

A revision of the Ancient Woodland Inventory for West Sussex

**Report and Inventory Maps
January 2010**



**Project carried out by the
Weald and Downs Ancient Woodland Survey**



WEALD AND DOWNS
ANCIENT WOODLAND SURVEY

A revision of the Ancient Woodland Inventory for West Sussex

Project carried out by Victoria Hume
and Matthew Grose for the Weald
and Downs Ancient Woodland Survey
October 2007 to January 2010

Report by Victoria Hume and Matthew Grose, with
contributions from Philip Sansum and Sally Westaway,
Weald and Downs Ancient Woodland Survey, and
Patrick McKernan, Natural England/ Forestry Commission

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West Sussex County Council, the districts and boroughs of West Sussex,
the Forestry Commission, the High Weald Joint Advisory Committee,
Natural England, the South Downs Joint Committee,
Sussex Biodiversity Record Centre, and Sussex Wildlife Trust





Natural England foreword

Natural England works for people, places and nature, to enhance biodiversity, landscapes and wildlife in rural, urban, coastal and marine areas; promoting access, recreation and public well-being, and contributing to the way natural resources are managed so that they can be enjoyed now and in the future.

Natural England considers that ancient woodlands are irreplaceable, and should therefore be protected and managed so as to maintain and enhance their special character. Knowing where ancient woods are is therefore a key nature conservation need.

The Ancient Woodland Inventory was originally compiled by the Nature Conservancy Council (a predecessor to Natural England) between 1981 and 1992, with the inventory for West Sussex being first produced in 1984. This inventory was further updated in 1989 and was digitized by the Forestry Commission in 2000 for use on Geographic Information Systems.

A new inventory revision began in Wealden District in East Sussex in 2004, consolidating the earlier work on the Ancient Woodland Inventory, and including woodlands below two hectares for the first time. The survey has continued to expand across the South East region, with similar revisions to the Ancient Woodland Inventory now being undertaken across Sussex, Surrey, Kent and the Chilterns.

This report outlines the work of the project in West Sussex, taking in additional historical map evidence and site surveys to verify the status of sites. Natural England will add the information captured by this project to the national inventory. Natural England welcomes the work of this survey and the increased protection and understanding of ancient woodland that it brings.

Emma Goldberg

Forestry and Woodland Specialist
Natural England



Forestry Commission foreword

As the government department responsible for forestry, the Forestry Commission works to ensure the protection and sustainable management of our woodlands. Ancient woodlands in particular are exceptionally rich in wildlife, and often contain important archaeological and heritage features relating to their past management. The appropriate management and protection of these sites is a key concern for the Forestry Commission, particularly in the South East, England's most heavily-wooded region, which contains some 40% of England's ancient woodlands.

The focus on ancient woodland received a new emphasis in 2005, with the launch by Defra and the Forestry Commission of 'Keepers of Time: A Statement of Policy for England's Ancient & Native Woodland.'¹ This set out the Government's vision that '*Ancient woodlands, veteran trees and other native woodlands are adequately protected, sustainably managed in a wider landscape context, and are providing a wide range of social, environmental and economic benefits to society.*'

Ancient woodlands are widely recognised as being irreplaceable habitats, but many are not protected through designation. Local authorities have a key role to play in the protection of this unique resource through the planning process. This role has been strengthened by the publication of Planning Policy Statement 9,2 which requires local authorities to identify any areas of ancient woodland that do not have statutory protection. The Forestry Commission recognises that this is a complex and potentially time-consuming task and its support for this revision of the Ancient Woodland Inventory for West Sussex is part of a wider initiative to help co-ordinate similar surveys throughout the South East.

This survey has resulted from a strong partnership between Adur District Council, Arun District Council, Chichester District Council, Crawley Borough Council, The Forestry Commission, the High Weald AONB Unit, Horsham District Council, Natural England, the South Downs Joint Committee, the Sussex Biodiversity Record Centre, the Sussex Wildlife Trust and West Sussex County Council.

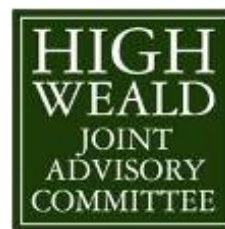
The Forestry Commission believes that such partnerships, working with local authorities, provide an important means for increasing the understanding, protection and sustainable management of our historic ancient woodlands.

Alan Betts

Regional Director
South East England Conservancy
Forestry Commission

¹ DEFRA and the Forestry Commission (2005)

² Office of the Deputy Prime Minister (2005)



High Weald AONB foreword

The High Weald Area of Outstanding Natural Beauty (AONB) Joint Advisory Committee (JAC) has been involved in the ancient woodland survey since its inception in 2003, employing the initial staff, and providing office and support services. Responsible for a large protected landscape in the South East, covering parts of East and West Sussex, Kent and Surrey, the High Weald JAC recognises that an understanding of our landscape is a vital pre-requisite for good decision making.

Ancient woodlands are a fundamental component of the High Weald's character for which it is designated as an Area of Outstanding Natural Beauty: one of England's finest landscapes. Maintaining their extent and ecological functioning is a primary objective of the AONB Management Plan. The Ancient Woodland Inventory provides us with a vital tool to achieve this objective, identifying woodlands with a new degree of accuracy, including those below two hectares. With the production of this report, 10 of the 11 districts covering the AONB have been completed.

We value these woodlands for many reasons, including soil conservation, carbon storage, biodiversity, recreation and timber supply but they also give us new insights into how humans interacted with the landscape in the past, and how people colonised and settled it, farmed and survived. There is an astonishing wealth of cultural history in these woodlands which the survey has brought to light.

I would like to thank the West Sussex project team – Victoria Hume, Matthew Grose, and Helen Burgess, and Patrick McKernan from Natural England for their enthusiasm and dedication to the project. We welcome the support and commitment of our partners in this project: the local authorities covering West Sussex, the Forestry Commission, Natural England, the South Downs Joint Committee, Sussex Wildlife Trust and the Sussex Biodiversity Record Centre.

Councillor Sylvia Tidy

Chairman

High Weald AONB Joint Advisory Committee



South Downs Joint Committee Foreword

The South Downs protected landscape stretches east from the River Itchen, across the ancient pastures and hanging woodlands of Hampshire, over the West Sussex hills, wooded estates and heathland to the Seven Sisters cliffs in East Sussex. This iconic landscape is perhaps best known for its ancient chalk downland however its woodlands also dominate the landscape, particularly between the river valleys of the Adur and Meon. Indeed, over 20% of the South Downs are covered by woodland and of this around half is ancient woodland.

Our history and culture are reflected within a diverse range of woodland landscapes. Hangers cling to steep chalk slopes, and gills, shaws, farm and estate woods of coppice and standards stretch across both the chalk hills and the western Weald, each reflecting a historic use and providing an array of opportunities for biodiversity, timber, recreation, resource protection and our well being.

It is essential to understand what we have if we are to value, protect and enhance our ancient woodland heritage. The revision of the Ancient Woodland Inventory for West Sussex has provided an opportunity to identify these ancient woodlands including those sites under two hectares in size, which were absent from previous work.

The South Downs Joint Committee was able to support this important project in West Sussex through its Sustainable Development Fund supporting the work of the survey team. Our thanks go to Victoria Hume, Matthew Grose, Helen Burgess and Patrick McKernan who have worked diligently in the field and at the desk to pull this project together.

We welcome the support and commitment of our partners in this project: the Forestry Commission, Natural England, Sussex Biodiversity Record Centre, Chichester District Council, West Sussex County Council, Arun District Council, Adur District Council, the High Weald AONB Unit, Horsham District Council and the Sussex Wildlife Trust.

Nick Heasman

Area Manager

South Downs Joint Committee

West Sussex County Council and the revision of the Ancient Woodland Inventory



The West Sussex landscape is precious and woodland is an important component, covering some 19% of the land area of the county. Ancient semi-natural woods contain irreplaceable ecological and historical features and must be protected and managed so that their special character can be conserved for future generations.

Knowing where ancient woodlands are and understanding this resource is a fundamental requirement for securing their long term future and key to making the right policy decisions. This survey accurately identifies our ancient woodlands, including those under two hectares, providing a robust evidence base for planners and other decision makers, helping to identify threats to this vulnerable resource but also opportunities for good management.

Woodlands are valued for a number of reasons including recreation, timber, flood amelioration, soil conservation, carbon storage, wildlife and how our ancestors shaped and interacted with their landscape. This and previous surveys have given a fascinating insight into our cultural history and complement the County Council's strategic landscape character work over several years.

This survey is now part of similar work throughout the south east of England, highlighting the hugely important and precious ancient woodland resource that exists in this densely populated region.

West Sussex County Council has supported the Weald and Downs Ancient Woodland Survey since 2006 and this document is the culmination of the hard work, dedication and enthusiasm of the survey team. I would particularly like to thank Victoria Hume, Matthew Grose, Helen Burgess and Patrick McKernan for making this project a reality. It could not have happened without the support and commitment of all the project partners: the Forestry Commission, Natural England, the High Weald AONB Unit, Sussex Biodiversity Record Centre, the Sussex Wildlife Trust and six district councils.

Deborah Urquhart

Cabinet Member for Environment & Economy
West Sussex County Council

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1. Summary

Ancient woodland is a nationally important and threatened habitat, and its existence over hundreds of years has preserved irreplaceable ecological and historical features. The South East has approximately 40% of the ancient woodland in England, but this valuable resource is increasingly under threat from development pressures in this densely populated region. The Weald and Downs Ancient Woodland Survey was set up in recognition of the increasingly important role of ancient woodlands and the deficiencies of the existing Ancient Woodland Inventory. It is undertaking a revision of the inventory in Kent and Sussex, with partner surveys also being undertaken in Surrey and the Chilterns.

This report summarises the methodologies and findings of a two year project (running from October 2007 to January 2010) to revise the Ancient Woodland Inventory for West Sussex. The Weald and Downs Ancient Woodland Survey has worked with Adur District Council, Arun District Council, Chichester District Council, Crawley Borough Council, The Forestry Commission, the High Weald Area of Outstanding Natural Beauty (AONB) Unit, Horsham District Council, Natural England, the South Downs Joint Committee, the Sussex Biodiversity Record Centre, the Sussex Wildlife Trust and West Sussex County Council, to provide a robust evidence base upon which to assign ancient woodland status.

The woodlands of Brighton and Hove City Council were revised in conjunction with the above mentioned districts. Traditionally, Brighton and Hove was considered a part of East Sussex and so the results from that area have not been incorporated within those for West Sussex. The methodology used for the Brighton and Hove Survey is identical to that set out below, however the results have been published in a separate appendix to avoid confusion.

Following on from the survey of Mid Sussex district, completed in 2007, the ancient woodland inventory for the remainder of West Sussex has been revised. Some minor changes to the Mid Sussex survey have been incorporated into this revision, and the updated results of the Mid Sussex survey have been incorporated into this report, to provide a full overview of the woodlands of West Sussex. For the original report for the Mid Sussex revision, see Westaway *et al* (2007).³

The last inventory for West Sussex was published in 1989.⁴ It only included woodlands greater than two hectares, and recorded a total area of 16,874 hectares of ancient woodland in the county. The area of ancient woodland since the original inventory was produced has risen to 21,375 ha, a net gain of 4,501 hectares as a result of this revision. This revision includes woodlands below two hectares for the first time, and represents an increase from approximately 8.3% to 10.5% of the county's area designated as ancient woodland. The number of parcels of ancient woodland in the revised inventory, by contrast, is over two and a half times that of the original inventory, with the gain mostly attributable to small parcels of woodland.

The revised inventory will assist planners in making decisions about development within West Sussex, ensuring that the effects of any development proposals on ancient woodlands can be properly assessed and considered. It will also enable a better assessment of the extent and quality of West Sussex's ancient woodland resource, as well as helping to identify threats to the resource, areas for improving habitat connectivity, and opportunities for the strategic management of key woodlands.

³ Westaway *et al* (2007a)

⁴ Whitbread *et al* (1989)

2. Introduction

2.1 Background

Ancient woodland sites over two hectares in size are recorded in the county Ancient Woodland Inventories which were compiled in the 1980s and 1990s by the Nature Conservancy Council (NCC).⁵ These inventories, now brought together as the National Ancient Woodland Inventory, have become an important tool for policy makers and planners whilst also assisting land managers to identify key areas for the restoration and planting of native woodlands and increasing awareness of the importance of ancient woodland.

At the time, the compilation of the original inventories was an extremely valuable process, and a landmark achievement for the conservation of British woodland. However, new information and advances in technology mean that their inaccuracies and omissions can now be addressed. With the pressure on land increasing year on year, these errors can cause significant problems for planning authorities. In addition, the exclusion of woodlands less than two hectares has undermined the protection afforded to these sites through the planning process. This is particularly the case in heavily wooded counties such as West Sussex, where small woodlands are a central part of the fabric of the countryside and make a significant contribution to the overall woodland resource. This inventory revision includes these small woodlands for the first time.

The original Ancient Woodland Inventory (AWI) for West Sussex was first produced in 1984, and revised in 1989, by the NCC.⁶ Originally, all of the county inventories were only available on printed maps, but between 1998 and 2000 they were digitally mapped (digitized) by the Forestry Commission. This first digitization is the electronic version that most resembles the original printed inventories, which have a published methodology, although it does include some changes made since the paper versions were produced. This digital dataset was subsequently updated on a case-by-case basis by English Nature (now part of Natural England), the successor to the NCC, and is now administered by Natural England. For this report, comparisons have been made to both the 1989 inventory, as the last complete county level inventory produced for West Sussex, and the 1998-2000 digitized version of it (from which more detailed statistics at the district and borough level can be derived than from the 1989 report). Hereafter, the 1989 inventory is referred to as the ‘original AWI’, and the 1998-2000 digitized inventory as the ‘first digitized AWI’.

2.1.1 The Weald and Downs Ancient Woodland Survey

The Weald and Downs Ancient Woodland Survey is the name given to the partnership of organisations revising the Ancient Woodland Inventory in Kent and Sussex. Similar surveys are also being undertaken in Surrey and the Chilterns. Key partners in the Weald and Downs Ancient Woodland Survey include the Forestry Commission, Natural England, the High Weald AONB Unit, Sussex Biodiversity Record Centre, Sussex Wildlife Trust, Surrey Wildlife Trust, Surrey Biological Records Centre, Kent and Medway Biological Records Centre, the South Downs Joint Committee, and the relevant local authorities. Additional funding has been provided by the South Downs Sustainable Development Fund.

The aim of the survey is to revise and update the Ancient Woodland Inventory in these areas, and to include, for the first time, ancient woodlands less than two hectares in size. For East

⁵ Spencer & Kirby (1992)

⁶ Whitbread et al (1989)

Sussex and Kent, the survey is based at the High Weald AONB Unit. For West Sussex, the survey was hosted by the Sussex Biodiversity Record Centre and Sussex Wildlife Trust. The survey in Surrey is hosted by the Surrey Wildlife Trust and Surrey Biological Records Centre. The Chilterns survey is hosted by the Chilterns AONB.

2.1.2 West Sussex Ancient Woodland Inventory revision

West Sussex is densely wooded. In total, there are 38,099 ha of woodlands that are greater than 0.1ha. Proportionately, this habitat covers 18.8% of the county. Of the nine counties in the South East region, West Sussex has the second highest density of woodland and ranks fifth in terms of total hectareage. Half of its woodland is designated as ancient. These ancient woodlands represent a significant resource, covering 10.5% of the county, based on this revision.

West Sussex includes part of the High Weald AONB and much of the new South Downs National Park. In addition, a large part of the county falls within the Low Weald, South Coast Plain and Wealden Greensand character areas (see Map 1). The highest density of woodland is in the north, where there are many shaws, belts of trees and woodlands that are less than two hectares in size.

The extent of woodland in the county and the exclusion of small woodlands in the original Ancient Woodland Inventory were important factors in deciding to undertake this revision of the inventory.

2.1.3 Historical and ecological overview of the woodland of West Sussex

West Sussex is rich in woodland, not just in the size of its resource but also in the great ecological and historical diversity of its woods. Some, such as Ebernoe Common, a Site of Scientific Interest (SSSI) and Special Area of Conservation (SAC), are of international importance in terms of their biodiversity.⁷ Many woodlands in the county are designated as SSSIs, National Nature Reserves (NNRs), Local Nature Reserves (LNRs) or Sites of Nature Conservation Importance (SNCIs). Furthermore, there are hundreds of small woods which have received relatively little study or attention.

West Sussex has a wide variety of woodland types, including beech hangers, woodland gills, historical parklands and wet floodplain woods to name but a few. The basis of this variety is the range of topography and geology encountered within West Sussex (see Map 1). The interacting factors that shape the character and distribution of woodland in West Sussex are climate, geology and soils. These factors, along with the historical management of a site, determine the development and composition of vegetation.

The first sign of woodland clearance comes from the Neolithic period, increasing in intensity throughout the Bronze and Iron ages. During this time extensive areas of the downs, close to settlements, were cleared for farming. The presence of archaeological features such as long barrows and causewayed enclosures suggests that some parts of the downs were cleared for ritual purposes.⁸ In the High and Low Weald, the rate of woodland clearance was much slower. The soils there were less fertile and less suited towards early agricultural management.

Whilst clearance for agriculture continued, particularly to the south of the county, wood was increasingly being utilised as a valuable resource for the manufacture of iron. The intensity of

⁷ Ratcliffe (1977)

⁸ Curwen 1929

iron production increased during the Roman occupation with the Weald providing all the necessary raw materials.

As the population in Sussex increased, so too did the demand for agricultural land and wood for fuel and timber. During the 15th century, new smelting practices enabled the production of cast iron but required a huge amount of fuel. The Royal Navy sought out timber for ship building, especially from sources close to the coast. In 1581, in an attempt to regulate the demand for this finite resource, a law was passed limiting the establishment of new iron works.

During the 17th century the planting of exotic species and large stands of trees became increasingly popular. This practice continued into the 18th and 19th centuries, with plantations established on areas that were previously more open heath and commons.

Due to a combination of factors, including the coming of railways and arrival of alternative fuel sources, the market for coppice produce went into decline during the late 19th century. Coppicing had reached a low ebb by the end of World War II and the planting of non-native, usually coniferous, tree species grew significantly. Today many woods suffer from lack of management. Without traditional coppice cycles, the ecological and cultural heritage of our woods is at threat. Renewed interest in wood-fuel may provide a means for reestablishment of widespread coppicing.

The County can be categorised into five different landscape zones: High Weald, Low Weald, South Downs, South Coast Plain and Wealden Greensand (see Map 1 for details).

The High Weald

The word *weald* comes from the Old English word for forest. The area is formed of a mix of clay valleys and sandstone ridges. In the sandstone areas, streams and rivers may erode through the rocks, forming steep gill woodlands. These gills harbour interesting communities of moisture loving plants, which are usually more typical of the western, Atlantic woodlands of the U.K.

Woodlands typically consist of a mix of oak, bracken and bramble with chestnut or hornbeam as frequent coppice species. Bluebells and anemones are common in the field layer and dog's mercury on base rich soils. In comparison to the more fertile coastal plains, the High Weald has a high density of intricately connected woods, shaws and hedgerows.

The Low Weald

The low-lying region to the west of the High Weald is called the Low Weald. The soils in this area are generally heavy, clay rich and have poor drainage. The Mens and Ebernoe Common are significant examples of pasture woodlands within the Low Weald. Canopy species include beech, yew and oak with field maple in the understory. Good examples of wet woodland can be found around the tributaries of the River Adur and Arun.

The South Downs

Beech, yew, oak, field maple and ash are amongst the many species encountered in these woodlands. Beech hangers tend to form on the more stable soils, with a mix of beech and yew on deeper soils and yew on the steeper, dryer slopes. Kingley Vale is a prime example of ancient yew woodland. Towards the west of the county there are stands of large-leaved lime. Examination of historical maps shows shifting patterns of the grass/scrub and woodland matrix of the downs. Over the years the wood on the downs seems to have expanded and contracted as grazing intensity and agricultural practices changed.

The Wealden Greensand

The Wealden Greensand is made up of a variety of sandy and loamy soils. On the higher ground large heaths and stands of beech, ash and oak can be found. Plantations of pine, sweet chestnut and other forestry species are a common feature to the north-west. Bracken, wavy hair-grass, wood sorrel, bilberry and heather are frequently encountered in the ground flora. The highest point of West Sussex, Blackdown Hill, lies on the border between the Wealden Greensand and the Low Weald.

Fertile areas of grazing marsh, such as Pulborough Brooks, lie along the plains of the Rother. Other notable sites include the ancient deer parks at Parham and Petworth, the latter having been landscaped by Capability Brown in the 1750s.

2.1.4 Project aims

The primary aim of the Weald and Downs Ancient Woodland Survey is to re-examine all available information and to present a revised Ancient Woodland Inventory for a local authority area. This enables local authority planning officers to identify areas of ancient woodland and hence provide these woodlands with the appropriate recognition in accordance with planning guidance and policy.

Additional aims of the survey are:

- To develop a better understanding of the key issues and threats affecting ancient woodland.
- To document the location of ancient woodland sites within the local authority areas which will help to identify areas of opportunity for environmental enhancement, increase the understanding of habitat connectivity, and highlight woodland areas for targeting woodland management programmes and grant funding.

2.1.5 Project funding

The revision of the Ancient Woodland Inventory for the county of West Sussex was funded by Adur District Council, Arun District Council, Chichester District Council, Crawley Borough Council, the Forestry Commission, the High Weald AONB, Horsham District Council, Mid Sussex District Council, Natural England, the South Downs Joint Committee through the South Downs Sustainable Development Fund, Sussex Biodiversity Record Centre, Sussex Wildlife Trust and West Sussex County Council. Additional support for the Mid-Sussex revision was provided by the INTEREG IIIB Programme “Lifescape your Landscape.”

2.2 Ancient woodland definitions

Woodlands in Britain are routinely grouped into the two categories of ‘ancient woodland’ and ‘recent woodland’ according to their history. This follows the pioneering research on the subject by George Peterken, Oliver Rackham and others in the 1970s.⁹ The distinction is now well established as a useful one and the concept of ‘ancient woodland’ is embedded in national forestry and nature conservation policy.

⁹ For example, Peterken (1977), Rackham (1980)

2.2.1 Recent woodland

Secondary or recent woodland (less than 400 years old), is where a wood has either been planted on an area of land, or where trees have been allowed to grow naturally through regeneration, usually as the result of a cessation in land use management.¹⁰ Recent woodland sites can show similarities to ancient woodland depending on their age, proximity to ancient sites and the diversity of microhabitats within the site. However, generally their biological diversity is not as great as that of ancient woodland. These woods are therefore excluded from the inventory.

2.2.2 Ancient woodland

The definition of ancient woodland used for this survey is that given by English Nature (now part of Natural England), as included in an English Nature guidance document on ancient woodland for local authorities.¹¹ The relevant extract from this document is included below:

‘Ancient woodland in England is defined as an area that has been wooded continuously since at least 1600 AD. Ancient woodland is divided into ancient semi-natural woodland and plantations on ancient woodland sites. Both types of stand are classed as ancient woods.’

The trees and shrubs in ancient woodlands may have been felled or cut for coppice at various times since 1600, but as long as the area has remained as woodland, i.e. the coppice stools have regrown or the stand has been replanted soon after felling, then it still counts as ancient woodland. Because it may have been cut over many times in the past, ancient woodland does not necessarily contain old trees.

The date used to define ancient woodland for England, 1600 AD, was chosen by Peterken,¹² because it reflected the point at which good maps started to become more common and was prior to the impetus for new woodland planting from the publication of Evelyn’s influential book ‘Sylva.’¹³ Other dates could be argued for: 1650 was used by Peterken and Harding¹⁴ to distinguish post-medieval woods in Rockingham Forest, as a detailed map for that area was produced at that time, while Rackham uses 1700.¹⁵ In practice 1600 has been adopted for policy and practical purposes in England.

Ancient woodland is divided into ancient semi-natural woodland and plantations on ancient woodland sites. Both types of stand are classed as ancient woods.

Ancient semi-natural woodland (ASNW)

Ancient semi-natural stands are those that are composed predominantly of trees and shrubs native to the site that do not obviously originate from planting. They include stands that may have been managed by coppicing or pollarding in the past, as well as those where the tree and shrub layer has grown up by natural regeneration.

Ancient replanted woodland (or PAWS)

Ancient replanted woodland sites (also called Plantations on Ancient Woodland Sites, or PAWS) are areas of ancient woodland where the original native tree cover has been felled and replaced

¹⁰ Bannister (2007)

¹¹ Kirby & Goldberg (2006)

¹² Peterken (1977)

¹³ Evelyn (1664)

¹⁴ Peterken & Harding (1974)

¹⁵ Rackham (2003)

by planted stock most commonly of a species not native to the site, for example conifers such as Norway spruce (*Picea abies*) or Corsican pine (*Pinus nigra var. maritima*), but also broadleaves such as sycamore (*Acer pseudoplatanus*) or sweet chestnut (*Castanea sativa*) [but see 3.2.5, below].

The division between semi-natural stands and plantations is not always easy to define, because there are intermediates, for example small clearings within woods, old plantations of native species, semi-natural structured stands of introduced species, planted conifer stands that now contain a proportion of self-sown native broadleaves, or semi-natural tree layers with no native understory or improved ground floras. Therefore, a judgement may be necessary as to the balance between the planted/introduced elements versus the native/naturally regenerating elements.

For the purposes of this survey, the following definitions have also been used to help define areas of ancient woodland:

- Areas with continuous woodland cover.
- Areas managed or periodically cleared for timber or underwood production.
- Areas regenerating following woodland management.
- Open grazed areas within the woodland (at least 20% canopy over 80% of the site).
- Temporary clearings that may have been created within the woodland complex but which have regenerated, or are regenerating, back to woodland.

2.2.3 Ancient wood pasture

Wood pasture describes woods derived from ancient pasture woodland managed for both trees and livestock or deer.¹⁶ These woodlands are usually associated with ancient deer parks, Royal Forests or wooded common land. They frequently occur in a mosaic with other habitats and the boundaries are often poorly defined. Wood pasture was previously included on the original Inventories as ASNW where recognisable stands of trees evident on old maps remain unchanged. Parkland sites with wide-spaced trees were omitted.¹⁷ However, the map sources used for the original Inventories were often inconsistent with only a partial coverage.

The revision of the Ancient Woodland Inventory in Wealden District, East Sussex highlighted the problems of classifying woodland sites in historically more open areas such as the Ashdown Forest and other former commons and hunting forests.¹⁸ Some of these woodlands had been classified on the original inventory as ancient whilst others had been omitted. However, re-examination of the historic map and other evidence does not always appear to support these decisions. Study of the historical extent of these sites can reveal a complex management history with a mixed pattern of woodland, grazing and shifting agricultural use.¹⁹ This spatial complexity and 'historical dynamism' within the woodland vegetation is a feature of many South Downs woodlands.²⁰

Within the revision of the Ancient Woodland Inventory for West Sussex, some sites were classed as a subcategory of ancient woodland, wood pasture, whilst keeping the ASNW/ PAWS split.

The following criteria were used to define the subcategory:

¹⁶ Harding & Rose (1986)

¹⁷ Spencer & Kirby (1992)

¹⁸ Westaway (2005)

¹⁹ Greenaway *et al* (2004)

²⁰ Bannister (2007). Land Use Consultants (2005)

- Wooded today (at least 20% tree cover over 80% of the site).
- Woodland shown on the Ordnance Survey First Edition County Series maps (produced for Sussex between 1869-75), with the cartography indicating at least 20% tree cover over 80% of the site.
- Former enclosed Forest or common land as identified on the Ordnance Survey Drawings (1795-1801).

(See section 3.2.2 for a fuller description of these map sources).

Pasture woodland was therefore defined as a semi-natural habitat that has retained a wooded nature throughout recent history as documented by the above map sources. The revised inventory includes these areas and they can be readily extracted from the dataset.

3. Methodology and Sources

The guiding principles followed in this project are those used to compile the original inventory. The work, combining desk-based analysis, field surveys and archive research, utilised methods piloted in the Wealden district inventory revision²¹ and developed in subsequent revisions to the inventory for Mid Sussex district and Tunbridge Wells and Ashford boroughs.²²

The revision represents a complete and systematic rebuilding of the Ancient Woodland Inventory dataset for West Sussex. It draws heavily on the established intelligence contained in the original inventory (and its subsequent amendments) but also reappraises this information in the light of a range of, often hitherto unavailable, evidence sources. The availability of high precision digital mapping tools and large-scale historical map sources in digital format meant that, for the first time, small ancient woods (less than two hectares in size) could routinely be included in the inventory revision for West Sussex. Whilst the methodology aims to be systematic and robust, because of the regional scope of this research, the methods are, by necessity, relatively simple and quick, with more detailed historical and field surveys confined to a priority set of sites. The inventory is therefore inclusive, meaning that the default for borderline sites, or those for which data is lacking, is that they are retained on the inventory, thus ensuring they can be considered in future surveys.²³

3.1 Software

The mapping of woodland in this project and much of the map research underpinning the final dataset was done in a Geographic Information System (GIS). This allows the relatively rapid comparison and combination of a variety of spatial data sources. Importantly, it also allows the editing of the dataset to a standard of spatial precision which would have been impossible to achieve within the space of time available without such technology. The GIS software used was *ESRI ArcMap 9.2*.²⁴ The resulting GIS database can be linked to external databases which hold more detailed site survey and archive data.

Data accrued from on-the-ground woodland survey in the project is held in a Recorder 6 database from which a report for each site outlining the main survey findings can be generated.²⁵ Recorder 6 is specifically designed for biological recording. It allows species observations and habitat data to be captured in an electronic format that is compatible with the National Biodiversity Network. This enables the methods of data storage to be easily reproduced and also allows easy exchange of data.

3.2 Inventory revision

The approach to mapping ancient woodland used in this project is deductive. A relatively large set of woods is first captured from highly accurate and reliable but relatively recent map evidence. This 'indicative ancient woodland dataset' is then sequentially refined and filtered by interpretation of further sources of evidence, historical, ecological and archaeological. The procedure for revising the Ancient Woodland Inventory has three interlinked elements:

²¹ Westaway (2005)

²² Westaway, *et al* (2007a); Westaway *et al* (2007b); Sansum *et al* (2009)

²³ Spencer & Kirby (1992)

²⁴ ESRI Inc (2008)

²⁵ JNCC (2007)

1. Desk-based mapping – capture of the dataset
2. Research on historical maps and documents – refinement of the dataset
3. Field survey work – refinement of the dataset

3.2.1 Desk-based mapping - capture of the dataset

The initial stage identified, with a high degree of spatial accuracy, that subset of the present-day woodland resource which could clearly be demonstrated to be long-established woodland. Woods of late 19th century and 20th century origin were thereby eliminated from the search.

This capture of potentially ancient woodland sites employed two key mapping elements:

- The current Ordnance Survey *MasterMap* Topographic Layer displayed over recent high-resolution aerial photographs covering West Sussex.
- Ordnance Survey First Edition County Series 25 inch to 1 mile map: Sussex 1869-1875 (also referred to in this report as Epoch 1 - a term used by historians).

The first of these is the modern vector dataset from which other current OS map products are derived. It is the ‘industry standard’ baseline for the creation of maps and geographic datasets in the UK. The second is the earliest very large scale mapping to give a complete and systematic national coverage. It is sufficiently accurate that, following its recent digitization and georectification by a partnership between the Ordnance Survey and Landmark Solutions, it can be routinely used in a GIS environment alongside modern datasets (see Figure 1). Both maps were surveyed at comparable scales of 1:2500 or greater and are arguably the most detailed and precise maps ever produced as a national coverage. As such, the comparison and integration of these sources provides an ideal method for the accurate capture of historic woodland boundaries – including small woods – as a first stage in revising the Ancient Woodland Inventory.

Working systematically through a grid of 500m x 500m cells covering the county, all *MasterMap* polygons visibly containing woodland on the aerial photograph were compared with the Epoch 1 maps in order to identify those areas of woodland common to both. Each woodland *MasterMap* polygon (or part of) was coded according to its presence or absence on the Epoch 1 map. This approach is flexible. If available for a given region, more layers of map evidence can be worked into the procedure. For the purposes of this mapping, woodland was defined as land with at least 20% canopy woodland over 80% of the site. Any continuous blocks of woodland were regarded as discrete sites with historical or ownership boundaries disregarded; ponds and other open areas within the wood less than one hectare in size were included. Man-made linear features passing through wooded areas such as surfaced roads have generally been edited out of the polygon whereas unsurfaced tracks and natural and semi-natural linear features such as watercourses less than 10m wide have been included as part of the woodland polygon.

Woods which were depicted on the Epoch 1 map but are no longer visible (lost woods) and woods which appear in *MasterMap* and recent photographs but which are not shown on the Epoch 1 map (woods apparently of recent origin) are systematically identified in this way. The absence of a wood on the highly accurate Epoch 1 maps was generally considered sufficient evidence to eliminate it from the search for ancient woodland where it only appeared on later maps or aerial photographs. An important tenet of the methodological approach adopted was that no other elimination of woods depicted on the Epoch 1 maps was carried out based on judgement or interpretation of the map at this capture stage. Many woods shown on these maps

have a modern, planted or planned appearance but may prove upon further examination (3.2.2) to have deeper historical origins. Premature removal of sites from the dataset would prevent any such examination being carried out.

The resulting dataset comprises a map of a particular subset of the woodland resource – the surviving portion of the woods which appeared on the Victorian Epoch 1 maps – in which woodland boundaries are both historically accurate and conform wherever possible to OS *MasterMap*. Theoretically speaking, the woods included in this dataset contain all the ancient woods in the area of interest in addition to some woods with origins in the 17th, 18th & 19th centuries (see ancient woodland definitions - 2.2).

This indicative ancient woodland dataset was then incorporated and compared with the digital version of the Natural England existing Ancient Woodland Inventory within GIS. This allowed:

- Currently designated ancient woodland sites to be attributed to the corresponding polygons in the new Ordnance Survey *MasterMap* derived dataset subject to further confirmation of status.
- Identification and enumeration of the sites identified by the process described above as potentially new (hitherto unrecorded) ancient woodland sites.
- Potential discrepancies between the two datasets to be marked for further investigation (for example where a piece of woodland recorded on the original inventory does not appear to be shown as woodland on either the Epoch 1 map or on current aerial photographs).

A general principle has been to retain areas of previously designated ancient woodland in the revised inventory where the evidence of Epoch 1 supports this (but with boundaries now mapped to *MasterMap* standard where appropriate) and place the thrust of the research effort on assigning the correct status to the additional potential sites identified by the process described above. If incontrovertible evidence subsequently emerged in further archival and field research (see below) against an original ancient woodland designation then appropriate boundary revisions to those areas have been made.

3.2.2 Refining the dataset using historical maps

The capture stage described above yielded an indicative ancient woodland dataset comprising some 6,149 *MasterMap* derived polygons. This consisted of:

- 2,714 ha of previously designated ancient woodland in the county or 1,372 polygons (equivalent to 470 polygons on the original inventory which was digitized with lower precision).
- 4,340 polygons of potentially additional ancient woodland (wooded areas in existence since at least the 1870s) amounting to approximately 9,840 ha.
- 437 previously designated ancient woodlands, which were not shown as wooded in the 1870s, this amounted to 853 ha.

The next stage in the methodology consisted of checking this indicative dataset against the evidence of a range of historical map sources held both in traditional archives and in digital form which could be analysed in a GIS as an extension of the desk-based mapping stage (above). Not all the evidence sources consulted can be detailed in this report but the key ones are described below in reverse chronological order.

The Ordnance Survey First Edition County Series 25 inch to 1 mile maps (produced for Sussex 1869-75)²⁶

These are the digital geo-referenced Epoch 1 images used in the capture process described above (3.2.1). These maps are superbly detailed and contain a wealth of information about the woods under review beyond that of simple presence or absence (Figure 1). The engravers used an extensive palette of symbols to depict different types of woodland and scrub vegetation including, simple coppice, coppice-with-standards, high forest, plantations - mixed and coniferous, osiers, pasture woodland, parkland, etc. It is also possible to discern from these maps which woods were enclosed and which were not, as well as to see features within woods such as buildings and enclosures. In fact, the attention to nuance in the vegetation and the varying character within and among woods shown in these maps far surpasses that of modern maps and reflects the still central importance of woods and woodland produce to the rural and wider economy at the time of their production.

From the perspective of this research – attempting to identify woods which have been in existence since at least 1600 AD – the main disadvantage of Epoch 1 maps is their relatively recent date. Because of the high level of accuracy of this source, absence of a wood on these maps is considered highly significant. On the other hand, whilst more recent woods can sometimes be identified as regularly shaped enclosures or having map symbols that indicate a previous non-woodland use or recent planting, the map does not, of itself, necessarily give grounds for elimination of such sites.



Figure 1. Example of the Ordnance Survey First Edition County Series 25 inch to 1 mile map for Sussex (1869-75) showing the woods and shaws around Sutton .

²⁶ Dates from the British Library: <http://www.bl.uk/reshelp/findhelprestype/maps/index.html>

The tithe maps for Sussex (produced from the 1834 to 1859)

Tithe Maps were produced under the direction of a parliamentary commission following the Tithe Commutation Act of 1836 when tithes in kind to the parish were replaced by payments in rental value. For this Act to be workable, a prerequisite was a consensus on ownership boundaries and the extents of properties. Furthermore, the state of cultivation of every parcel of land needed to be recorded as this determined the charges due. For example, land classed as 'wood' was exempt from Tithe payment within the legal boundary of the Weald and sometimes also elsewhere. In the parish of Rusper, 825 acres (334 ha) of woodland, hedgerows, lanes and roads had traditionally been free from tithe.²⁷ The maps provide an invaluable record of the land-use and economy of mid 19th century England²⁸ at the local level in the way that the Domesday Book does for the 11th century but with the important advantage of spatial precision.

The maps relating to the parishes of West Sussex (see Figure 2 for an example) were drawn up between 1834 and 1859. Sompting and South Stoke were the first parishes to be mapped with West Stoke the last to be published. The majority of the maps were created between the mid 1830s to the late 1840s. The maps for Sussex vary in scale from 1" to 1 chain (80" to 1 mile) to 1" to 10 chains (8" to 1 mile), though more commonly they vary between 20" and 27" to 1 mile.

West Sussex is covered by 197 individual maps but some of the larger parishes may be split into two or more maps.²⁹ Maps were usually created on a parish by parish basis. Two areas of West Sussex have no tithe coverage. Where tithes were all in the hands of one owner, there was no need for maps and apportionments to be drawn up. The largest data gap occurs in Upper Beeding, around St Leonard's Forest. Here the tithes and revenues went directly to Sele Priory and later to its successor, Magdalen College, Oxford.³⁰ Gaps also occur in South Stoke and within the walls of Chichester.

The tithe maps show compartments of land together with a code, which is indexed and listed in a bound apportionment volume detailing the owner(s) and/or occupier(s), the name of each parcel of land, a description of its 'state of cultivation' and the associated rent charge calculation. The maps vary in quality and accuracy from parish to parish. The original intention of the commission was to produce all the maps to a uniformly high standard but the cost implications of this meant that there was much local variability in the results achieved and not all of the maps were ultimately given the commissioners' seal. Those which did became known as 'first class' maps and the rest as 'second class'. Almost one third of Sussex tithes were rated 'first class'.³¹

The modern boundary of West Sussex overlaps with 164 parish territories. The West Sussex Tithe Maps were made available as digital images by the West Sussex Record Office, along with transcribed copies of the apportionments. The authors are grateful to the transcribers of these documents for their generosity in making the resulting information available for use. In order to correlate the tithe maps with the revised Ancient Woodland Inventory, the geo-rectification of the maps was instigated. Funding for this was provided by the Forestry Commission and West Sussex County Council. The Geography Department of Portsmouth University carried out the work.

²⁷ Rusper tithe map (1839). Map Reference Number TD/W104. With acknowledgement to West Sussex Record Office

²⁸ Kain & Prince (1985)

²⁹ Pers. Comm. Gillian Edom, West Sussex Record Office

³⁰ Pers. Comm. Claire Snoad, West Sussex Record Office

³¹ Kain et al (1995)

The whole of the indicative ancient woodland dataset, for which there was tithe coverage, was compared to the tithe maps and apportionments. This provided a second filter to the potential revisions as well as further verification and evidence to support ancient woodland status. It was beyond the means of the project to cross-reference all woodland within the Mid-Sussex District against the tithes.



Figure 2. Example of a Tithe Map (1840).³² Drawn at a scale of 5 chains to 1" (20" to 1 mile). The detail in this figure shows the same area of the parish of Sutton as Figure 1. Note the richness of information relating to woodland including depictions of enclosed woodland as well as the small hedges and shaws along field boundaries, informal areas of unenclosed scrub and dispersed bands of trees on the downs. In the upper-right corner, orchards are depicted as formal lines of trees. Pasture (including the downs) are shaded a light blue. Land parcels are inscribed with unique numbers, which relate to a book of apportionments listing the owner, extent, state of cultivation and payment. Areas that fall outside the parish boundaries have been left blank.

Comparisons to the tithes could be made for 97% of the sites. The remainder fell in areas where parts of the map in question were unreadable, missing or damaged or the corresponding number in the apportionment volume was missing or illegible.

These maps possess certain advantages to the Epoch 1 maps – often a greater level of accuracy and high information content. However, they lack the antiquity needed to demonstrate that a wood is truly ancient. The tithe maps were largely produced only a few decades before Epoch 1. Nonetheless, they remain a useful evidence source. The tithe maps come at an opportune moment in the history of Sussex, being produced at the beginning of the Victorian period during which woodland produce would reach unprecedented heights in its economic value (prior to a decline of equal proportions at the end of the 19th century). Consequently, the first half of Queen Victoria's reign was a time of considerable change for wood resources both in the style and efficiency of management and the proportion of the land given over to managed woodland.

³² Sutton Tithe Map (1840). Reference Number: TD/W123. Reproduced with acknowledgement to West Sussex Record Office.

Many woods, or parts of them, appear to have their origins in this period or in the decades immediately before. Examination of the Epoch 1 and *MasterMap* derived polygons in the light of tithe map evidence often resulted in further edits to the polygons being made, for example where part of a wood was shown to have been a field or plantation in the 1830s. Following a complete check of the polygons from the capture stage, 30% of sites were recorded as having a non-woodland land-use – generally pasture, arable or meadow but also downland, commons and gardens. This means that almost 70% of the sites were recorded as partially or wholly wooded, with roughly 5% of these woods shown as some form of plantation. Usually the apportionments do not refer to species in the plantation but there may be clues within the name, for example The Fir Tree Piece, Firs Plantation, Furze Field, Willow or Withey Bed. Seven sites were marked as New Plantation and were therefore treated with caution.

Analysis of the tithe layer, in collaboration with other sources, provided a means to eliminate secondary woodland and make many additional alterations. The Tithe Maps represent a very valuable tool for refining the inventory.

Ordnance Survey Drawings, 2 to 6 inches to 1 mile (produced for West Sussex 1797-1808), prepared for the First Edition Ordnance Survey maps³³

The Ordnance Survey Drawings and drafts (see Figure 3 for an example) are the manuscript maps upon which the first fully triangulated large scale published maps of southeast England were based. The published maps, referred to as the ‘Old Series,’ were published in 1813. This endeavour was a military response by the English government to the Napoleonic threat of invasion from across the English Channel. It was undertaken by the Board of Ordnance (a body something akin to the modern Ministry of Defence) from which the Ordnance Survey takes its name. Work on the preliminary drawings for West Sussex officially begun in 1797 with the final map being produced in 1808.³⁴

The most detailed drawings were made at a scale of six inches to the mile in areas of military importance. Particular attention was paid to rivers, roads, woods that could provide cover or obstruction and the contours of hills. Elsewhere, the maps were drawn at smaller scales - sometimes as low as two inches to the mile. The data from these drawings was reduced and standardised in order to produce the published ‘Old Series’ maps. These maps were drawn at a scale of one inch to the mile. The printed maps therefore had an attendant loss of information and simplification in the depiction of features, for instance, the straightening of woodland boundaries, the truncation of tapering gills and other linear woodland shapes and the removal of smaller woods.

The original drawings are held by the British Library, and geo-referenced scans of these data were used to supply coverage of West Sussex. The images were examined along with the tithe and Epoch 1 data using GIS software. Most of the relevant information is contained on nine overlapping sheets of varying size. Where maps overlap, woods may be served by two or more drawings whilst some small areas have no surviving coverage. Individual sheets were often produced by different surveyors and map styles and dates vary accordingly. The level of accuracy also varies greatly, with the finest sheets depicting, very precisely, woods as small as an acre (or 0.4ha) in size but with the poorest sheets coarse and distorted with little information on small woods.

³³ Dates sourced from the British Library website: <http://www.bl.uk/onlinegallery/onlineex/ordsurvdraw/>

³⁴ *ibid*



Figure 3. Example of an Ordnance Survey Drawing for Sutton (produced in the field at 2 inches to 1 mile in 1805). This employs a more generalized set of symbols to indicate trees but the sophistication of the surveying is clear with careful attention to the depiction of relief through cross hatching and the inclusion of small wooded enclosures.³⁵

Absence of a wood from these maps cannot be taken as proof of woodland not existing at this time. Comparison with the Yeakell & Gardener maps (1778-1783) sometimes reveals the surveyors' apparent omission of sizeable woods. The experience of the research in West Sussex and elsewhere seems to suggest that while enclosed woods containing significant timber would generally be accurately depicted, simple coppices (without standards), brushwood, gills and shaws are often omitted. Similarly, where steep ground is occupied by woodland or scrub, such as the downland hangars, the surveyors have often placed priority on conveying the physical relief of the land above depiction of the vegetation cover. In other places the surveyors' preoccupation with the lie of the land and use of dense hachuring to indicate steep topography obscures other coincident features.

The suggestion has also been made that woods which had recently been cut were simply overlooked by the surveyors or that they mistook recent woodland harvesting for conversion to agriculture³⁶ (an error which sometimes occurs in modern map making). Large woods managed in the traditional way by coppicing would tend to be divided into a series of compartments harvested on a cyclic rotation. Such woods would perpetually contain some conspicuous growth and be visible as woodland. Small woods however, were sometimes harvested in their entirety, with a dispersed group of copses across a farm or larger estate each acting as a felling compartment within the coppice rotation. At the time of the first Ordnance Survey most, if not all, woods would have been actively managed. At any one time then, a relatively large proportion of small woods may have been at a low and inconspicuous state of growth.

³⁵ <http://www.bl.uk/onlinegallery/onlineex/ordsurvdrawing/>

³⁶ Hodson and Campbell (1989)

We should not expect to see every small wood depicted on these maps. However, where woodland is recorded these maps are considered to be reliable and give a strong indication of possible ancient woodland status when this is supported by the context of the site and the evidence from other sources. Following the approach of the original AWI,³⁷ which utilised the smaller scale printed version of this source (see below), a presumption in favour of retaining those woods shown on these maps (as provisionally ancient woodland sites) has been made.

As with the tithe maps, the indicative ancient woodland dataset (excluding Mid-Sussex) was systematically cross-referenced with the Ordnance Survey Drawings. Approximately 43% of polygons were shown wholly or partially wooded. In terms of total area, a much larger proportion, 66% of the indicative layer, was shown as wholly or partially wooded. Over 40% of sites were not depicted as wooded at the time the maps were drawn. But in terms of area only 16% of the indicative layer showed no sign of being wooded. This illustrates the skew towards the depiction of larger woodlands in the drawings. The average parcel size for sites that were illustrated as wooded was 5.85 ha, compared to 1.44 ha for sites that were not depicted with trees. An additional 13% of polygons were shown as common or parkland. The remainder of sites could not be analysed due to map damage or lack of coverage.

Ordnance Survey First Edition, 1 inch to 1 mile, 1813³⁸

In spite of the disadvantages of using this map to identify ancient woodland rather than the larger scale drafts produced in its development (discussed above) this source was referred to on an ad-hoc basis. Although it represents a ‘loss of information’ relative to the drawings it also represents the definitive distillation of an immense body of work and the Ordnance Survey’s final decision on what should and should not be mapped at the time.

Yeakell & Gardner, 2 inches to 1 mile, 1778 – 1783³⁹

Yeakell and Gardner originally intended to survey the whole of Sussex in eight sheets. However, a lack of subscriptions and the deaths of several sponsors meant only four sheets were published. These sheets correspond to the southern part of the county (they extend to 50°56’30” north).

This map was the first, large scale, detailed maps of Sussex that used triangulation. This meant that actual field boundaries, rather than diagrammatic illustrations could be drawn. The surveyors also laid claim to illustrate ‘every inclosure, however small ... every road, public and private... the rivers, with their bends, fords and bridges’.

The ‘Great’ or ‘Large’ survey maps, as they were referred to, are comparable in style and method to the later Ordnance Survey Drawings. They proved a useful point of comparison, especially on heavily hachured areas such as the downs, where land use was difficult to interpret. The entire provisional ancient woodland resource (except in Mid Sussex district), for which there was coverage, was compared to this map.

The Mid Sussex revision published in 2007 did not utilise the Yeakell & Gardner map. Only a relatively small area of the county is covered by the map but it was outside the scope of this project to cross reference this woodland against the resource.

14,178 ha of woodland was not covered by the Yeakell & Gardner maps (or 61% of the provisional resource), reflecting the density of woodland in the north of the county. This relates to 4,201 sites.

³⁷ Whitbread et al (1989)

³⁸ <http://visionofbritain.org.uk/maps/>

³⁹ Yeakell & Gardner (1778-83)

It was possible to compare 39% of the indicative sites to the Yeakell and Gardner maps. Of these sites, 1,425 ha (790 sites) or 15% were not illustrated as wooded, 6,968 ha (906 sites) or 75% were shown as wholly or partially wooded. 572 ha (133 sites) or 6% were illustrated as parkland or common and the remainder were either damaged or could not be interpreted.



Figure 4. Example of the Yeakell and Gardner Map for the area of Sutton. This employs a more generalized set of symbols to indicate trees but the sophistication of the surveying is clear with careful attention to the depiction of relief through cross hatching and the inclusion of small wooded enclosures.⁴⁰

Estate maps

The use of the theodolite for triangulation from 1570 onwards (rather than the less satisfactory trigonometry produced by the ‘plane table’) resulted in increasingly accurate maps. Mediaeval cartographers had often relied on tradition and local wisdom for their information. The introduction of a standard length chain in the early 17th century improved the quality and accuracy further.

Individual Estate maps were usually drawn for a particular purpose, such as to show land boundaries, buildings, issues of ownership and land use. They can also include correspondence, accounts and surveys. But they were also used as a status symbol and many were elaborately decorated. As a result, they may therefore emphasise or omit select features. They also vary significantly in their quality, accuracy and extent, and as such they do not give a complete coverage of the county.

The West Sussex Record Office holds a large number of estate maps and has access to other major collections such as the Petworth Estate records. The study of estate maps can be time consuming and not always fruitful. Whether a map is relevant to woodland sites being targeted

⁴⁰ Yeakell & Gardner (1778-83)

for research is often not evident until it has been examined, sometimes at length. Each map must be interpreted on its own merit and with an awareness of its possible original purpose.

In view of the limited time resources available to the project staff, eight volunteers were recruited to help with the examination of the maps. Training was provided and they were allocated set areas to examine. This search concentrated on maps dating from the period 1590-1800, given the greater availability of information for the 19th century, as previously discussed. 231 sites were investigated for additional historic evidence. This represents 4% of the indicative Ancient Woodland Inventory. Of these, 123 were either wholly or partially wooded. The earliest map on which a recognisable wood was illustrated dated back to 1656.

It should be noted that there are likely to be other, significant historical documentary resources of relevance to the inventory of West Sussex's ancient woodland resource. Within the time constraints of the project, it was not possible to examine a greater amount of the likely resource available.

3.2.3 Other evidence sources

This revision of the Ancient Woodland Inventory was primarily a mapping exercise supported by research on historical maps and field survey (see below), and evidence from these sources was given the greatest weight. However, there are important additional factors which are brought into interpretations of woodland status during the decision making process. These include:

Place names

The attraction of historic place names is the link they speak of to features in a past landscape for which we have no description. Unfortunately place-name scholars often disagree as to the true meaning of a name, with some assigning quite different topographic associations to the same term. They can however, with caution, be used as a guide to help reconstruct the landscape.⁴¹ For example 'leah' or 'ley' refers to a woodland glade or clearing, 'den' to a woodland swine pasture and 'hyrst' or 'hurst' to a wood or a grove especially one on a hill.⁴² The disadvantage is that many topographic place names probably relate to features which were atypical, and therefore distinctive, rather than describing the general situation. Hence, when the term *hurst*, originally applied to a small and distinctive hilltop grove, is later transferred to the general area of the hill, it does not necessarily support ancient woodland status for sites in the vicinity.

Wood names can also help to identify non-ancient woods. 'The plantation' or 'The Grove' for example, may indicate more recently planted woodland particularly where the site is associated with a large house and/or on cultivable land. However, a large degree of caution should be exercised because names change over time and 'The Plantation' might well occupy the site of a pre-existing wood.

Woodland shape and situation in the landscape

Larger ancient woodland sites often survive on parish boundaries or follow steep inaccessible topography such as the slopes down to a gill or the land surrounding old iron extraction pits. The boundaries of intact older woodlands are rarely straight and often follow natural features such as streams. Surviving fragments of historically larger woods, however, often do have straight margins where their modern boundaries have been chased back to the limits of viable cultivation by successive agricultural improvements.

⁴¹ Brandon (2003)

⁴² *ibid.*, and Rackham (2003)

3.2.4. Refining the dataset through field survey

On completion of the capture stage (see 3.2.1) and in tandem with historical research (see 3.2.2), a priority set of woodlands was identified for ground survey. These sites were selected in consultation with the relevant local authorities and were generally situated in areas of potential growth and development or where other activities potentially impinged on woodland. Survey site selection was further informed by the emerging historical evidence for woodland status and sites were prioritised where this evidence was weak or ambiguous. The surveying work excluded Mid-Sussex district.

The field surveys were carried out from April to September in both 2008 and 2009. Some species, such as early dog-violet (*Viola reichenbachiana*), could not be identified later in the season, once they had flowered. The survey aim was to make a quick assessment of each site recording the key information needed to aid in the identification of ancient woodland. The methodology was broadly in keeping with the ‘walk-about’ survey recommended by the Nature Conservancy Council for the original inventory work.⁴³ Where possible, site boundaries were walked and the interior of the wood was traversed. Potential sources of variation were investigated. Emphasis was placed on recording the following:

- A list of vascular plant species.
- Living evidence relating to the past management of a wood, for example, coppice structure, aged coppice stools, veteran trees or pollards.
- Archaeological evidence relating to the past management of the site such as saw pits, charcoal hearths, drainage systems, old banks, mineral diggings, etc.
- Physical features indicating a previous agricultural land use, such as ridge and furrow plough markings and lynchets.
- Historical boundary features, such as wood banks, stubbed trees or outgrown laid hedges, delineating the wood.
- Current uses or factors causing disturbance or damage to the wood.
- Structural and habitat diversity, presence of dead wood and the presence of streams and ponds following natural courses and depressions.

These features can all provide evidence of past land use and so help determine ancient woodland status. For example:

Wood banks

Distinct wood banks are characteristic indicator features of lowland ancient woodlands. A wood bank consists of an earth bank, often though not always with an associated ditch, constructed at the boundary of woodland or of compartments within it. These banks, which were constructed to keep out both grazing animals and human intruders, would in most cases have been topped by a hedge or fence.⁴⁴

Ancient woodland indicator species

The presence of these vascular plant indicator species can aid in the identification of ancient woodland, and ancient woodland sites tend to be richer in terms of their species composition.⁴⁵ However, care is required as other factors affect the presence and abundance of these species. These factors include the area of the wood, the time of year of the survey, the diversity of

⁴³ Kirby (1988)

⁴⁴ Rackham (2003)

⁴⁵ Hornby & Rose (1986), Rose (1999) and Rackham (2006)

habitats within the wood, soil type, and the position of the woodland relative to other wooded areas. Current uses, including disturbance, damage or invasive species may also influence species diversity and the time spent surveying will affect the number and abundance of species recorded as well as the likelihood of other features being recorded.

Lists of vascular plant species strongly associated with ancient woodland sites known as ‘indicators’ have been compiled for different geographical areas of the British Isles. These lists are based on the occurrence of species in known ancient woodland sites.⁴⁶ The South East list used in this revision is shown in Appendix 1a.

3.2.5 Deciding on ancient semi-natural or replanted ancient woodland status

The Forestry Commission’s National Inventory of Woodland and Trees (NIWT)⁴⁷ was used as the core dataset to redefine the boundaries of PAWS and ASNW. This dataset classifies woodlands into categories such as broadleaved, coniferous, mixed, and coppice.⁴⁸ For ancient woodland less than two hectares, a judgement on ASNW or ancient replanted status was based on an interpretation of aerial photographs. Boundaries were then further refined using aerial photography, the existing AWI boundaries, Ordnance Survey *MasterMap* boundaries and the results from field survey work.

The reliance on aerial photography for identifying PAWS means that there were inevitably some inaccuracies in the classification, for example, in distinguishing between mature broadleaved plantations and stands of semi-natural woodland. Ancient Semi-Natural Woodland was used as the default classification where it was not possible to determine the woodland type.

It should also be noted that there has been a considerable amount of PAWS restoration since the NIWT was published in 2000, not least as a result of the Defra/ Forestry Commission ‘Keepers of Time’ policy in 2005.⁴⁹ This encouraged the re-establishment of broadleaved tree cover on ancient woodland sites, particularly on the Forestry Commission estate. It has not been possible, within the resource constraints of this survey, to identify all areas of PAWS restoration that have occurred since the last inventory of the county was published in 1989. The area of PAWS shown in the results of this survey may therefore be an overestimate of the actual remaining resource.

Sweet chestnut

Sweet chestnut (*Castanea sativa*) is a non-native species, but is a very long established introduction, and widely planted, in the woods of Kent, Sussex and Surrey.⁵⁰ This species may occur as a naturalised element within a diversity of other woodland species in woodland, but also occurs as densely planted coppice (particularly in Kent), often established in the 19th century.⁵¹ There is therefore a case for accepting sweet chestnut as a semi-natural element in some ancient woodlands in West Sussex, as well as recording it as ancient replanted woodland, or PAWS, where the species is dominant to the exclusion of other components of semi-natural underwood. Hutton, considering this issue in the 1990 report on the provisional Ancient Woodland Inventory for Kent, provided the following comments.⁵²

⁴⁶ Kirby & Goldberg (2006)

⁴⁷ Smith (2000)

⁴⁸ *ibid*

⁴⁹ Defra and the Forestry Commission (2005).

⁵⁰ Whitbread et al (1989)

⁵¹ Bannister (2002).

⁵² Hutton (1990)

It is thought that sweet chestnut was introduced to Britain in Roman times (Rackham, 1980). Evidence that it persisted through the Dark Ages comes from the Anglo-Saxon's knowledge of the tree and from the nature and distribution of mediaeval records. By the 13th century many records specifically mention chestnut in woods which were well away from habitation. Records from the Forest of Dean and from Sittingbourne state that it was accompanied by oak and beech with which it can still be found in the same stand today, e.g. in Ellenden Wood near Canterbury. This association of chestnut with what were then the typical trees of very acid soils shows that it did not depend totally on where growers had put it.

On the basis of this historical 'naturalisation' of sweet chestnut in the woods of the county, and of the present character of known ancient woods in which sweet chestnut comprises a major component of the woodland community, some sweet chestnut coppices have been included in the semi-natural category of the inventory.

Many formerly mixed coppice stands have been interplanted with sweet chestnut, and the stumps of existing native trees and shrubs treated and killed. This type of management results in a dense monoculture of sweet chestnut coppice which, in many cases, has the effect of suppressing the semi-natural flora. Where the later planting of sweet chestnut in ancient woods is known to have resulted in a marked suppression of the semi-natural underwood and ground flora, such woods have been recorded as replanted.

The information so far gathered in this inventory is insufficient to identify all sweet chestnut coppices where the semi-natural vegetation has been suppressed and the extent of ancient woodland in the county which should be recorded as replanted may, consequently, have been considerably underestimated.

It has not been possible to identify all sweet chestnut coppices, nevertheless, sweet chestnut is not as widespread a species in West Sussex as it is in Kent. Its under-recording is therefore unlikely to represent a significant addition to the area of PAWS in the county.

3.2.6 Minimum size of a wood to be included in the inventory revision

0.25 ha was generally the lowest size of woodland polygon considered for inclusion in the revised inventory, making it directly comparable with the Forestry Commission's NIWT. However, each wood is considered separately and factors such as the location and historical extent of the woodland mean that some woods under 0.25 ha may be included. This allows these woods to be considered when looking at the whole habitat matrix. Querying the GIS dataset's attribute table will allow a size restriction to be imposed if required.

3.2.7 Ancient woodland status

It is recognised that a largely desk-based exercise will always be flawed and ideally ground survey work would be undertaken in every wood. Due to time and financial constraints it was only possible to ground survey a proportion of the woodlands, so the decisions for the majority of the sites were based on map and archive research data. Whilst every effort has been made to make this revision as accurate as possible, the inventory is still regarded as provisional, as new evidence may come to light in the future that challenges the ancient woodland status of a site.

Such information, when provided to Natural England, will be considered and a decision taken on whether a site should be removed or added to the inventory. Nevertheless, although the revised inventory is described as provisional, the survey's thorough methodology, with the use of both desk-based and field work, and the use of digital mapping technology, mean that the project represents the most complete and detailed update of the inventory yet undertaken.

4. Results

The results of the Ancient Woodland Inventory revision are primarily stored in digital format. Natural England will incorporate the final dataset for West Sussex into the national Ancient Woodland Inventory. It will also be available to download from www.magic.gov.uk in due course. The revised map boundaries are shown at the end of this report. Survey data will be held by Natural England and the Sussex Biodiversity Record Centre and will be incorporated into the West Sussex county dataset of biological records.

4.1 The ancient woodland resource

The total amount of all woodland (ancient and recent) within West Sussex, as recorded in the Forestry Commission's National Inventory of Woodland and Trees (2000), is 38,099 ha (Table 1). This amounts to nearly 19% of the county's area, and as such is well above the England average of 8.4%.⁵³ In terms of absolute area, West Sussex has the second greatest area of woodland of a county in the South East region.

4.1.1 Extent of ancient woodland

The 1989 inventory recorded 16,874 ha of ancient woodland in West Sussex, covering 8.3% of the county's area.⁵⁴ The revised inventory contains 21,375 ha of ancient woodland and now covers 10.5% of the county's area, an increase of 2.22%. The net gain in provisional ancient woodland area across the county, compared to the 1989 inventory, is 4,501 ha (see Table 1).

Table 1: Summary of the woodland area and number of separate woodland parcels from the National Inventory of Woodland and Trees (NIWT, Forestry Commission, 2000), the original AWI for West Sussex (1989), the first digitized AWI for West Sussex (2000) and the revised AWI (2010). All areas in hectares.

	Area	% of the County	Number of woodland parcels	Average area of woodland parcel
West Sussex	203,023			
All woodlands (NIWT) >2 ha	38,099	18.77	1,415	26.93
Original AWI (woods >2ha)	16,874	8.31	-	-
First digitized AWI (woods >2ha)	17,634	8.69	992	17.77
Revised AWI (including woods <2ha)	21,375	10.53	2,611	8.19
Overall ancient woodland gain – compared to original AWI (1989)	4,501	2.22	-	
Overall ancient woodland gain – compared to first digitized AWI (2000)	3,741	1.84	1,619	

⁵³ Smith, National Inventory of Woodland & Trees

⁵⁴ Whitbread et al (1989)

The woodland area removed from the first digitised AWI amounts to 2,016 ha. This loss was due to a combination of inaccuracies in the initial mapping process, misattribution of some woods or parts of woods in the original inventory, and conversion of ancient woodland to other land-uses since the original inventory was compiled. These areas were removed following re-alignment of boundaries with OS *MasterMap* and Epoch 1 maps and re-examination of the historic map evidence.

The additions to the area of ancient woodland were greater in aggregate than the areas removed. In Table 1, comparisons have been made to both the original, 1989 inventory, and the first digitized version available in 2000. The latter has been included as it is a digital dataset and can be analysed to produce a range of woodland statistics not possible with the paper-based 1989 inventory. Appendix 3 shows similar results for each of the local authorities of West Sussex.

The revised ancient woodland area includes 5,762 ha of woodland not previously illustrated on the inventory. The average size of the additional parcels of woodland was 1.80 ha. The average size of woodland parcels in the revised inventory is 8.19 ha. As would be expected, the majority of the additions to the inventory fall into the sub-2 ha size classes (Figure 5). There are also far more woods in the sub-5ha size range (Figure 5). Some of these are genuine additions, but many have been formed by the breaking up of larger woods into smaller units, as a result of the more precise mapping of neighbouring but non-contiguous woodland parcels that use of *MasterMap* has brought to the inventory.

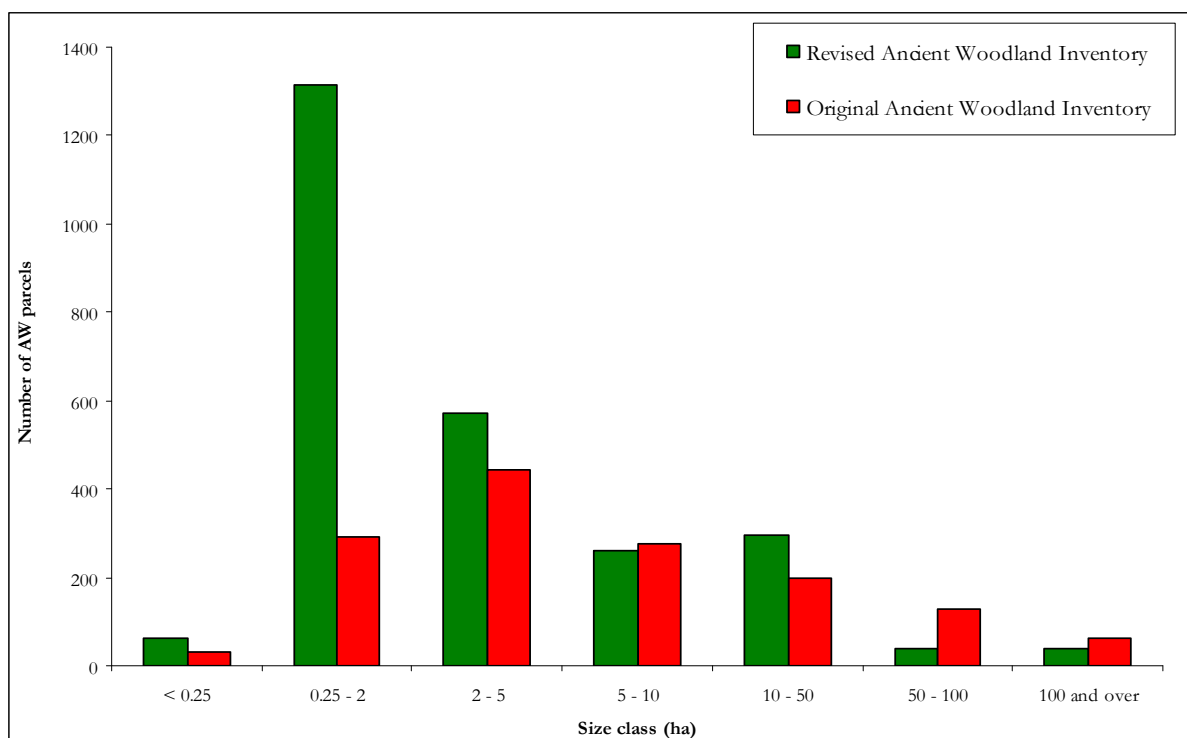


Figure 5. Histogram of the size class distribution for the original and the revised AWIs.

4.1.2 Plantations on Ancient Woodland Sites

In the revised inventory, 55% of the ancient woodland area is recorded as ancient semi-natural, with an area of 11,733 ha (Table 2). However, as discussed in section 3.2.5, the area of replanted ancient woodland, or PAWS, may be an overestimate, given the difficulty of identifying all ancient woodland sites which may have been restored to native broadleaved cover in recent years.

Table 2: Ancient woodland types (areas in hectares).

Ancient woodland type	Area (hectares)	% of ancient woodland area
Revised AWI - ASNW	11,733	55
Revised AWI - PAWS	9,642	45
Total:	21,375	

4.2 Results from the woodland survey

Field surveys were a central part of the project. They allowed the investigation of potential additions to the inventory, confirmation of ancient status for pre-established sites and the elimination of those with recent origins. It must be stressed that the woods surveyed do not constitute an unbiased sample of West Sussex woodland and therefore are not necessarily representative of the wider resource.

Survey effort was split between the different districts. In the first year, a surveying target of 200 ha per district was set and areas of potential development around towns such as Petworth, Crawley, Horsham, Chichester and the coastal towns were targeted.

In total, 400 sites were visited, which amounted to 1,830 ha of woodland (about 5% of the county's total woodland resource). Of this area, about three quarters were accepted as provisional ancient woodland on the basis of the field survey data interpreted alongside the other historical information available. 337 ha were judged to be of recent secondary origin or else too degraded to be defined as ancient woodland and thus eliminated from the inventory.

The survey methodology sought to establish a woodland plant list for each site, along with a record of a series of features that helped decide on the status of a site. These included site damage, management, habitat features, and archaeological and boundary features. The summary statistics for these features are given in Appendix 2.

4.2.1 Site damage

Site damage was taken to mean both direct physical damage, such as fly tipping or loss of woodland through garden extension, to biological factors including invasive species and over-grazing. 64% of the surveyed woodlands showed some sign of damage, with invasive species



Photograph 1. Damage to a sweet chestnut coppice. A series of ramps had been created out of wood and soil. Similar constructions were seen at various sites throughout West Sussex, some of which were extensive and elaborate.

(25% of sites), grazing damage (19% of sites) and rubbish dumping (20% of sites) being by far the most frequently encountered.

Overgrazing

19% of the woods surveyed were judged to be damaged. Overgrazing is taken to mean action either through lack of sufficient livestock control or through the action of wildlife such as rabbit or deer. Many of the small shaws and gills of West Sussex are open to livestock for drinking and shelter. This can cause poaching of the ground and trampling of the flora. High rabbit densities were often associated with localised soil erosion and poor ground flora.

Rubbish dumping

A high proportion of the surveys were located in or close to urban centres. In some of the larger towns, such as Crawley, small gill woodlands were completely surrounded by houses and roads. In many cases these small woodlands would serve as dumping grounds for a variety of rubbish including cars, sofas and fridges. In more rural environments rubbish ranged from dumped tractors and rubble to kitchen sinks. In total 20% of sites showed some form of dumping varying from casual rubbish to the use of woods as regular waste disposal sites.

Garden encroachment

Of the sites surveyed, 6% had lost some of their area to the expansion of gardens. These effects were mainly seen in sites where woodland and gardens graded into one another, often without defined boundary features. In these cases garden planting and garden escapes were common. Grass clippings, compost and other garden waste would often be disposed of in woodland at the back of gardens, thus dispersing garden escapes further and causing localised nutrient enrichment. This type of activity was recorded in 13% of sites.

Invasive species

25% of the woods surveyed had non-native species recorded on them. This ranged from the almost complete dominance of the vegetation by rhododendron (*Rhododendron ponticum*) or cherry laurel (*Prunus laurocerasus*), to localised patches of Himalayan balsam (*Impatiens glandulifera*).

Sycamore (*Acer pseudoplatanus*) was the most frequently recorded non-native species, occurring on 44% of sites. Sweet chestnut (*Castanea sativa*) was recorded on 31% of sites, and rhododendron was found on 22% of sites.

Recreational activities

Recreational damage to the survey sites was recorded at 16% of the sites. This could range from low-level erosion and expansion of path networks to the trampling of extensive areas and high levels of dog fouling. In several sites, severe damage had been caused by the construction of bike ramps (for both mountain and motor bikes) – see example in Photograph 1. One site had been completely destroyed and turned into a race track, presumably for quad or motor bikes. Paintballing and associated forts and ditches were seen at one site as well as informal camping sites, complete with abandoned tents and fire pits.

4.2.2 Woodland management

Coppice or coppice-with-standards were the most commonly recorded management types. Oak-hazel coppice-with-standards was the most widespread woodland type but stands of hornbeam or sweet chestnut coppice were also frequent.

Most of the coppice was outgrown with no evidence of recent management. Only 2% of sites showed recent coppicing, but 14% of sites had some degree of felling - this ranged from the felling of individual trees to large scale clearance. A large number of sites were scrubby and overgrown with no distinct structure and many of the smaller woods had poor access and evidently a history of neglect.

4.2.3 Ancient woodland indicator species

400 sites were surveyed for the revision, totalling 1,830 ha, with an average size of 4.58 ha. Of these, 43% had at least 10 ancient woodland indicator species recorded, with 4.5% of sites having 20 or more. 31% of sites had five or less indicator species recorded, with the average number of indicators per site overall being nine (minimum 1, maximum 32).

Bluebell (*Hyacinthoides non-scripta*), holly (*Ilex aquifolium*), field maple (*Acer campestre*), pendulous sedge (*Carex pendula*), primrose (*Primula vulgaris*) and wood sedge (*Carex sylvatica*) were the most frequent indicators, with all being present in 40% or more of the sites. Wood anemone (*Anemone nemorosa*) was recorded in 30% of sites. Wood anemone is known to be an ancient woodland specialist. It is very slow to colonise new areas, making it a good indicator of the antiquity of a wood, especially where it occurs in abundance.⁵⁵ In total, 82 out of the 100 vascular plant indicator species thought to be indicative of ancient woodland in the south-east were recorded at least once. See Appendix 1a for the list of ancient woodland indicator species along with an indication of the proportion of woods surveyed in which each species was recorded.



Photograph 2. The parasitic species toothwort (*Lathraea squamaria*) was recorded at two sites during the survey.

Great wood-rush (*Luzula sylvatica*) is mainly found in the Low Weald and has previously been recorded at 51 sites. During the survey, this species was found in an additional 15 sites. Likewise, the study added significant records to the database for lily of the valley (*Convallaria majalis*), small-leaved lime (*Tilia cordata*) and spurge laurel (*Daphne laureola*).

4.2.4 Archaeological and boundary features

The woods of West Sussex are a repository of cultural heritage in the form of archaeological features. These are associated not only with the former management of the woods themselves but also with preceding historic and prehistoric land-uses.⁵⁶ This woodland archaeology is an under-recorded resource. The survey did not have the time or resources to record the features present in great detail. However, where possible, features were roughly mapped and measurements were estimated.

⁵⁵ Rackham (2003)

⁵⁶ Bannister (2007)

By far the most common features recorded were banks and ditches on the boundaries of sites. These were recorded in 51% of all sites. Older trees, stumps and outgrown hedges were sometimes found associated with these features. Simple ditches were found along at least parts of the boundaries of 19% of the sites surveyed and simple low banks along 43%. Other linear features such as streams and walls were found in 41% of the sites. In the southern part of the county, old flint walls were a common feature alongside many woods.

Whilst 15% of sites had internal ditches, only a few showed widespread, complex drainage patterns across the whole site. Internal banks or banks and ditches together were found in 21% and 17% of sites respectively. These features could be indicative of administrative boundaries, ownership or management areas or they may have been associated with sunken tracks.



Photograph 3. Earthworks dividing an area of ancient woodland. The immensity of these structures and the labour involved in their construction shows the value of the renewable resources they enclosed.

40% of sites contained old mineral or stone extraction pits, ponds and water-filled hollows and depressions. This does not detract from their ecological value as ancient semi-natural woodland and often the form of the pit enhances biodiversity by providing a range of environmental conditions within a relatively small area. Archaeological features contributed to the wealth and diversity of woodland vegetation, and small pits, ponds, streams and ditches created variation in topography and environmental conditions. Ancient land use techniques provided pockets of diversity in what might otherwise be species-poor sites.

Other notable archaeological features recorded during the survey were two ice houses (both marked on the Epoch 1 maps), moats, pond bays and various diggings, mounds and excavations of unidentified purpose.

5. Outputs

Maps 5 to 13 at the end of this report show the revised Ancient Woodland Inventory on an Ordnance Survey 1:50,000 scale base map. Due to the map scale and the volume of small woods added to the inventory this map should be treated as indicative only. These maps represent a snapshot in time and will not show any subsequent revisions. Digital boundaries will be available to download online (www.magic.gov.uk) as part of the national Ancient Woodland Inventory dataset administered by Natural England. Any changes to the inventory made on a case-by-case in the future by Natural England will be incorporated into the national dataset over time.

Planning Policy Statement 9 (PPS9)⁵⁷ has strengthened the protection granted to areas of ancient woodland. PPS9 states that local authorities should identify any areas of ancient woodland in their areas that do not have statutory protection. As well as fulfilling this requirement, this inventory revision also provides an important information base for informing local authorities' planning policies, and will enable planning decisions relating to wooded areas in West Sussex to be made in the light of a greatly improved evidence base. The net gain of 1,619 new ancient woodland parcels in West Sussex not only affords these woodlands a higher degree of protection, but also emphasises the need for a review of the inventory in other well wooded areas.

The revised inventory also provides a more complete picture of the location of the county's ancient woods within a habitat network and will help to identify areas of opportunity for environmental enhancement. It also has the potential to inform the more strategic distribution of funding for woodland management programmes, such as the English Woodland Grant Scheme (EWGS). The survey data and revised inventory will also be useful to inform the West Sussex woodland Habitat Action Plan (HAP) and Biodiversity Action Plans.

6. Discussion

The majority of sites identified were small in size, with 1.80 ha being the average size of additional parcels. Figure 5. illustrates the contrast between the size of parcels in the original inventory compared to the revised inventory. Overall, the average woodland size has decreased from 17.77 ha to 8.19 ha. The Ancient Woodland Inventory now contains more than two and a half times the number of sites than its predecessor, a large proportion of which are under 2ha in size.

These results imply that, in terms of numbers, many ancient woodland sites were not identified in the original surveys. There were many small sites, under 2ha, which we have been able to include on the revised inventory. Most of which are located to the north, where woodland density is generally higher due to historic land use patterns. Districts in the south of the county showed a lower degree of woodland gain.

An important consequence of the revision to the Ancient Woodland Inventory for West Sussex is the georectification of the tithe maps for West Sussex. The tithe maps are now in a format that can be easily compared to modern maps. Almost 70% of woodlands in the indicative layer were shown as either wholly or partially wooded. The tithe maps added a further layer of verification onto the decision making process and helped to build a clearer picture of management history. This fascinating resource should prove invaluable for future projects seeking to investigate land-use history in West Sussex.

⁵⁷ Office of the Deputy Prime Minister (2005)

The boundaries to the original inventory were significantly refined. A total of 2,016 ha were removed from the first digitised version of the AWI. The changes to the Ancient Woodland Inventory were due to a combination of three factors; lack of (or contradictory) historical evidence, improved mapping techniques and focused surveying effort. In some cases, changes in land use have necessitated revisions to the original inventory.

A survey of 400 sites or 1,830 hectares of woodland was undertaken. Most of these sites were around areas of potential growth and development. As well as improving the evidence base for the revised inventory this provided an opportunity to increase our knowledge and understanding of West Sussex's current woodland resource, its ecology, history and management. Not only did the surveys contribute valuable biological data concerning the distribution and abundance of species throughout Sussex, but it also provided a snapshot of those woodlands and their archaeology.

The predominantly semi-natural condition of the small ancient woodland resource coupled with its widespread distribution of sites has many positive implications for nature conservation in the county. The accurate mapping of this resource provides important opportunities for understanding and improving connectivity of semi-natural habitats and biodiversity at the landscape scale. The standards of mapping used in this project mean that the revised Ancient Woodland Inventory dataset will be readily synthesised with a range of other compatible spatial datasets and inventories by researchers, conservationists, planners and policy makers addressing the complex landscape scale issues of the 21st century.

The importance of ancient woodland is widely acknowledged.⁵⁸ This resource is increasingly threatened by development pressures and lack of appropriate management. It is hoped that the work outlined here will make a useful contribution towards the long-term protection and appropriate management of this irreplaceable resource.

6.1 Limitations of the survey

The West Sussex project built on the methods trialled in Wealden and Mid Sussex, and in the subsequent revisions to Tunbridge Wells and Ashford.⁵⁹ The solutions to problems encountered in these previous revisions have been fed into the procedure for mapping and identifying ancient woodland used in the West Sussex project. There will, however, always be limitations with the types of evidence used in assessing ancient woodland status and these need to be considered by all users of the dataset:

- The limitations and inaccuracies associated with early map sources were discussed in the relevant section of this document. No decision based on historical map evidence relating to woodland can be completely infallible and a project such as this must inevitably make many such decisions. This is especially true where woods of diverse historical character, which have been little studied in this way before, are concerned.
- Botanical evidence varies in its value as a guide to the antiquity of a wood. The use of such data is more problematic in heavily disturbed woods and PAWS sites where vascular plant floras are often poor. Similarly, ancient semi-natural woods managed traditionally as coppice over centuries can become less conspicuously diverse when the coppice structure becomes derelict and the ground flora enters a prolonged shade phase

⁵⁸ English Nature (2002), Defra and the Forestry Commission (2005), Ellis (2004)

⁵⁹ Westaway (2005), Westaway, *et al* (2007a); Westaway *et al* (2007b); Sansum *et al* (2009)

with suppression of some of the diagnostic elements of an ancient semi-natural ground flora. Sudden changes in management or disturbances can bring strong secondary elements to ancient woodland vegetation locally which can mask the presence of diagnostic specialist species. In large woods such an effect is more easily identified and understood but in small woods with high ratios of edge to area the effect of disturbance, where the whole site may be affected, can be to confuse the decision making process significantly.

- Woodland archaeological features, of considerable diagnostic value in interpreting the history of a site, are most conspicuous in the winter and early spring, but ground flora recording dictates that the bulk of field surveying is done in spring or early summer. Rarely are sufficient resources available to visit a site twice in order to form a more complete picture.

6.2 The future of the inventory

It is hoped that this project will encourage a wider take-up of the survey with other local authorities in the South East. The Weald and Downs Ancient Woodland Survey is also working in partnership with local authorities in East Sussex and Kent to revise the inventory, and partner surveys are being undertaken in Surrey and the Chilterns.

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Photograph credits

Front and back cover photographs by Patrick McKernan, all other photographs by Victoria Hume.

Report authors:

Victoria Hume, Ancient Woodland Survey Officer, Weald and Downs Ancient Woodland Survey, based at the Sussex Biodiversity Record Centre.

Matthew Grose, GIS, Access, and Habitats Mapping Officer, High Weald AONB Unit.

With contributions from Philip Sansum, Ancient Woodland Survey Officer, based at the High Weald AONB Unit, and Patrick McKernan, Forestry and Woodlands Senior Specialist (South East region). Some text has been taken from the previous Ancient Woodland Inventory reports for Wealden and Mid Sussex districts and Tunbridge Wells borough.

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Appendix 1a: Ancient woodland vascular plant ‘indicator species’ in the South East

The 100 species in NCC’s South East Region that are most strongly associated with ancient woodland and are typical components of botanically rich ancient woodland communities.⁶⁰

Grasses, Sedges, Rushes and Ferns	Black bryony	Stinking iris
Bearded couch	Bluebell	Three-nerved sandwort
Common polypody	Broad-leaved helleborine	Toothwort
Creeping soft-grass	Bush vetch	Tutsan
Giant fescue	Chaffweed	Violet helleborine
Great wood-rush	Columbine*	Wild daffodil*
Hairy brome	Common Solomon’s-seal	Wood vetch
Hairy wood-rush	Common cow-wheat	Wood spurge
Hard shield fern	Early dog-violet	Wood speedwell
Hard fern	Early-purple orchid	Wood anemone
Hart’s-tongue fern*	Goldenrod	Wood-sorrel
Hay-scented buckler fern	Goldilocks buttercup	Woodruff
Lemon-scented fern	Greater butterfly orchid	Yellow archangel
Narrow buckler fern	Greater burnet-saxifrage	Yellow pimpernel
Pale sedge	Green hellebore	Trees and Shrubs
Pendulous sedge*	Herb-paris	Alder buckthorn
Remote sedge	Ivy-leaved bellflower	Aspen
Scaly male fern	Lady orchid	Bilberry
Smooth-stalked sedge	Large bitter-cress	Black currant*
Soft shield fern	Lesser skullcap	Butcher’s-broom
Southern wood-rush	Lily-of-the-valley*	Crab apple*
Thin-spiked wood sedge	Marsh violet	Field maple*
Wood melick	Moschatel	Field rose
Wood meadow-grass	Narrow-leaved everlasting-pea	Guelder-rose
Wood small-reed	Nettle-leaved bellflower	Holly
Wood sedge	Opposite-leaved golden saxifrage	Hornbeam*
Wood millet	Orpine	Midland hawthorn
Wood club-rush	Pignut	Red currant*
Wood horsetail	Primrose*	Sessile oak*
Wild flowers	Ramsons	Small-leaved lime*
Allseed	Sanicle	Wild cherry
Barren strawberry	Saw-wort	Wild service tree
Betony	Slender St John’s-wort	Wych elm
Bird’s-nest orchid	Small teasel	
Bitter vetch	Spurge-laurel	

* Only where these species occur well within a wood and do not appear to have been planted.

⁶⁰ NCC’s South East region comprised Kent, Surrey, Sussex, London and Hertfordshire. See Hornby & Rose (1986)

Appendix 1b: Percentage occurrence in the West Sussex sites surveyed of ancient woodland vascular plant ‘indicator species’ in the South East (400 separate sites were surveyed)

Latin Name	Common Name	No. sites	% of sites
Bluebell	<i>Hyacinthoides non-scripta</i>	333	83.25
Holly	<i>Ilex aquifolium</i>	307	76.75
Field Maple	<i>Acer campestre</i>	208	52
Pendulus Sedge	<i>Carex pendula</i>	173	43.25
Primrose	<i>Primula vulgaris</i>	171	42.75
Wood-Sedge	<i>Carex sylvatica</i>	167	41.75
Remote Sedge	<i>Carex remota</i>	138	34.5
Wood Anemone	<i>Anemone nemorosa</i>	121	30.25
Wood Melick	<i>Melica uniflora</i>	119	29.75
Yellow Archangel	<i>Lamiastrum galeobdolon</i>	114	28.5
Wood Speedwell	<i>Veronica montana</i>	106	26.5
Hart's-Tongue	<i>Phyllitis scolopendrium</i>	96	24
Red Currant	<i>Ribes rubrum</i>	87	21.75
Black Bryony	<i>Tamus communis</i>	87	21.75
Wood-Sorrel	<i>Oxalis acetosella</i>	83	20.75
Butcher's-Broom	<i>Ruscus aculeatus</i>	80	20
Moschatel	<i>Adoxa moschatellina</i>	73	18.25
Hard Shield-Fern	<i>Polystichum aculeatum</i>	72	18
Wood Spurge	<i>Euphorbia amygdaloides</i>	69	17.25
Wild Cherry	<i>Prunus avium</i>	67	16.75
Three-Nerved Sandwort	<i>Moebringia trinervia</i>	65	16.25
Hornbeam	<i>Carpinus betulus</i>	64	16
Barren Strawberry	<i>Potentilla sterilis</i>	64	16
Ramsons	<i>Allium ursinum</i>	52	13
Hairy Wood-Rush	<i>Luzula pilosa</i>	47	11.75
Hard Fern	<i>Blechnum spicant</i>	44	11
Yellow Pimpernel	<i>Lysimachia nemorum</i>	43	10.75
Wood Millet	<i>Milium effusum</i>	42	10.5
Sanicle	<i>Sanicula europaea</i>	40	10
Midland Hawthorn	<i>Crataegus laevigata</i>	39	9.75
Scaly Male Fern	<i>Dryopteris affinis</i>	38	9.5
Stinking Iris	<i>Iris foetidissima</i>	31	7.75
Pignut	<i>Conopodium majus</i>	31	7.75
Box	<i>Buxus sempervirens</i>	30	7.5
Opposite-Leaved Golden-Saxifrage	<i>Chryso-splenium oppositifolium</i>	28	7
Field Rose	<i>Rosa arvensis</i>	27	6.75
Spurge-Laurel	<i>Daphne laureola</i>	25	6.25
Guelder-Rose	<i>Viburnum opulus</i>	22	5.5
Bush Vetch	<i>Vicia sepium</i>	21	5.25
Narrow Buckler-Fern	<i>Dryopteris carthusiana</i>	20	5
Tutsan	<i>Hypericum androsaemum</i>	19	4.75
Narcissus pseudonarcissus	<i>Narcissus pseudonarcissus</i>	19	4.75
Hairy Brome	<i>Bromopsis ramosa</i>	19	4.75
Early Dog-Violet	<i>Viola reichenbachiana</i>	18	4.5
Crab Apple	<i>Malus sylvestris</i>	18	4.5

Latin Name	Common Name	No. sites	% of sites
Wild Service-Tree	<i>Sorbus torminalis</i>	17	4.25
Small-Leaved Lime	<i>Tilia cordata</i>	17	4.25
Bilberry	<i>Vaccinium myrtillus</i>	17	4.25
Slender St. John's-Wort	<i>Hypericum pulchrum</i>	15	3.75
Great Wood-Rush	<i>Luzula sylvatica</i>	15	3.75
Early-Purple Orchid	<i>Orchis mascula</i>	15	3.75
Goldilocks Buttercup	<i>Ranunculus auricomus</i>	14	3.5
Soft Shield-Fern	<i>Polystichum setiferum</i>	13	3.25
Wood Vetch	<i>Vicia sylvatica</i>	12	3
Creeping Soft-Grass	<i>Holcus mollis</i>	11	2.75
Aspen	<i>Populus tremula</i>	11	2.75
Lily of The Valley	<i>Convallaria majalis</i>	10	2.5
Solomon's-Seal	<i>Polygonatum multiflorum</i>	9	2.25
Sessile Oak	<i>Quercus petraea</i>	9	2.25
Woodruff	<i>Galium odoratum</i>	7	1.75
Violet Helleborine	<i>Epipactis purpurata</i>	7	1.75
Giant Fescue	<i>Festuca gigantea</i>	7	1.75
Betony	<i>Stachys officinalis</i>	7	1.75
Nettle-Leaved Bellflower	<i>Campanula trachelium</i>	6	1.5
Black Currant	<i>Ribes nigrum</i>	6	1.5
Alder Buckthorn	<i>Frangula alnus</i>	6	1.5
Wood Meadow-Grass	<i>Poa nemoralis</i>	5	1.25
Thin-Spiked Wood-Sedge	<i>Carex strigosa</i>	5	1.25
Columbine	<i>Aquilegia vulgaris</i>	5	1.25
Broad-Leaved Helleborine	<i>Epipactis helleborine</i>	5	1.25
Wood Club-Rush	<i>Scirpus sylvaticus</i>	2	0.5
Toothwort	<i>Lathraea squamaria</i>	2	0.5
Smooth-Stalked Sedge	<i>Carex laevigata</i>	2	0.5
Intermediate Polypody	<i>Polypodium interjectum</i>	2	0.5
Common Cow-Wheat	<i>Melampyrum pratense</i>	2	0.5
Pale St. John's-Wort	<i>Hypericum montanum</i>	1	0.25
Orpine	<i>Sedum telephium</i>	1	0.25
Lemon-Scented Fern	<i>Oreopteris limbosperma</i>	1	0.25
Large Bitter-Cress	<i>Cardamine amara</i>	1	0.25
Hay-Scented Buckler-Fern	<i>Dryopteris aemula</i>	1	0.25
Greater Butterfly-Orchid	<i>Platanthera chlorantha</i>	1	0.25
Bitter-Vetch	<i>Lathyrus linifolius</i>	1	0.25

Appendix 2: Summary of findings from the woodland survey work

Feature type	% of sites
Damage	64
Significant presence of invasive species	25
Rubbish	20
Heavy recreation	16
Grazing	14
Garden Waste/Planting	13
Other localised damage	7
Gardenization	6
Browsing	5
Physical boundary features	89
Bank & ditch at boundary	51
Bank without ditch at boundary	43
Other feature at boundary (stream, walls, fences, houses etc)	41
Track at boundary	33
Ditch at boundary	19
Physical internal features	72
Pits	40
Track running through wood	25
Internal bank	21
Internal bank & ditch	17
Internal ditch	15
Built structures	13
Mounds	7
Saw pits	2
Charcoal hearths	1
Living features (qualify age)	14
Other notable trees	7
Veteran coppice stools	3
Boundary stubs	3
Old outgrown hedges	2
Pollards	1
Current management activities	25
Felling	14
Planting in wood	13
Recent coppicing	2
Woodland Structure	91
Coppice with standards	33
Immature, scrub or no clear structure	30
Conifer plantation	17
Broadleaf plantation	16
High forest	16
Coppice	12

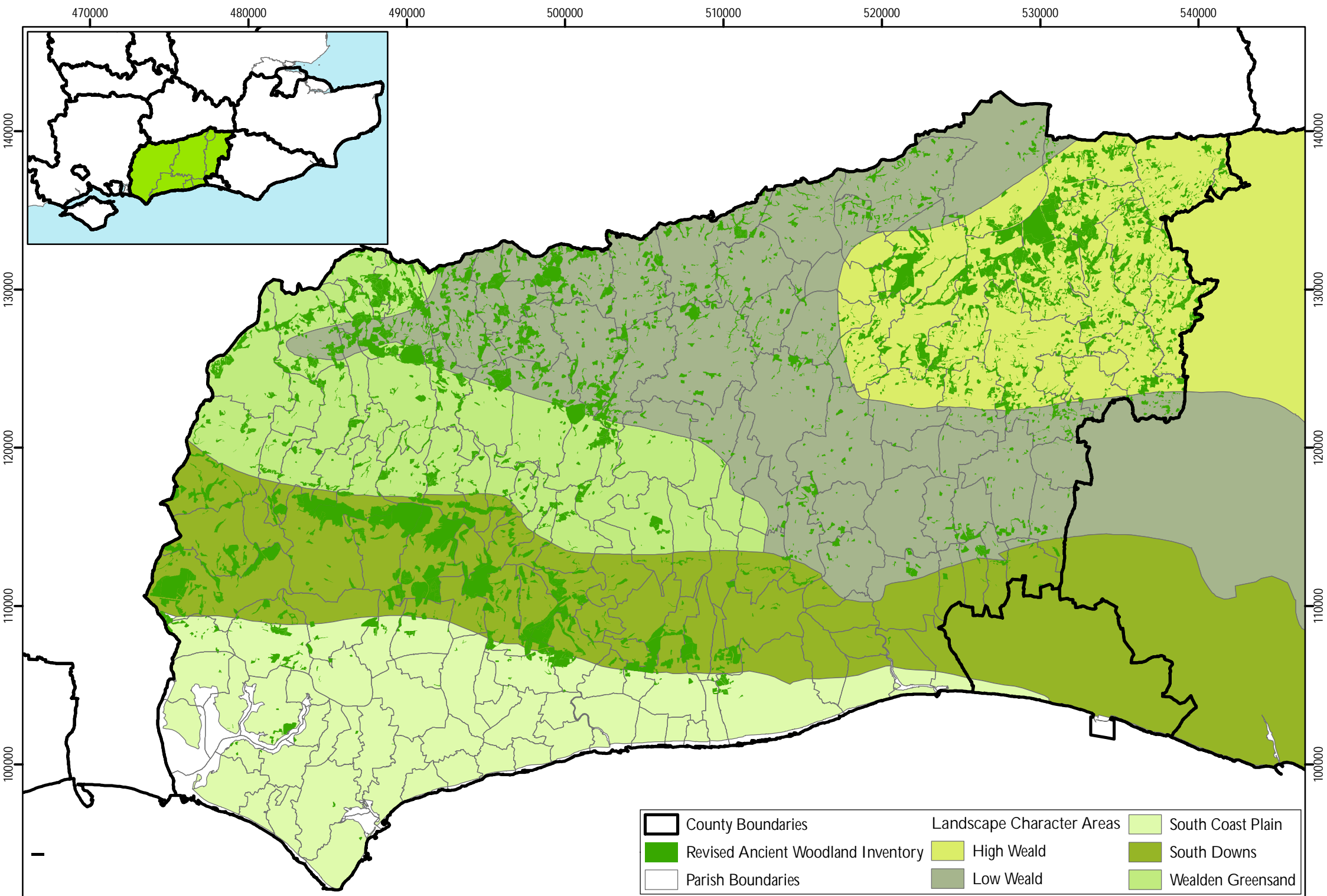
Appendix 3: Summary of findings for the districts and boroughs of West Sussex

	Area in hectares	% of the District	Number of woodland parcels	Average area of woodland parcel
Adur	4,355			
All woodlands (NIWT) >2 ha	72.20	1.66	11	6.56
First digitized AWI (woods >2ha)	1.66	0.44	1	1.66
Revised AWI (including woods <2ha)	5.24	0.12	2	2.62
Overall ancient woodland gain – compared to first digitized AWI (2000)	3.58	0.32	1	
	Area in hectares	% of the District	Number of woodland parcels	Average area of woodland parcel
Arun	22,796			
All woodlands (NIWT) >2 ha	3,204	14.07	88	36.41
First digitized AWI (woods >2ha)	1,730	7.60	64	27.04
Revised AWI (including woods <2ha)	1,998	8.78	117	17.16
Overall ancient woodland gain – compared to first digitized AWI (2000)	268	1.18	53	
	Area in hectares	% of the District	Number of woodland parcels	Average area of woodland parcel
Chichester	81,406			
All woodlands (NIWT) >2 ha	19,722	24.23	475	41.52
First digitized AWI (woods >2ha)	9,072	11.14	451	20.12
Revised AWI (including woods <2ha)	10553	12.96	864	12.24
Overall ancient woodland gain – compared to first digitized AWI (2000)	1,481	1.82	387	
	Area in hectares	% of the Borough	Number of woodland parcels	Average area of woodland parcel
Crawley	4,497			
All woodlands (NIWT) >2 ha	438.86	9.76	33	13.30
First digitized AWI (woods >2ha)	123.89	34.86	15	8.26
Revised AWI (including woods <2ha)	191.50	4.26	75	2.59
Overall ancient woodland gain – compared to first digitized AWI (2000)	67.61	1.50	51	

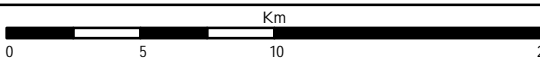
	Area in hectares	% of the District	Number of woodland parcels	Average area of woodland parcel
Horsham	53,096			
All woodlands (NIWT) >2 ha	7,146	13.46	490	14.58
First digitized AWI (woods >2ha)	2,429	4.58	206	11.79
Revised AWI (including woods <2ha)	3,243	6.01	635	5.11
Overall ancient woodland gain – compared to first digitized AWI (2000)	762	1.43	388	
	Area in hectares	% of the District	Number of woodland parcels	Average area of woodland parcel
Mid Sussex	33,402			
All woodlands (NIWT) >2 ha	7,375	22.08	360	20.49
First digitized AWI (woods >2ha)	4,220	12.63	265	15.93
Revised AWI (including woods <2ha)	5,289	15.85	929	5.69
Overall ancient woodland gain – compared to first digitized AWI (2000)	1,069	3.20	664	10.24
	Area in hectares	% of the District	Number of woodland parcels	Average area of woodland parcel
Worthing	3,496			
All woodlands (NIWT) >2 ha	140.05	4.01	11	12.73
First digitized AWI (woods >2ha)	50.56	5.18	8	6.32
Revised AWI (including woods <2ha)	67.47	1.93	11	6.13
Overall ancient woodland gain – compared to first digitized AWI (2000)	16.91	0.48	3	

Maps

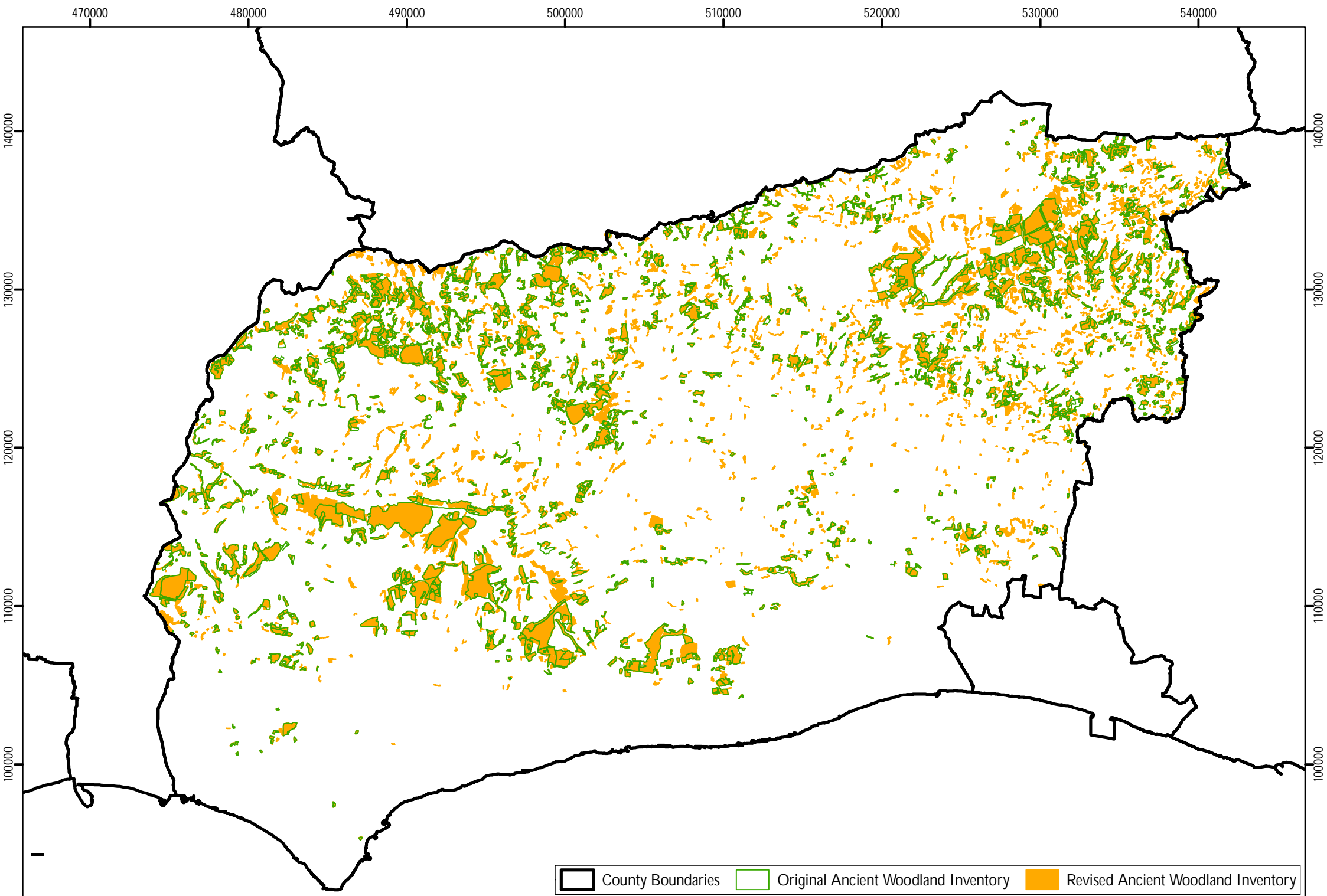
- Map 1: Location of West Sussex in the SE region showing Character Areas
- Map 2: Comparison of the Ancient Woodland Inventories for West Sussex
- Map 3: Comparison of planted and semi natural ancient woodland
- Map 4: The revised inventory for West Sussex – overview and index sheet
- Map 5: The revised inventory for West Sussex – north west
- Map 6: The revised inventory for West Sussex – north
- Map 7: The revised inventory for West Sussex – north east
- Map 8: The revised inventory for West Sussex – mid west
- Map 9: The revised inventory for West Sussex – mid
- Map 10: The revised inventory for West Sussex – mid east
- Map 11: The revised inventory for West Sussex – south west
- Map 12: The revised inventory for West Sussex – south
- Map 13: The revised inventory for West Sussex – south east



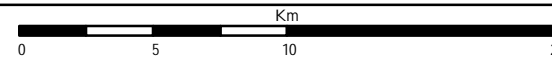
Map 1: The location of West Sussex in the South East showing Landscape Character Areas



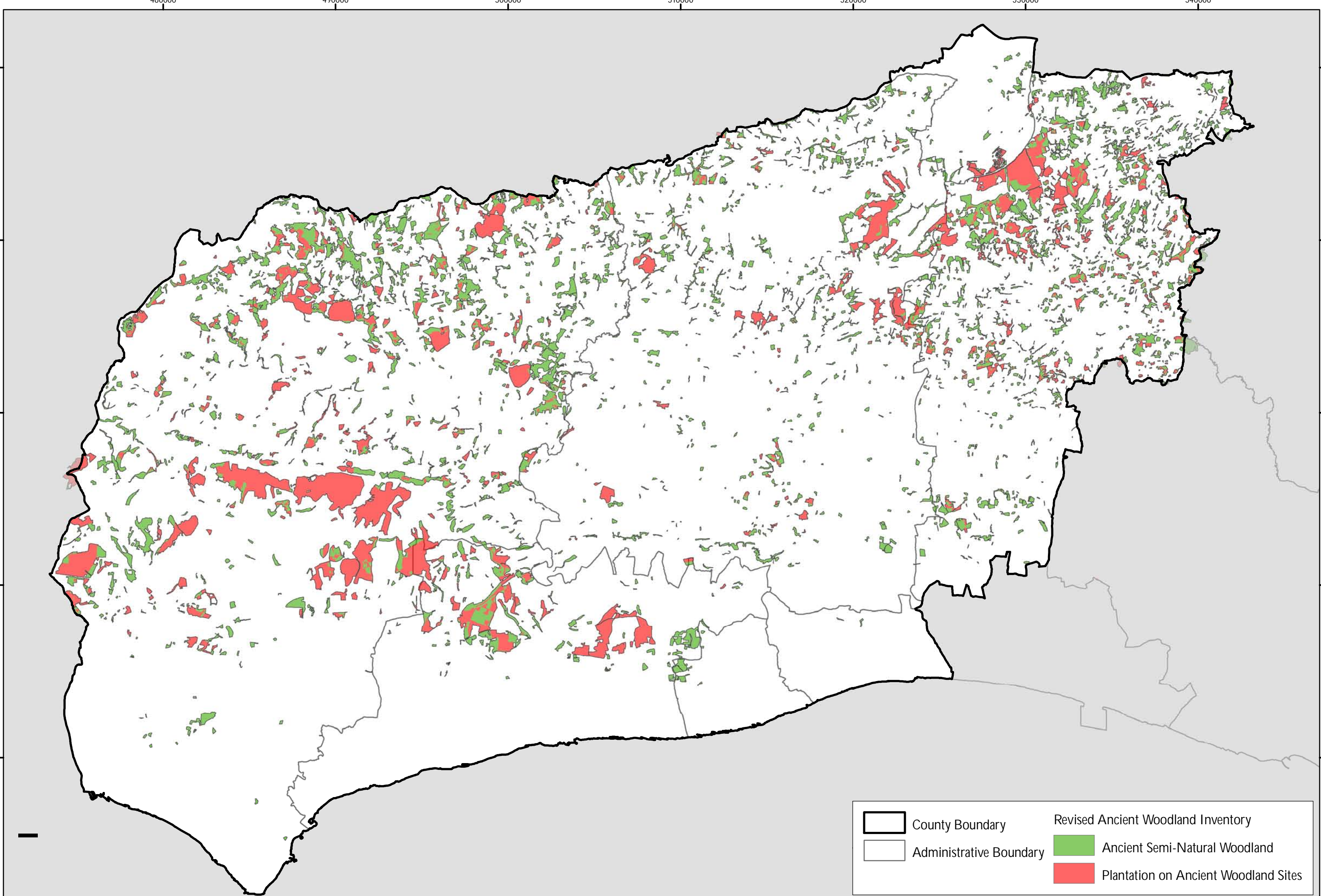
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Map 2: Comparison of the Ancient Woodland Inventories for West Sussex

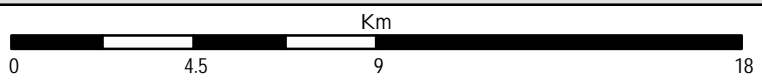


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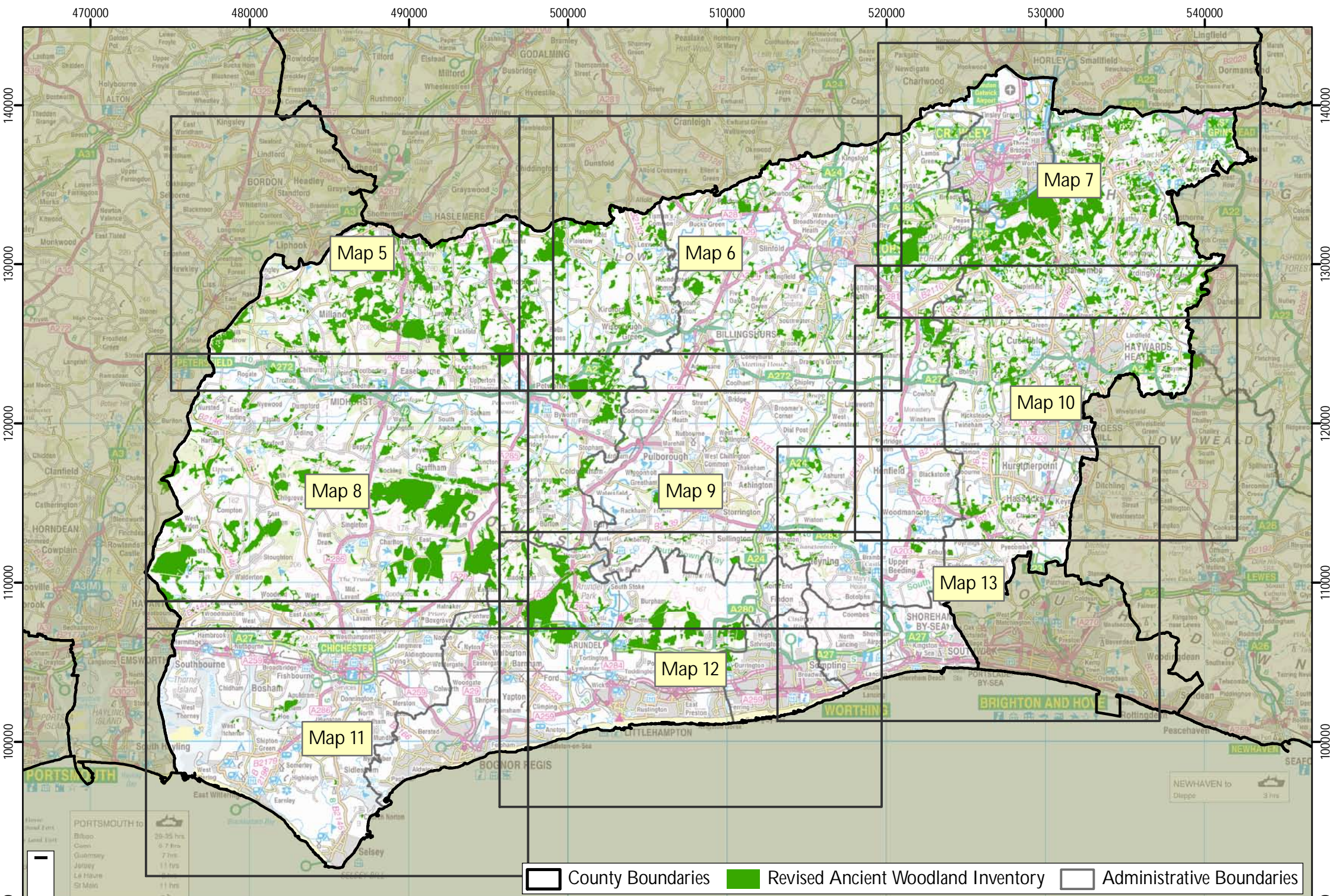


Map 3: Comparison of planted and semi natural ancient woodland

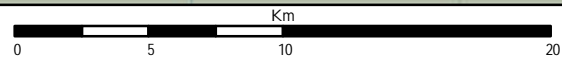
	County Boundary		Ancient Semi-Natural Woodland
	Administrative Boundary		Plantation on Ancient Woodland Sites
		Revised Ancient Woodland Inventory	



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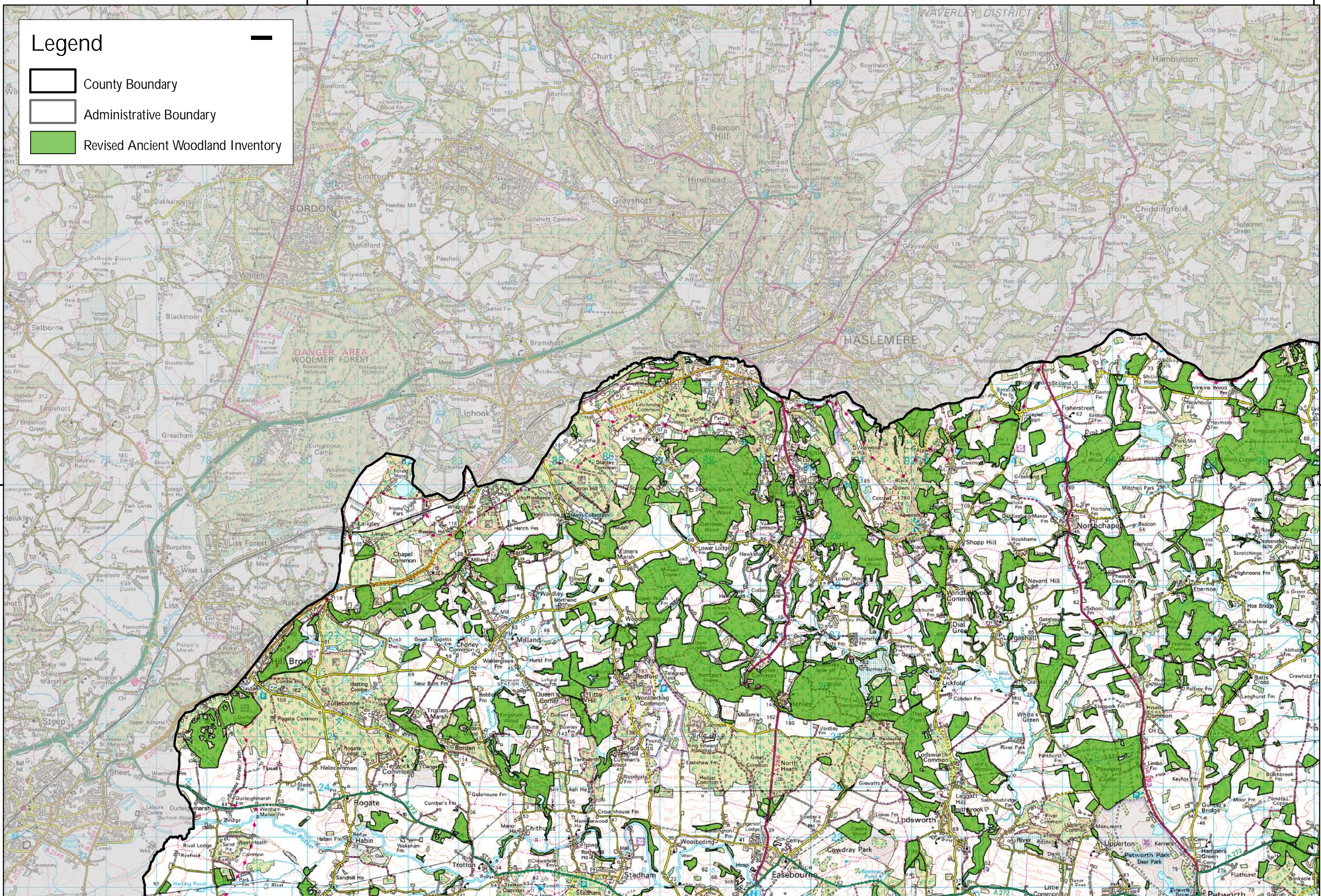
Map 4: The Revised Inventory for West Sussex: Overview and Index Sheet



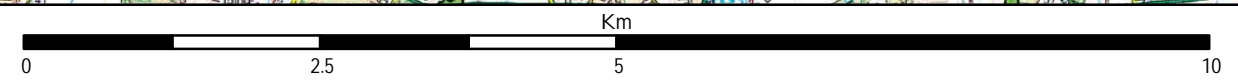
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Legend

-  County Boundary
-  Administrative Boundary
-  Revised Ancient Woodland Inventory



Map 5: The revised Ancient Woodland Inventory - North West






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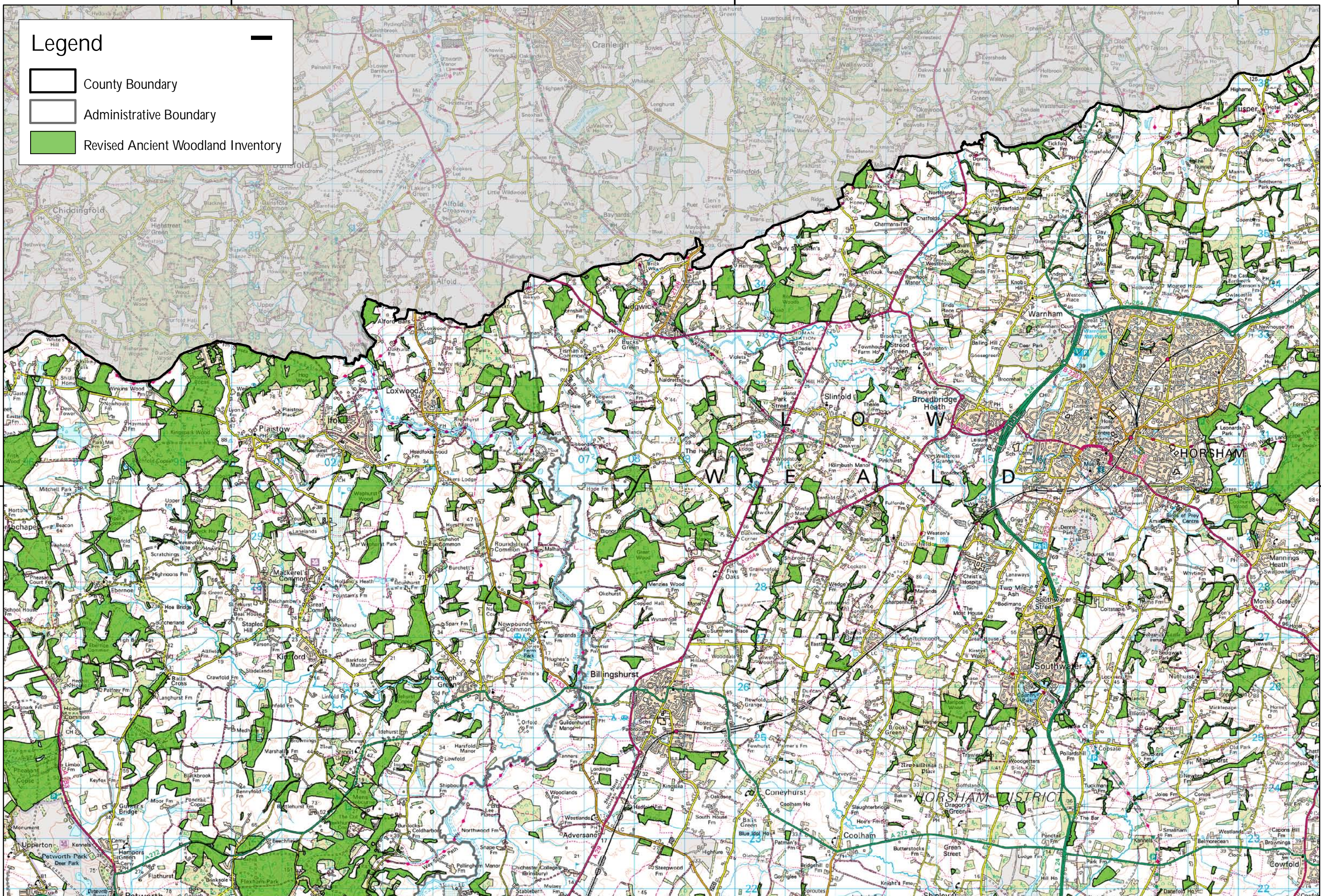
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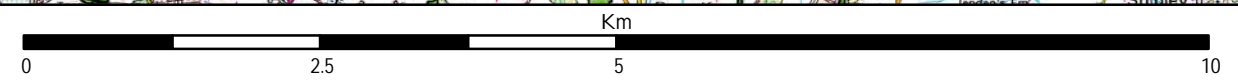
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Legend

-  County Boundary
-  Administrative Boundary
-  Revised Ancient Woodland Inventory



Map 6: The revised Ancient Woodland Inventory - North






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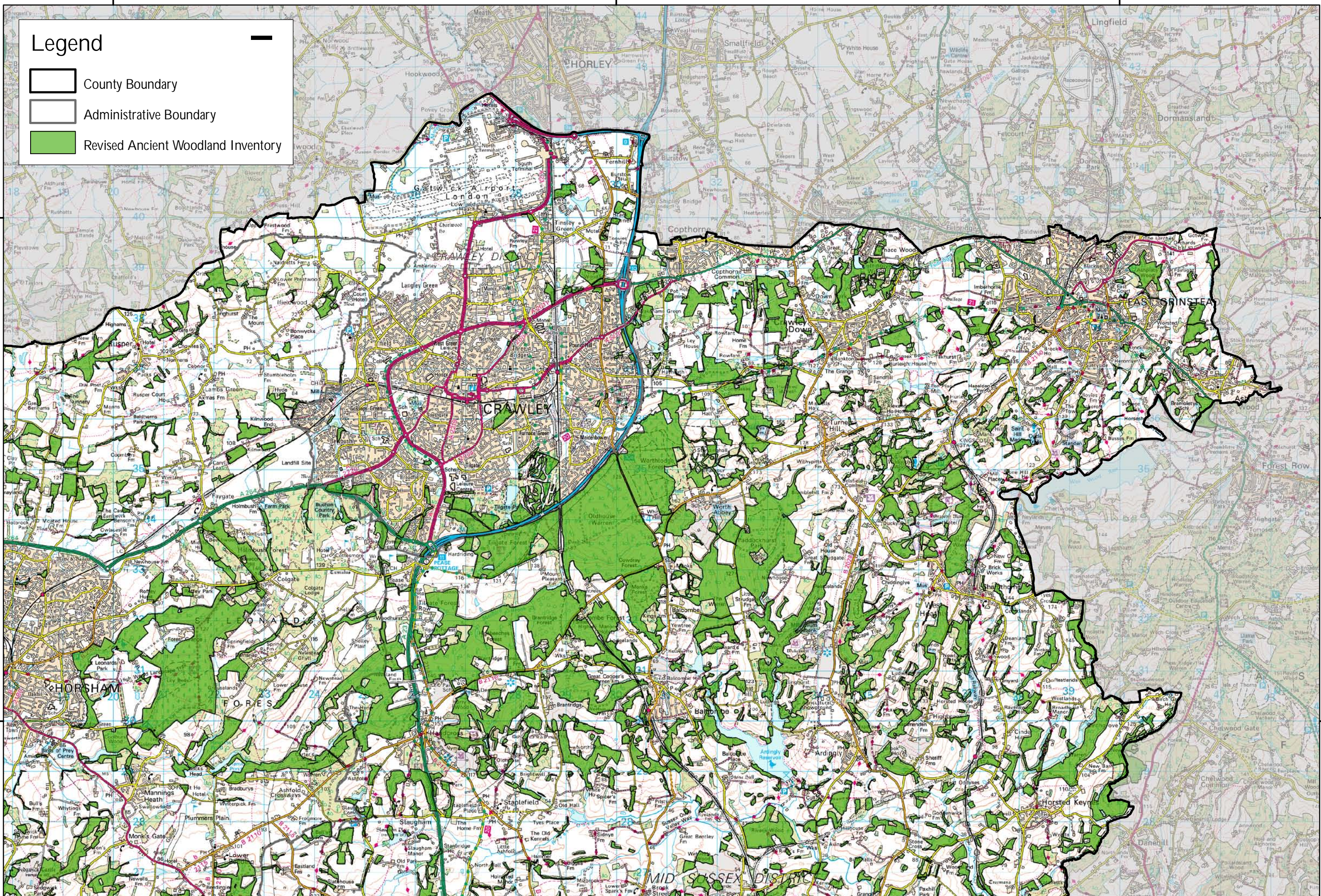
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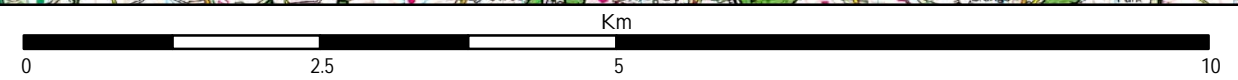
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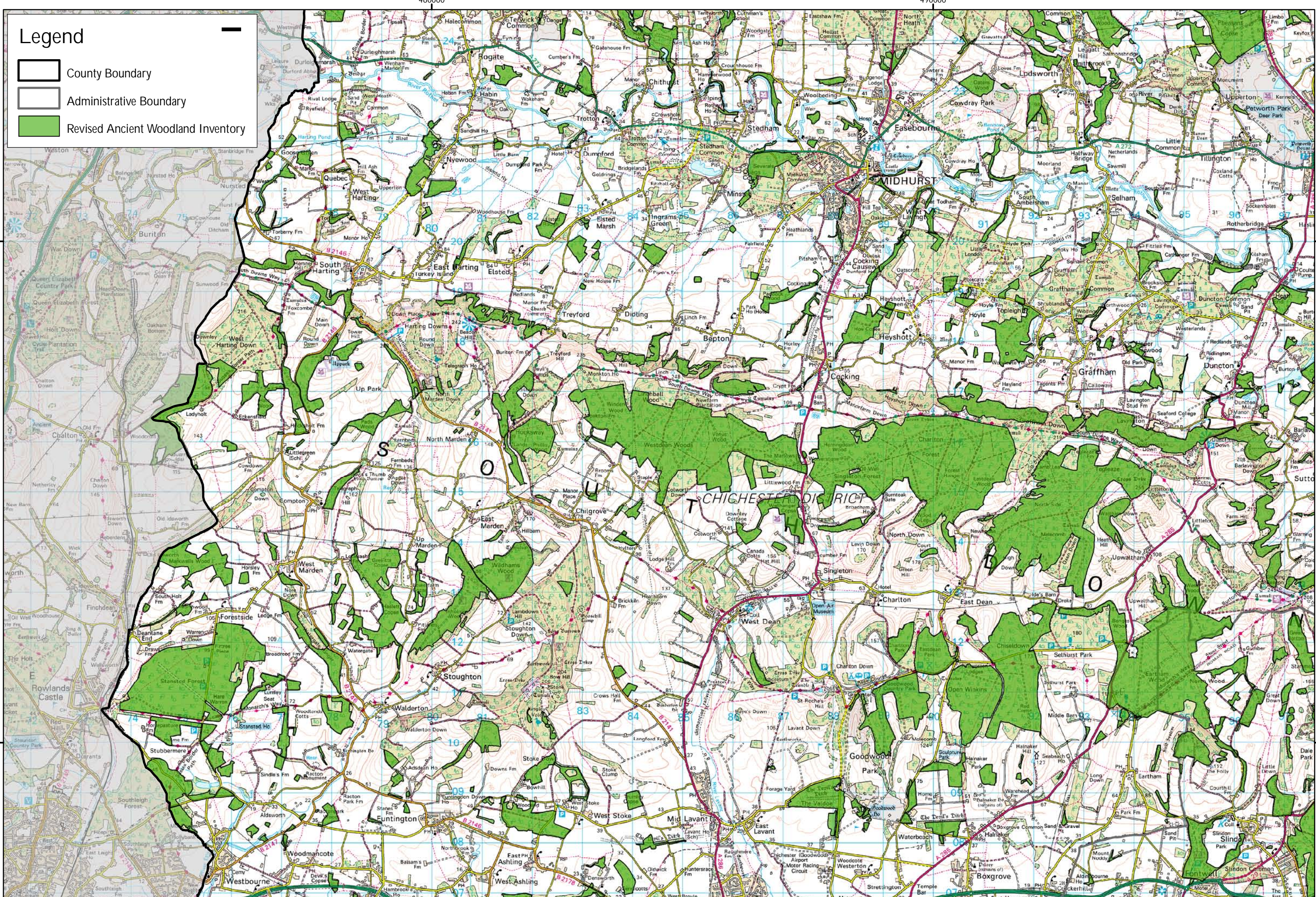
-  County Boundary
-  Administrative Boundary
-  Revised Ancient Woodland Inventory



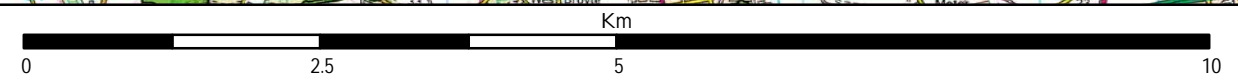
Map 7: The revised Ancient Woodland Inventory - North East



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Map 8: The revised Ancient Woodland Inventory - Mid West



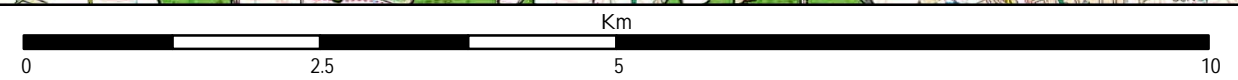
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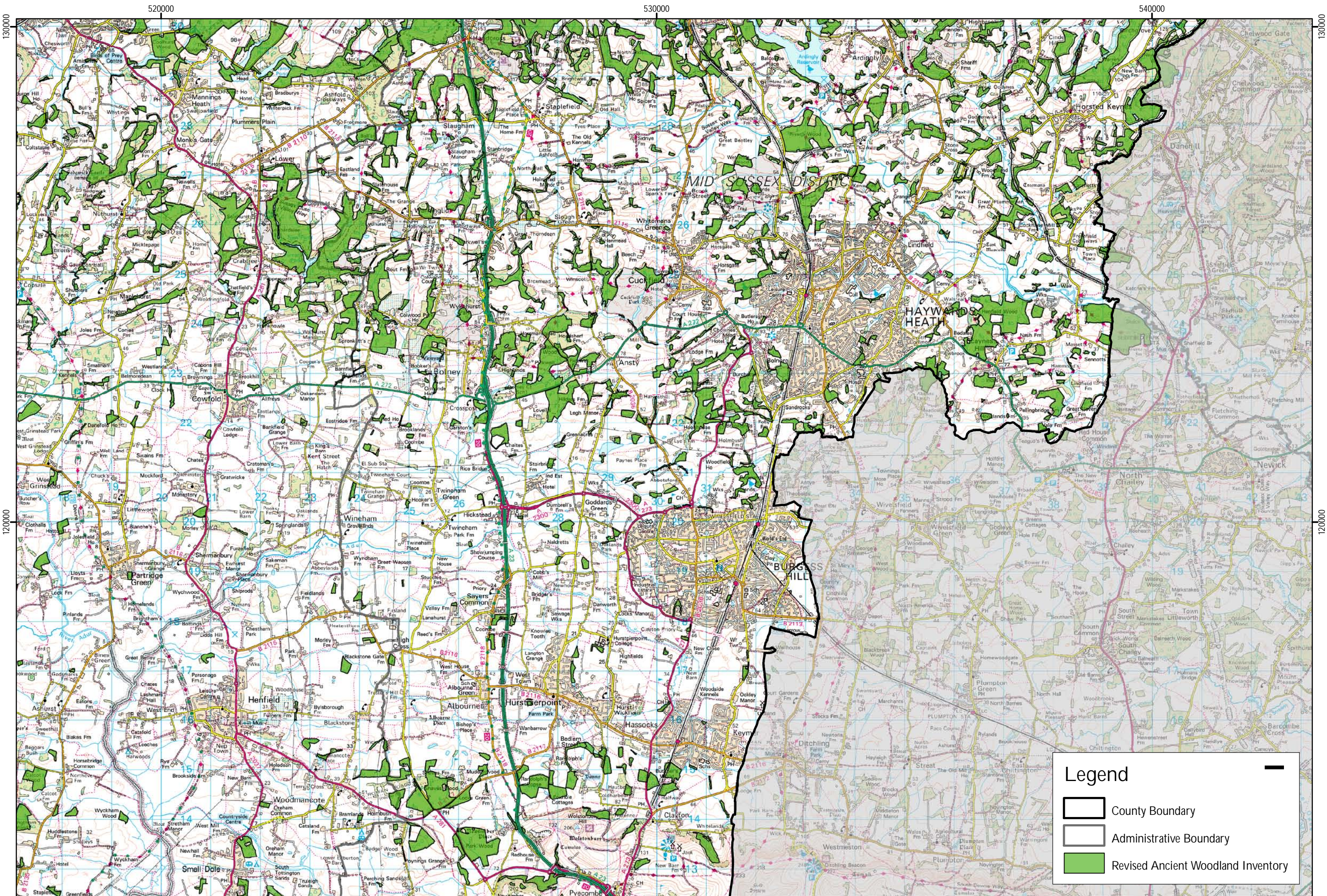
Legend

-  County Boundary
-  Administrative Boundary
-  Revised Ancient Woodland Inventory

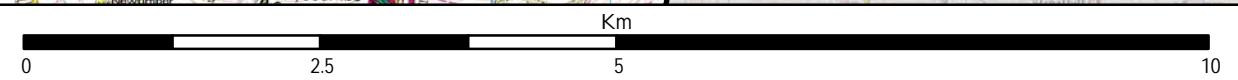
Map 9: The revised Ancient Woodland Inventory - Mid



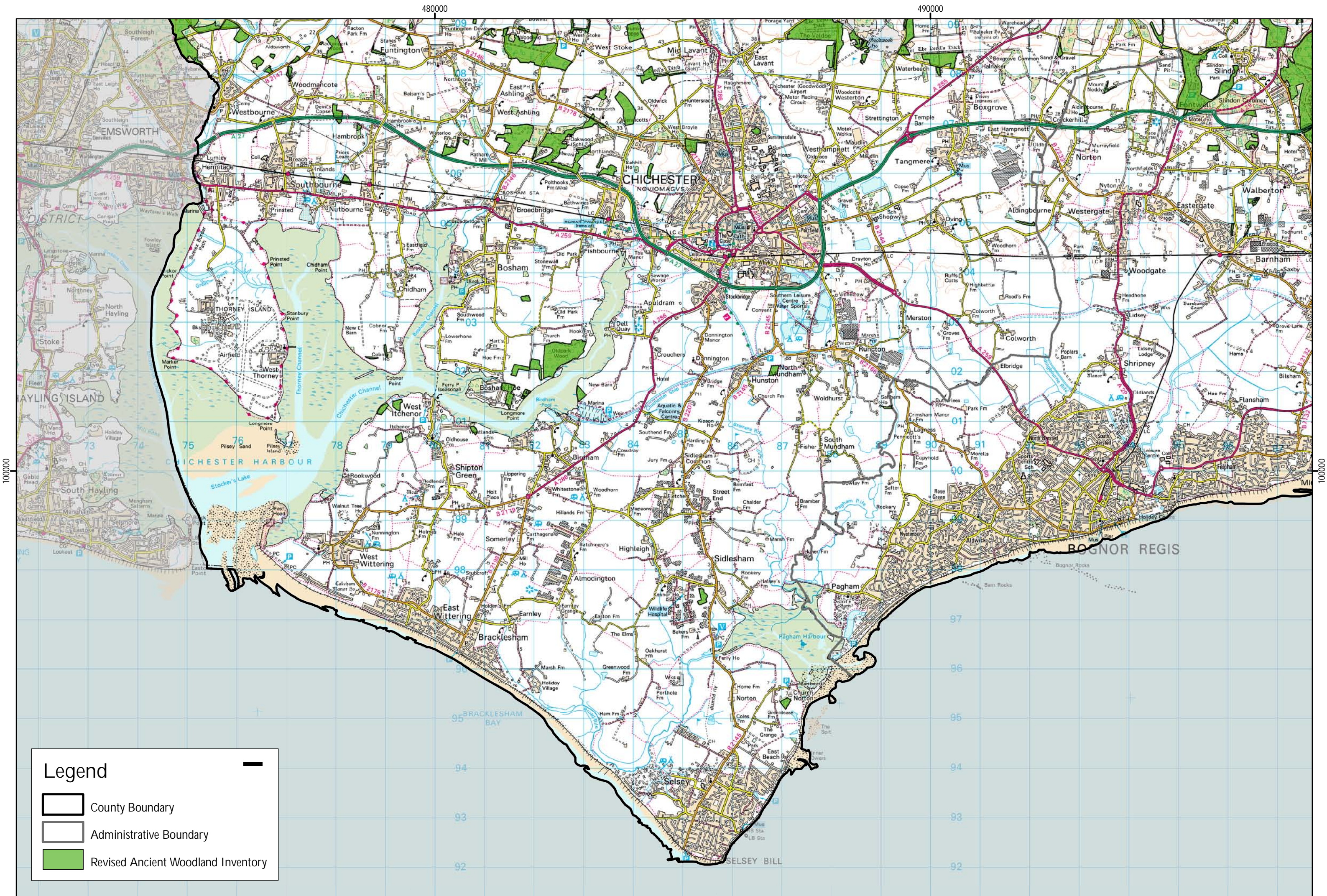
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Map 10: The revised Ancient Woodland Inventory - Mid East



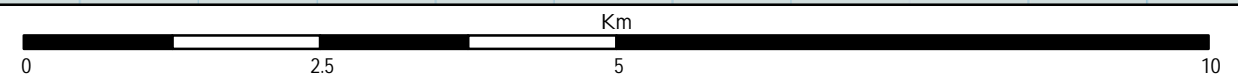
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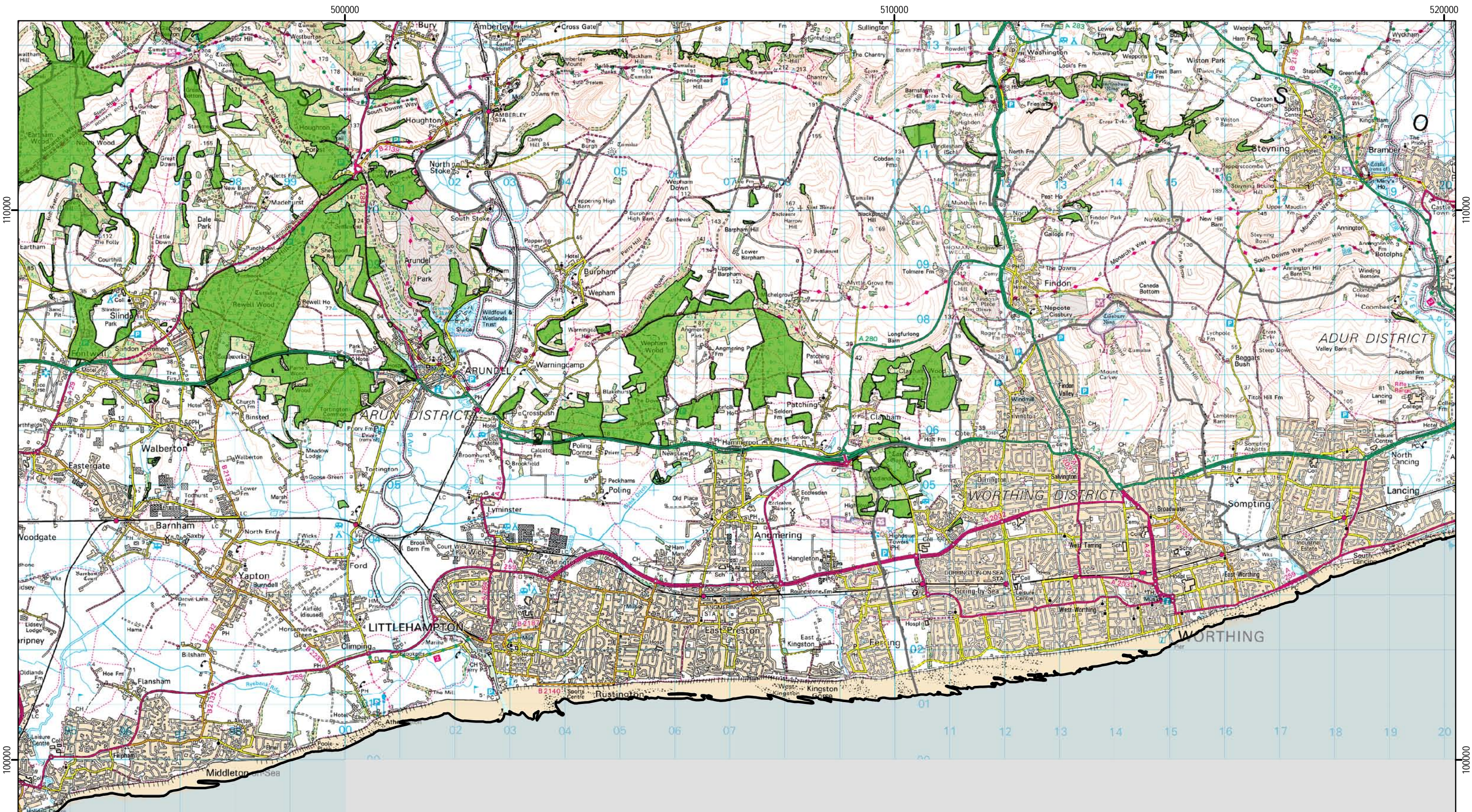
Legend

-  County Boundary
-  Administrative Boundary
-  Revised Ancient Woodland Inventory




Map 11: The revised Ancient Woodland Inventory - South West



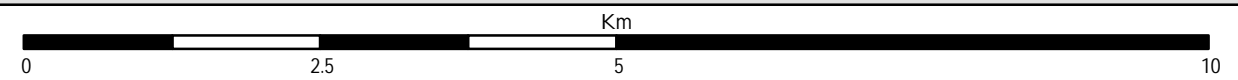
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Legend

-  County Boundary
-  Administrative Boundary
-  Revised Ancient Woodland Inventory




Map 12: The revised Ancient Woodland Inventory - South



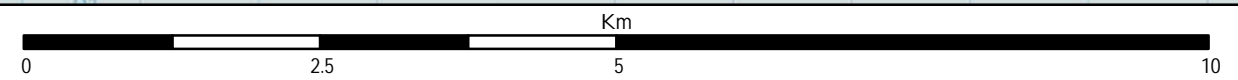
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Legend

-  County Boundary
-  Administrative Boundary
-  Revised Ancient Woodland Inventory

Map 13: The revised Ancient Woodland Inventory - South East



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WEALD AND DOWNS
ANCIENT WOODLAND SURVEY

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contributions from Philip Sansum and Sally Westaway,
Weald and Downs Ancient Woodland Survey, and Patrick
McKernan, Natural England/ Forestry Commission

For information concerning the Weald and Downs Ancient Woodland
Survey contact Patrick McKernan, Natural England/ Forestry Commission
e-mail: patrick.mckernan@naturalengland.org.uk

The Weald and Downs Ancient Woodland
Survey for West Sussex hosted by:

Sussex Biodiversity Record Centre
Woods Mill
Henfield
West Sussex BN5 9SD
Tel: 01273 497553
www.sxbrc.org.uk

*Front cover photograph: Ancient woodland near West Hoathly, West Sussex
(photograph © Patrick McKernan, Natural England/ Forestry Commission)*

