

Introduction.

The benefits and concerns relating to wood pasture and parkland was one of the subjects highlighted at the Rio Summit in 1992.(HMSO1995/1). This reports describes the habitat and the associated conservation issues and provides an analysis of wood pasture and parkland in Bedfordshire with respect to ‘Target Note 2’ of the English Nature ‘Lowland Wood Pasture And Parkland Biodiversity Action Plan July 1997.’(Reid C) (Appendix 1).

1.0 Wood Pasture and Parkland in Britain

Wood Pasture (*silva pastilis*) and parkland as outlined in Rackham (1986) is the use of the same the land for trees and for grazing animals, predominately deer. This practice is thought to have began during the Neolithic Age or possibly earlier (Rackham 1986). By Medieval times through to the early nineteenth century wood pasture and Parklands were widespread throughout the lowlands of Britain and Europe. (HMSO 1995). They existed in various forms which Rackham (1986) and Peterken (1993) divide into three main groups, wooded forest, parks and wooded commons.

1.1 Wooded Forest

Wooded forest were areas of unenclosed land containing a variety of land uses; arable farmland, open pasture, settlement and woodland. These areas of land were subject to forest law and originally provided an administrative basis for government whilst providing venison for the early medieval kings and their courts. Forest were widespread throughout England up until 1170 when approximately one fifth of England was under forest law. There was a gradual decline in the area of land under forest law due to financial and civil pressure up until the seventeenth century when deforestation increased with land being converted to agricultural use. Where woodland cover remained it has since been converted to commercial forestry use. Currently the New Forest now contains the only large areas of open pasture woodland but a number of smaller areas of pasture woodland still survive in ancient deer parks and wooded commons. (Peterken 1993).

1.2 Parks

Parks Originate from the Norman practice of deer husbandry and were areas of enclosed land for grazing (Rackham 1986). The main purpose of parks was, as with forest , to supply fresh meat (Harding & Rose 1986). There were two distinct types of parks. 'Uncompartmented', the typical 'Parkland' landscape of grassland and scattered pollarded trees (Rackham 1986). These

were the most predominant parks throughout England (Harding & Rose 1986). Compartmented parks consisted of areas of coppice which were fenced until a point at which the deer would not be detrimental and grassland with pollards (*lauds*) which were accessible to deer at all times (Rackham 1986).

A decline in parks occurred after the mid fourteenth century up until the eighteenth century when landscape designers such as Repton and Brown redesigned old parks and created new ones on enclosed agricultural land (Peterken 1993).

The twentieth century has seen a reclamation of many parks to agricultural land or treeless pasture (Harding & Rose 1986).

1.3 Wooded Commons

Wooded commons were areas of open grassland and heathland that contained some element of tree cover usually in the form of pollarded trees. The right of common grazing prevailed on these areas and they often overlapped with forest's and some parks.

Public recreation is now the main use of many wooded commons and in most cases grazing livestock is rare and the practice of pollarding appears to have ceased over sixty years ago. (Peterken 1993).

1.4 Conclusions

Some relic areas of wood pasture and parkland, with old broad-leaved trees, will provide a unique combination of continuity of habitat structure not found in other more common types of managed woodland, such as coppice and high forest, which has favoured the survival of species and communities dependent upon large old trees. They are considered of ecological importance for the following 3 reasons;

1. The species of trees present, although undoubtedly influenced by centuries of management, including in some parkland sites exotic species planted for amenity reasons,

may largely represent survivals of the genetic stock from the primeval forest, and ancient trees are often still present

2. The epiphyte flora, in areas not seriously affected by atmospheric pollution, is often very rich and the communities of epiphytes are regarded as relics of similar communities present in the primeval forest.
3. Dead, dying and overmature trees often contain populations of local or rare saproxylic invertebrates. These invertebrates, especially some beetles (Coleoptera) and flies (Diptera), are also regarded as relic populations whose survival has been possible through the continuity of suitable habitat. . (Harding & Rose 1986)

2.0 Parkland Habitat

Relatively few ground plants survive the intensive grazing indicative of wood pasture and parkland, though violets (*Viola* spp.) the food plants of the true fritillary butterflies are one of the exceptions.(Springthorpe 1985). The real value of wood pasture and parkland exist above ground level. The survival of ancient trees through pollarding has ensured the survival of fragments of our native ecology in the form of epiphytic flora and saproxylic invertebrates (Harding & Rose 1986) as well as providing suitable habitats for many birds such as the woodpeckers and bats.

The native tree species of Britain are considered to be of varying importance as phorophytes for both epiphytes and saproxylic invertebrates.(table 1). It has been suggested however, (Harding & Rose 1986), that four species of tree should be regarded as particularly important where they are present as mature and over mature trees in wood pasture and parkland. These are Oak (*Quercus petraea/robur*), Beech (*Fagus sylvatica*), Elm (*Ulmus* spp.) and Ash (*Fraxinus excelsior*).

Table 1. **Total numbers of taxa of epiphytic lichens and phytophagous insects and mites associated with trees and shrubs in Britain.** (Harding & Rose 1986)

Tree/shrub	Numbers of lichen taxa	Numbers of insects and mite species
Field Maple (<i>Acer campestre</i>)	101	51
Sycamore (<i>Acer pseudoplatanus</i>)	194	43
Alder (<i>Alnus glutinosa</i>)	116	141
Birch (<i>Betula pendula</i>)	134	334
Hornbeam(<i>Carpinus betulus</i>)	44	51
Hazel (<i>Corylus avellana</i>)	162	106
Beech (<i>Fagus sylvatica</i>)	213	98
Ash (<i>Fraxinus excelsior</i>)	265	68
Holly (<i>Illex aquifolium</i>)	96	10
Pine (<i>Pinus sylvestris</i>)	133	172
Oak (<i>Quercus petraea/robur</i>)	326	423
Willows (<i>Salix</i> spp.)	160	450
Rowan (<i>Sorbus aucuparia</i>)	125	58
Limes (<i>Tilia</i> spp.)	83	57
Elms (<i>Ulmus</i> spp.)	200	124

2.1 Epiphyte Habitats

On tree trunks subject to good illumination and to frequent drying-out by the sun and the wind the epiphytes which occur such as *Evernia prunastri* are also characteristic of hedgerows, roadsides, and in some cases closed woodland. Where the bark of such trees has been enriched with animal faeces and urine, generally deposited as dust carried by the wind, a community of lichens classified as *Xanthorion* develops. This community is most characteristic of elms and maples with bark of naturally high pH, but is also found on ash and sometimes old oaks where enrichment is sufficient. Since the introduction of chemical fertilisers into pastured parklands it is tending to disappear probably as a result of nutrient concentrations becoming too high for it to persist on the bark. (Harding & Rose 1986).

Where more sheltered conditions occur within pasture woodlands and parklands a different type of epiphyte community develops which on the whole does not occur elsewhere. On the younger trees communities of crustose lichens classified as *Graphidion* occur along with cushion forming mosses of the genera *Ulota* and *Orthotrichum*. As the trees age the bark particularly on oak and ash becomes more fissured and spongy, and in long undisturbed areas large foliose lichens of the genera *Lobaria* colonise the tree boles along with various mat forming mosses. This in turn leads to a very species rich alliance known as the *Lobarion* the natural climax community on mature trees in old wood pasture. At this stage the species of tree upon which they occur becomes less important, occurring on a wide range of broad-leaved trees but not however on coniferous species. As many as forty lichen taxa associated with the *Lobarion* alliance may be found on a single old tree. In areas of heavy shade lichens tend to be less prominent and bryophytes form the main epiphyte cover. (Harding & Rose 1986)

Optimum development of the lichen communities described occurs on the south or south west sides of the tree boles and also on the upper surface of horizontal branches. The north and east

sides of vertical trunks develop shade tolerant and less moisture demanding lichens. The pattern of rain-tracks on a trunk which bring nutrients as well as water is particularly important in controlling the pattern of lichen communities. The centre and wettest area is colonised by the bryophytes with the margins containing lichens of the *Lobaria* genera while the drier areas further out develop communities of crustose lichens. On very old trees especially oak where the bark has become more brittle and less water retentive a post climax community of crustose lichens may develop which includes such species as *Lecanactis premnea* as found at Woburn (appendix 1). When the bark finally falls from the tree lignicolous lichen communities develop on the exposed wood containing mainly species of *Calicium*, *Chaenotheca* and *Cladonia*, (Harding & Rose 1986), all of which are present at Woburn. When the wood has rotted further and become very soft the lichens disappear and are replaced by saprophytic fungi and Myxomycetes.

2.2. Invertebrate Habitats

The invertebrates associated with wood pasture and parklands utilise a wide range of habitats, with some associated with the foliage of trees throughout the life cycles. The epiphytes also provide habitats for large numbers of insects especially bugs (*Hemiptera*) and book-lice (*Psocoptera*). It is the dead wood and its associated saproxylic fauna however that is the special feature of wood pasture and parklands. (Harding & Rose 1986). Saproxylic species are those which depend on wood, usually but not exclusively dead wood, for some part of their life cycle. Harding & Rose 1986, categorise dead wood into four structural types.

1. The living or partly dying standing trees;
2. Boles after the tree crowns have collapsed;
3. Logs of various sizes;
4. residual stumps.

The numbers of insects associated with decaying and dead wood are extremely large. Some 900 species of invertebrates live in or on dead wood alone. A piece of dead timber just 200cm long and 5cm in diameter may have as many as 50 species of insect living in or on it. (RSPB Undated). Saproxylic invertebrates include those that feed on the wood itself as well as predatory and parasitoid species, species feeding on fungi, both within the dead wood and in their fruiting bodies, species using sap exudates from the trees and species that use empty insect emergence holes in which to nest. (K.J. Kirby & C.M. Drake)

2.3 Conclusions

Wood pasture and parkland provides a unique habitat which is home to many species of epiphytes and saproxylic invertebrates not found elsewhere.

The inadequate information about the life histories of most of the invertebrates associated with old trees in wood pasture and parkland has meant that a comparison of the habitat requirements of invertebrates and epiphytes is not readily forthcoming. (Harding & Rose 1986). However it can be concluded that a fundamental difference is that the epiphyte flora is surface dwelling whereas the fauna is largely confined internally to the dead wood.

3.0 Conservation Issues

It is estimated that less than 10,000 to 20,000 hectares of working wood pasture and parkland remains. A larger area of relic wood pasture and parkland exist either unmanaged or as scattered trees in arable or improved pasture. This habitat is believed to have been widespread in lowland landscapes through the medieval age and up to the early 19th century. Enclosure, conversion to forest or intensive agriculture has led to a decline in quantity and quality of sites. The greatest extent of this habitat in western Europe probably survives in southern England.

Wood pasture and parklands contain large numbers of veteran trees. They are regarded as being of international importance for saproxylic invertebrates such as the violet click beetle and for a range of epiphyte flora dependant on ancient trees.(HMSO 1995)

3.1 The Trees

As mentioned earlier (Chapter 1.5) the cessation of pollarding may have reduced the long term survival potential of many old trees. It has been observed that many old trees have not been pollarded for over a century or more. (K.J.Kirby & C.M.Drake 1993). Such trees are prone to wind damage as they are now in effect a grove of mature trees growing on top of the original bolling which is often decayed internally or has a relatively shallow rootplate and therefore in areas where public access is allowed are viewed as a potential hazard. This should be remedied not by felling but by recommencing a traditional pollard cycle.

At sites where there are few over mature trees there is often the problem of generation gaps, as seems to be typical of many parkland sites, (K.J.Kirby & C.M.Drake 1993). The establishment of new pollards on mature trees not yet producing dead wood, will have the effect of pre-ageing the trees and therefore maintain a continuity of habitat. The significance of pollarding for saproxylic invertebrates is that it prolongs the life of a tree considerably and is likely to speed up the inception of wood decay. Pollarded trees may survive for 300-500 years in the

case of ash beech and hornbeam and up to 800 years for oaks considerably longer than their natural life spans.(Biodiversity File 200/N Beds CC)

The owners of sites have a variety of objectives for the parks, most of which relate to getting a financial return from the land. These objectives often conflict with the conservationist's need to ensure the survival of large old trees and to manage the site for a long-term continuum of habitat availability.

Conflicts of objectives include:

- Increase public access
 - fell 'dangerous' trees
 - increase access areas such as paths and car parks
- Increase grazing potential
 - improve pasture fertility
 - remove lower limbs from trees to reduce shading
 - remove fallen dead wood
- Capitalise on timber
 - fell mature trees (remove the next potential generation of old trees)
- Recreate historic landscape-
 - remove old or 'damaged' trees
- Introduce diversity
 - plant exotic species of trees
- Leave it alone
 - long-term neglect and lack of regeneration.

(K.J.Kirby & C.M.Drake 1993)

3.2 **Dead Wood**

On sites of potential importance for saproxylic invertebrates as much large dead wood as possible should be left. Fallen dead wood is certainly more accessible to entomologist trying to survey a site, but living large trees with some dead wood in the canopy and with heart rot are the true reservoirs of most populations.(K.J.Kirby & C.M.Drake 1993) Standing dead trees are of great value and should be left wherever possible. Fallen boles and large branches are

also highly important. Dead wood in the crowns of trees is entirely natural and should be left unless a positive threat to the stability of a given tree can be proved.(Harding 1979). Dead wood exposed to heat and sunlight desiccates and sterilises rapidly and ceases to support much biological activity after 4 years. Dead wood in partial or total shade can be biologically viable for over 20 years. (Harding 1979). However, any attempts to retain fallen dead wood, preferably in partial shade, will inevitably enhance the wildlife value of the site and will favour a number of saproxylic species.

3.3 Subsidiary Habitats

A number of features of the habitat surrounding the trees themselves may be of importance for saproxylic invertebrates. Principally this concerns the availability of flowers as the prime source of energy from nectar, and protein from pollen and predation on other insects visiting such flowers. (K.J. Kirby & C.M. Drake 1993). Research has shown that flowers of hawthorn(*Crataegus monogyna*), hogweed(*Heracleum sphondylium*), angelica(*Angelica sylvestris*), ragwort(*Senecio jacobaea*), and thistles(*Carduus/Cirsium* spp) should be maintained or created on sites of known or potential value for saproxylic invertebrates. (K.J. Kirby & C.M. Drake 1993).

3.4 The Invertebrates

The available information on the ecology, rarity and degree of threat for many saproxylic species has been summarised in Red Data books with many species exhibiting very disjunct distributions believed to reflect a random pattern of survival in relics of habitat with a continuity of ancient trees. (K.J. Kirby & C.M. Drake 1993). A list of species (Coleoptera) indicative of a long continuity of saproxylic habitat has been produced. (Harding & Rose 1986). The autoecology of most species is still not well understood and great deal of research still needs to be done to produce a better understanding of species niche specialisation's which will allow predictions of their likely response to current management techniques. This is

where the knowledge of entomologist is invaluable. Only they are able to survey sites to assess their conservation value, but in doing so they inevitably have to destroy habitat and kill individual specimens. There is no quantitative evidence to suggest that collecting has so far threatened populations of saproxylics in Britain, but there is a real danger that unrestricted access for entomologist to collect could threaten the survival of some species at individual sites. Traditional survey methods have been fairly crude, often with fallen dead wood being destroyed in the process of sampling. Less destructive methods are now being used on large scale surveys, but the majority of entomologist will probably retain their technologically less sophisticated methods, which, when used by a skilled expert are highly effective for finding species. A conservation guide for the entomological investigation of dead wood habitats is located in appendix VI. (K.J. Kirby & C.M. Drake 1993).

Direct translocation of invertebrates to try to re-establish populations will only be possible for those species whose ecology is well known.(Speight 1989).

3.5 Summary of factors currently effecting wood pasture and parkland

The UK Biodiversity steering group report Volume 2 1995 and The English Nature Biodiversity Action Plan 1997 outlines the issues which are considered to be a threat to the continuation of wood pasture and parklands in Britain;

- Changes in rural economies have led to withdrawal of grazing from commons, former Royal Forest and parks.
- Lack of regeneration and/or planting of subsequent generations of trees. This has leads to classes being skewed towards the very old, foreshadowing breaks in continuity of dead wood habitat and likely loss of specialised dependent species.
- Neglect of traditional management (e.g. pollarding) or inappropriate management of individual old trees, leading to their collapse or subsequent felling.

- Loss of trees through disease (e.g. Dutch elm disease, oak dieback), physiological stress such as drought and storm damage.
- Loss of old trees and dead wood through perceptions of safety and tidiness, (where sites have a high amenity use), forest hygiene and the supply of firewood.
- Soil compaction around old trees through trampling (by livestock and people), and car parking by visitors.
- Changes to the water table resulting from abstraction, neighbouring development, roads, prolonged drought and climate change, leading to water stress and tree death.
- Isolation of remaining parkland and wood pasture at a landscape level particularly with regard to slow colonisation rates of many of the species dependant on old trees.
- Habitat loss through conversion to arable and other land uses such as golf courses, zoos, and conifer plantations.
- Pasture “improvement” through reseeded, deep ploughing, fertiliser and other chemical treatments, leading variously to tree root damage, loss of nectar plants, damage to soil habitats and epiphytes.
- Inappropriate grazing levels: under-grazing leading to loss of the unique habitat structure through bracken and scrub invasion; or, over-grazing leading to bark browsing, soil compaction and loss of nectar plants.
- Air pollution derived either remotely from industry and traffic or locally from fertiliser application and ammonia emissions from livestock, leading to epiphyte and soil damage.

3.6 **Conclusions**

The problems facing wood pasture and parkland are issues that given current financial resources will not easily be solved. However it is evident that if this habitat is to be preserved then a return to traditional management techniques is essential as well as developing a greater understanding of the needs of the saproxylic invertebrates associated with it.

4.0 An Analysis of wood pasture and parkland in Bedfordshire

Bedfordshire lowland wood pasture and parkland is an important landscape feature and some sites are of ecological importance. The habitat has been neglected in recent years by naturalist's and there has not been a coherent picture of the extent and value of this habitat in the County.

The English Nature Parkland Inventory list 95 'sites' perhaps 10 of which are suspected of containing ancient trees. The Phase 1 Habitat survey 1987/88 identifies parkland type habitats. Champion trees of Bedfordshire and background documentation identifies large and ancient trees throughout the County. Reports in the Bedfordshire Natural History Society Journal identify notable fauna and flora from parkland. No attempt had been made to draw this information together. (Biodiversity File 200/N BedsCC)

4.1 The aim of the study

The study carried out aimed to assemble data from all available sources to identify those wood pastures and parkland which appear to remain of considerable wildlife and landscape interest, and to identify gaps in the knowledge of this habitat in Bedfordshire and priorities for further study. The results will be forwarded to English Nature in accordance with Target note 2 of the 'English Nature Biodiversity Action Plan 1997' (Appendix 1), and submitted to Bedfordshire County Council for inclusion in the 'Woodland Action' planning process as part of the Councils commitment to Local Agenda 21.

4.2 Information Sources

Prior to the survey it had been established that at least 95 sites were recognised as having been wood pasture and parkland. After consultation with John Comont (County Ecologist) and David Alderman (County Arboriculturist) 22 of these 95 sites were selected for further investigation on the basis that they were the most significant sites in terms of mature trees. It

was evident from the English Nature survey and the 1987/88 phase 1 habitat maps that many parks survived in name only or as odd trees in an arable landscape.

The following sources of information were used in the compilation of the survey:

- John Dony Data: Sites of Natural History Interest 1975-6
- The English Nature Parkland Inventory (Research report 147).1995
- The Phase 1 Habitat Survey 1987/88.
- The Sites and Monuments records within Bedfordshire County Council.
- The Bedfordshire Natural History Society Journals.
- The 1996 aerial photographs
- Bedfordshire County Councils Geographical Information Service (G.I.S.)
- The data on bats was provided by Joan Childs of the Bedfordshire Bat Group.
- The data on lichens was provided by Frances Davies Lichen recorder for the Beds Natural History Society.
- The data on fungi was taken from the Bedfordshire Natural History Society Journals and information provided by Dr Reid, recorder for the Beds Natural History Society.
- Except where a full tree survey has been included the data for the tree survey reproduced in the report has been taken from the Champion trees of Bedfordshire records which was produced jointly by Bedfordshire County Council and the Tree Register of the British Isles (T.R.O.B.I.).

4.3 Site Report Layout

For each of the 22 sites selected a brief report was compiled with information assembled under the following headings;

- Site name, Grid reference, Area (hectares), Owners/Occupiers
- Use of site (eg forestry, agriculture, recreation)

- Public access (Footpaths, roads, bridleways)
- Official designations(National park, public park/open space, Area of Outstanding Natural Beauty, Green Belt, Conservation Area, Site of Special Scientific Interest, National/Local Nature Reserve English Heritage Gradings)
- Current condition and management (Brief description to include; Landform(earthworks, rocks, soil), historic enclosed areas for cattle and/or deer, tree clumps, associated shelter belts, designed woodlands, avenues ,drives lakes,water courses, constructions, buildings, architectural ornaments, plants, planting, agricultural land(arable,pasture, paddock, farmyard), other rural land (uncultivated land e.g. scrub, pasture woodland, moors, marshes, water meadows), forestry, sports fields, race courses, golf courses, inserted new development(visitor centres, car parks). Traditionally maintained, over grown with scrub/trees/weeds, restoration in hand, remnants, abandoned)
- Landscape significance (Brief description to include topography, visual impact and habitat diversification.)
- Details of mature trees
- Fungi, Lichens, Bats, Beetles, flies (to include species, abundance and status)
- O.S. 1:10000 location map
- 1:10000 aerial photograph - computer generated black and white.
- Maps of earlier boundaries where available.

4.4 **List of Sites Studied**

1.Amphill Park

2.Battlesden Park

3.Bromham Park

4.Bushmead Priory

5.Chicksands Priory

6.Clapham Park

7.Colworth House Park

- | | |
|--------------------|---------------------------|
| 8.Flitwick Manor | 10.Kempston Grange Park |
| 9.Ickwell Bury | 11.Kempston Medieval Park |
| 12.Luton Hoo | 17.Turvey Abbey Park |
| 13.Old Warden Park | 18.Westoning Manor Park |
| 14.Roxton Park | 19.Woburn Park |
| 15.Southill Park | 20.Woodbury Park |
| 16.The Lodge Sandy | 21.Wrest.Park |

4.5 Analysis of Remaining Sites

The remaining seventy four sites where surveyed in the following way.

Using the Ordnance survey maps compiled by John Dony on the sites of natural history interest in Bedfordshire 1976-7 the remaining sites were located and their grid reference recorded. Then using the Bedfordshire County Councils GIS system the area of each site was measured and recorded to provide an overall view of the total area of parkland left within Bedfordshire and the implications arising from this.

4.6 Results

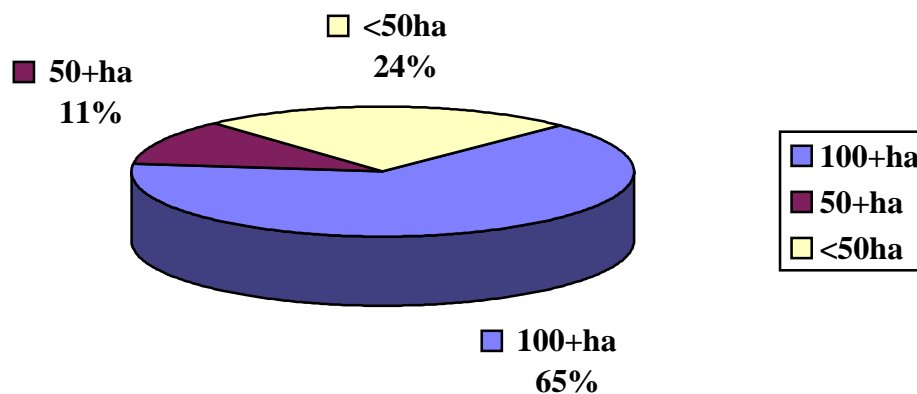
The information gathered via the surveys provides a view as to current remaining area of wood pasture and parkland in Bedfordshire and pointers as to its varying condition and natural history importance. The location, size and currently available surveys with respect to the flora and fauna of the sites is listed in table 5. A number of sites were unlocated and consequently have been presumed as no longer existing and others were located but subsequently found to no longer exist. A number of the sites still in existence poorly represent the habitat having been converted in some degree to other uses (i.e. arable, forestry, or areas of recreation such as golf courses). The exceptions to this are Woburn, Luton Hoo, and the 3 parks in Turvey (New Park, Turvey Abbey and Turvey Manor) all of which via casual observations of the parks has

revealed that they are still grazed predominantly by deer but to some extent sheep and cattle and should therefore be considered as working examples of wood pasture and parkland.

4.6.1 Extent of wood pasture and parkland in Bedfordshire

The total area of wood pasture and parkland in Bedfordshire has been calculated to the nearest hectare (ha), as 3960 ha. The mean area of parkland was calculated as 55 ha. The sites were divided, (figure 1), into those areas considered to be of significant size, (in excess of 100 ha), those areas of average size (less than 100 ha but greater than 50 ha), and those areas considered to be of lesser significance in terms of size, (less than 50 ha).

Figure 1: Chart showing percentage distribution of parkland areas

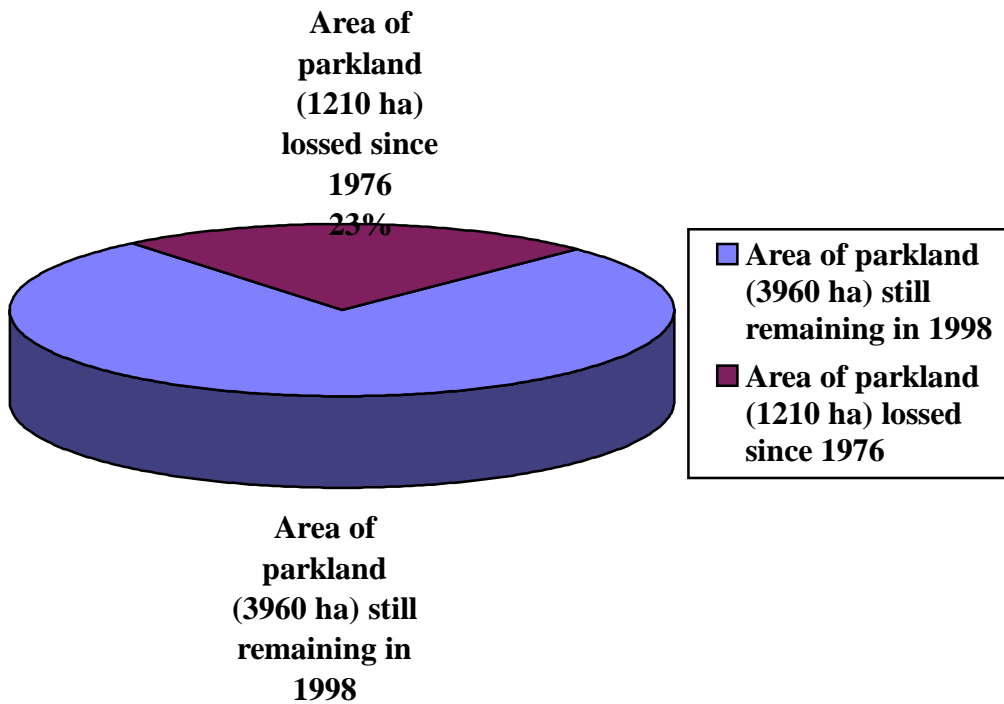


A total of six sites form 65% of the total area of remaining parkland in Bedfordshire. These are Battlesden Park, Chicksands Priory, Luton Hoo, Melchborne Park, Stockwood Park, and Woburn, (Numbers 7,17,54,55,79 and 92 respectively in table 5.) The most significant of these is Woburn covering an area of 1200ha twice the size of Luton Hoo the second largest site in Bedfordshire. A total of eight sites constitute the 11 % of area considered to be of

average size. These are Ampthill Park, Bushmead Priory, East Hyde Park, Ickwell Bury, Old Warden Park, Southhill Park, Turvey Abbey Park, and Wrest Park. (Table 5 numbers 2, 15, 64, 48, 60, 74, 89, and 95.) The remaining 59 sites make up those areas considered to be of lesser significance in terms of their size. An anomaly to these figures are the 3 parks located in Turvey, (New Park, 46 ha, Turvey Abbey Park, 56 ha and Turvey Hall Grounds 27 ha), all of which share common borders and subsequently may be regarded as one large area of parkland habitat covering 129 ha.

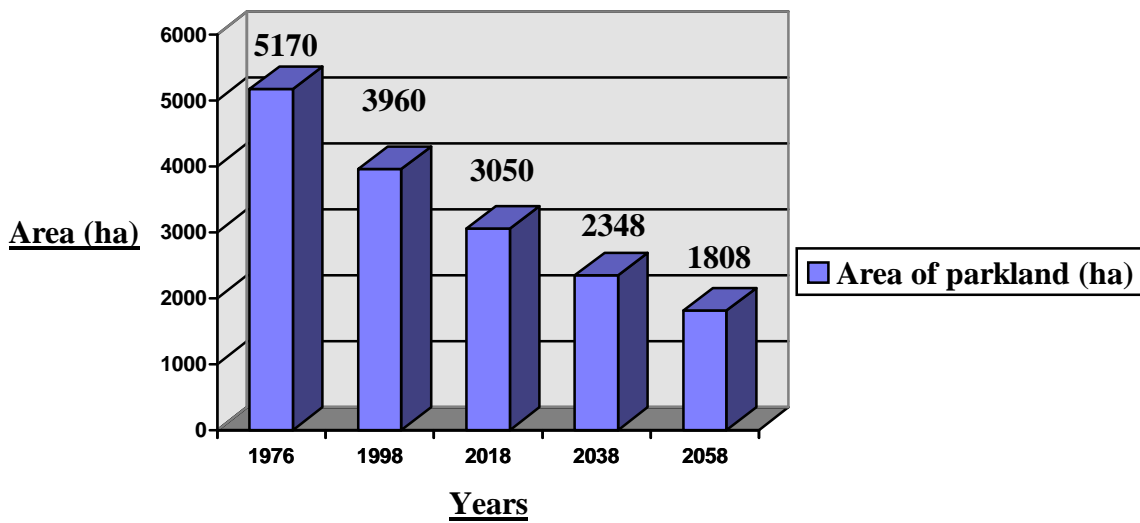
The combined survey revealed that of the original list of 95 sites only 73 now remain. Sixteen sites were unlocated and are presumed to no longer exist, (Table 5 numbers 4, 11, 16, 31, 32, 33, 39, 45, 52, 53, 61, 63, 65, 73, 75, and 76). Four sites were located but subsequently discovered via the use of the GIS system to longer exist. (Table 5 numbers 20, 50, 51, and 69). The remnants of a further two sites have been amalgamated with neighbouring areas. (Battlesden Park second with Battlesden Park and Houghton Park with Houghton Hall; table 5 numbers 8 and 7 and 44 and 43 respectively). Taking the mean area of parkland to be 55 ha this means that a total area of parkland lost since the compilation of data by John Dony in 1976 is 1210 ha. This indicates that as much as 23 % of Bedfordshire's parkland habitat has been lost since 1976.(Figure 2).

Figure 2: Total area of parkland in 1976 and degree of loss



If this rate of loss continues, (figure 3) then by 2058 as little as 1808 ha of parkland could remain in Bedfordshire. An area equal to that of the combined area of Bedfordshire's current largest sites, Woburn (1200 ha) and Luton Hoo (600 ha).

Figure 3: Area of parkland (ha) showing the predicted rates of loss of 23% over periods of approximately twenty years



4.6.2 Condition

The condition of the parks were assessed with regard to the presence of habitat types recorded in the Phase 1 Habitat surveys 1987/88; areas of unimproved grassland, semi improved grassland, improved grassland amenity grassland or arable land. The result are shown in table 2 below. Official designations of natural history relevance were also noted.

Only 3 sites (numbers 1, 16, and 21 table 2) were found to contain areas of unimproved grassland habitat. The majority of areas now consist of semi-improved or improved grassland, often with small areas of amenity grassland. Of those sites containing arable land (table 2 numbers 2, 3, 4, 7, 11, 15, 19, and 20), the arable areas are predominant with the exception of Bromham Park, Southill and Woburn (table 2 numbers 3, 15, and 19). The current trend of degradation of Bedfordshire's parklands to other uses, (ie arable and forestry) is illustrated by the maps and aerial photographs located in appendix II.

Investigation into official natural history designations revealed that sites exist in 'Conservation Areas'. Ickwell Bury has been given the status of a 'Nature Reserve'. The Lodge Sandy and Southill Park have been designated as Site of Special Scientific Interest

(SSSI's). Westoning Manor has been designated as a 'Green Belt Site' and 'Area of Great Landscape Value'. Wrest Park has been designated an 'Area Of Outstanding Natural Beauty'. Woburn somewhat suprisingly has no official designation with regard to its natural history composition.

Table 2 Summary of habitat types

<u>Site</u>	<u>Unimproved Grassland</u>	<u>Semi- improved Grassland</u>	<u>Improved Grassland</u>	<u>Amenity Grassland</u>	<u>Arable Land</u>
Ampthill Park	⊗			⊗	
Battlesden Park		⊗	⊗	⊗	⊗
Bromham Park		⊗		⊗	⊗
Bushmead Priory		⊗			⊗
Chicksands Priory		⊗		⊗	
Clapham Park			⊗		
Colworth House					⊗
Flitwick Manor		⊗		⊗	
Ickwell Bury		⊗			
Kempston Grange				⊗	
Kempston Medieval					⊗
Luton Hoo		⊗	⊗	⊗	
Old Warden Park			⊗		
Roxton Park			⊗		

Southill Park			⊗		⊗
The Lodge Sandy	⊗			⊗	
Turvey Abbey Park			⊗		
Westoning Manor		⊗	⊗		
Woburn Park		⊗			⊗
Woodbury Park			⊗		⊗
Wrest Park	⊗				

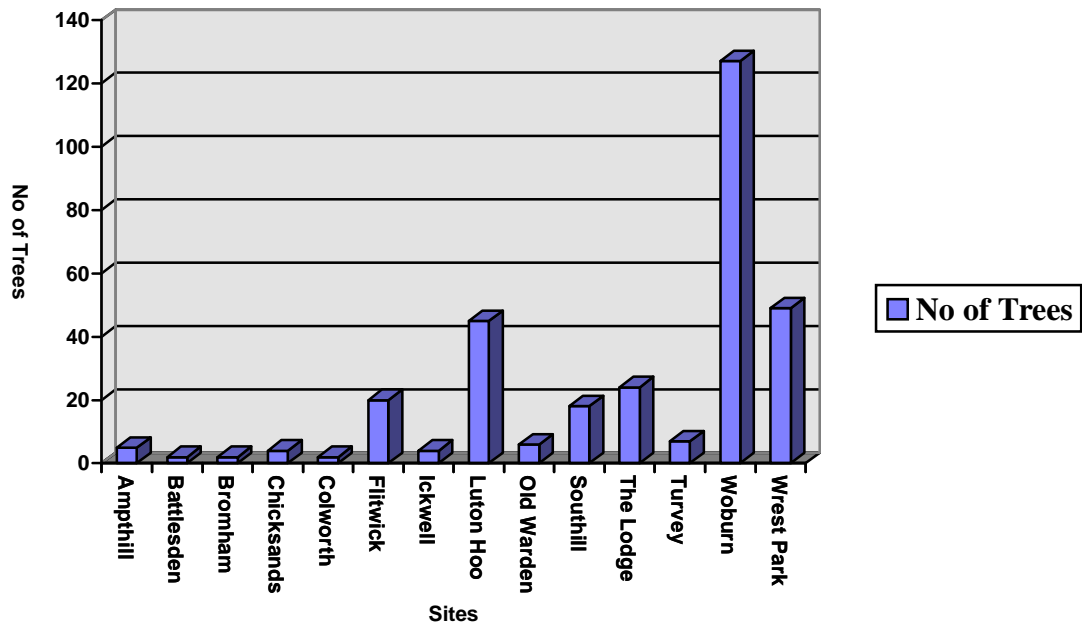
4.6.3 Trees

Fourteen sites were found to contain evidence of mature and overmature trees. Those sites found to contain significant numbers of trees were Woburn(129), Wrest Park(49) Luton Hoo(20), The Lodge Sandy(24) and Flitwick Manor(20). The remainder of sites surveyed contained less than 10 trees on each site. Consultation with John Comont has revealed that the draft criterion for County Wildlife Site status for wood pasture and parkland is “an average of more than 5 veteran trees per hectare. The minimum population size being 10 trees.” A definition of ‘veteran’ has not yet been qualified. The results are shown below in table 3 and figure 4. A total of 315 mature and overmature trees are known to exist on Bedfordshire’s parklands.

Table 3: Numbers of Champion trees

Site	Oak (<i>Quercus petraea/robur</i>)	Beech(<i>Fagus sylvatica</i>)	Ash (<i>Fraxinus excelsior</i>)	Other broadleaved and conifer
Ampthill Park	1	2	0	2
Battlesden Park	1	1	0	0
Bromham Park	0	0	0	2
Chicksands Priory	4	0	0	0
Colworth House Park	2	0	0	0
Flitwick Manor	3	0	0	17
Ickwell Bury	2	1	0	1
Luton Hoo	3	3	2	37
Old Warden	1	0	0	5
Southill Park	0	2	0	16
The Lodge Sandy	1	0	0	23
Turvey Abbey	7	0	0	0
Woburn Park	59	19	8	41
Wrest Park	2	0	2	45

Figure 4: Graph showing comparison of the total numbers of Trees



4.6.4 **Bats**

The surveyes revealed that parkland sites in Bedfordshire are important for five species of bat as feeding areas and in many cases as roosts/hibernation areas. The details are summerised in table 3.

4.6.4.1 **Species of bat associated with parklands in Bedfordshire and key to table 3**

1. Pipistrelle (*Pipistellus pipistrellus*): County status, commonest species of bat but declining.
2. Daubenton's Bat (*Myotis daubentonii*): County status, uncommon and declining.
3. Natterer's Bat (*Myotis natteri*): County status, uncommon and declining.
4. Noctule (*Nyctalus noctula*): County status, very uncommon, big decline
5. Brown long-eared Bat (*Plecotus auritus*): County status, second commonest species of bat, but declining.

Table 3: Summary of use of parkland sites in Bedfordshire by bats

Site	Roost/Hibernation Areas	Feeding Areas
Ampthill Park	None	1, 2 & 4
Battlesden Park	3	1, 2 & 3
Bromham Park	None	1, 2, 3 & 4
Bushmead Priory	3 & 5	1, 2, 3 & 5
Chicksands Priory	5	1, 2, 4 & 5
Clapham Park	None	2
Colworth House Park	1	1 & 5
Flitwick Manor	1	1 & 5
Kempston Grange	1	1 & 2
Luton Hoo	None	1, 2 & 4
Old Warden Park	1 & 5	1, 2 & 5
Roxton Park	1	1 & 3
Southill Park	1, 3 & 5	1, 3 & 5
The Lodge Sandy	1, 2, 3, 4 & 5	1, 2, 3, 4 & 5
Turvey Abbey Park	None	1, 2, 3, 4 & 5
Turvey Hall Grounds	1, 3 & 5	1, 2, 3, 4 & 5
Westoning Manor	None	1 & 3
Woburn	2, 3 & 5	1, 2, 3 & 5
Wrest Park	1, 2, 3 & 5	1, 2, 3 & 5

Additional information provided by Joan Childs suggests that four other parkland sites should be considered important for bats, (Dean House, East Hyde Park, and Ickwell Bury) and that the presence of bats is an indicator to the health of these habitats. (C.Leach 1997).

4.6.5 **Fungi**

Of the 21 sites surveyed, records of fungi for eight of the sites were available. Many of the records with the exception of Old Warden Park and The Lodge Sandy are now dated. A list of those sites for which data was available and the year in which they were surveyed is given below: No rare or notable species were recorded.

1. Ampthill Park (1953, 1977, 1982)
2. Chicksands Priory (?)
3. Colworth House Park (1968)
4. Old Warden Park (1991)
5. Southhill Park (1971)
6. The Lodge Sandy (1997)
7. Woburn Abbey (1988)
8. Wrest Park (?)

4.6.6 **Lichens**

Of the parklands surveyed information on lichens was only available for five sites, Woburn, Wrest Park, Flitwick Manor, Bromham Park and Chicksands. From the list of lichens ‘faithfull’ to wood pasture and parkland (Appendix II) list of taxa have been selected, (Appendix III), that correlate well with woodland sites known to ancient in the New Forest and elsewhere, and also have a reasonably wide geographical distribution in England.(Harding & Rose 1986). These ‘indicator species’ are used to calculate Indices of Ecological Continuity. The index is based on the percentage occurrence of up to a maximum of 20 taxa out of a total of 30. The ratings for the five sites surveyed are shown below in table 4.

Table 4: Results Of Index Of Ecological Continuity Test

Site	Percentage Rating
Bromham Park	0
Chicksands Priory	0
Flitwick Manor	0
Woburn Abbey	5
Wrest Park	0

Both Chicksands and Wrest Park however contained the rare lichen (*Ramalina farinacea*) and two rare lichens (*Ramalina farinacea* and *Evernia prunastri*) have been discovered at Woburn. Although dates were available for then the lichen surveys were undertaken it is presumed that they are pre 1986 as Harding & Rose 1986 have made reference to the numbers of lichen taxa recorded at Woburn.

4.6.7 Invertebrates

Of all the parklands surveyed The Lodge Sandy was the only site for which records of invertebrates were available. The site was surveyed by Johnathan Cole in 1996 and found to contain two Red Data Book (RDB) species of diptera, *Erynnia ocyptevata* (RDB2) and *Empris woodii* (RDB3). Neither of these species are readily associated with wood pasture and parkland. (K.J. Kirby & C.M. Drake). Eleven notable species were also discovered during the survey. Two notable species of coleoptera (*Euplectus duponti* and *Diplocoelus fagi*) were discovered during pitfall trap surveys in 1988. Neither of these species are readily associated with wood pasture and parkland. (Harding & Rose 1986).

Woburn is currently being surveyed by Paul Hyman (Luton Museum), with whom discussions have revealed that Woburn will be a valuable habitat for saproxylic invertebrates, although nothing has yet been qualified.

4.6.8 **Historic Interest**

The English Heritage designation system was noted on those sites where applicable. Fourteen of the sites surveyed were found to have been awarded a designation by English Heritage. Three sites were designated as Grade I (Exceptional Historic Interest) and the remaining eleven were designated Grade II (Site of Special Interest). The results are as follows;

- Ampthill Park, Grade II
- Battlesden Park Grade II
- Bromham Park Grade I
- Bushmead Priory Grade II
- Chicksands Priory Grade II
- Flitwick Manor Grade II
- Ickwell Bury Grade II
- Luton Hoo Grade II
- Old Warden Park Grade II
- Southill Park Grade II
- The Lodge Sandy Grade II
- Westoning Manor Grade II
- Woburn Park Grade I
- Wrest Park Grade I

4.6.9 Summary of results

Table 5 shown below provides a summary of the results with regard to site location, size, and knowledge of surveys.

Table 5: Location, Size and Surveys Available For Bedfordshires Parklands.

<u>Site</u>	<u>Grid Reference</u>	<u>Size: Hectares</u>	<u>Surveys Available ⊕</u>
Ampthill House Grounds	TL0337	9	None
Ampthill Park	TL0239	85	T, F& B
Aspley House Grounds	SP9436	4	None
Barley Croft, Sharnbrook	NOT LOCATED	–	–
Barwythe House	TL0214	8	None
Basmead Grounds	TL1461	13	None
Battlesden Park	SP9529	110	T & B
Battlesden Park (second)	SP9529	Included with above	As Above
Billington Manor	SP9422	3	None
Blunham House Grounds	TL1550	10	None
Brogborough Deer Park	NOT LOCATED	–	–
Bromham House Grounds	TL0151	16	None
Bromham Park	TL0151	27	T, L & B
Broom Grounds	TL1742	8	None
Bushmead Priory	TL1160	50	B
Cainhoe Deer Park	NOT LOCATED	–	–
Chicksands Priory	TL1139	400	T, F, L,& B

Clapham Park	TL1452	21	B
Clifton Manor Grounds	TL1639	3	None
Cockayne Hatley House Grounds	TL2549	GONE	–
Colworth House Park	SP9860	20	T, F,& B
Cranfield Court Grounds	SP9541	12	None
Crawley Park	SP9536	13	None
Dean Grange Grounds	TL0567	7	None
Dean House	TL0467	7	None
East Hyde Park	TL1317	64	None
Eggington House Grounds	SP9625	0.9	None
Flitwick Manor	TL0234	22	T, L, & B
Golgington Bury Grounds	TL0750	4	None
Great Barford House Grounds	TL1353	13	None
Grove House Dunstable	NOT LOCATED	–	–
Harrold Der Park	NOT LOCATED	–	–
Harrold Hall Grounds	NOT LOCATED	–	–
Haynes Park	TL0841	21	None
Hasells Park	TL1950	14	None
Henlow Park	TL1838	38	None
Hexton Manor	TL1030	4	None
Higham Bury Grounds	TL0532	17	None
Higham Ferrars Deer Park	NOT LOCATED	–	–

Hinwick House	SP9361	2	None
Hinwick Hall	SP9361	5	None
Hockcliffe Grange Grounds	SP9627	16	None
Houghton Hall	TL0223	18	None
Houghton Park	AS ABOVE	AS ABOVE	AS ABOVE
House Wharf and Pleasure Ground	NOT LOCATED	–	–
Howards House Grounds	TL0848	2	None
Howbury Hall Park	TL0951	30	None
Ickwell Bury	TL1445	65	T & B
Kempston grange park	TL0348	10	T & B
Kempston Medieval Park	SP9947	GONE	–
Kempston Manor Grounds	TL0247	GONE	–
Linden House	NOT LOCATED	–	–
Little Stauton Lodge	NOT LOCATED	–	–
Luton Hoo	TL1018	600	T, & B
Melchbourne Park	TL0364	133	None
Milton Bryan Manor Grounds	SP9730	8	None
Morhanger Park/Moggerhanger Park	TL1348	10	None
New Park	SP9352	46	None
Oakley House Grounds	TL0053	6	None
Old Warden Park	TL1445	60	T, F & B
Park Close	NOT LOCATED	–	–

Pavenham Bury Grounds	SP9955	20	None
Pertenhall manor	NOT LOCATED	–	–
Pictshill House grounds	SP9652	20	None
Prebendal Mansion	NOT LOCATED	–	–
Ravensden	TL0754	14	None
Ravensen House Grounds	TL0655	12	None
Roxton Park	TL1554	16	B
Sandy Place Grounds	TL1748	GONE	–
Segenhoe Manor Grounds	SP9836	28	None
Sharnbrook Grange Grounds	SP9959	8	None
Shillington Manor House	TL1232	1.5	None
Shortmead House Grounds	NOT LOCATED	–	–
Southill Park	TL1441	75	T, F & B
Staploe Medieval Park	NOT LOCATED	–	–
Stevington Park	NOT LOCATED	–	–
Stockgrove Park	SP9129	32	None
Stockwood Park	TL0819	109	None
Stratton Park	TL2144	2	None
Sutton Park	TL2147	49	None
Tempsford Hall Park	TL1653	38	None
The Grange Milton	TL0255	14	None
The Highlands	TL1353	12	None
The Lodge Sandy	TL1947	43	T, F, B & I
The Park	TL0551	25	None

Tingrith Park	TL0032	46	None
Toddington Manor	TL0029	5	None
Tofte Manor Sharnbrook	SP9961	9	None
Turvey Abbey Park	SP9552	56	T & B
Turvey Hall Grounds	SP9451	27	B
Westoning Manor Park	TL0232	42	T & B
Woburn Park	SP9632	1200	T, F, L,& B
Woodbury park	TL2152	8	B
Wotton House Grounds	TL0044	20	None
Wrest Park	TL0935	50	T, F, L,& B

⊕**Key To Table:**B= Bat Survey/Information, , F= Fungi Survey, I= Invertebrate Survey

L=Lichen Survey, T= Tree Survey.

4.7 Conclusions

The results provide an affirmation that Woburn is by far the most prominent parkland within the county for several reasons. It provides the single largest area of parkland habitat constituting 30 % of the known area of parkland in Bedfordshire. In addition it is home to 40% of the mature trees that are known to exist on Bedfordshire's parkland. It can be presumed therefore that it will provide the greatest chance for the survival of saproxylic invertebrates in Bedfordshire. It is essential therefore that Woburn be assigned some official designation with regard to its natural history. (It is a prime site for consideration as a 'County Wildlife Site')

The decline in the condition and area of parkland habitat available and the acknowledge decline in all species of bats is a correlation which should not be ignored.

The absence of the lichen communities referred to as the Lobarion alliance has been attributed to the high levels of atmospheric pollution. (Harding & Rose 1986)

The surveys also reveal the large gaps that appear in knowledge of the flora and fauna of this habitat. If the importance of Bedfordshire's parkland habitat is to be fully understood in both a national and international context particularly with regard to the epiphytes and saproxylic invertebrates these gaps in the knowledge need to be addressed.

5.0 Conclusions

The report provides an explanation of wood pasture and parkland and the conservation issues associated with the habitat. It is hoped that this will be of use to all those involved in the conservation and management of such areas, whilst creating awareness amongst such individuals as to the international, national and local importance of wood pasture and parkland.

The analysis of Bedfordshire parklands will of use to those involved in assembling a coordinated inventory of all wood pasture and parkland sites in Britain by 2002 and fulfils Bedfordshire's commitment to this process. The report will also provide useful information and guidance to all those involved in the woodland action planning process headed by Bedfordshire County Council.

Appendix I

Extracts From 'English Nature Biodiversity Action Plan July 1997'

Targets

1. Maintain and safeguard the existing parkland and wood pasture, and restore 2500ha of derelict wood pasture and parkland to appropriate pasture and tree management with suitable grazing regime by 2010
2. Produce a co-ordinated inventory of all parkland and wood pasture sites and their condition, together with pointers to data available on wildlife and heritage evaluations. Integrate such an inventory with a national register of Veteran Trees by 2002.
3. Ensure sustainable management for the key sites (identified through the inventory evaluation) and all other sites in public or conservation ownership by 2003, by the production of plans, put into implementation by 2007.
4. Identify 50 sites where expansion of the area managed as wood pasture is practicable and where linkage may be possible between existing sites by 2005. Initiate expansion by 1000 ha by 2008.

Appendix II
Maps and aerial photographs depicting parkland degradation.

Appendix III
Lowland Wood Pastures And Parkland Survey
1997 C.Leach

Site: Woburn Park

Grid Reference : SP9632

Area: 1200ha

Owners & Occupiers: Bedford Estates
Bedford Office
Woburn Park
Woburn
Beds

Telephone: 01525 290202

Use Of Site:Deer Park, Forestry, Agriculture.

Public Access:.Footpaths, Bridleways,

Official Designations: Conservation Area, English Heritage Grade I (Exceptional historic interest).

Current Condition & Management:

Woburn park consist predominantly of semi improved neutral grassland, with some semi improved acidic grassland and small areas of amenity grassland around the house. The boundaries of the park have not change since 1867. The present park breaks down into two broad areas. Firstly in what is mainly the older part of the park, an open area of parkland surrounding the house and Pleasure Ground. Secondly the peripheral areas, taking in the surrounding shelterbelts which open up in places to give a cellular landscape where we find nurseries, arable fields, meadows, coverts, farm buildings and walled gardens.

Over time the shelterbelts particularly in the north western part of the Park, have broadened at the expense of the open parkland and this parkland has been further reduced in scale by the insertion of Redlodge Plantation. Elsewhere in the park the major changes are the reduction of

the shelterbelt in the south east and small areas of clear felled plantations around the park which signify the process of constant and sensitive renewal.

Landscape Significance:

The largest area of parkland in the county with numerous mature trees and a wide variety habitats make Woburn the most significant parkland site in Bedfordshire.

Tree Survey:

Quercus petraea (Sessile Oak) **24 x 239** 1992
East of Duncombe's Breeches Pond

Quercus petraea (Sessile Oak) **27 x 218** 1992
South of Duncombe's Breeches Pond

Quercus petraea (Sessile Oak) **28 x 214** 1992
Nr. Upper Hopgarden on roadside (twin from ground)

Quercus petraea (Sessile Oak) **25 x 196 @1.1m** 1992
Nr. Upper Hopgarden on roadside (twin from ground)

Quercus petraea (Sessile Oak) **22 x 180** 1992
South of Duncombe's Breeches Pond

Quercus petraea (Sessile Oak) **28 x 179** 1992
South of Basin Pond

Quercus petraea (Sessile Oak) **17 x 157** 1992
West of roadside opposite Hopgarden Pond (top blown out).

Quercus petraea (Sessile Oak) **20 x 149** 1992
West of roadside opposite Hopgarden Pond.

Quercus petraea (Sessile Oak) **26 x 147** 1992
West of roadside opposite Hopgarden Pond

Quercus petraea (Sessile Oak) **32 x 134** 1993
West of Crawley Road ride between lodge and log hut

Quercus petraea (Sessile Oak) **24 x 134** 1992
West of roadside opposite Hopgarden Pond

Quercus petraea (Sessile Oak) **21 x 132** 1992
South of Basin Pond

Quercus petraea (Sessile Oak) **24 x 126** 1992
South of Basin Pond

Quercus robur (Common Oak) **17 x 296** 1992
Gateway to Keepers House

Quercus robur (Common Oak) **17 x 257** 1992
Between Safari Park and Stumps Cross (**221cm @2m**)

Quercus robur (Common Oak) **27 x 249** 1992
South west of Berryend Plantation

Quercus robur (Common Oak) **25 x 236** 1992
 Duncombe's Breeches Pond
Quercus robur (Common Oak) **28 x 232** 1992
 Duncombe's Breeches Pond
Quercus robur (Common Oak) **25 x 230** 1992
 Nr. Dog's Cemetery (over burrs)
Quercus robur (Common Oak) **22 x 226** 1992
 Duncombe's Breeches Pond (twin from ground)
Quercus robur (Common Oak) **14 x 224** 1992
 Avenue by drain, South west of Berryend Plantation
Quercus robur (Common Oak) **13 x 223** 1992
 Duncombe's Breeches Pond (253cm over burrs)
Quercus robur (Common Oak) **24 x 218** 1992
 Avenue by drain, South west of Berryend Plantation
 Duncombe's Breeches Pond
Quercus robur (Common Oak) **19 x 214** 1992
 West of Basin Pond
Quercus robur (Common Oak) **25 x 208** 1992
 Nr. Dog's Cemetery
Quercus robur (Common Oak) **21 x 205** 1992
 Duncombe's Breeches Pond
Quercus robur (Common Oak) **21 x 204** 1992
 Avenue by drain, South west of Berryend Plantation
Quercus robur (Common Oak) **26 x 199** 1992
 Nr Basin Bridge toward Coldbath Clump
Quercus robur (Common Oak) **17 x 198** 1992
 Between road and south west corner of garden
Quercus robur (Common Oak) **18 x 196** 1992
 Park side of eastern boundary of garden
Quercus robur (Common Oak) **12 x 196** 1992
 Avenue by drain, South west of Berryend Plantation
Quercus robur (Common Oak) **14 x 195** 1992
 Avenue by drain, South west of Berryend Plantation
Quercus robur (Common Oak) **18 x 195** 1992
 Duncombe's Breeches Pond
Quercus robur (Common Oak) **30 x 195** 1992
 Nr Upper Hopgarden
Quercus robur (Common Oak) **15 x 194** 1992
 Between main road and Whitnoe Orchard Pond
Quercus robur (Common Oak) **20 x 192** 1992
 "Abbot's Oak" North side of new pond
Quercus robur (Common Oak) **18 x 192** 1992
 West of Berryend Plantation (burred)
Quercus robur (Common Oak) **21 x 190** 1992
 Nr south east corner of garden
Quercus robur (Common Oak) **22 x 189** 1992
 Duncombe's Breeches Pond
Quercus robur (Common Oak) **20 x 189** 1992

Nr Basin Bridge toward Coldbath Clump
Quercus robur (Common Oak) **27 x 185** 1992

Duncombe's Breeches Pond
Quercus robur (Common Oak) **21 x 185** 1992

Nr south east corner of garden
Quercus robur (Common Oak) **24 x 184** 1992

Avenue by drain, South west of Berryend Plantation
Quercus robur (Common Oak) **24 x 183** 1992

The Evergreens. West of log hut, largest of boundary trees on raised bank.
Quercus robur (Common Oak) **20 x 181** 1992

North of Froxfield, toward Safari Park
Quercus robur (Common Oak) **25 x 179** 1992

Nr. Dog's Cemetery
Quercus robur (Common Oak) **18 x 177** 1992

North west of Berryend Plantation
Quercus robur (Common Oak) **18 x 177** 1992

West of Berryend Plantation
Quercus robur (Common Oak) **23 x 177** 1992

On roadside south of Dog's Cemetery
Quercus robur (Common Oak) **23 x 176** 1992

Duncombe's Breeches Pond
 South of Basin Pond nr. Basin Bridge
Quercus robur (Common Oak) **29 x 176** 1992

South of Basin Pond nr. Basin Bridge
Quercus robur (Common Oak) **20 x 175** 1992

Nr south east corner of garden
Quercus robur (Common Oak) **19 x 171** 1992

North of Froxfield, toward Safari Park
Quercus robur (Common Oak) **17 x 169** 1992

North of Froxfield, toward Safari Park
Quercus robur (Common Oak) **21 x 163** 1992

Roadside belt North of Froxfield
Quercus robur (Common Oak) **24 x 145** 1992

The Evergreens. North edge of Pinetum, west end
Quercus robur (Common Oak) **29 x 130** 1992

The Evergreens. Cpt. East of Crawley Road track, pinetum end
Quercus robur (Common Oak) **26 x 126** 1992

The Evergreens. North edge of Pinetum, between No's 73 & 93
Quercus robur (Common Oak) **29 x 124** 1992

The Evergreens. Cpt. East of Crawley Road track, pinetum end

Fagus sylvatica (Common Beech) **35 x 181** 1992

Roadside belt North of Froxfield
Fagus sylvatica (Common Beech) **31 x 171** 1993

North west corner of Lower Drakeloe Pond, south of cable car
Fagus sylvatica (Common Beech) **14 x 158** 1993

The Evergreens. Shattered 10-12m stump NNE of Lower Drakeloe Pond.
Fagus sylvatica (Common Beech) **28 x 145** 1992

South of Froxfield Gate.

Fagus sylvatica (Common Beech) **26 x 144** 1992

Avenue from Star Lodge to Safari Park

Fagus sylvatica (Common Beech) **33 x 143** 1992

South west of Berryend Plantation.

Fagus sylvatica (Common Beech) **27 x 136** 1994

West of log hut beyond track.

Fagus sylvatica (Common Beech) **21 x 135** 1993

The Evergreens North of cable car, west of Pinetum Drive.

Fagus sylvatica (Common Beech) **32 x 130** 1993

West edge of belt on east side of metal ride.

Fagus sylvatica (Common Beech) **18 x 130** 1992

Nr Upper Hopgarden

Fagus sylvatica (Common Beech) **32 x 120** 1993

Within young Scotts pine Plantation north of easterly ride.

Fagus sylvatica (Common Beech) **31 x 116** 1994

The Evergreens North of Pinetum toward Crawley road track before ditch.

Fagus sylvatica (Common Beech) **32 x 115** 1993

Nr Crawley Road wall just beyond first ride from lodge.

Fagus sylvatica (Common Beech) **32 x 113** 1993

West Crawley Road ride between lodge and log hut

Fagus sylvatica (Common Beech) **30 x 112** 1992

Roadside belt North of Froxfield

Fagus sylvatica (Common Beech) **28 x 111** 1994

The Evergreens North of Pinetum toward Crawley road track before ditch.

Fagus sylvatica (Common Beech) **27 x 110** 1992

Roadside belt North of Froxfield

Fagus sylvatica (Common Beech) **21 x 104** 1992

Nr drain leading to Milton Wood.

Fagus sylvatica (Common Beech) **29 x 099** 1994

The Evergreens North of Pinetum toward Crawley road track before ditch.

Fraxinus excelsior (Common Ash) **14 x 190** 1992

Nr Lower Hopgarden Pond (decaying hollow hulk)

Fraxinus excelsior (Common Ash) **27 x 141** 1992

Cowmans Cottage

Fraxinus excelsior (Common Ash) **15 x 135** 1992

South side, east end of Upper Drakeloe Pond (hollow)

Fraxinus excelsior (Common Ash) **19 x 107** 1992

North roadside belt, south west corner of Lower Drakeloe Pond.

Fraxinus excelsior (Common Ash) **18 x 092** 1992

By Park farm ponds.

Fraxinus excelsior (Common Ash) **22 x 090** 1992

North side of Upper Drakeloe Pond.

Fraxinus excelsior (Common Ash) **26 x 079** 1992

The Evergreens. Nr boundary of stud nr Star Lodge.

Fraxinus excelsior (Common Ash) **24 x 076** 1992

East of Upper Drakeloe Pond

Acer macrophyllum (Oregon Maple) **16 x 62** 1992
Acer platanoides (Norway Maple) **22 x 98** 1992
Acer platanoides "Schwedleri" **20 x 75** 1992
Acer pseudoplatanus (Sycamore) **22 x 121** 1992
Acer pseudoplatanus "Purpureum" **28 x 99** 1992
Aesculus hippocastunum (Horse Chestnut) **17 x 162** 1992
Alnus cordata (Italian Alder) **20 x 76** 1992
Alnus glutinosa (Common Alder) **20 x 82** 1992
Carpinus betulus (Hornbeam) **20 x 111** 1992
Carya cordiformis (Bitternut) **22 x 39** 1992
Castanea sativa (Sweet Chestnut) **26 x 169** 1992
Fraxinus excelsior "Pendula" (Weeping Ash) **11 x 81** 1992
Juglans nigra (Black Walnut) **31 x 121** 1992
Nothofagus obliqua (Roble Beech) **8 x 68** 1992
Ostrya carpinifolia (Hop Hornbeam) **12 x 48** 1992
Platanus x acerfolia (London Plane) **25 x 112** 1992
Populus canescens (Grey polar) **23 x 82** 1992
Prunus avium (Wild Cherry) **20 x 50** 1992
Quercus cerris (Turkey Oak) **29 x 133** 1992
Quercus x hispanica "Lucombeana" (Lucombe Oak) **15 x 107** 1992
Quercus rubra (Red Oak) **19 x 90** 1992
Sorbus aria "Majestica" (Whitebeam) **16 x 56** 1992
Tilia x europaea (Common Lime) **33 x 137** 1992
Tilia platyphyllos (Large Leafed lime) **26 x 121** 1992
Zelkova sinica (Chinese Zelkva) **17 x 71** 1992

Abies procera (Noble Fir) **20 x 75** 1992
Araucaria araucana (Chile Pine) **22 x 77** 1992
Calocedrus deccurrens (Incense Cedar) **22 x 118** 1992
Cedrus atlantica var *glauca* (blue atlas cedar) **27 x 162** 1992
Cedrus deodara (Deodar Cedar) **22 x 118** 1992
Cedrus libani (Cedar of Lebanon) **31 x 222** 1992
Chamaecyparis lawsoniana (lawson cypress) **22 x 100** 1992
Picea abies (Norway spruce) **26 x 74** 1992
Picea orientalis (Oriental Spruce) **27 x 83** 1992
Pinus nigra var *caramanica* (Crimean Pine) **35 x 151** 1992
Pinus nigra var *maritima* (Corsican Pine) **34 x 83** 1992
Pinus ponderosa (Western Yellow Pine) **24 x 80** 1992
Pseudotsuga menziesii (Douglas Fir) **31 x 104** 1992
Sequoiadendron giganteum (Wellingtonia) **33 x 224** 1992
Thuja plicata (Western Red Cedar) **17 x 112** 1992
Tsuga canadensis (Eastern Hemlock) **13 x 69** 1992

Fungi:

Corprinus stercoreus 12.5.88 Coll. Dr Jerry Cooper.

Ascobolus immersus 10.4.88 Coll. Dr Jerry Cooper.

Meloderma desmazieresii 10.4.88 Coll. Dr Jerry Cooper.

Schizothecium conicum 10.4.88 Coll. Dr Jerry Cooper.

Podospora curvula 10.4.88 Coll. Dr Jerry Cooper.

Phomopsis araucariae 10.4.88 Coll. Dr Jerry Cooper.

Lichens: Walls and trees and parkland around house.

Acarospora fuscata

Anaptychia ciliaris

Aspicilia calcarea

Aspicilia contorta

Buellia punctata

Caloplaca aurantia

Caloplaca citrina

Caloplaca flavescens

Caloplaca holocarpa

Caloplaca teicholyta

Candelariella aurella

Candelariella medians

Candelariella vitellina

Catillaria lenticularis

Chaenotheca ferruginea

Cladonia coniocraea

Cladonia conista

Cladonia fimbriata

Cladonia macilenta

Cliostomum griffithii

Collema auriforme

Collema crispum

Cyphelium inquinans

Diplocia canescens

Diploschistes muscorum

Diploschistes scruposus

Diplotomma albostratum

Evernia prunastri -**Rare**

Foraminella ambigua

Haematomma ochroleucum var
porphyrium

Hypocenomyce scalaris

Hypogymnia physodes

Lecanactis premnea

Lecanora campestris

Lecanora chlorotera

Lecanora conizaeoides

Lecanora crenulata

Lecanora dispersa

Lecanora expallens

Lecanora muralis

Lecanora polytropha

Lecidea erratica

Lecidella scabra

Lecidella stigmatea

Lepraria incana

Ochrolechia tuneri

Opegrapha varia

Opegrapha vermicellifera

Opegrapha vulgata

Parmelia acetabulum

Parmelia elegantula

Parmelia subaurifera

Parmelia glabratula v. *fuliginosa*

Parmelia saxatilis

Parmelia subrudecta

Parmelia sulcata

Pertusaria amara

Pertusaria coccodes

Pertusaria corallina

Pertusaria hymenea

Pertusaria pertusa

Phaeophyscia orbicularis

Phlyctis argena

Physcia adscendens

Physcia caesia

Physcia tenella

Physconia grisea

Placynthium nigrum

Platismatia glauca

Porpidia crustulata

Protoblastenia rupestris

Psilolechia lucida

Ramalina farinacea (**Rare**)

Rinodina teichophila

Schismatomma decolorans

Tephromela atra

Toninia aromatica

Toninia tumidula

Trapelia coarctata

Trapeliopsis granulosa
Verrucaria hochstetteri
Verrucaria muralis
Verrucaria nigrescens
Verrucaria viridula

Xanthoria calcicola
Xanthoria candelaria
Xanthoria parietina
Xanthoria polycarpa

Bats:

Removed

Beetles:

No records found.

Flies:

No records found.

Appendix IV

Species of lichen faithful to Pasture Woodland and Parkland.(Harding & Rose 1986)

<i>Agonimia octospora</i>	<i>Lecidea sublivescens</i>
<i>Arthonia vinosa</i>	<i>Leptogium burgessii</i>
<i>A. stellaris</i>	<i>L.cyanescens</i>
<i>Arthropyrenia ranunculospora</i>	<i>L.teretiusculum</i>
<i>Arthothelium ilicinum</i>	<i>Lobaria amplissima</i>
<i>Bacidia biatorina</i>	<i>L.virens</i>
<i>Bactrospora corticola</i>	<i>L.pulmonaria</i>
<i>Biatorina atropurpurea</i>	<i>L.scrobiculata</i>
(= <i>Catillaria atropurpurea</i>)	<i>Megalospora tuberculosa</i>
<i>Catillaria pulverea</i>	<i>Nephroma laevigatum</i>
<i>C.sphaeroides</i>	<i>N.parile</i>
<i>Catinaria grossa</i>	<i>Ochrolechia inversa</i>
<i>C.laureri</i>	<i>Opegrapha sorediifera</i>
<i>Cetrelia olivetorum</i>	<i>O.ochrochelia</i>
<i>Chaenotheca brunneola</i>	<i>O.corticola</i>
<i>Dimerella lutea</i>	<i>Pachyphiale cornea</i>
<i>Enterographa crassa</i>	<i>Pannaria mediterranea</i>
<i>Haematomma elatinum</i>	<i>P.conoplea</i>
<i>Heterodermia obscurata</i>	<i>P.rubiginosa</i>
<i>Lecanactis amylacea</i>	<i>P.sampaiana</i>
<i>L.lyncea</i>	<i>Permelia arnoldii</i>
<i>L.premnea</i>	<i>P.crinata</i>
<i>Lecanora quercicola</i>	<i>P.minarum</i>

P.horrescens

P.reddenda

Parmeliella triptophylla

P.jamesii

P.plumbea

P.testacea

Peltigera collina

P.horizontalis

Pertusaria velata

Phyllopsora rosei

Porina borreri

P.coralloidea

P.hibernica

P.leptalea

Pseudocyphellaria crocata

P.inricata

Pyrenula macrospora

P.chlorospila

Rinodina isidioides

Schismatomma niveum

S.quercicolum

S.virgineum

Stenocybe septata

Sticta limbata

S.sylvatica

Strangospora ochrophora

Thelopsis rubella

Thelotrema lepadinium

Appendix V

Species of Lichens used to Calculate The Revised Index of Ecological Continuity (RIEC)

(Harding & Rose 1986)

<i>Arthonia vinosa</i>	<i>Pannaria conoplea</i>
<i>Arthropyrenia ranunculospora</i>	<i>Permelia crinita</i>
<i>Biatorina atropurpurea</i>	<i>P.reddenda</i>
(= <i>Catillaria atropurpurea</i>)	<i>Parmeliella triptophylla</i>
<i>Catillaria sphaeroides</i>	<i>Peltigera collina</i>
<i>Dimerella lutea</i>	<i>P.horizontalis</i>
<i>Enterographa crassa</i>	<i>Porina leptalea</i>
<i>Haematomma elatinum</i>	<i>Pyrenula</i> (either <i>macrospora</i> or <i>chlorospila</i> but do not count both)
<i>Lecanactis lyncea</i>	
<i>L.premnea</i>	<i>Rinodina isidioides</i>
<i>Lobaria amplissima</i>	<i>Schismatomma quercicolum</i>
<i>L.virens</i>	<i>Stenocybe septata</i>
<i>L.pulmonaria</i>	<i>Sticta limbata</i>
<i>L.scrobiculata</i>	<i>S.sylvatica</i>
<i>Nephroma laevigatum</i>	<i>Thelopsis rubella</i>
<i>Pachyphiale cornea</i>	<i>Thelotrema lepadinium</i>

Appendix VI

A conservation guide to the entomological investigation of dead wood habitats.

(KJ Kirby & CM Drake).

- Do not remove bark or dig into dead wood on living trees and so endanger their long-term survival. In particular do not make a “first incision”.
- Try to use non-invasive methods. Emergence and interception traps and the examination of nearby nectar sources provide alternative methods to investigate the dead wood fauna.
- Individual old trees of known value for rare species should be left alone, rather than be visited by a succession of entomologist’s.
- Replace bark if possible. It is worth carrying a small hammer and nails to do this but do not do so if there is the slightest chance of the wood subsequently being cut up with a chain saw. Refrain from removing vertical bark if it cannot be replaced.
- Do not remove all available fungal fruiting bodies from dead wood and after investigating them, put them back.
- Replace old nest, leaf litter. Fungi and wood mould from hollows and forks so that larvae and pupae can complete their development.
- Replace overturned logs. This applies equally to stones, litter, moss, piles of excavated soil, shingle etc.
- Do not damage or move dead wood used by solitary wasps and bees. These relocate their burrows by sight and may be unable to find them again if they cannot recognise their surroundings.
- It is better to investigate a small quantity of dead wood thoroughly, perhaps even to destruction, than make superficial studies on, and hence damage, a large quantity.

- Give due consideration to other biological interest of dead wood. It may be important for fungi, lichens and bryophytes.

Grubbing, beating and sweeping.

- These can be potentially quite damaging to vegetation. Exercise restraint in orchid meadows etc.- the sweep net may inadvertently double as a scythe.
- The most effective form of beating is a short, sharp shock- a sudden tap on a branch is more likely to dislodge beetles than a prolonged thrashing which can damage foliage and branches.
- Searching vegetation for feeding signs can be much more productive and lead to a far better understanding of species ecology
- Carry out only a small number of sweeps before examining the catch and releasing unwanted insects. Species of other groups are often less robust than beetles. Otherwise the result is a mangled ball of squashed flies and bugs.
- Beware of nesting birds when carrying out any of these operations. Disturbance near a nest site may cause birds to desert.

Surplus material- specimens and pabulum

- Do not release surplus beetles into the garden or add pabulum to the compost heap to allow any remaining insects to “take their chance”. If at all possible return surplus living specimens and pabulum to the site from which it was taken. If it is not possible to return such material, it is better destroyed any surplus livestock killed and distributed to other entomologist. Other entomologist may discover released specimens or ones emerging from discarded material. This will obscure knowledge of species natural distribution and make them appear more widespread than they really are.

Introduction

- Any establishments or introductions should not be undertaken without consulting the statutory nature conservation body for the county, the Biological Records Centre or the JCCBI, who have produced a code for insect introductions.

Protected species

- These should not be collected or their habitats disturbed in any way. In certain circumstances a licence to conduct serious studies of protected species may be obtained from the statutory conservation body of the country in which the study is to be carried out- English Nature , the Countryside Council for Wales or Scottish Natural Heritage.

Bibliographic References

Bedfordshire County Council Biodiversity File 200/N Unpublished

Harding P.T. 1979 Dynevor Deer Park Dyfed: A description and survey, with proposals for management Institute Of Terrestrial Ecology. Huntingdon

Harding & Rose 1986 Pasture Woodlands In Lowland Britain Henry Ring. Dorset

HMSO 1995 UK Biodiversity Steering Group Report Volume 1 HMSO London

HMSO 1995 UK Biodiversity Steering Group Report Volume 2 HMSO London

Kirby K.J. & Drake C.M.1993 Dead Wood Matters: the ecology and conservation of saproxylic invertebrates in Britain. English Nature. Peterborough.

Peterken G. 1993 Woodland Conservation and Management. Chapman & Hall London

Speight MCD 1989 Saproxylic Invertebrates and their Conservation Institute Of Terrestrial Ecology. Huntingdon

Springthorpe G.D. 1985 Wildlife Rangers Handbook Forestry Commision.

Reid C. 1997 Biodiversity Action Plan Lowland Wood Pasture and Parkland. English Nature. Peterborough._