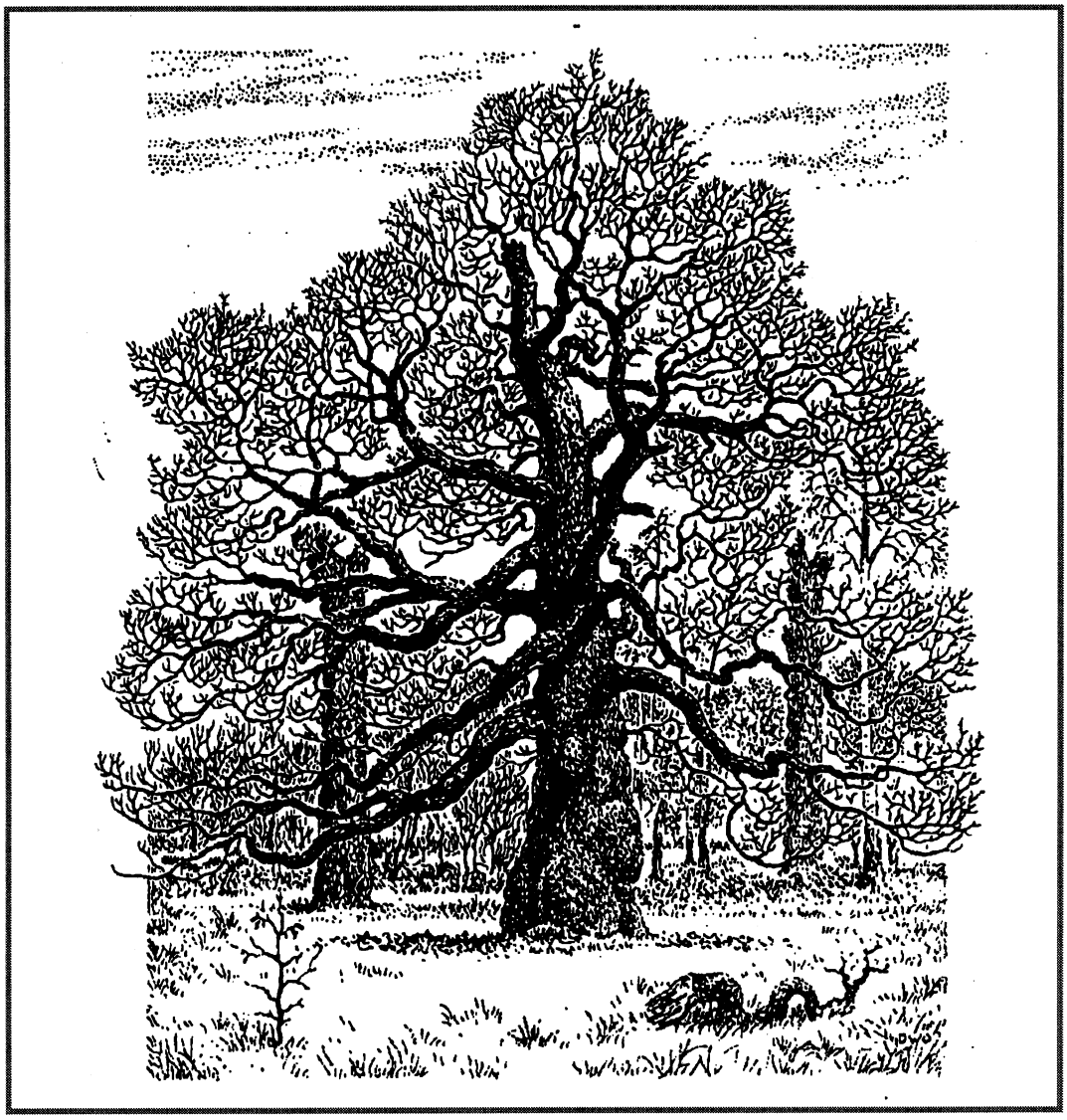
ENGLISH NATURE

The veteran trees of Birklands and Bilhaugh, Sherwood Forest, Nottinghamshire

No. 361 - English Nature Research Reports



working today
for nature tomorrow

English Nature Research Reports

Number 361

The veteran trees of Birklands and Bilhaugh, Sherwood Forest, Nottinghamshire

S J Clifton

English Nature
East Midlands Team
The Maltings
Grantham NG31 6BH

ISSN 0967-876X

Acknowledgments

This report would not have been possible without the continued co-operation of the site managers. Thanks to staff of Forest Enterprise (Sherwood & Lincolnshire District), the Thoresby Estate, Nottinghamshire County Council, RJB Mining (UK) Ltd. and the Ministry of Defence (East Midland Training Areas) for kindly allowing access for the surveys.

Many thanks to Paul Barwick for permitting the reproduction of Forest Enterprise data. Thanks also to Norman Lewis, Andrew Poole and Dr Charles Watkins for their useful comments on this report and for sharing their extensive knowledge and experience during its production.

Dr Roger Key and Dr Keith Kirby of English Nature provided valuable comments on an earlier draft of this report.

Summary

This report reviews information collected during the period 1996-99 regarding the size, distribution and condition of the ancient, or veteran, tree population of Birklands and Bilhaugh, the last surviving fragment of the old forest of Sherwood. The study area of almost 800 hectares encompasses the woodland boundary as mapped during the 1730s and includes Birklands and Bilhaugh Site of Special Scientific Interest (SSSI) and candidate Special Area of Conservation (cSAC), an internationally significant site for wildlife noted for its rich saproxylic invertebrate fauna and its lower plant flora.

This assessment confirms that Birklands and Bilhaugh supports one of the largest populations of ancient trees in the UK. At least 2386 veteran trees were identified, using locally defined characteristics, from across the study area, usually in the form of pedunculate oak *Quercus robur* and sessile oak *Q. petraea*. Approximately 1643 (69%) of these were standing trees. Of these standing trees, 991 were considered to be living, representing 42% of all veteran trees recorded. A further 27% were recorded as standing dead trees and 23% fallen trees or trunks. Only 8% of the total number of records were classified as stumps.

Veteran trees were locally concentrated but widely scattered in their distribution across the study area, confirming the historic extent of the ancient woodland. Approximately 72% of the tree population occurred within Birklands. Important compartments were found to be Sherwood Forest Country Park and Bilhaugh Buckgates which both contain large numbers of veterans of all classes and support large proportions of living and standing dead trees. The density of ancient trees within each compartment varied widely, ranging from 0.4 - 8.5 trees per hectare and up to 7.1 standing trees per hectare but the greatest densities were found within compartments dominated by semi-natural woodland. Standing trees were a feature of all compartments but varied in their abundance, forming between 18 - 97% of veterans found within each compartment. An abundant fallen dead wood resource was also characteristic of areas with high numbers of standing veterans.

Over 80% of the veteran tree population was found within the boundaries of the Site of Special Scientific Interest and candidate Special Area of Conservation. A significant population of standing veteran oaks (342) were found outwith these designated areas, however. It is also suggested that the full extent of the ancient woodland site has yet to be fully recognised.

These results are discussed and placed in their historic context in an effort to clarify trends affecting the tree population over the centuries. It is clear that veteran trees and large quantities of dead wood have long been a feature of the site, despite its increasingly intensive management since the 11th Century. The last Millennium has been a turbulent one for Birklands and Bilhaugh and the wider Sherwood Forest. Following the demise of the Royal Hunting Forest, the study area has been subject to immense land use pressures. Harvesting of timber, illegal felling, unrestrained grazing, ornamental landscaping, coniferous and broad-leaved afforestation, military training, mineral extraction and mass tourism, in response to rapidly changing socio-economic and political climates, have all influenced the size and condition of the ancient tree population. It is suggested that there is likely to have been a steady decline in the number of ancient oaks during the last 200 years in particular.

In view of the area's immense natural heritage and historic significance, recommendations are made to reverse this trend at the dawn of a new Millennium involving a partnership approach to conserving the special nature conservation interest of Birklands and Bilhaugh. The study area is considered to be suitable to promote the gradual restoration of coniferous plantation to native woodland characteristic of Sherwood. Measures to promote appropriate woodland management designed to sustain the veteran tree population and its rich associated wildlife and to cater for the sustainable use of the area by future generations of visitors are the key priorities. In the long-term this should include the restoration of extensive grazing to suitable compartments in an effort to restore an open pasture-woodland structure. A common vision should aim to safeguard the integrity of Sherwood's last remaining ancient woodland and maintain, and ideally increase, the ancient tree population of the study area during the next 1000 years.

Contents

1. Introduction

Birklands and Bilhaugh is the last surviving fragment of the Royal Forest of Sherwood which covered over 50,000 hectares of Nottinghamshire at its inception in the 11th Century. Covering the dry acid soils of the Sherwood Sandstone plateau, the Forest was essentially a 'heathland forest' by this period (Rackham, 1986), consisting of scattered oak-birch woodland amongst extensive areas of lowland heath, acid grassland and semi-enclosed arable land, all of which was subject to grazing by a range of animals both wild and domestic (Boulton, 1965). Following the end of possession by the Crown, the Forest was largely dismantled and cleared by subsequent landowners with core areas of the forest becoming large aristocratic estates.

Now, almost 1000 years later, only a few hundred hectares of its ancient woodland remain but with a large population of ancient or 'veteran' oak trees, a sight now extremely rare in the UK and Europe. This last surviving fragment of woodland known as Birklands and Bilhaugh was first referred to in 1251 and is now one of the most important localities for ancient trees in England. It is home to one of the most famous and most visited veteran trees in the country, the Major Oak, which is estimated to be over 1000 years old. The area is also famously associated with the legendary exploits of Robin Hood and this cultural heritage enjoys international recognition.

Woodland with significant numbers of very old trees is widely acknowledged to be of great nature conservation significance and often take the form of wood-pasture or open parkland systems of considerable antiquity (Kirby *et al.*, 1995). The flora and fauna of these woods can often be exceptionally rich and highly specialized in their habitat requirements. In particular, communities of saproxylic invertebrates - those animals dependent upon habitats with an abundance of decaying wood and mature timber - are closely associated with old woodland and ancient trees and are often characterised by an abundance of rare and endangered species (Kirby & Drake, 1993; Alexander, 1999). These communities are amongst the most threatened faunas in Britain, being restricted to a limited number of sites across the UK (Harding & Rose, 1986). To encourage the successful conservation and management of these habitats, lowland wood-pastures and parklands are a Priority Habitat identified by the UK Biodiversity Action Plan (Biodiversity Steering Group, 1995).

The study area of Birklands and Bilhaugh covers 797 hectares (ha) and is illustrated by Figure 1. It covers the larger woodland complex as indicated by some of the earliest detailed maps of the area dating back to 1735. However, it is known that these woods were distinguishable on maps of Sherwood Forest as early as the 14th Century (Mastoris & Groves, 1997). The study area also includes 326 ha of Birklands and Bilhaugh Site of Special Scientific Interest (SSSI).

This report seeks to review the existing information on veteran trees for the SSSI, present information for those areas not previously surveyed for veteran trees and, for the first time in recent years, present a clear picture of the present size, distribution and condition of the whole veteran tree population in Birklands and Bilhaugh.

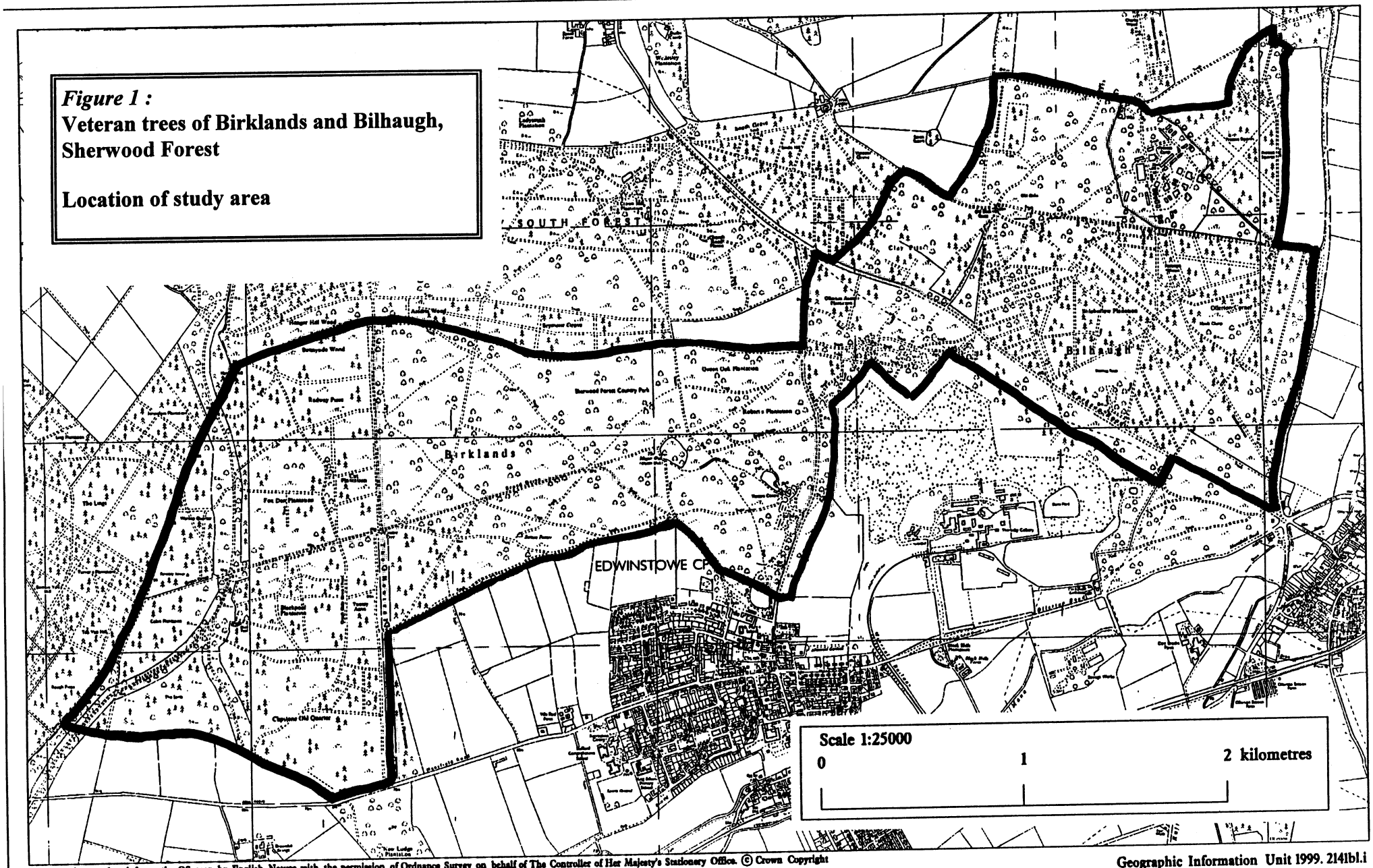


Figure 1 :
Veteran trees of Birklands and Bilhaugh, Sherwood Forest

Location of study area

Geographic Information Unit 1999. 2141bl.i

1.1 The importance of Birklands and Bilhaugh SSSI for nature conservation

Birklands and Bilhaugh SSSI (Sherwood Forest) is a nationally important wildlife site (see appendices) and the only Nottinghamshire site identified by Ratcliffe (1977). In addition to large areas of dry lowland heath, it includes the finest remnants of ancient semi-natural woodland within the study area. This woodland is dominated by pedunculate oak *Quercus robur*, sessile oak *Q. petraea* and birch *Betula pendula*, forming stands of predominantly W16a *Quercus* spp - *Betula* spp - *Deschampsia flexuosa* woodland, typical sub-community and W10 *Quercus robur - Pteridium aquilinum- Rubus fruticosus* woodland (Rodwell, 1991). Both woodland types at Birklands and Bilhaugh contain significant populations of old or veteran oak trees, characterised by their large girth and a noticeable loss of crown which produces a 'stag-headed' appearance. Estimates of their age vary but most trees are thought to be between 400-600 years old.

The ancient woodland of Birklands and Bilhaugh is best described as relict or derelict pasture-woodland. The form of many of the large veteran trees which remain suggest they developed in open woodland conditions, their growth shaped by historic management practices of timber harvesting and grazing. The wood was historically grazed by a variety of herbivores, originally deer and later domestic stock such as pigs and sheep (Watkins, 1998) but such practice is thought to have largely ceased by the early 1900s. Although early maps of the site suggest a varied woodland structure, with areas of open heath and bracken-dominated glades, the site is now largely closed-canopy woodland.

The woodland has a characteristically species-poor ground flora typical of the acid free-draining soils of the Sherwood Sandstones, with only locally notable vascular plants such as bilberry *Vaccinium myrtillus,* but supports a rich fungi flora including the oak polypore *Buglossoporus pulvinus / Piptoporus quercinus*, a nationally rare and internationally endangered species which receives special protection under Schedule 8 of the *Wildlife & Countryside Act 1981* (as amended). A national Species Action Plan within the UK Biodiversity Action Plan has been produced for this fungus and Birklands and Bilhaugh is one of its few stations in the UK.

The bird and mammal fauna of the SSSI includes species largely dependent on old trees, such as woodpeckers and a number of bat species. However the site is most notable for an exceptionally rich invertebrate fauna, particularly the assemblage of saproxylic invertebrates. The study area has long been known as an outstanding site for Coleoptera (beetles) and Arachnida (spiders) associated with the decaying wood and mature timber of native oaks and birch. In terms of Coleoptera alone, 37 Red Data Book species have been recorded at Birklands and Bilhaugh, along with a further 109 species which are Nationally Scarce. Over 50 of these recorded species are indicative of the long continuity of semi-natural woodland habitat in this area. The site is amongst the top ten sites for rich saproxylic beetle faunas in Britain with a high Index of Ecological Continuity and a notable concentration of species confined to or very closely associated with over-mature timber habitats (Harding & Alexander, 1994).

Many of the classic Sherwood Forest rarities found by early entomologists (e.g. Carr, 1916) have also been recorded in recent years. Amongst the beetle rarities typical of Sherwood are *Microscydmus minimus*, a small ant-like beetle found in cavities of old hollow trees; *Teredus*

cylindricus a predatory beetle known from only three sites and strongly associated with old oaks; *Prionychus melanarius* a darkling beetle found in old forests and rotten wood of old oak and birch; *Cryptocephalus querceti* a rare species of leaf beetle associated with ancient oaks and *Corticeus unicolor*, a rare darkling beetle found under bark of deciduous trees. The largest false scorpion in Britain, *Dendrochernes cyrneus*, a species found in dry sapwood and bark of dead and over-mature trees, is also a Sherwood speciality. RDB species amongst the spider fauna include *Lepthyphantes midas*, a money spider found in hollow oak trees and under bark and *Mastigusa macrophthalama*, a cobweb spider associated with ant nests in dead or decaying oak trees. Unconfirmed reports exist of the greater stag beetle *Lucanus cervus*, a BAP 1 priority species of rotting timber and stumps and old Sherwood records for the nationally rare hazel pot beetle *Cryptocephalus coryli*, a species associated with young birch in open sunny situations and also a priority BAP species, date back to 1906. In addition, the geographical position of the site in the English north Midlands results in a distinctive and unique collection of species at both their northern and southern extremes of range.

A number of forest and pasture-woodland sites are considered to be of European significance for their saproxylic invertebrate faunas, including Birklands and Bilhaugh SSSI (Speight, 1989). Parts of the SSSI have been selected as a candidate Special Area of Conservation (cSAC) by the UK Government, as required by the 1992 EEC Directive on the conservation of natural habitats and of wild fauna and flora (92/43/EEC), commonly known as the European Habitats Directive. The site has been selected as the most northerly UK example of old acidophilous oak woodland on sandy plains, with a notable assemblage of ancient trees and a rich associated invertebrate fauna.

This area holds the greatest concentration of such trees in Nottinghamshire and is likely to represent the largest veteran tree population within central and northern England. Other important Sherwood localities such as Welbeck Park, Thoresby Park and Clumber Park SSSI now support small and scattered parkland populations of veterans, remnants of the original Forest, although the last site also retains a rich deadwood beetle fauna of national importance. Outside Sherwood, veteran trees become increasingly scarce and are largely restricted to isolated individuals in the wider countryside and a small number of key sites such as Norwood Park in Southwell, a relic medieval deer park with good numbers of veteran oaks (Lyth, 1986).

2. Purpose of this review and survey

Previous surveys commissioned by English Nature in 1991 and 1996 (Lavers & Watkins, 1996a; Watkins & Lavers, 1998) have produced detailed information on the veteran tree populations within parts of the SSSI (Birklands Sherwood Forest Country Park, FE Birklands East and Bilhaugh Buckgates). Forest Enterprise (FE) have also undertaken similar studies for the remainder of their landholding using consistent recording methods (Lavers & Watkins, 1996b).

The principal aim of the 1999 survey carried out by local English Nature staff was to fill important gaps in our knowledge of the tree population in the wider area. Communications with the principal landowners and managers of the study area suggested strong evidence of significant concentrations of old trees outside of the SSSI areas, reflecting the historic extent of woodland illustrated by available documentary evidence. To establish the full extent of the tree population, it was important to survey these remaining non-SSSI areas using a similar but (due to time constraints) more basic methodology.

Such information is important if the outstanding nature conservation interest of this Sherwood Forest remnant is to be conserved, enabling this particular site to be considered more fully in its national context. It is hoped that this report will contribute to the continued conservation of the surviving Sherwood veterans and inform future site management. This information will also help with the development of a long-term woodland management strategy for the area, designed to retain the veteran tree resource and restore its pasture-woodland heritage to benefit its considerable wildlife interest. It is also hoped that this survey will clarify the extent of ancient woodland in the study area and illustrate the degree to which the SSSI designation covers the veteran tree interest.

2.1 National and local context

This report contributes to the national BAP targets within the Lowland Wood-pasture and Parkland Action Plan (English Nature, 1998) in respect of the following actions:

- protect and maintain the current extent and distribution of lowland wood-pasture and parkland in a favourable ecological condition;
- initiate in areas where examples of derelict wood-pasture and parkland occur a programme to restore 2500 ha to favourable ecological condition by 2010;
- undertake strategic targeted survey of parklands and wood-pastures;
- encourage recording and monitoring of tree population, age structure survivorship and condition at key sites across the country to identify site specific and general trends.

More specifically, this report will be able to contribute towards the following action outlined within the Oak-Birch Woodland Habitat Action Plan, of the Nottinghamshire Local Biodiversity Action Plan (Notts Biodiversity Action Group, 1998):

- prepare an inventory of woodland and non-woodland ancient trees within the Sherwood area building on the survey of Birklands and Bilhaugh SSSI;
- promote the management and restoration of oak-birch woodland in Forest Enterprise Forest Design Plans especially where the impacts of habitat fragmentation can be reduced or collections of ancient trees protected;
- review and update the Ancient Woodland Inventory for Nottinghamshire by 2005.

3. Methodology

3.1 Field surveys

The veteran tree surveys of 1996 aimed to establish an inventory of trees for particular compartments within Birklands and Bilhaugh SSSI and land managed by Forest Enterprise. The methodology used was based on previous ancient tree surveys pioneered by E.E. Green and involved the marking of individual veterans using aluminum tags, the mapping of individual trees using aerial photographs, recording of tree condition and the detailed measurement of a wide variety of variables for each tree (Watkins & Lavers, 1998).

The survey of 1999 by English Nature was less detailed and focused on those areas where no previous tree recording had been undertaken. Individual blocks of woodland within the study area were identified (Table 1 & Figure 2) and walked in early May and late September using public rights of way and forestry rides and tracks to ensure complete visual coverage of each compartment. The location of veteran trees was recorded onto Ordnance Survey or more detailed estate maps where available, although individual trees were not tagged during this survey. To ensure consistency with previous tree surveys, each record was then classified into one of the following condition categories:

1. Standing live tree
2. Standing dead tree >1 metre high
3. Fallen tree or trunk
4. Stump or standing dead < 1 metre high

Only large over-mature trees and their associated dead wood material were recorded in this way and those mature trees which did not display local veteran tree characteristics (see 3.2) were omitted from the record.

This method was found to be satisfactory and there was no need to use more laborious techniques such as line transects across the survey area. As most of the survey blocks consisted of coniferous plantation, veterans were easily identifiable as they formed a conspicuous part of the woodland understorey and their large girth and low crown were in

sharp contrast to the regimental lines of tall thin pine crop. Often trees were clearly visible at a considerable distance through the timber crop. This became increasingly difficult in areas of broad leaved woodland where veterans were not always clearly visible from woodland edges and more thorough searching within the interior of the woodland block was required.

The survey was undertaken to avoid peak growth of the woodland ground layer which was typically characterised by a dominance of bracken and bramble. This ground layer did not generally preclude visibility across the woodland understorey or the detection of standing trees through plantation areas but may well have led to under-recording of low stumps and/or fallen trees.

It is equally possible that a small proportion of standing trees were not identified or recorded during the surveys, as a result of the nature of the methodology. This would lead to an under-estimate in the numbers of these trees also, although it is suggested that this is likely to be limited to a very small number. More detailed repeat surveys in the future, perhaps using Global Positioning Systems (GPS), will hopefully eliminate these inaccuracies.

On completion of the 1999 fieldwork, the results were compiled and integrated with previously collected data (Lavers & Watkins, 1996a, 1996b). Field maps illustrating the location and distribution of individual trees were retained by English Nature and circulated to the appropriate landowners.

3.2 Definition of a 'typical' veteran tree in Sherwood

In an effort to promote greater accuracy and consistency across the survey work, it was important to clarify the local characteristics of veteran trees. Although such trees are generally old and in decline, age and size are too imprecise to form a broadly accepted definition of a veteran tree as a wide range of factors influence tree morphology and make it almost impossible to quantify and apply across the UK as a whole (e.g.White, 1998). In Nottinghamshire, a very useful definition of a veteran tree was generated during the recent revision of criteria for the selection of non-statutory wildlife sites within the county; 'an outstanding individual of unique age or character, a giant amongst plants, capable of supporting a remarkable range of dependent organisms therefore being of biological and maybe of historical and cultural significance' (Norman Lewis, *pers.comm*).

Surveys commissioned by English Nature assessing the veteran tree resource within Birklands and Bilhaugh SSSI revealed a number of more specific attributes which may be used to define veteran trees in this particular area (Watkins & Lavers, 1998). The results of this survey have been applied to aid the 1999 survey and are briefly summarised below.

Veteran trees in Sherwood are generally native oaks, either sessile oak *Quercus petraea*, pedunculate oak *Q. robur* or hybrids of the two, and these trees form an important component of semi-natural woodland cover within the study site and the wider Sherwood area. These veteran oaks are typically large in girth and have a mean diameter at breast height ranging from 118-148 cms. Well over half of all trees within SSSI compartments are affected by heart-rot (between 62-91% of trees) with up to 73% of veterans, in Sherwood Forest Country Park for example, hollow. Bark loss on veterans is more variable but generally high in SSSI compartments; trees within replanted coniferous forest typically showed higher mean bark loss per tree (79%) with lower values (50-59%) in deciduous woodland compartments.

Veteran oaks typically possess quantities of related dead wood habitat, although this varies between compartments. A high mean number of fallen limbs per tree, up to 1.68 in Sherwood Forest Country Park (n=932) is matched by a high incidence of dead limbs attached to trees. In Bilhaugh Buckgates, nearly 4 limbs per tree is the average, almost twice that of trees found within coniferised compartments. In terms of living trees, generally high proportions also have dead limbs attached, over 50% of attached limbs per tree in some cases. A key feature of the Sherwood veterans is a significant and noticeable loss in tree crown; a consistently high number of trees have lost their heads at some time, between 60-80% of all trees in each compartment, resulting in a 'stag-headed' appearance.

These key attributes - large girth, high degree of bark loss on trunks, high frequency of dead and fallen limbs, signs of tree decay and a significant reduction in crown - were used to identify individual trees during the 1999 field survey. Large stumps and fallen trees showing similar characteristics were also recorded.

3.3 Description of survey compartments with approximate areas (Figure 2)

- (A) Sherwood Forest Country Park (177.1 ha)

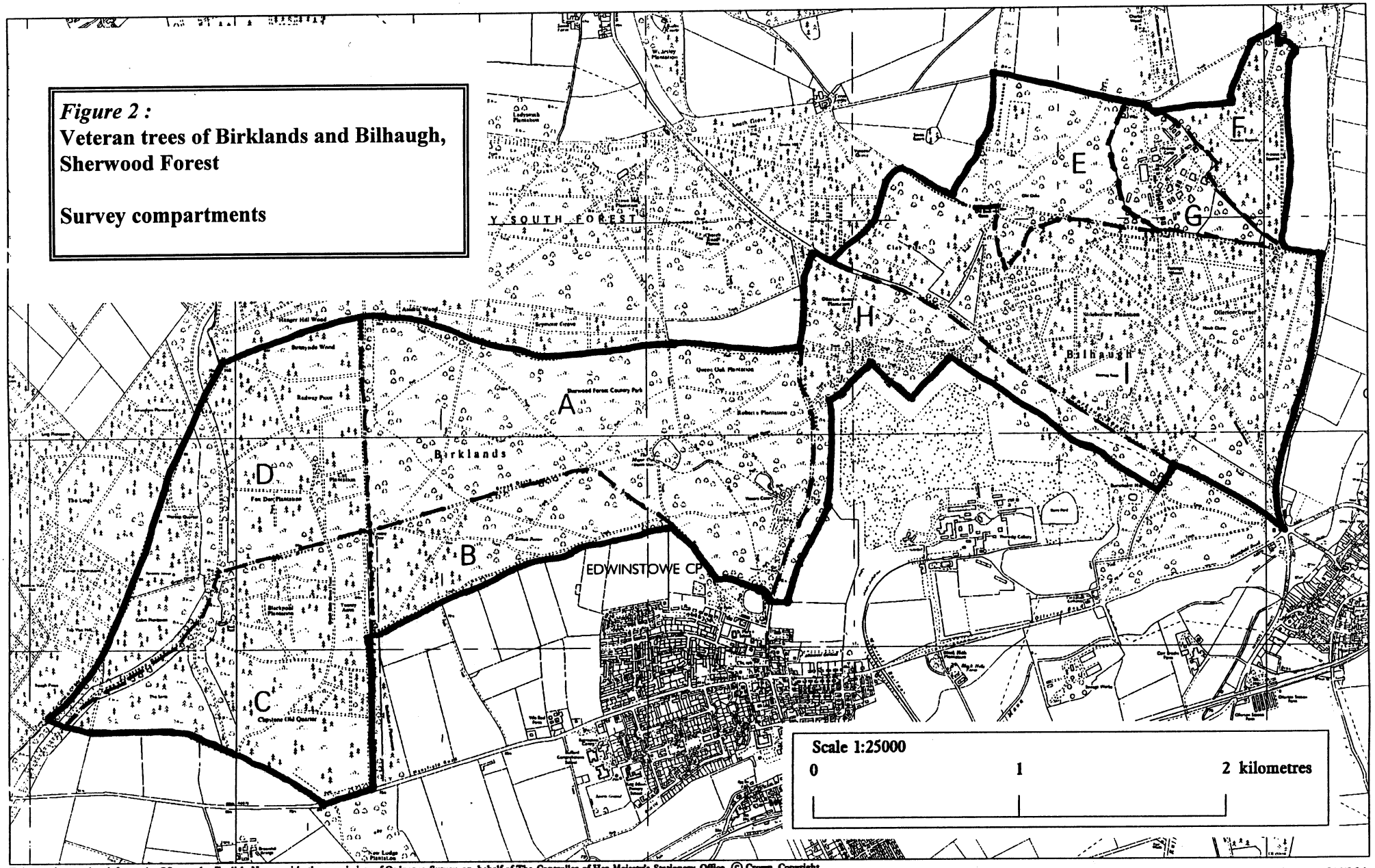
  The largest compartment within the SSSI/cSAC, this large area of semi-natural oak-birch woodland and grass-heath contains the Major Oak and serves as a popular tourism and recreational facility managed by Nottinghamshire County Council. Formerly more open in structure, areas were planted with oak of unknown provenance in the early 1970s and the site can now best be described as closed canopy relict pasture-woodland. This block is free from coniferous plantation to a large extent and has been subject to minimal woodland management over the last 20 years.

- (B) FE Birklands East (51.1 ha)

  Part of the SSSI and cSAC managed by FE, originally stocked with Corsican pine *Pinus nigra maritima* between 1966 and 1971. Half the area was clear-felled in 1985 and restocked with locally native oak in a pattern to mimic the shape of the British Isles. Future harvesting through an agreed management plan will aim to clear around veteran trees and promote semi-natural oak-birch woodland.

- (C) FE Birklands West including The Sarts, Clipstone Old Quarter & Blackpool Plantation (108.7 ha)

  An area of predominantly coniferous plantation (Corsican pine and Scots pine *Pinus sylvestris*) planted during the 1950s, now partly being restored to oak-birch woodland as harvesting progresses. Traversed by wide forestry tracks, smaller rides, together with broad-leaved areas of oak, sweet chestnut *Castanea sativa* and birch of 'reserved timber' along the margins of the old park drives. Some stands of sycamore *Acer pseudoplatanus* occur along the southern boundary. Some of the rides and track-side verges contain remnant grass-heath vegetation.



Geographic Information Unit 1999. 2141bl.i

- (D) FE Birklands North incl. Fox Den Plantation, Sunnyside Wood, Warsop Quarter and Cabin Plantation (113.3 ha)

An area of predominantly coniferous plantation planted in the 1950s, together with blocks of beech and the exotics turkey oak *Quercus cerris* and red oak *Quercus rubra.* Traversed by wide forestry tracks and smaller rides, together with broad leaved areas of 'reserved timber' along the lower-lying slopes. Forestry rides contain remnant grass-heath vegetation.

- (E) Bilhaugh Buckgates (47.8 ha)

Approximately 48 ha of semi-natural ancient oak-birch woodland and smaller areas of open grass-heath and bracken, presently grazed and subject to bracken management as part of a Management Agreement between the site owner and English Nature. Formerly part of the large Thoresby deer park, the site includes a length of avenue dating to the 18th century, flanked by veteran oaks and large mature sweet chestnut. This avenue has recently been re-established to restore its wide and open nature. A small block of conifer plantation also occurs.

- (F) Bilhaugh Proteus Squares (30.7 ha)

Historically managed as deer park and subject to ornamental landscaping of Thoresby Park, these privately-owned blocks of coniferous plantation varying in density are dissected by wide straight rides dominated by birch scrub, bracken and, on lower ground, stands of grass-heath vegetation containing heather *Calluna vulgaris.* Areas of oak - birch woodland also occur along the edges.

- (G) Bilhaugh Proteus Camp (27.2 ha)

An enclosed area of open parkland used as a military training facility by the Ministry of Defence. The camp consists of regularly mown lawns amongst a range of buildings and accommodation, together with scattered veteran trees and small areas of oak-birch woodland on steeper slopes. The planting of young trees - oak, rowan *Sorbus aucuparia* and sweet chestnut- has also taken place. To the east, an area of birch woodland is utilized as a staging area for training events.

- (H) Bilhaugh Mine belt (62.5 ha)

A long linear block on the northern edge of Thoresby Colliery, the remnant of a much larger area of woodland and grass-heath (formerly part of the SSSI) destroyed by colliery spoil tipping during the 1970s. The belt is now a mix of open coniferous woodland, oak-birch woodland and grass-heath.

- (I) Bilhaugh Grove (178.6 ha)

A large block of private commercial coniferous woodland which forms the bulk of the old forest of Bilhaugh, traversed by forestry rides and surfaced tracks with fragmentary stands of grass-heath.

Table 1 : The study area - compartment details and data source

Area	Compartment	Primary land uses	Date of survey & source
Birklands	Sherwood Forest Country Park	Tourism/conservation	1996[1]
	FE Birklands East	Forestry /conservation	1996[1] & 1996[2]
	FE Birklands West	Forestry /conservation	1996[2]
	FE Birklands North	Forestry	1999[3]
Bilhaugh	Bilhaugh (Buckgates)	Landscape/conservation	1996[1]
	Bilhaugh (Proteus Squares)	Forestry	1999[3]
	Bilhaugh (Proteus camp)	Military training	1999[3]
	Bilhaugh (Mine belt)	Forestry/aesthetic value	1996[1]
	Bilhaugh (Grove)	Forestry/military training	1999[3]

Non-SSSI compartments in *italics*

1 Lavers, C. & Watkins, C. 1996a. Survey of veteran oak trees of Sherwood Forest. Unpublished report to English Nature East Midlands Team.

2 Lavers, C. & Watkins, C. 1996b. Survey of veteran oaks of Birklands. Unpublished report to Forest Enterprise Sherwood & north Lincolnshire District.

3 English Nature 1999. This study.

4. Results

4.1 Population size and condition class variations

Table 2 demonstrates that a minimum of 2386 veteran trees of all categories were recorded within the survey area, 1643 or 69% of which were standing trees. Of these standing trees, 991 were considered to be living, representing 42% of all veteran trees recorded. A further 27% were recorded as standing dead trees and 23% fallen trees or trunks. Only 8% of the total number of records were classified as stumps. Only veteran oaks *Quercus robur* and *Q. petraea* and perhaps hybrids were encountered, although no attempt was made to record each individual tree or gather species data. The relict avenue in Buckgates contains a number of large sweet chestnut *Castanea sativa* but these were not included in the survey.

If undetected trees in whatever form were included in these overall figures, it is likely that the total number would exceed 2400.

Sherwood Forest Country Park supports 41.3% of all veteran trees recorded across the study area, followed by Bilhaugh (Buckgates) at 17% (see Figure 3). Woodland managed by Forest Enterprise contained 30% of the veteran tree population in Birklands and Bilhaugh, with the largest collection in Birklands West, an area currently out with the SSSI . Proteus Squares holds the least number of veterans, totaling just 1.8% of the total population.

The greatest number of veterans were found in Sherwood Forest Country Park with 985 trees, 439 (45%) of which were standing live trees. 47% of all standing veterans, both alive and dead, are found within the park. Almost 80% of these trees were standing, the remaining fifth consisting of fallen trees/trunks and stumps (see Figure 5).

As illustrated in Figure 4, the surviving living oaks are concentrated in three compartments; Sherwood Forest Country Park (44.3% of all live trees), Buckgates (25.4%) and FE Birklands West (12%), the latter an area not included within the SSSI or cSAC boundaries. Bilhaugh (Buckgates) has the highest individual proportion of live trees across all compartments within the study area with 62%, with just less than half of trees in Sherwood Forest Country Park living. Certainly the greatest concentration of living trees outside of the SSSI occurs within Bilhaugh Proteus Squares, an area with the lowest total of records but with a high proportion of standing live trees within its local veteran tree population. Part of the Forestry Enterprise landholding at Birklands supports the lowest grouping of live trees (FE Birklands North) but the highest group of standing dead trees (85%) across the study area, with few fallen trees and stumps recorded. Over half of the veterans recorded in an adjacent area of timber crop in Birklands West, which supports the greatest collection of veteran trees outside of the SSSI (15% of total), were fallen trees or trunks.

There is generally a low stump occurrence across Birklands but a noticeably higher proportion in Bilhaugh. Accordingly, there is a much smaller population of standing trees in Bilhaugh (Table 3), an area which accounts for just over one-quarter of all trees in this category. The proportions of fallen trees and stumps were higher in coniferous blocks such as Bilhaugh Grove (50% of veterans), FE Birklands West (55%) and Bilhaugh Mine Belt (77%) and in compartments subject to other forms of intensive land use, such as Bilhaugh Proteus Camp where 82% of veterans are fallen trees or cut stumps.

Table 4 illustrates that the greatest overall population of standing (both live and dead) veterans, as a proportion of each compartment, was found in FE Birklands North, where 97% of trees were standing. These were mostly dead and constitute less than 7% of the total number of standing trees. This compartment was closely followed by Buckgates (83%), Sherwood Country Park (80%) and, interestingly Bilhaugh Proteus Squares (77%), an area which only represents 1.8% of the total population. The lowest proportions of standing veterans were within Bilhaugh, along the Mine Strip, Proteus Camp and Bilhaugh Grove where the highest number of fallen trees and stumps occur.

4.2 Density of veteran trees

Table 5 outlines the estimated densities of the tree population within each individual compartment. The whole study area covered an approximate area of 797 ha and supported an average density of just under 3 veterans per hectare (ha). Buckgates supported the highest density of trees at 8.5/ha, followed by other SSSI and cSAC compartments of Sherwood Forest Country Park (5.6/ha) and FE Birklands East (5.3/ha). Bilhaugh Proteus Camp also had a comparatively dense population at 4.3/ha but a low grouping of standing trees at only 0.8/ha.

In terms of standing oaks, Buckgates again clearly contained the greatest density of trees, averaging 7.1 trees per ha, followed by Sherwood Forest Country Park (4.4/ha) and FE Birklands East (3.3/ha). The tree density amongst other compartments was generally low and differed little, ranging from 0.2 to 1.4 trees/ha. The average density of standing veterans across the study area as a whole is relatively low at 2 per ha, outlining the relative importance of compartments such as Buckgates, Sherwood Forest Country Park and Birklands East (see also Figures 6 and 7).

4.3 Distribution of veteran trees

The survey illustrated that veteran oaks continue to be widely scattered across the whole study area, reflecting the ancient woodland boundary of Birklands and Bilhaugh indicated in maps of the 18th Century, the earliest of which by Reynolds, a 1735 map of Thoresby Park, shows the medieval extent of Birklands and Bilhaugh, extending the boundary beyond that illustrated by Rooke in 1799 (reproduced in Watkins, 1998). Over two-thirds of all standing veterans are located in Birklands and some compartments such as Bilhaugh Grove and Bihaugh Mine Belt contained only a very low concentration of trees, suggesting either extensive clearance of trees and/or a historically scattered distribution of trees as indicated by old site maps.

The greatest densities of trees occurred in just three key compartments (Bilhaugh Buckgates, Sherwood Forest Country Park and FE Birklands East). Of all of the standing veterans across the study area, 68% were restricted to just two compartments - Sherwood Forest Country Park and Buckgates - with a further 10.4% within Forest Enterprise Birklands East. All of these compartments lie within both the SSSI and cSAC. Of the non-designated land, the most important compartments were within the FC landholding - Birklands North and West - supporting 9% and 6.6% of the standing tree population respectively.

Much of the study area had clearly been subject to intensive woodland management at some time in the past; six of the nine survey compartments were dominated by coniferous plantation or broad-leaved plantation dominated by red oak and sweet chestnut, with locally dense stands

of *Rhododendron ponticum.* Here, standing live trees were generally associated with forestry rides and open plantation edges where there seems to have been a greater chance of survival. Areas of species-rich woodland on moister deeper soils were restricted to lower-lying main rides or avenues in Clipstone and Warsop Old Quarters (FE Birklands West) where conifers are less conspicuous and the ground flora richer with significant reductions in the frequencies of bracken and wavy hair-grass and a greater prominence of bramble. These areas similarly contained a good scattering of veteran trees throughout along with important intermediate-aged stands of oak.

4.4 Coverage in designated areas

Table 6 provides a breakdown of veteran tree class across the SSSI area. Over 72% of all veterans lie within the boundaries of the Site of Special Scientific Interest, which also contained 79.2% of all standing veterans and 80.6% of all live veterans. 502 standing dead trees were also found within the SSSI, representing 77% of this resource. The SSSI also included a relatively high proportion of fallen trees and stumps (58% and 46% respectively) but almost equal numbers lie within non-SSSI compartments.

Nevertheless, a count of 677 trees (28% of the total veterans recorded) including 342 standing trees, of which 192 remain alive, outside these designated areas constitutes a substantial collection of trees. Notably, FE Birklands West and North include almost 20% of the total population, 16% of all standing veterans and 13.4% of all standing live trees in the study area, very significant proportions of the veteran tree population as a whole.

Whilst 70% of all records occurred within the boundaries of the cSAC, 78.4% of the entire standing tree population, and 79.6% of all living veterans, are within the boundaries of the international site (Table 7).

Nevertheless the vast majority of trees were found within the currently recognised boundary of ancient semi-natural woodland, although a large number of trees were located in stands of woodland replanted with conifer and non-native trees and which have not been provisionally classed as ancient replanted woodland. The presence of these veterans, and a rich associated fauna (see 5.5), would seem to indicate that the ancient woodland boundary of the study area, as indicated in Lister *et al.* (1990), is not entirely coincident with the SSSI area and requires revision to include these non-SSSI compartments.

Table 2 : Number of veteran trees recorded (all categories) n:%

Compartment	Standing live	Standing dead	Fallen tree/ trunk	Stump	TOTAL
Birklands					
Sherwood Country Park	439 (45)	344 (35)	149 (16)	53 (5)	**985**
FE Birklands East	98 (36)	73 (27)	93 (34)	7 (3)	**271**
FE Birklands West	119 (35)	33 (10)	179 (53)	9 (2)	**340**
FE Birklands north	14 (12)	95 (85)	2 (2)	1 (1)	**112**
Bilhaugh					
Bilhaugh (Buckgates)	252 (62)	85 (21)	59 (15)	11 (3)	**407**
Bilhaugh(ProteusSquares)	24 (55)	10 (22)	3 (7)	7 (16)	**44**
Bilhaugh (Proteus camp)	20 (17)	1 (1)	29 (25)	68 (57)	**118**
Bilhaugh (Mine belt)	10 (22)	0	16 (34)	20 (43)	**46**
Bilhaugh (Grove)	15 (24)	11 (16)	15 (24)	22 (36)	**63**
TOTALS	**991 (42)**	**652 (27)**	**545 (23)**	**198 (8)**	
	1643 (68.9)		**743 (31.1)**		
					2386 (100)

Non-SSSI compartments in *italics*

Table 3 : Total standing veteran trees by site

Compartment	Total veterans	Number of standing veterans (live and dead) and % of site total	Number of fallen trees & stumps and % of site total
Birklands	1708	1215 (71%)	493 (29%)
Bilhaugh	678	428 (63%)	250 (37%)
TOTAL	**2386**	**1643**	**743**

Table 4 : Distribution of standing veterans by compartment

Compartments ranked according to %	Total number of standing (live and dead) veterans	% of veteran population within compartment standing (live and dead)	% of total standing trees within study area
FE Birklands North	109	97%	6.6
Bilhaugh (Buckgates)	337	83%	20.4
Birklands (Sherwood CPark)	783	80%	47.6
Bilhaugh (ProteusSquare)	34	77%	2.1
FE Birklands East	171	63%	10.4
FE Birklands West	152	45%	9.2
Bilhaugh (Grove)	26	40%	1.8
Bilhaugh (Mine belt)	10	22%	0.6
Bilhaugh (Proteus camp)	21	18%	1.2
TOTALS	**1643**		**100**

Non-SSSI compartments in *italics*

Table 5 : Densities of veteran trees by compartment

Compartment	Area (hectares)	Density of all veterans (n/ha)	Density of standing (live and dead) veterans (n/ha)
Birklands			
Sherwood Forest Country Park	177.1	5.6	4.4
FE Birklands East	51.1	5.3	3.3
FE Birklands West	108.7	3.2	1.4
FE Birklands North	113.3	1.0	1.0
Bilhaugh			
Bilhaugh (Buckgates)	47.8	8.5	7.1
Bilhaugh (ProteusSquares)	30.7	1.4	1.1
Bilhaugh (Proteus camp)	27.2	4.3	0.8
Bilhaugh (Mine belt)	62.5	0.7	0.2
Bilhaugh (Grove)	178.6	0.4	0.2
Study Area Averages	797	2.99	2.06

Non-SSSI compartments in *italics*

Table 6 : Veteran trees within national SSSI designation (n:%)

Compartments	Standing live	Standing dead	Fallen tree/trunk	Stump	TOTAL
SSSI	799 (80.6)	502 (77)	317 (58.2)	91 (46)	1709 (72)
Non-SSSI	192 (19.4)	150 (23)	228 (41.8)	107 (54)	677 (28)
TOTAL	**991**	**652**	**545**	**198**	**2386**

Table 7 : Veteran trees within international SAC designation (n:%)

Compartments	Standing live	Standing dead	Fallen tree/trunk	Stump	TOTAL
SAC	789 (79.6)	502 (77)	301 (55.2)	71 (35.9)	1663 (69.7)
Non-SAC	202 (20.4)	150 (23)	244 (44.8)	127 (64.1)	723 (30.3)
TOTAL	**991**	**652**	**545**	**198**	**2386**

Figure 3 : total veterans by compartment

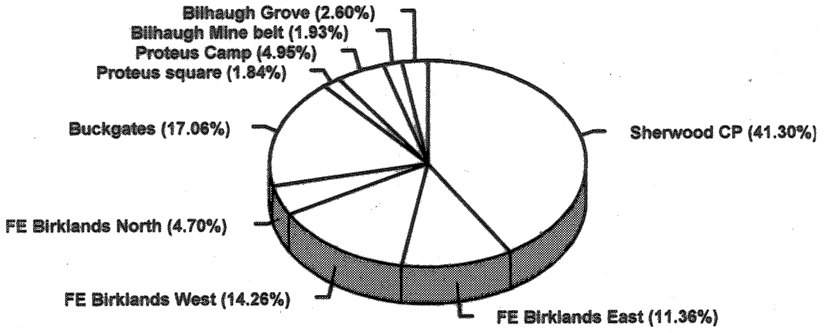


Figure 4: living veterans by compartment

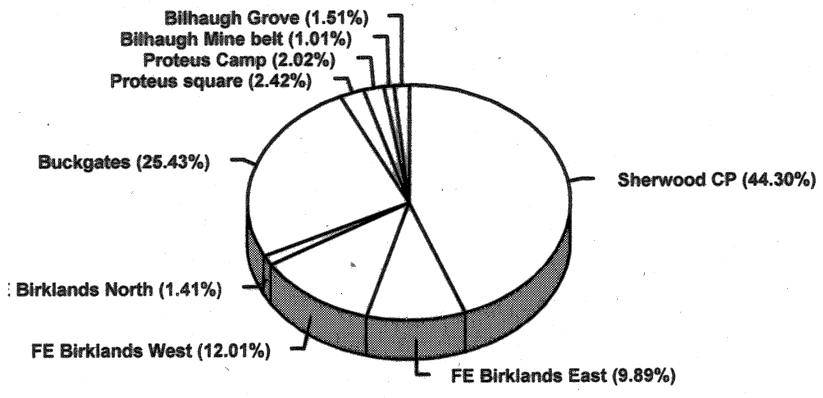


Figure 5 : standing veterans (live & dead) by compartment

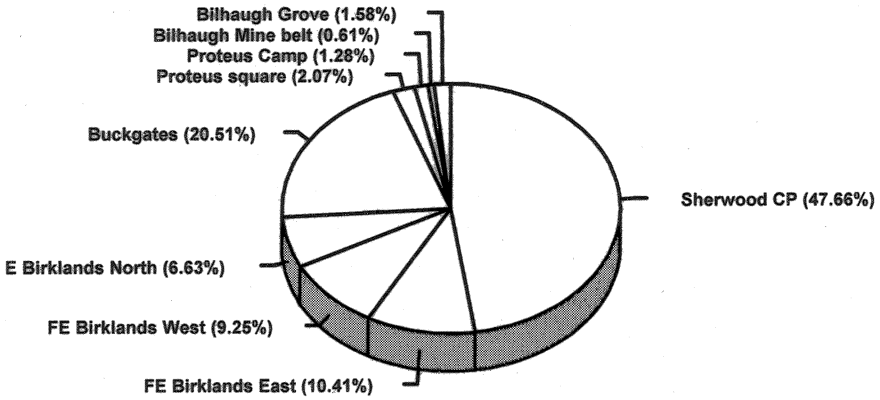


Figure 6 : veteran tree density (all categories)

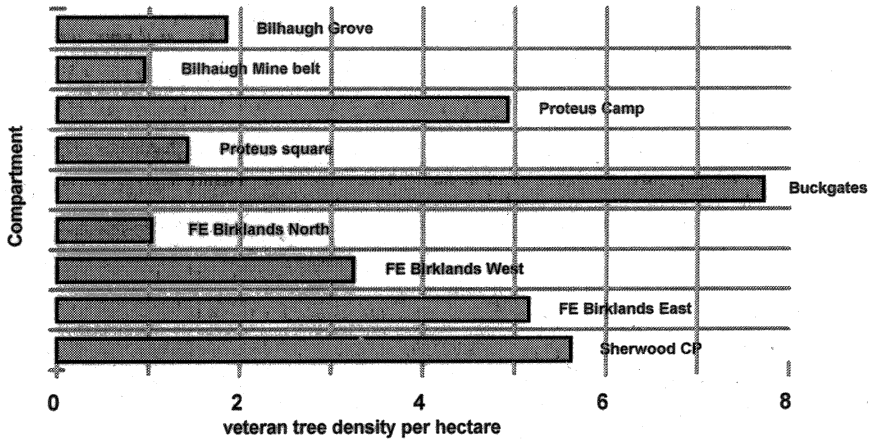
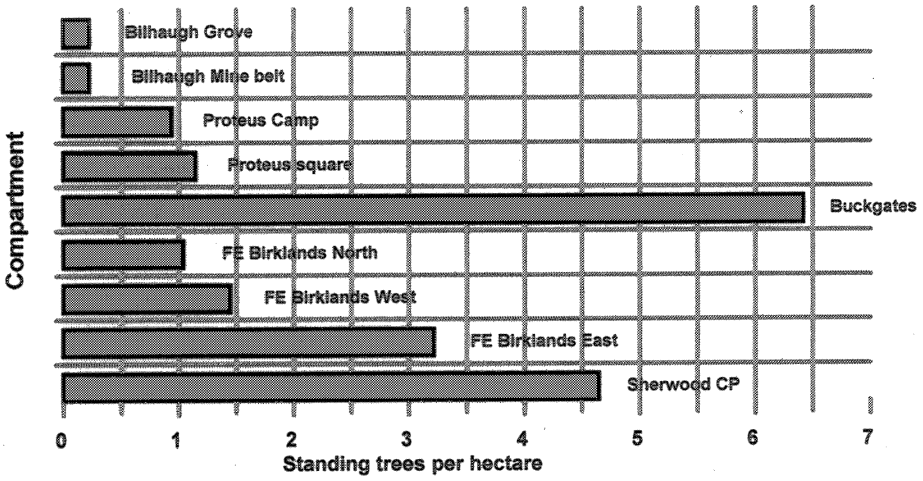


Figure 7 : veteran tree density (standing trees only)



5. Discussion

5.1 The veterans in their historic context

Surprisingly, the study area has been subject to only a limited number of intensive studies most notably that of Hopkinson (1927) whose classic study into the vegetation of the Sherwood Sandstone focused upon the oak-birch stands of Birklands. Documentary evidence directly relating to Birklands and Bilhaugh has been usefully evaluated by Watkins (1998) and provides a valuable and fascinating illustration of the changing fortunes of the veteran tree population of the area which is worth considering here in relation to the results of this review.

It is clear that by 1609 a large proportion of the old forest of Sherwood was no longer under woodland cover and it is estimated that just 10% of the forest area at this time constituted woodland, compared to 37% of 'waste' or grass-heath and 47% of land under various forms of cultivation (Mastoris & Groves, 1997). There is strong evidence provided by Domesday material suggesting that much of the original woodland cover of Sherwood had already been reduced to one-third by 1086, 70 years prior to the requisitioning of the area by the King as a Royal Forest (Rackham, 1986). A Royal Commission into the extent of surviving Crown rights, as part of an attempt to increase the revenue provided by royal estates, included a report on Birklands and Bilhaugh in 1793. This report noted that the trees of the wood were already of considerable age and stature showing noticeable signs of senescence, which inevitably meant they were spared the axe and allowed to continue their natural development into old-growth. The Commissioners also noted the progressive decline in the extent of the tree population at the site as a result of the mismanagement of the Royal Forest, which is now thought to date back as early as the 1300s (Laxton, 1997). Figures recorded are as follows:

- 1608 - 49,900 trees, 26800 (54%) oaks not for timber, implying decay;
- 1680 - 33,996 trees of which 32,956 (96%) were unsuitable as timber for the English Navy and 8060 were subject to "oft lopping";
- 1788 - 10,117 trees of which only 1368 were of use as timber for the navy.

Numerous historians also noted the ancient condition of the oaks of Birklands and Bilhaugh, reviewed by Hopkinson (1927). Camden in 1625 noted that "the forest is sadly altered now only a few vestiges of its olden glories survive....at Bilhaugh, are oaks which cannot be less than six or seven centuries old", whilst Cox noted in 1680, "although there were many thousand standing trees, few there were but what were decaying". By 1794, Lowe noted the very open nature of the woodland and this is supported by the scattered representation of trees in parts of Birklands and Bilhaugh on the 1794 map of Sherwood by Chapman and subsequently by Sanderson in 1835. It is however clear from this evidence that veteran trees were a significant feature of Birklands and Bilhaugh as far back as the 1600s.

Throughout the 18th century timber was progressively extracted from the woods, yet there is continued reference within the Royal Commission report to old and decaying trees and to the presence of grazing through the exercising of rights of pannage and pasturage by pigs and sheep during the 1700s, restricting natural regeneration of trees (Watkins, 1998). Some early maps of Birklands and Bilhaugh clearly illustrate the location of sheep pens in certain compartments and it is thought that the Black Pool, a small open water feature within FE

Birklands West, was dug to water grazing animals (Paul Barwick, *pers.comm*). By this time, the wider Forest had been fragmented into five enclosed deer parks, including Clipstone and Rufford, both of which were also gradually cleared of woodland during the 1600s during the political instability created by the English Civil War. Watkins (1998) concludes that at Birklands and Bilhaugh, it was the involvement of the Crown, the generally poor timber quality of the oak, its distance inland from a naval dockyard and the interference of the Duke of Newcastle and successive aristocratic landowners with a great appreciation of its beauty which allowed the site to retain its woodland integrity.

5.2 Has there been a decline in the number of ancient standing oaks?

The continued presence of large numbers of old trees within Birklands and Bilhaugh subject to timber harvesting, grazing under rights of common and oak depletion is consistently stated throughout local documentary evidence. Two possible scenarios can be inferred based on this review. If the Royal Commission figures referred to in 5.1, in terms of trees unsuitable for timber, are taken as an accurate record of the number of veteran trees within Birklands and Bilhaugh during the 1600s, it could be suggested from the results of this study and historical data that there has continued to be a progressive decline in the number of ancient standing trees within the area since 1800. The implication is that around 1700 there were almost 33,000 trees showing signs of over-maturity, falling to under 9000 by 1788. After this, the loss of trees from Birklands and Bilhaugh appears to have continued as the remnant veteran tree population is estimated from this review to be now less than 2400 with only 1643 standing trees.

The alternative presumption, that the figures on decaying oaks gathered by the Royal Commission may have included a large number of mature oaks which do not fit our modern definition of over-mature or veteran, constrains immediate interpretation and analysis. The apparent reduction in veterans since the 1800s may then be explained by the periodic harvesting of mature timber up to the present day, leaving a wide gap between the younger oak generations on the site and a relict population of 2386 veteran oaks.

A further area of debate concerns the longevity of the veterans. Estimates of 400-600 year old trees would date their generation to approximately the 13th and 15th Centuries, although it is apparent that veterans of great stature and associated deadwood were already a significant feature of the study area during the 1600s. This may reinforce the notion that timber harvesting throughout the 'royal' period was selective, allowing 'damaged' trees of poor timber quality to proceed towards over-maturity and providing the next generation of veterans on a site which is unlikely to have ever been totally devoid of woodland cover. The current population of standing veterans may indeed be older than anticipated as the actual date of death is unknown. The development of dendrochronological techniques to investigate this issue has great potential to make a significant contribution to our knowledge of the Sherwood veterans. This form of research may also be able to determine the impact of particular events on tree mortality, e.g. drought events, catastrophic storms etc.

Actual documentary evidence for a continued decline in the veteran tree population during the last 200 years is also scarce, with very few modern accounts of management within the study area. From published material, we know that the area was finally conveyed in 1827 from the Crown into the ownership of the Duke of Portland at Welbeck and later the Manvers family at Thoresby. Prior to this, the trees were retained by the Crown and although it was theoretically

illegal to remove trees, this still took place (Rodgers, 1906). In the hands of the Dukes, the woods of Birklands and Bilhaugh soon became areas for private recreation and hunting, with long, straight ridings 20 to 30 metres wide cut through both woods to provide a network of drives and avenues. It is certainly possible that more veterans were lost during this period of the great Estates both as a source of timber to provide growing agricultural development of estate land and to make way for the great schemes of parkland landscaping, filling in before timber became available from the hundreds of acres of plantation created during this period.

Rodgers (1908) refers to an area within FE Birklands West which contained one of the many large and well-known veterans, the Shambles Oak or Robin Hoods Larder, and makes a rare comment on woodland management during the 1830s, castigating the activities of the landowning estate in this area as visitors recalled in their letters "great quantities of picturesque old trees being cut down to make room for what was considered to be more profitable timber". This account corresponds with one of the few written accounts of woodland management practices within the site at this time. The compartments of FE Birklands North and West were re-planted with 'oaks and chestnuts' from 1821 - 1851 by the Duke of Portland of the Welbeck Estate, soon after Birklands and Bilhaugh was relinquished by the Crown. Old estate books dated 1852 record in detail the planting operations. Many woodland blocks were first 'cleared' (of what is not stated) and then sown with turnips and sheep grazed for a year or two prior to the planting of acorns and saplings in hand-dug trenches. The evidence presented by Rodgers perhaps suggests that clearance of veteran oaks did indeed take place as part of these operations. However, there is also clear reference within estate books to groups of 'old oaks' throughout this area, suggesting some veterans were deliberately retained during re-planting operations. The distribution of these oaks on the 1852 maps correspond well with the present-day concentrations of veterans within Clipstone Old Quarter and Warsop Old Quarter as recorded during the 1996 and 1999 tree surveys.

5.3 20th Century impacts

The 19th and 20th Centuries were periods of great social and economic upheavals in the county - increasing human populations, increasingly intensive agricultural production, the development of heavy industry as a result of coalfield exploitation and increasing demand for timber. This period in particular requires more thorough investigation of the pressures placed upon the study area.

During the two world wars, Birklands was requisitioned by the Secretary of State for War for military training from 1914-19 and for bomb and munitions storage from 1940-47, when even after the war the military continued to have a presence until the mid-1970s. Tree cover was required to hide facilities but is likely that a number of veterans were lost to make way for tank corridors, buildings, training purposes or general safety purposes. A major felling proposal put forward by the Defence Ministry in 1955 was strongly resisted by a range of organisations and was eventually amended to avoid any significant adverse impacts of the ancient tree population. The impact of wartime fellings on Birklands and Bilhaugh is poorly understood but it is known that many Nottinghamshire woodlands were devastated as part of the war effort (Watkins, 1981).

Regeneration of oak within the Forest has historically been intermittent since the 12th Century and was largely dependent on the type and effectiveness of management and the degree of control exercised over the land (Laxton, 1997). Modern forestry practices have intensified

this trend in Birklands and Bilhaugh and have resulted in either a resurgence of birch and oak regeneration (within the un-managed semi-natural woodland stands) or the almost complete removal of oak generations to accommodate coniferous and broad-leaved planting. Coniferous afforestation by both the landowning estates and the Forestry Commission began during the 1920s with activity peaking during the 1950s. This is likely to have had the most profound modern impact on the veterans of Birklands and Bilhaugh, evident in those compartments much altered by afforestation such as Proteus Squares, Birklands North and Birklands West.

Although a significant proportion of trees still remain within afforested compartments, the vast majority of individuals are concentrated along plantation edges and inter-block rides, suggesting those which remained within the centre of plantations were removed during planting. Narrow broad-leaved woodland edges are a distinctive feature of Sherwood plantations and it was standard practice to either retain or plant such strips to form fire-breaks (Watkins, 1984). A large number of ancient trees are likely to have survived purely by their location within these untouched strips of oak-birch woodland, explaining their present distribution. However, dead wood was often seen as a threat to forest health, harbouring a wealth of destructive invertebrates, and the large proportions of stumps and fallen trees within compartments dominated by coniferous forest, up to 83% of recorded veterans in some cases (see Table 2), perhaps reveal the impact of preparatory forestry operations on the ancient tree population as a whole. The large number of standing trees which are dead may also be indicative of the heavy shading those that survived were then subject to following conifer canopy closure.

Following discussions with the managers of conifer-dominated compartments, there is growing anecdotal evidence to support the notion that preparatory forestry operations did involve the substantial removal of standing and fallen trees and the associated decaying wood resource. The burning of standing hulks, followed by the mechanical removal of the remaining woody debris, aimed to maximize planting space in areas designed for re-stocking with commercial tree species and remove the risk of tree disease. It is thought that this was employed as an efficient method of ground preparation as the study area was largely afforested during the 1950s and 1960s. The practice of 'firing' hollow standing trees may explain the high incidence of fire damage encountered on trees in certain compartments within the study area (Lavers & Watkins, 1996b). It is likely that those rideside veterans were retained as landscape features where they did not impinge upon forestry operations.

All of these practices are likely to have contributed to the loss of veteran oaks, either incrementally or as specific catastrophic events, augmented by the death of a certain number through natural disturbances (for example a series of well-documented storm events of 1222, 1362 and 1976 affected the Sherwood area). The premature dieback of maturing oak is also a feature of a number of compartments and may well be linked to bouts of tree stress initiated by drought conditions, although this has yet to be fully explained (Gibbs & Greig, 1997). It may be that the oaks of the Sherwood Sandstone have been particularly susceptible to intermittent episodes of such dieback for many centuries, triggering periods of stress, tree decline and the development of 'veteran' characteristics, followed by periods of recovery.

Additional and significant pressures on the veterans include atmospheric pollution (illustrated by the species-poor and pollution-tolerant lichen flora of the wood) and the lowering of the Sherwood water table as a consequence of unconstrained groundwater abstraction to meet the

overwhelming demand for public water supply and irrigation and to satisfy the local requirements of deep coal mining.

The immense recreational and tourist potential of the area, capitalizing on the great cultural and historic significance of the old Forest, has led to considerable pressure on the ancient trees. The development of facilities to accommodate thousands of visitors to Birklands has taken place within the most important compartment of the study area, concentrating large numbers of people and vehicles in specific areas. This is likely to result in much greater pressure on ancient trees through excessive ground trampling, soil compaction, root exposure and damage, together with a much increased demand to carry out remedial tree surgery to maintain public safety. Coincidentally, there are real opportunities to ensure thousands of people are able to experience the veteran tree population at first hand, providing a significant focus for environmental interpretation and education.

5.4 Veteran tree density

The Birklands and Bilhaugh veteran tree population is widely scattered in its general distribution but locally concentrated, occurring at various densities largely as a result of different woodland management histories. Comparative studies of veteran tree density and guidance on ideal requirements for nature conservation purposes are scarce. Recent studies into the measurement of dead wood resource within woodlands have produced provisional guidance based on timber volume and dead trees per hectare (Kirby *et al*, 1998). Suggested benchmarks for a high level of dead wood include more than 50 standing dead trees per hectare with a proportion over 40 cms diameter at breast height (DBH). The Birklands surveys did not attempt to quantify the total dead wood resource present within each compartment, although the gathering of similar information has already been undertaken in certain compartments (Lavers & Watkins, 1996a; 1996b).

This study has been able to show a much lower average density of standing trees (2/ha) than those suggested but with a much greater amount of large diameter timber in the form of individual trees, fallen trunks and stumps. For example, Watkins & Lavers (1998) found a mean DBH of 129 cms (n=812 trees) within Sherwood Forest Country Park and 138 cms within Bilhaugh Buckgates (n=381). Whilst there is clearly an important dead wood resource within the SSSI, it would therefore appear that this particular methodology may not be suitable for assessing this resource in a wood-pasture or parkland situation.

In terms of the management of ancient semi-natural woodland, advice often includes the retention of a number of trees to provide mature timber habitat during management operations and an oft quoted figure is 5 per hectare. This is however often applied where closed-canopy woodland is being intensively-managed and there is a desire to retain a wide range of woodland conditions and features. Such an approach has been adopted at key veteran tree localities such as Windsor Great Park where the retention of at least 6 mature trees per hectare has been agreed during management operations in order to ensure a continuity of mature timber habitat (Searle, 1996).

It is difficult to relate saproxylic invertebrate abundance to veteran tree density, numbers or dead wood quantity. This study has not attempted to correlate invertebrate datasets with compartment densities, but it may be fair to assume that a greater density or number of large old trees will be able to provide greater availability of habitat and variation in microhabitat for

species such as saproxylic invertebrates, although the structure of the woodland may have a stronger influence for some species than those heart-rot-associated species for example. It is likely that the density of surrounding trees is a more useful measure in generating information on the desirability of particular woodland structures, as a high proportion of the special invertebrate fauna and rare species such as *Dendrochernes cyrneus* are closely associated with open-grown trees and open woodland conditions where high levels of sunlight and warmth are available (Alexander, 1999). Further research into the habitat requirements of such saproxylic species is likely to help with future interpretations.

Using these examples in relation to the densities of standing oaks, it is evident that Buckgates and Sherwood Forest Country Park clearly provides a useful model for other compartments to replicate, whereas other compartments are providing important numbers of trees but at undesirably low densities.

5.5 Faunal interest

As stated earlier, the presence of good numbers of veteran trees, both standing and fallen, outside SSSI areas is of considerable interest. These trees may also be expected to support a notable associated fauna and flora comparable to that of the SSSI compartments. To examine this, in the first such study of the non-SSSI areas, Lott (1999) has been able to demonstrate that veterans surviving within coniferous plantation in Birklands West have considerable saproxylic beetle interest. Species associated with tree heart-rot and living within the stable environment of boles and hollow trunks of the veterans were particularly characteristic of restored conifer stands with a low and structurally-poor cover of broadleaves. In one surveying season, 5 nationally rare species and 15 nationally scarce species were recorded from this compartment where a significant concentration of standing trees, both alive and dead, occur amongst coniferous forest (see Tables 2 and 4). The quality of this fauna is considered to be of SSSI standard by English Nature. From these initial findings, it is fair to assume that there is a strong likelihood of important faunas elsewhere within the wider study area and further studies are required to assess any similarly relict invertebrate interest, particularly in Warsop Old Quarter and Proteus Squares where significant groups of living and dead trees outside of the SSSI occur.

The value of both living and dead standing trees for wildlife is clear. It is important, however, that the fauna of individual areas of veteran trees are not considered independently from each other. The rich invertebrate fauna of Sherwood is almost certainly dependent on the existence of the wider area and the absolute number of trees within the whole area. Given the rarity of large populations of veteran trees, collections of trees in peripheral compartments of the study site will continue to be important for species such as deadwood beetles which find their habitat requirements scarce in the wider countryside.

6. Management recommendations

If the characteristic and internationally famous over-mature oaks of Sherwood, and their internationally significant fauna, are to be retained into the future, there is an urgent need to address these modern issues and promote an increase in cover of native oak-birch woodland with an abundance of over-mature timber throughout the study area.

Firstly, maintaining the integrity of the study area as the largest remaining fragment of Sherwood's woodland must be fundamental. Stands of semi-natural woodland within the site form a largely unmodified core central to the conservation of its natural heritage. Areas of woodland subject to past modification through felling and re-planting offer potential to be restored to more typical Sherwood habitat. Significantly damaging developments, changes in land use and overall reductions in the extent of woodland cover within the study area should be resisted. In addition, there is an urgent need to establish a long-term sustainable approach to managing access and recreation within the site confines. This must be an integral part of marketing the wider Sherwood Forest area as a tourism destination.

6.1 Key principles

Of prime importance is the continued survival of all standing veterans across the entire study area. It is vital that these trees are retained and maintained for as long as possible to allow for the development of new oak generations through modern woodland management. The lack of evidence surrounding the historic management of these veterans clouds any clear modern rationale which can be adopted to manage these trees to prolong their survival in the short-term; very few veterans show evidence of pollarding (although a suspected practice up to the 1700s) or coppicing and documentary evidence has so far proved to be vague and inconclusive as to tree management practices of the 17th and 18th Centuries (Watkins, 1998). Opinions continue to differ widely and a number of theories suggest that the morphology of Sherwood oaks has been historically influenced by factors such as shredding, a timber harvesting technique common elsewhere in Europe, or extreme weather events.

However, in recent years, there has been a strong presumption to restore woodland condition to that resembling its former pasture-woodland structure. Contemporary policies such as releasing veterans from woody competition, retaining large quantities of dead wood, managing bracken and avoiding unnecessary tree surgery works, which have developed from increased interest and research amongst ancient tree specialists and invertebrate ecologists (e.g. Alexander, Green & Key, 1996; Lewis & Shepherd, 1996; Read, in press), have therefore been applied to those compartments subject to conservation management.

Equally important is the re-structuring of the oak population to promote a range of age groups across the study area. Retaining or developing the next immediate generation of veteran oaks is also paramount and the management of existing mature oaks 150-200 years of age should aim to allow a large proportion to develop naturally to over-maturity. In a number of compartments, oak regeneration can be considered to be adequate to provide for future generations of veteran trees. In areas of coniferised woodland which contain veterans but have a generally low cover of oak with the canopy and shrub layer, rates of recruitment are clearly insufficient at present to maintain or increase the number of ancient trees. This could be achieved by the phased reversal of coniferous forest within Birklands and Bilhaugh to native oak-birch woodland and the incorporation of native woodland corridors within commercially

managed areas. Clearly, maintaining the historic continuity of mature timber and veteran oaks within those coniferous stands is difficult but vital, and encouragingly, efforts to integrate conservation with silvicultural practices are already underway in certain compartments of the site and have been successful (Barwick, 1998). In the interim, management to replicate habitat for saproxylic invertebrates should be more widely considered as a component of forest management in these compartments, for example, restoring open woodland space, artificially 'ageing' non-native trees and creating decaying wood habitat.

The decline in grazing management practices, which would have regulated periods of tree regeneration creating a diverse age structure, has resulted in a rapid change in woodland condition, favouring birch regeneration in particular. The loss of open pasture-woodland structure and the dominance of bracken within the woodland ground layer will also impact upon tree regeneration. Unrestrained regeneration of birch, despite its significant contribution to the wildlife interest of the site, and non-native species such as sycamore and sweet chestnut, compete with ancient trees for available nutrients, adding further stress to the veterans. The restoration of more positive woodland management to parts of the SSSI is seeking to manipulate woodland structure and composition towards a more favourable condition in terms of nature conservation.

6.2 Site management strategy

The significance of the study area as a final remnant of Sherwood Forest, on a variety of levels, cannot be overstated. As a result, general recommendations to woodland owners and managers, based on the key principles of 6.1, are suggested below to form a basis for future woodland management planning:

- all SSSI areas will be managed to ensure **all** veterans are retained, complete with a healthy dead wood resource and with new generations of trees encouraged, via natural regeneration or local seed, to provide for a continuity of over-mature timber;

- all non-SSSI areas should be managed to ensure **all** veterans, and oaks of earlier generations, are retained and positively managed. Reversion of replanted woodland to semi-natural oak-birch composition should be the long-term ideal in all compartments. Where this is impractical, veteran trees along woodland edges should be managed appropriately as part of wide semi-natural woodland corridors along forestry rides and tracks, with glades around veterans incorporated into woodland management.

Specific non-SSSI compartments outlined for positive management are:

- Bilhaugh Proteus Squares - a small area with less than 2% of the total population but with 77% of trees still alive, one of the highest proportions of live trees across the whole study area. This, plus the presence of relatively large areas of grass-heath, means this area makes an important contribution to the conservation interest of the study area. Future woodland management should ideally aim to progressively restore areas of coniferous high forest to semi-natural oak-birch woodland, retaining all veteran trees (living, standing dead and fallen), following harvesting of timber crop. A long-term aim should be to restore light grazing to this compartment;

- FE Birklands West & North - an important area supporting almost 20% of the veteran tree population with a rich dead-wood beetle fauna recently recorded. These blocks consist mostly of coniferous and broad-leaved plantation with smaller areas of grass-heath. Future woodland management should ideally aim to restore areas of coniferous high forest to semi-natural oak-birch woodland, retaining all veteran trees (living, standing dead and fallen) following harvesting of timber crop. A long-term aim should be to restore light grazing to this compartment;

- Bilhaugh Grove - an ecologically important area linking the SSSI/cSAC blocks of Buckgates and Sherwood Country Park with veterans concentrated along woodland edges. This area should be managed to retain and expand wide corridors of open broad-leaved woodland to cater for the requirements of veterans, with glades cleared around surviving trees to reduce competition from surrounding tree and shrub growth. A priority should be to create a broadleaved woodland link from Buckgates to Birklands;

- Bilhaugh Proteus Camp - an area now resembling open parkland with scattered veteran trees of great stature but previously forming a continuous link with Buckgates and Proteus Square. Although intensively-used as an army training area all remaining live oaks (over-mature, mature and young) should be retained with the minimum of remedial tree surgery for safety purposes. Future tree planting should consist purely of native Sherwood oaks which should also replace existing whips where provenance is dubious. Existing areas of oak-birch woodland within the camp should be retained also. In the event of army training ceasing at this site, measures to enhance its veteran tree interest and restore areas to native oak-birch woodland should be explored and implemented.

7. Future actions

To maintain the existing special interest of the study area and enhance the quality of habitat available for its associated plants and animals in the longer-term, English Nature would suggest the following actions are required. These will involve a range of partners and interested organisations working in partnership towards a common aim. These actions will directly contribute to the targets within the Nottinghamshire LBAP and the national Lowland Wood-pasture and Parkland Action Plan (NHAP) and will also deliver some of the wider objectives endorsed by the England Forestry Strategy, the UK Biodiversity Action Plan and the Sherwood Natural Area Profile (Windrum, 1997):

- Continue to manage cSAC & SSSI areas to achieve favourable ecological condition by implementing sympathetic woodland management where appropriate (**NHAP target**).

  (ACTION: owners and occupiers, English Nature)

- Devise and implement woodland management recommendations for compartments within the study area, utilizing Woodland Grant Scheme or other land management incentive schemes. Action should include the restoration of coniferous and broad-leaved plantation to native oak-birch woodland and the establishment of strategic corridors of semi-natural woodland within coniferous forest (**NHAP target**).

  (ACTION: owners and occupiers, Forestry Commission, English Nature)

- Develop a Joint Statement of Intent to guide future management of the study area, agreed and signed by all influential managers of Birklands and Bilhaugh, which endorses the shared objectives of positive veteran tree management and the restoration of semi-natural oak-birch woodland across the study area.

  (ACTION: English Nature, owners and occupiers)

- Continue to promote the management and restoration of oak-birch woodland and veteran trees within the study area into Forest Design Plans

  (ACTION: Forest Enterprise)

- Encourage woodland managers to undertake Veteran Tree recording based on English Nature/Ancient Tree Forum Specialist Survey Method, allowing future monitoring of tree health and easy handling of data and use in national overview of such trees. Investigate use of tree tagging using more sophisticated IT-compatible means such as GPS (**NHAP target**).

  (ACTION: English Nature)

- Continue to add records of veteran trees to this inventory to improve detail and accuracy and ensure medium to long-term repeat monitoring of veteran tree surveys within the SSSI.

  (ACTION: owners and occupiers, English Nature)

- Extend boundary of ancient semi-natural woodland on the English Nature Inventory of Ancient Woodland, reflecting the distribution of ancient trees & associated invertebrate fauna indicative of ancient woodland.

  (ACTION: English Nature, Forestry Commission)

- With the co-operation of woodland managers, use the study area to implement actions to conserve *Buglossoporus pulvinus/quercinus* as part of the National Species Action Plan (**NHAP target**).

  (ACTION: English Nature, owners and occupiers, local natural history groups)

- Encourage survey and monitoring of important faunal and botanical groups by local societies and groups across the study area, particularly saproxylic invertebrates and fungi.

  (ACTION: Sherwood Forest Trust, English Nature, owners and occupiers)

- Continue to survey to ascertain if *Cryptocephalus coryli* and *Lucanus cervus* persist on the site.

  (ACTION: Leeds University, People's Trust for Endangered Species, English Nature)

- Promote continued research into the land use and woodland management history of the study area and its veteran trees, particularly post-1800.

  (ACTION: universities, Sherwood Forest Trust, English Nature)

- Seek to establish a National Nature Reserve (NNR) within the study area.

  (ACTION: English Nature, owners and occupiers)

- Establish a locally-derived supply of site-native trees and shrubs for restocking restored compartments where required

  (ACTION: Sherwood Forest Trust, owners and occupiers, English Nature, Forestry Commission, local nurseries)

References

ALEXANDER, K.A., GREEN, E.E. & KEY, R. 1996. The management of over-mature tree populations for nature conservation - the basic guidelines. *In*: READ, H.J. (Ed). *Pollard and veteran tree management II*. Corporation of London. pp122-135.

ALEXANDER, K.A. 1999. The invertebrates of Britain's wood-pastures. *British Wildlife*, **11**(2), 108-117.

BARWICK, P. 1996. The Birklands oak project. *In*: READ, H.J. (Ed). *Pollard and veteran tree management II*. Corporation of London. pp 69-70.

BIODIVERSITY STEERING GROUP. 1995. *Biodiversity : the UK Steering Group Report - Volume 2 : Action Plans*. London: HMSO.

BOULTON, H. E., 1965. *The Sherwood Forest Book.* Thoroton Society of Nottinghamshire, Records Series, 23.

BRADBURY, D.J. 1987. *Secrets of Sherwood.* Mansfield: Wheel Publications.

CARR, J. W. 1916. *The invertebrate fauna of Nottinghamshire*. Nottingham: J & H Bell Ltd.

ENGLISH NATURE. 1998. *Tranche 2 Action Plans : Volume II - terrestrial and freshwater habitats*. Peterborough: English Nature.

GIBBS, J.N. & GREIG, B.J.W. 1997. Biotic and abiotic factors affecting the dying back of pedunculate oak *Quercus robur*. L. *Forestry*, **70**(4), 399-406.

HARDING, P.T. & ALEXANDER, K.A. 1994. The use of saproxylic invertebrates in the selection and conservation of areas of relic forest in pasture-woodland. *British Journal of Entomology and Natural History*, **7** (Suppl.), 21-26.

HOPKINSON, J. W. 1927. The ecology of the Bunter sandstone. *Journal of Ecology*, **15**, 130-171.

KIRBY, K. J. & DRAKE, C. M. (eds). 1993. *Dead wood matters : the ecology and conservation of saproxylic invertebrates in Britain.* (English Nature Science No.7.) Peterborough: English Nature.

KIRBY, K.J., THOMAS, R.C., KEY, R.S., MCLEAN, I.F. G & HODGETTS, N. 1995. Pasture-woodland and its conservation in Britain. *Biological Journal of the Linnean Society*, **56** (Suppl.), 135-153.

KIRBY, K.J., REID, C.M. THOMAS, R.C. & GOLDSMITH F.B. 1998. Preliminary estimates of fallen dead wood and standing dead trees in managed and un-managed forests in Britain. *Journal of Applied Ecology*, **35**, 148-155.

LAVERS, C. & WATKINS, C. 1996a. Survey of veteran oak trees of Sherwood Forest. Unpublished report to English Nature East Midlands Team.

LAVERS, C. & WATKINS, C. 1996b. Survey of veteran oaks in Birklands. Unpublished report to Forest Enterprise Sherwood and North Lincolnshire District.

LAXTON, R.R. 1997. A 13th Century crisis in the Royal Forest of Sherwood in Nottinghamshire. *Transactions of the Thoroton Society*, **101**, 73-97.

LEWIS, N.R.L & SHEPHERD, P. 1996. The management of bracken in Sherwood Forest, Nottinghamshire. *In*: READ, H.J. (Ed). *Pollard and veteran tree management II*. Corporation of London. pp118-121.

LISTER, J.A., ROBINSON, D.P. & WHITBREAD, A. 1990. Nottinghamshire Inventory of Ancient woodland. Unpublished report. Peterborough: Nature Conservancy Council.

LOTT, D. 1999. A comparison of saproxylic beetle assemblages occurring under two different management regimes in Sherwood Forest. *Naturalist*, **124**, 67-74.

LYTH, P. 1986. The deer parks of the Archbishops of York at Southwell. *Transactions of the Thoroton Society*, **90**, 14-29.

MASTORIS, S. & GROVES, S. (Eds.) 1997. Sherwood Forest in 1609 - a Crown survey by Richard Bankes. *Thoroton Society of Nottinghamshire,* Record Series Vol. XL.

NOTTINGHAMSHIRE BIODIVERSITY GROUP (TAYLOR, J. ed). 1998. *Local Biodiversity Action Plan for Nottinghamshire*. Nottinghamshire County Council.

RACKHAM, O. 1986. *The History of the Countryside*. London: Dent & Sons.

RATCLIFFE , D.A. 1977. *A Nature Conservation Review*. Cambridge: Cambridge University Press.

READ, H.J. (ed.). In press. *Veteran trees : a guide to good management*. Peterborough: Veteran Trees Initiative & English Nature.

RODGERS, J. 1908. *The Scenery of Sherwood Forest*. London: Fisher Unwin.

RODWELL, J.S. (ed). 1991. *British Plant Communities - Woodlands and Scrub*. Cambridge: Cambridge University Press.

SEARLE, S.H. 1996. Management of veteran trees in Windsor Forest. *In*: READ, H.J. (Ed). *Pollard and veteran tree management II*. Corporation of London. pp 67-69.

SPEIGHT, M.C.D. 1989. *Saproxylic invertebrates and their conservation*. Strasbourg: Council of Europe.

WATKINS, C. 1981. An historical introduction to the woodland of Nottinghamshire. *In*: WATKINS, C. & WHEELER, P.T. (eds). *The Study and Use of British Woodlands*. Nottingham: Department of Geography, University of Nottingham. pp 1-25.

WATKINS, C. 1984. The planting of woodland in Nottinghamshire since 1945. *East Midland Geographer*, **8** (5), 147-159.

WATKINS, C. 1998. 'A solemn and gloomy umbrage' : changing interpretations of the ancient oaks of Sherwood Forest. *In:* WATKINS, C. (Ed). *European Woods and Forests : studies in cultural history*. CAB International. pp 93-113.

WATKINS, C. & LAVERS, C. 1998. Losing one's head in Sherwood Forest : the dead wood resource of the ancient oaks. *In*: ATHERDEN, M.A. & BUTLIN, R.A. (eds). *Woodland in the landscape : past and future perspectives*. University College of Ripon & York St John, Leeds University Press. pp 140-152.

WHITE, J. 1997. What is a veteran tree and where are they all? *Quarterly Journal of Forestry*, **91** (3), 222-227.

WINDRUM, A. 1997. *Natural Area Profile : Sherwood*. English Nature, Grantham.

Appendices

COUNTY: NOTTINGHAMSHIRE **SITE NAME: BIRKLANDS AND BILHAUGH**

DISTRICT: NEWARK

STATUS: **Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981**

Local Planning Authority: Newark & Sherwood District Council

National Grid Reference: **Area 1: SK 620 683** **Area 2: SK 640 694** **Area: 507.8 (ha) 1254.8 (ac)**

Ordnance Survey Sheet: 1:50,000: 120 **1:10,000: SK 66 NW**

Date Notified (under 1949 Act): 1954 **Date of Last Revision: 1981**

Date Notified (under 1981 Act): 1983 **Date of Last Revision: 1993**

Other Information: **The boundary has been amended to exclude an area of tipping and an arable field.**

Reasons for Notification

This site is a remnant of the historic Sherwood Forest and contains the best remaining examples of oak-birch woodland in Nottinghamshire together with tracts of acid grassland and heath. The invertebrate faunas, particularly those associated with old trees and dead wood, are exceptional. The site is included within the 'Nature Conservation Review'.

Biology

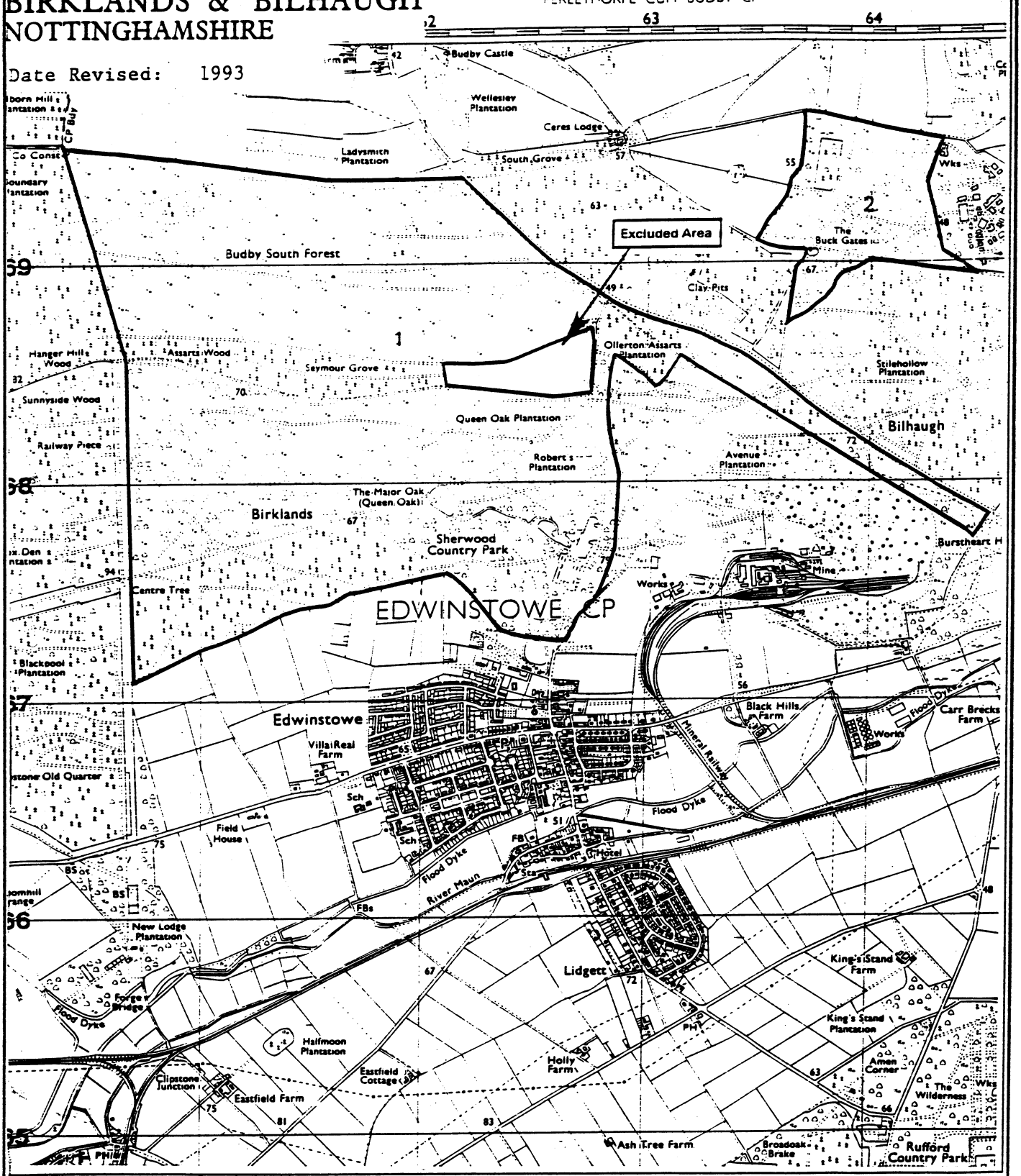
A very fine remnant of Sherwood Forest developed on freely-draining, acidic, sandy soils derived from the Triassic Bunter Pebble Beds. The vegetation comprises an actively regenerating population of oak and birch together with extensive areas of grass heath. The oak population consists of approximately equal numbers of the pedunculate oak *Quercus robur* and the sessile oak *Q. petraea* covering a wide range of size and age, including an exceptional population of ancient standing oaks. Although birch, mainly *Betula pendula*, forms groves between the oaks the canopy is, over large areas, still rather open allowing a dense bracken field layer to develop. A wide variety of fungi are present; many of the old oaks have been attacked by such bracket fungi as *Grifola sulphurea* and the beefsteak fungus *Fistulina hepatica*, while many of the mature birches have been attacked by such fungi as *Piptoporus betulinus* and *Polyporus brumalis*.

Within the woodland occur glades of acid grassland dominated by the tussock-forming wavy-hair grass *Deschampsia flexuosa* and which contain such characteristic herbs as heath bedstraw *Galium saxatile* and tormentil *Potentilla erecta*. In parts of Budby South Forest this acid grassland is replaced by heath dominated by heather *Calluna vulgaris*, and also by a mosaic of heath and acid grassland. On the periphery of the heathland occur species-rich heath verges containing such plants as petty whin *Genista anglica* and harebell *Campanula rotundifolia*.

The invertebrate fauna of the site is exceptional. In particular it contains outstanding populations of beetles and arachnids, being especially notable for species, including many rare species, characteristic of ancient trees and dead wood. The grassland and heathland invertebrate fauna is also outstanding, containing many species which are typical of heath and of sandy and coastal habitats. Additional interest is provided by the variety and quality of the bird community of both woodland and heathland.

BIRKLANDS & BILHAUGH
NOTTINGHAMSHIRE

Date Revised: 1993



ENGLISH NATURE Nature Conservancy Council for England

Scale 1:2500

0 100 metres

0 1000 feet

Grid North

Prepared by Geographic Information Unit, English Nature