thus with some trees we may be approaching a pollarding ‘cycle’ but the shape of others means that this will never be an option.

The reason for the work is to make the trees more stable, lowering their centre of gravity and removing heavy weight from high in the canopies, then to keep them at this level. The ‘end point’ specified is an estimate of the lowest point to the bolling that it might be reasonable to expect the cutting to reach. While for some trees this might be quite close, for others it may be very high in the canopy. This means that trees are effectively ‘stuck’ at point which can be called 1A until a way of reducing them lower is found; in effect some may develop secondary bollings. This is not ideal in terms of stability but may have to be continued until another option is found. It may be easier to avoid this situation with oak as increased light levels often results in adventitious growth lower on the tree.

In the future there may be techniques available to stimulate the growth of new shoots lower on ‘clean’ and mature branches but at the present time it has been assumed that this is not possible. For some trees cut in the 1950’s the estimated end point is close to the cuts made at this time.

Cutting back repeatedly to the point of cutting in the 1950’s or more recently, well above the bolling will undoubtedly create problems in the future as the weight on these stems increases but there is currently no other solution. The best recommendation is that it is important to ensure that these trees are cut regularly and are not left a long time again otherwise this will exacerbate the problem. Once in a pollarding cycle the trees must remain so.

Thus the pollards at Burnham Beeches in forthcoming years will be at a variety of stages, some almost like true pollards, some in a programme of staged reduction and some being maintained at a ‘false’ pollarding level because they cannot be reduced further. As the trees will be at different stages their continued work will require a variety of approaches, making use of climbing, a platform and a polesaw as well as a range of different cutting methods.

The work programme

During the survey trees were divided into 6 categories according to the urgency of work required:

1 = within 1 year,

- 2 = with five years and trees where we have specified within 3 years,
- 3 = trees we have specified for 4-5 years
- 4 = trees within 5-10 years and trees where we have specified within 7 years
- 5 = trees where we have specified 8-10 years
- 6 = trees we have specified for more than 10 years.

Note that three different people wrote management prescriptions during the course of the survey although they were almost all discussed with at least one other person. Undoubtedly there will be some differences in how the work to be carried out is expressed. These descriptions are also based on information available at the time of the survey. The necessity of carrying out the work by use of a platform, climbers or either should also be viewed as a guideline not as an absolute.

From these a work programme was produced for the next 10 years which is given in Appendix 3. Where ever possible trees in the same area have been selected for work in the same year. The table below lists the number of trees requiring work in each of the next 10 years. Note that the numbers in the later years may need updating as earlier work progresses and minor adjustments can also be made between the years.

Year	Pollards requiring work	Pollards requiring cutting
2007-8	88	31
2008-9	91	56
2009-10	87	47
2010-11	40	29
2011-12	43	31
2012-13	75	61
2013-14	74	48
2014-15	34	27
2015-16	35	25

The number of trees requiring work in the earlier years will be challenging. However, the number of pollards needing cutting should be manageable and is not dissimilar to the numbers worked on each year in the first phase of the restoration. For some trees a fairly small amount of work is required. For many the work requires clearance of surrounding trees for light and much of this work would be better carried out at a different time of the year to the pollarding. It will however be necessary to be **very organised** about the work required to ensure that it does get done at the correct time. This will necessitate time scheduled early in each year to plan out what work needs doing and when it should be done. The work can be divided into five main types:

- Clearance of surrounding trees for light that can be carried out by CoL staff from the ground
- High clearance for light involving climbing or platform work
- Cutting of pollards by CoL staff either from the ground using a pole saw or hired platform
- Cutting of pollards by contractors from access platform or climbing
- Other work required such as mulching, blocking desire lines over roots etc..

Many of these five activities could be carried out at different times of the year. The cutting of some old pollards could be done in the summer months as long as the year is not exceptionally dry and squirrel damage not exceptional (this latter should now be rarer as the squirrel control measures have been increased). Summer cutting should not be carried out on pollards looking poor or vulnerable, or where large branches need to be cut. Wounds, especially large ones are susceptible to drying out and this is accentuated in summer, especially if the weather is particularly hot and dry. However, better comparison of summer and winter pollarding would be helpful and is not really possible at present due to the low numbers of trees cut in the summer. Most of the young pollards are currently being cut in summer and useful information may be obtained regarding the responses of these in the future.

The crucial point is that these trees are what makes Burnham Beeches a site of International Importance and their successful management should be the first priority regarding site management.

Appendix 4 gives a suggested action plan for work on each pollard, including preparatory work and specifying where information is stored.

Techniques needed for cutting the pollards

Continued work on the trees will require a variety of approaches, using climbing, and access platform and a polesaw. No one method is possible for all trees. During the survey notes were taken of whether each pollard could be cut from an access platform, if it could only be done by climbing or if either method was possible. For the first week of survey only platform use or climbing was selected, the ‘either’ option was added later. For some trees it is not possible to get an access platform near enough to use this method so climbing is still the only option. The Health and Safety Executive currently regards the climbing of trees less favourably and the ‘working at height’ regulations prefer the use of access platforms. Note also that assessments were sometimes made by Jezz but at other times by surveyors with less experience of climbing/platform use so they should be used as a guideline only.

For pollards in the first three years of the work programme the balance of methods is as follows:

Method	Platform	Climbing	Either platform or climbing possible	Pole saw
% pollards	64	14	15	7

Time of year to carry out work

It is recommended that the types of work are carried out as follows:

Clearance round pollards (high or low)

Autumn is probably the best time. Out of bird nesting season and preferably not in bat hibernation time.

Cutting of pollards

Winter (December – March depending on the year) or
Summer (July – August)

Mulching, path blocking etc.

Any time dependent on creation of materials and other work plans

For tall pollards it is important that they should not be cleared around and then left, as they are very vulnerable in this state; cutting should follow shortly after clearance (i.e. in the same year).

Appendix 5 gives guidelines for the actual cutting of old pollards that should be referred to by anyone cutting any old trees at Burnham Beeches.

Recording future work

ANY work or anything which affects or is done to an old pollard (e.g. brash fencing, moving footpath etc.) should be recorded. This information should be stored with the paper files for each tree and also electronically. It is equally important to record if a conscious decision was made to do nothing.

Future checks on old pollards

It is essential that these old pollards are checked regularly to ensure that there have not been any changes in their surrounding area that may threaten their survival and which can be rectified. These checks need only be quick visits and should be carried out every other year in summer so that shading can be better assessed.

A more complete survey and revision of the management plans will also be needed to plan future work schedules. This will certainly be needed by year 10 of the present plan; ideally it should be carried out in year 8 or 9. It may not be necessary to carry out a survey as detailed as this one but assessing the health and responses of the trees to cutting are essential in order to help plan future work.

DISCUSSION OF ISSUES RAISED DURING SURVEY

The work carried out to date on the old pollards at Burnham Beeches appears to be beneficial in terms of prolonging their lives, at least in the short term. The implications for the longer term are less clear but, as the new generation of young pollards grows and maiden trees get older, there is hope that some of the conditions required for the specialist invertebrates and plants will increase in abundance and there will be sufficient overlap between the old and young generations. The current survey has shown that the old pollards have an abundance of wildlife features such as holes, sap runs and areas of decaying wood. However, the numbers of these old pollards will inevitably continue to decline in future years; some trees are in very poor health, others still very unstable, still others may not respond to cutting in ways we expect. The trees are also vulnerable to a new set of challenges; climate change, pollution levels (for example increased nitrogen levels) and the impact of grey squirrels are those prominent at the current time. The older branches on the beech pollards are generally in very poor health, how much this is just the natural aging process and how much due to external factors is unknown.

Impact of different restoration cutting techniques

Over time the restoration cutting techniques used at Burnham Beeches have changed. In the 1950's the trees were generally cut quite hard, often close to the bolling and with the stubs left all the same length. The success rate of this style of cutting is not known but those beech trees that survived and grew often show a better response to cutting again now (however their shapes may cause different problems). Many of the oaks were cut right back to the bolling and either died or continued growing in a very weak way.

Twenty years ago the restoration cutting following experimentation on younger trees was also quite hard, with some branches being cut close to the bolling, but it was more selective and some branches (usually the smaller ones) were left intact or only lightly trimmed. Apart from a couple of obviously very poor trees which died, most of these trees are still alive today. Some are now showing excellent growth but in others the die back of the large branch stubs has caused more extensive decay in parts of the bollings. Since 1987 different people have been employed or contracted to do the cutting work and, guided by different people on the ground this has resulted in a range of different techniques. This can be seen as a positive point as it enabled some comparisons to be made and conclusions drawn. Unfortunately as all the trees are so different it was not easy for this to be carried out in a truly experimental way with blocks of different treatments and controls. An examination of the responses of pollards to cutting by different cutters showed no significant differences (Read, 2006). The restoration cutting of the pollards is being refined every year and in time a more definitive set of guidelines may be possible. In the meantime some points are worthy of further discussion.

Type of cutting and amount to remove

Is it better to do the first restoration cut on the tree evenly all over or leave a few laterals untouched at the first restoration cut and reduce them the second time? Both methods have been tried and both can succeed. Trees with the laterals left uncut can have a rather unnatural shape some years on but generally they appear in good health and the next cut is relatively easy to prescribe and usually improves the shape of the tree.

It is unknown how important the shape of the tree after cutting is and what impact this may have on the tree as it puts energy in to creating the “natural dome” shape best suited for photosynthesis. Trees with many small cuts (e.g. tip pruned) may grow very quickly to try and get back to their ‘original crown’ as it was before cutting (D. Lonsdale pers. comm.). Trees pollarded in the ‘classic’ way generate a lollipop like head of dense foliage initially that, over time develops into a dome shape (seen for example on young ash, lime or willow pollards).

The impact of hard cutting (i.e. removing more of the branches) in stimulating the growth of branches should also not be overlooked. There is little doubt that a few trees have produced large numbers of new shoots when cut hard and certainly in the Basque Country this type of cutting has elicited new shoots from and below the stubs and is described as traditional by the cutters who believe that a staged reduction is harmful to the tree. From our experience it appears that trees out of a regular cutting cycle respond differently to those in a regular cutting cycle. Because of the long lapse since the last cut of many of the trees at Burnham Beeches, and the subsequent large diameter of the branches, the more prudent approach is to try to avoid creating large wounds that result from cutting the trees hard unless we are absolutely sure the tree will survive. Experience of beech pollard restoration in southern England suggests it cannot be achieved by removal of all the branches. Cutting like this in the Basque Country may be successful either because of the wetter climate or because the trees are not out of a (long) pollarding cycle. Alternatively time may show that Basque trees develop extensive areas of decay from the hard cuts and subsequent branch growth is unstable. Whilst removal of all (or almost all) branches from beech pollards in Burnham Beeches is not recommended, some trees cut hard have responded well and their long term prognosis is good. The essential point here is that these trees are generally the exceptions and are in small numbers. Staged and more gentle cutting is, on the whole, much safer for the whole population. This notwithstanding, harder cutting may sometimes elicit positive reactions and it would be helpful to know more about the physiology of the trees in relation to the balance of foliage removed to that left.

As a complete contrast to cutting hard, tip pruning has also been carried out on a few trees at Burnham Beeches. The hope was that the removal of apical buds re-allocates the distribution of suppressant hormones so that dormant and adventitious buds are stimulated lower down on the stems. It is difficult to know how long should tip pruning be left before the results can be evaluated. Results so far have not been encouraging, one large oak lost a huge branch and required heavier surgery to make stable, a large beech has grown well from the cut points but neither these nor any of the other trees cut this way have yet shown clear signs of branch or leaf development substantially lower on the branches.

Very poor beech trees, i.e. those that have a single live branch, appear to die quickly if that single branch is cut, even just a small amount. Unless severely unstable these trees are best left uncut. Oak however may benefit from tip pruning of the sole branch on a poor tree.

Habitat issues

As pollards are further restored a lot of the old hollow stems are being removed and this may actually be reducing their wildlife value. Where possible, when cutting lower down would remove good habitats (such as extensive decaying wood, holes etc.) and it is not considered essential to the survival of the tree then this has not been prescribed. Unfortunately there are situations where there are good branches for wildlife high up that are contributing to the overall weight/stability of the tree. We have tried to bear this in mind so some cutting prescribed is not as hard as normal in order to retain good habitat.

Some unstable trees in poor condition may be cut largely to extend their life as good habitat trees. If the tree will almost certainly die as a result of cutting, is in poor health but has so much weight in the heavy branches that it will soon collapse it may have significant wildlife value as a standing tree. In this situation it may be worth cutting the branches in order to stabilise the tree, knowing that it will die but that the wildlife value will be partly preserved in the short term. The same situation may arise in trees with very poor health (i.e. with few leaves) but with a larger number of branches.

Shade and surrounding vegetation

A significant amount more work is required to stop most trees being too shaded. This work is required not only to deal with over topping by neighbouring trees but due to retained trees at the time of the first clearance growing into the gaps where some were felled or cut earlier.

It has been demonstrated in Burnham Beeches (as elsewhere) that opening up old trees from dense secondary woodland too rapidly can cause their decline and death. Thus in recent years the removal of holly and birch has concentrated on the innermost circle of clearing, creating a 'halo' round each tree, however now more needs to be done for almost all the trees. A larger circle of clearance is also required as the pollard canopies become progressively lower but are situated in areas of tall maiden trees.

To give some old pollards more light can only be achieved by doing work on mature beech/oak trees, which may include felling. The tree management prescriptions we have given have outlined this unless the pollard is in such poor health that the work is unlikely to have any impact on its growth. In view of the potential impacts of climate change on beech trees and looking at the long term continuity of beech on the site, felling of mature beech trees should be avoided unless absolutely necessary. Natural regeneration of beech in Burnham Beeches is generally good but the problem may come as young trees reach maturity. Various techniques have already been used on

mature trees needing to be cut in order to let light to the old pollards and where ever possible we have specified high pruning, crown lifting or giraffe pollarding for surrounding maiden trees although it is not certain that these trees will all survive the work. In general the view has been taken that substantial clearance of beech maidens is worthwhile in order to have a positive effect on the old pollards, the exception being two very large pollards that have not yet been reduced. A decision was made to leave these and not to attempt to restore them due to the extensive clearing of very mature beech trees from around them that would be required (some of which can be considered of high wildlife value themselves).

Surrounding vegetation may not only compete for shade. Shrubs and herbs will compete for water and nutrients too. Vigorous young growth of holly/Rhododendron that has been cut back may be particularly thirsty and with the predicted warmer summers this may become an increasingly important issue. Note that grass may take up more water than some shrubs, but it is not known what vegetation would be the least competitive to have round the roots of the old trees. Method of control for surrounding vegetation is also worth considering. With the presumption against the use of herbicides close to the old trees repeated cutting is still the preferred method. Is it possible the toxins in the Rhododendrons may also be detrimental to the pollards? If so, then it becomes more imperative to remove them. Repeated cutting does need to be **repeated frequently** to stand any chance of having the desired effect.

Other tree management techniques

Mulching has been specified for some trees where the area around the roots appears to be very compacted. Over a few years this will normally restore structural and biological soil conditions suited to healthy development of tree roots. Compaction decreases diversity and ecological functioning of soil organisms around the tree. Without the relationship with beneficial soil organisms the tree's ability to obtain water and essential elements from the soil is reduced and the weakened tree becomes vulnerable to pathogen attack. The mulch should be well composted, ideally be of the same tree species or at least deciduous and be applied to a depth of 5-10cms around the tree, extending to at least the drip line. Deeper layers should be avoided because excessive use of mulch can induce fermentation, immobilize nutrients, cut off the oxygen supply, and lead to tree death. The mulch layer should not be laid in direct contact with the base of the stem as the above harmful effects may cause bark death and leave the tree susceptible to pathogenic colonisation. More work is required regarding mulching, different types of mulch and the impact of it on fungal pathogens.

Stimulating growth lower on the branches of the beech pollards, especially those with very long, clean stems, remains a priority for research. The use of hormones, tip pruning and grafting are all still techniques that should be explored further.

Consequences of a staged reduction

For trees where there are substantial lower branches and where cutting has stimulated a good response the management prescriptions are based on a staged reduction of the crown, the aim of which is to get the cutting point eventually as close as possible to the original bolling so the tree is more stable. This avoids the removal of large amounts of photosynthetic material at one time and the creation of associated large wounds that may dry out and provide weak attachment points for future branches. It also avoids the substantial reduction in roots caused by large scale pruning.

This staged reduction is not without problems however. Eventually large wounds will have to be created, but hopefully the tree will have been able to adapt to a smaller canopy and root system over a longer period of time. It also involves the removal of new growth (leaves and woody material) that the tree has produced in recent times, but hopefully at least some of this is now closer to the bolling and can be retained.

FUTURE WORK

Recommendations for Burnham Beeches

As well as continuing the vital work on the old pollards it is essential to ensure continuity of deadwood habitat. For this reason the young pollard programme is important and the value of other veteran trees (other than pollards) should not be overlooked. A project to identify and map veteran and 'wildlife trees', and then ensure their protection, would be very valuable.

Opportunities to carry out veteranisation of trees has been taken within Burnham Beeches during the course of other projects. Largely this has been when a tree has needed branches removed for safety reasons or to let light to an old pollard. Coronet cuts and the cutting of slits for bats etc. are the main methods that have been used. This work can be time consuming and, due to the large amount of deadwood habitat being created during the course of regular work it is probably not worthwhile seeking extra opportunities to do this at the present time (although opportunities can be taken as they arise). In the future this policy may need to be revised.

The tree species generating the most deadwood within Burnham Beeches are beech, oak and birch. The presence of old birch trees should not be overlooked as saproxylic species do use the decaying heartwood. Other tree species may act as possible replacements for beech and oak (for example sweet chestnut for oak and horse chestnut for beech) and pollards of other species are already being started. Further information about possible replacements for beech would be beneficial in order to have more options when planning for future impacts such as climate change.

It has been suggested (N. Fay pers. com.) that a calculation can be made regarding continuity of age classes in sites with veteran tree populations. To ensure a cohort every 100 years (for replacement veterans) a site requires twice the number of trees in the most extensive veteran class divided by the number of centuries in that class. For Burnham Beeches, assuming that the current population of pollards represents a single cohort this equates to:

$$(420 \times 2) / 5 = 176 \text{ (in 2007)}$$

$$(572 \times 2) / 5 = 229 \text{ (in 1987)}$$

$$(3000 \times 2) / 5 = 1200 \text{ (in 1939) or allowing for an age difference, } (3000 \times 2) / 4 = 1500$$

These figures suggest that in order to replace the current population we need to ensure the recruitment of only 176 new pollards to replace the veterans each 100 years. However, this overlooks the fact that in the past there were many more pollards. The estimate of 3000 was made by Le Sueur in the 1930's and this suggests that a recruitment of over 1000 is necessary. Both these figures overlook the fact that recruitment is ideally each 100 year period and, at Burnham Beeches there has not been any for at least 200 years, probably 300 or more. In the young pollard programme it was recommended that 1000 new pollards should be created within the life of that plan and this number does fit reasonably well with the figure suggested by the calculations. The creation of new pollards needs to be watched very carefully

though, as many young trees have been killed or severely injured by squirrel damage, it may be necessary to increase the number further during the next young pollard plan to ensure adequate recruitment. Of course the impact of climate change will also be an issue of concern.

The survey method – recommendations for the future

- While it is valuable to have an indication of the health of the trees the method used (using twig architecture for the old growth and young growth) did not yield as much useful information as expected. In effect it described the best and worst health for each tree. This did highlight the poor quality of much of the older canopy and the contrast between this and the new young growth but as an overall value of tree health it was not good. Canopy thinness may be a better indicator but this cannot be assessed in the winter.
- Winter assessments were generally better for examining the details of the trees, although it was sometimes difficult to tell if branches were dead or alive.
- Repeating scores for stem condition and canopy condition, although rather subjective did allow some comparisons to be made, this may be worth repeating in future surveys.

Questions requiring more study

As a consequence of this work the following issues have been raised which would be useful to explore:

- How long should tip pruning be left before it can be evaluated?
- Shape of tree after cutting – what impact does this have in terms of the tree putting energy in to creating the “natural dome” shape best suited for photosynthesis? Many trees have been cut flat across the crown (both in recent years and in the 1950’s) is this detrimental?
- Hard cutting to stimulate growth vs ‘soft’ cutting. See also comment about trees growing back to their ‘original crown’ after cutting.
- Is it better to cut tree the tree evenly all over or leave a few laterals untouched at the first restoration cut and reduce them the second time? Does this differ with trees that have plenty of branches relative to those that have only a few? Very poor trees appear to be best left uncut – is this the same for all species?
- Some trees that are not tagged may be pollards. Do we add them into the programme as we find them? There are probably very few of these now.
- There are some very good, large wildlife trees that are not pollards, some with multiple stems and some which are possible pollards. A project to identify wildlife trees (veterans?) would be valuable. This would need to define them

(eg. they are hollow or have three or more characteristics of veteran trees), plot their location and make sure that management favours their long term survival.

- Mulching is it good or bad for *Meripilus*?
- What are the differences when mulching with different tree species i.e. is it favourable to mulch like with like?

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**APPENDIX 1
EXAMPLE RECORDING SHEET**

Tree No.	
Species	
Girth	
Height of girth m'nt if not 1.2m	
Bole Ht (estimate)	
No trunks	
Tree form (pollard/Stump)	
Standing/fallen	
Current live growth (1(>50%) 2(25-50%) 3(<25%) 4(dead crown) 5(whole tree dead)	
Epicormic growth (B-base, T-Trunk, C-crown)	
Bark condition (B-base, T-trunk, C-crown)	
Sap runs (Dry, wet, sticky, bubbly, none)	
Split limbs	
Tears	
Scars	
Stubs (number old + new)	
Hollowing - top (1 - 5)	
Hollowing - middle	
Hollowing - base	
Hollowing -crown	
Holes	
Water pockets	
Rot (white, red, wood mould)/lots=*	
Management issues	
Response to cutting (0-4)	
Estimated end point (ht above bolling)	
Est. no. of operations to achieve this	
How much in first operation (% crown reduction or m reduction)	
Length of time to reach est. end point	
When to do next work	Urgent <1 year
	1-5 years
	5-10 years
	>10 years

Climbing/platform/either	
New pollard potential nearby (yes/no)	
Deadwood attached (Optional)	
Damage (e.g. Fire, compaction, lightning, waterlogging)	
Squirrel Damage (present/lots)	
Shade (0-4)	
Bats/birds	
Fungi	
Epiphytes lower plants	
Epiphytes higher plants	
Repeats of 1990 survey	
<i>Stem cond (H/R/S)</i>	
<i>Stem con (1-10)</i>	
<i>Canopy (good/fair/poor/v.poor) from original</i>	
<i>Canopy (% live growth) (1-10) existing</i>	
Tree health	
Twig structure old growth (0-3)	
Twig structure new growth (0-3)	
Notes	

APPENDIX 4

ACTION PLAN FOR WORK ON EACH POLLARD

Before any work is done – in the office

1. Check the work programme for what is prescribed and take a copy out with you. Locate the tree on maps and take out with you.

Before any work is done – standing by the tree

2. Review the prescribed work programme and check that no details about the tree have changed (i.e. it has lost a significant branch), therefore that the management plan needs altering in any way. If the plan is altered this should be recorded, including the reason why.
3. Complete a bat recording form.
4. Take at least one digital photograph of the tree prior to cutting (to include the whole canopy).

After any work is done – in the field

5. Record all work done on a standard recording slip (this should include any clearance work and if a decision was taken to do nothing).
6. Take at least one digital photograph of the tree, to include the whole canopy.
7. Record anything else required, for example bat information.

After work is done – back in the office

8. Transfer the details from the recording slip onto the computer file (H>Pollards>Completed slips 2007 onwards).
9. Record the fact that the tree has been worked on in the management plan spreadsheet (H>Pollards>Work programme 2007 onwards) noting if any changes to the prescribed plan were made. If any changes require action to be taken in less than 10 years this needs to be added to the relevant work sheet.
10. Store the recording slip in the polythene folder relevant to that tree in the library.
11. Label the photographs clearly with the number of the tree, date and before or after and store in folder H>Pollards>Photographs temporarily. At the end of each cutting season copies should be put on disks for long term storage and a set put on an external hard drive. The disks should be properly labelled and stored in the eco office.
12. Print a copy of each of the photographs to store in the clear folder for the tree, make sure it is labelled as in 11.
13. Store the copies of any bat forms in the bat file.
14. Review work done at the end of each season via a meeting.

This should be done each time any work is carried out on the tree or when work is scheduled. This includes any emergency work, cable bracing etc. Note that a separate slip should be completed for each pollard, for example if a single branch is removed from one pollard during the course of work on another.

Occasional events

When events have occurred affecting an old pollard these should also be recorded (for example substantial branch loss or death).

These should be recorded on the occasional events slips, on the computer file (H>Pollards>Occasional events) and the completed slips stored in the clear folders in the library.

Files

All the relevant files are stored in the H drive under the folder 'pollards'. Copies can be kept under individual names if required. Photographs will take up too much storage space so should be stored on disks and an external hard drive.

APPENDIX 5

GUIDELINES FOR CUTTING OLD POLLARDS AT BURNHAM BEECHES

General comments on the work programme

A management plan has been drawn up for each veteran pollard at Burnham Beeches in relation to its individual condition and requirements. The full details are given in Appendix 3. This identifies treatment priorities, sometimes spanning quarter of a century. The highest priority treatments are scheduled for trees in danger of structural disintegration or accelerated physiological decline, but which are considered possible to save with intervention.

The management schedule has been arranged by priority. However, each tree may have a range of phased treatments ordered in stages over a number of years. Monitoring and regular re-inspection of trees is essential for the full benefit of the management regime to be realised. Subsequent stages of management programmes should take account of the response of veteran trees to previous phases of treatment. Work programmes should be sensitive to adjustment. Adjustment to the programme of work should also be given following extreme weather conditions e.g. severe drought or extreme water logging.

Recording is essential to ensure that the best value is obtained from the system of assessment, management and monitoring. Therefore it will be necessary to record and archive changes in tree condition and to detail all works carried out on or around the tree. The recording system should record both biotic (e.g. incidence of fungi) and abiotic factors (e.g. drought, compaction, severe water logging) that may affect tree growth.

It is important that the arborists employed to undertake this work have proven experience and training in the management and treatment of ancient trees.

Specific guidelines for working on old pollards at Burnham Beeches

The descriptions of work to be carried out on each tree are based on the available information at the time of the survey. Trees and situations change; when preparing to cut trees additional information can be gathered and we are continually learning about techniques in cutting these old trees. However the guidelines here are based on previous experience at Burnham Beeches.

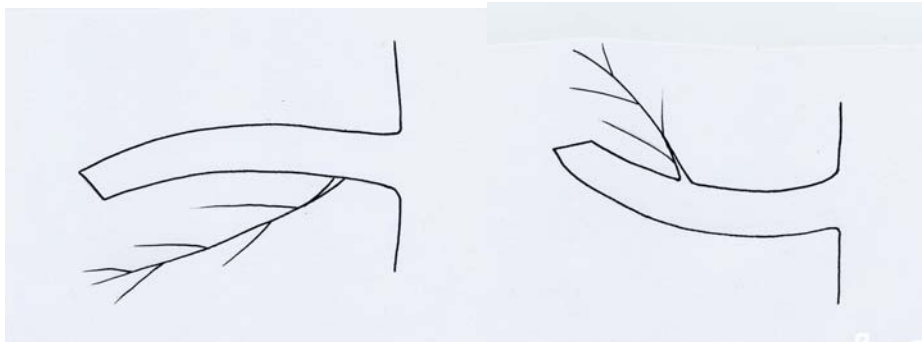
- Suggested **prescriptions should not be followed automatically**; if something is discovered in the course of the work to suggest the tree will not respond as we might expect (for example branches already dead, extensive squirrel damage etc.) then the prescription will need to be altered accordingly. This is likely to be especially true when following guidelines set for work further in the future.
- **Brash** from the pollards, or that produced as a result of clearance work, can be used to protect tree roots from compaction due to paths etc. Brash should not be ON obvious roots as there are organisms that require exposed roots for their

existence (for example the rare moss *Zygodon forsteri*). Protection of roots from compaction is worth considering even when the paths appear quite small (for example at Egypt) in order to prevent them from developing into major tracks.

- Any **trees growing IN the bollings** of the old pollards should be removed. They may compete with the old trees for water and other resources.
- Based on the current available information the making of **coronet cuts** or other methods of making the cuts appear more natural are probably not worthwhile. These take time and energy to produce. However, they may be considered in places where the trees are in a high profile public area in order to soften the appearance. As a general rule at Burnham Beeches they are probably more appropriate for large maidens cut to let light to pollards than the old trees themselves.
- **Rip and tear cuts** have been tried on some trees. Based on available information this does not appear to be beneficial in promoting new growth although there may be some advantages in younger oak trees. Small tears may still be produced when cutting the old trees as long as there is good control over their extent and they do not threaten other features on the trees that may encourage regrowth.
- Cuts on the old trees **should always be carried out professionally**, regardless of the size of the branch and notwithstanding the sections above on rips and tears. This also applies when cutting branches using a polesaw, undercuts should be made.
- **Climbing spikes.** Evidence from trees at Burnham Beeches to date suggests that there is no significant advantage in using climbing spikes regarding the response of the tree to cutting. The holes made by spikes may be detrimental in providing points in which decay can start. It therefore seems prudent not to use spikes on the old trees unless future evidence proves the contrary.
- **Mulching** has been prescribed for a small number of trees. This should be carried out using composted wood chip mulch and leaf mould generated from the site. The mulch should be applied to a depth of 5-10cms around the tree, extending to at least the drip line. Deeper layers should be avoided because excessive use of mulch can induce fermentation, immobilize nutrients, cut off the oxygen supply, and lead to tree death. The mulch layer should not be laid in direct contact with the base of the stem. Generally mulching should be avoided on trees with exposed roots that may host the moss *Zygodon forsteri*.
- **Bats** and their resting places are protected by law. A bat assessment should be carried out for each tree (using the guidelines in the Burnham Beeches bats and trees document) as close as possible to any work being carried out. Tree surgeons should have completed a BCT 'Bats and Arbs' course and should bear in mind the needs of bats as the tree is being

worked on. If in any doubt holes should be examined in more detail and sections of branches removed and carefully lowered to the ground. See Bats and Trees document for full guidelines and procedures.

- **Length of stubs.** It has been shown for Burnham Beeches that the longer the stub left the significantly greater the chance of new shoots arising from it. Also the greater the number of new shoots arising. **IT IS THEREFORE VERY IMPORTANT TO LEAVE LONG STUBS.** Cutting leaving no stub, as in amenity trees, is not to be carried out except on occasional branches where there is no alternative.
- **Diameter of branch.** Indications are that branches over approximately 30 years in age (on beech) are unlikely to be able to heal over. Large wounds should be avoided where possible, however, in order to reduce the weight on many of these old trees it is necessary to cut branches of at least 30 years. There appears to be no relationship between stub diameter and production of new shoots at the Beeches but where ever possible the creation of large wounds should be avoided.
- **Retained branches.** The survival rate of branches on beech pollards that have been cut and where no branches were retained below the point of cutting is extremely low. This situation should be avoided unless it is impossible and the tree is in danger of collapse. **EACH BRANCH CUT SHOULD HAVE AT LEAST ONE RETAINED BRANCH BELOW THE POINT OF CUTTING.**
- Where ever possible the **retained branch should be above the cut** (as in the right hand illustration below). If the branch is below the cut, dieback from the cut stub may weaken the attachment of the retained branch.



- A significant number of the beech pollards have one or more ‘**mini-mes**’ or suckers from the base that are developing into new trees. Where appropriate these mini-me’s should be cut (as pollards) at same time as the main tree. This should avoid the sucker drawing all the resources from main tree.

- Each tree should have **all the necessary cutting work** specified for that year carried out **at the same time**. Unless unavoidable tree should not be part cut and then left.
- **Ivy** should be removed from the pollards if it is/or is likely to be competing for light and/or adding excessive weight and sail area to the bolling. Ivy is beneficial to many other organisms, removal is carried out on the old pollards as it may threaten their survival.
- Where cutting lower on a tree/branch will remove **good habitats**, such as hollow stems, and is not considered essential to the survival of the tree it has not been prescribed. A more difficult situation is where there are good branches for wildlife high up that do contribute to the overall weight/stability. Occasionally cutting has not been recommended as hard as normal in order to retain good habitat. Good wildlife features should be retained where ever possible when the trees are cut
- Trees requiring work that are situated on one of the **Scheduled Ancient Monuments** special measure may be needed to avoid compaction or physical damage to the earthworks. The use of a platform needs to be assessed/approved by English Heritage and the use of boards and tyres as protection from falling limbs or an equivalent system should be used too.
- **Rhododendron** or **holly** growing round the base of old trees should be repeatedly cut back. These plants may be competing for water and nutrients as well as light. Based on current information the use of herbicides within the canopy of the old trees should be avoided. This may mean that cutting of Rhododendron needs to be at least annually and preferably more frequently.
- When **clearing surrounding trees** to let light to the pollards it should be recognised that, as the pollards reduce in height, the ring of land clear from trees around them needs to be larger. Clearance should avoid drastic changes in light and moisture which threaten the survival of old trees, thus several stages of clearance are preferred.
- ANY work or anything which affects or is done to an old pollard (e.g. brash fencing, moving footpath etc.) should be **recorded**. This information should be stored with the paper files for each tree and also electronically. It is equally important to record if a conscious decision was made to do nothing.

Special techniques

A literature review has been commissioned regarding techniques for encouraging the growth of new shoots on the pollards (particularly beech) lower on the branches. As a result of this some experimental work may be carried out on mature maiden beech trees. Should any of these techniques prove potentially useful they may be employed on certain of the old pollards in the future. Such techniques may include specific targeted pruning, use of hormones etc.

APPENDIX 6 – GLOSSARY OF TERMS USED IN THE REPORT

Adventitious buds	Secondary buds arising in already existing tissue, often as a result of damage.
Aerial roots	Adventitious roots, developing from bark tissue on the above-ground parts of a tree, sometimes into the decaying trunk
Bolling	The trunk of a pollard.
Brown rot	Rot where the cellulose is degraded but the lignin is only modified.
Canopy	The uppermost layer of twigs or foliage in a woodland, tree or group of trees.
Coronet cut	Irregular cuts made in the stub left after a branch has been removed the aim of which is to give the cut surface a natural appearance
Crown	The spreading branches and the foliage of the tree supported by trunk(s).
Crown reduction	Overall reduction of both the height and spread of the crown.
Dead wood	Wood that no longer fulfils any function for the tree. Deadwood can be as pieces on the ground, branches in the canopy of the tree or within the trunk of a tree where it can be exposed (i.e. visible from the outside) or not.
Dieback	The death of a part of a tree, usually starting from the branch tips and progressing in stages.
Dormant buds	Those formed during the development of the current year's shoots but which do not develop unless stimulated to grow.
Habitat	The natural or semi-natural home of a plant or animal or groups of animals; it is the place where a plant or animal occurs. Thus for example, trees may be part of a woodland, hedgerow, or wood-pasture habitat.
Haloing	The removal of trees and shrubs from around an old tree in a series of small steps in order to give it more light without exposing it to a sudden increase in light and heat that may be caused by large scale clearance of neighbouring vegetation.
Lapsed pollard	A pollard that has been left uncut longer than the (for it's) normal cutting cycle.

Laterals	(In this report) The branches of a pollard that are growing out from the sides rather than upright at the top. Usually they are mentioned because they were left uncut at the time of the first restoration pollarding cut but need reducing in the second phase.
Maiden	A tree that has not been modified by cutting as a pollard, coppice or other working tree.
Maintenance cut	Cutting a pollard on a regular basis when it has been restored to it's original point of cutting or a temporary point above the original bolling.
Microclimate	The climate of a confined space or minute geographical area. Microclimates are particularly important in terms of shelter (as opposed to local climates).
Mini-me	A sucker from at or near the base of a tree trunk that has grown large enough to be considered almost a tree in its own right.
Monolith	A large hulk of standing dead wood. Usually just the trunk of the tree or the trunk with the base of the branch framework.
Pole thin	Pollard management where selected branches are removed (usually the larger ones) by cutting and others are left intact.
Pollard	A tree that has been cut once or repeatedly at intervals in order to obtain a crop (usually wood or foliage). The point of cutting is above ground level and usually so that new branches will be out of reach of grazing livestock.
Reduction	Management prescription specified usually as a percentage which indicates the quantity that should be removed relative to the length of the branch.
Restoration pollarding	The management (by cutting) of a lapsed pollard in order to lengthen the life of the tree.
Sail area	The amount of tree canopy that is exposed to the wind.
Saproxyllic species	Species that depend on dead wood habitats for a part of their life-cycle. Note that they may not actively feed on deadwood but still require the presence of it or species that do feed on it.
Scrub	Small trees and bushes, forming a successional stage between open habitat and woodland. It is very valuable for invertebrates and birds, but is often invasive and can threaten the survival of other rarer habitats if left unmanaged.

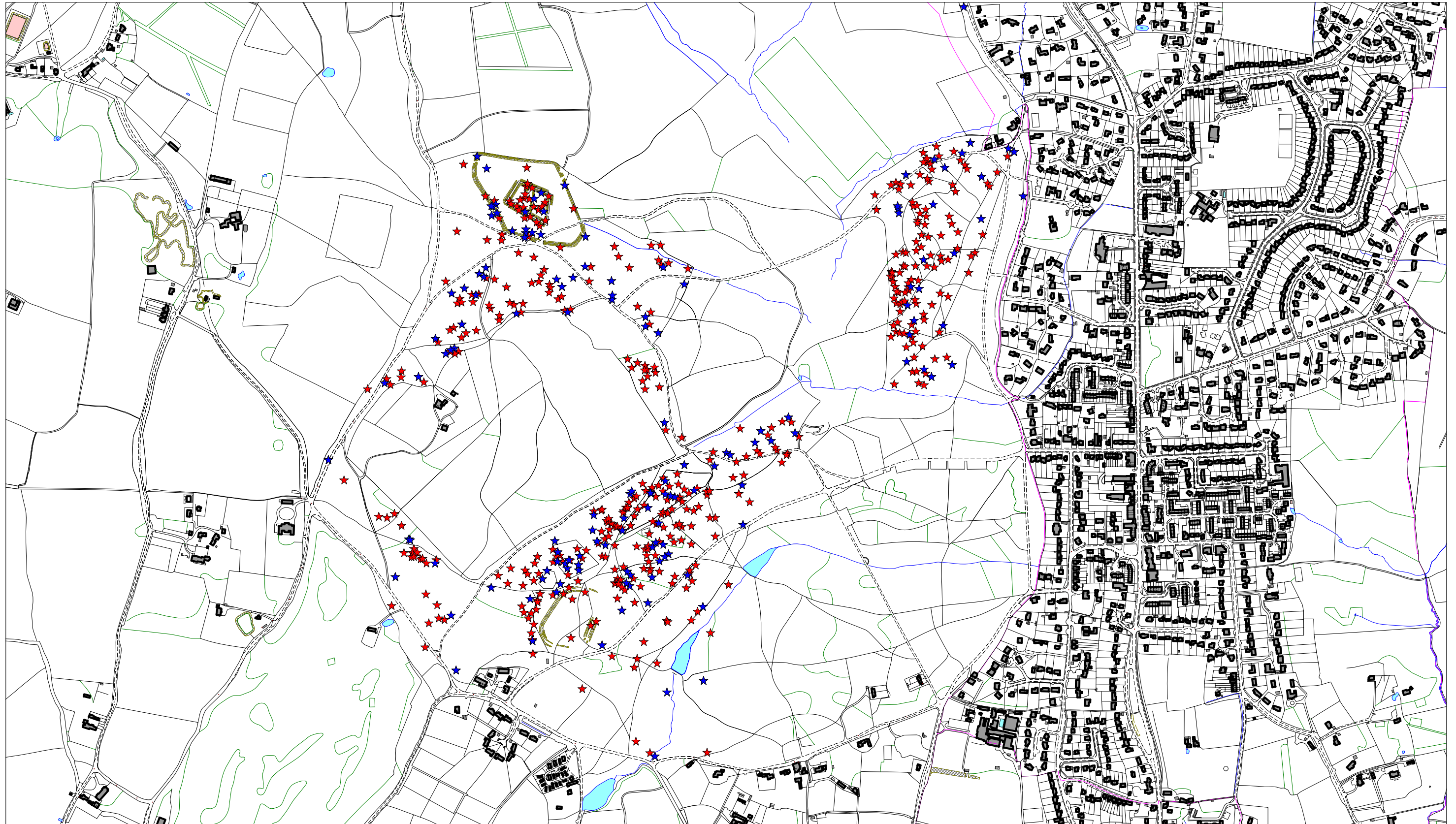
Soil compaction	Soil compaction restricts the growth of trees, damages roots and reduces infiltration of water into the soil. As the air getting into the soil is also restricted, the biological activity and root growth is affected. This reduces the fertility of the soil and, more specifically, the availability of plant nutrients. So it is important to minimise all forms of soil compaction. If soil structure is damaged, positive steps can be taken to correct the problem.
Stress	In plant physiology, a condition under which one or more physiological functions are not operating within their optimum range, for example due to lack of water, inadequate nutrition or extremes of temperature.
Veteran trees	Veteran trees are trees that are old for their species and valued for their historical, biological, aesthetic or cultural significance. They are significant for the habitat that they provide in their complex woody structure that provides continuity for species that depend on this substrate at some stage of their life cycle.
Vitality	In tree assessment, an overall appraisal of physiological and biochemical processes. High vitality equates with healthy function.
White rot	Decay where the lignin and cellulose are both broken down
Wood mould	The end result of the wood decay process, a rich, humus like substance
Wood-pasture	Woodland in which grazing or browsing has been a dominant influence.

Map 1. Current status of pollards at Burnham Beeches

Red - Alive, Blue - Dead

Scale 1:9000

Burnham Beeches
Corporation of London
Hawthorn Lane
Farnham Common
Bucks. SL2 3TE



Beech - Red, Oak - Blue

Scale 1:9000

Burnham Beeches
Corporation of London
Hawthorn Lane
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