Natural England Commissioned Report NECR248

Ancient Woodland Inventory Handbook for England

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NATURAL ENGLAND

Foreword

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

Background

The compilation of the Ancient Woodland Inventory in the 1980s was a landmark achievement for the conservation of British woodland. However, the work had its origins in the period before computer mapping became routinely used and the need to modernise and update the inventory has become increasingly apparent in recent years.

The majority of the south east counties were updated, in a pilot project, between 2006 and 2014 using this methodology, and included smaller woods for the first time, dropping the threshold to 0.25 hectares from the previously mapped two hectares threshold. This technical handbook was commissioned to set out the methodology currently adopted by Natural England in updating the ancient woodland inventory. It will provide a useful resource for undertaking systematic updates of the inventory and will help to improve the ancient woodland inventory as a conservation tool.

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Further information
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A handbook for updating the Ancient Woodland Inventory for England

P. Sansum & N.R. Bannister

Acknowledgements

This handbook is based on approaches to revising the ancient woodland inventory that were piloted in heavily wooded parts of Southeast England under the auspices of a partnership led by Natural England and the Forestry Commission and hosted by the High Weald AONB Unit in East Sussex. Here Patrick McKernan (Natural England) and Sally Marsh (High Weald AONB) worked with local authority staff to establish a programme of ancient woodland identification, mapping and survey which responded to the pressing need for more spatially precise and historically accurate environmental information in planning bodies. Their commitment to driving forward this agenda has paved the way for the further major revisions to the ancient woodland inventory that the guidance in this handbook aims to support. The pilot methodology was initially developed and refined by project officers such as Matthew Grose and Sally Westaway with the support of Sussex Biodiversity Record Centre before being rolled out to a number of counties.

Initiatives to refine the approach to ancient woodland and wood-pasture identification or mapping elsewhere in England - in particular work at Sheffield Hallam University sponsored by the Woodland Trust and work in Herefordshire and in Dorset - have also been important influences on devising a consistently applicable framework for future work planned by Natural England and its partners and these projects are acknowledged directly by citation in the text.

The authors of this document are grateful to the following individuals and organisations who either helped to provide suitable maps and data to illustrate it or granted permission for such material to be reproduced (sometimes waiving or reducing fees): Jackie Brown (The British Library); Peter Dudley (Cornwall Archaeological Unit); Ian Killick (United Kingdom Hydrographic Office); Sally Marsh (High Weald AONB Unit); Adam Mindykowski (Worcestershire Archive & Archaeology Service); Chris Mullen (www.fulltable.com); Julian Pooley (Surrey History Centre); Hannah Ross & Paul Dutton (Natural England); Deborah Saunders (Kent County Council Archives); David Thomas, Claire Wardle & Katrina Griffiths (Cornwall Record Office); Christopher Whittick & Jenny Geering (East Sussex Record Office).

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Foreword

This technical handbook sets out the methodology used by Natural England to update the ancient woodland inventory. This methodology was developed during the south east ancient woodland revision project. The authors are experts in ancient woodland, wood pasture and parkland.

It provides a clear and consistent methodology for updates, so that the inventory can be systematically updated by Natural England and partners, and for others to understand and apply the methodology. Natural England is planning a major revision programme over the next few years, which will result in a more robust inventory.

The majority of the south east counties were updated from 2006 through to 2014 using this methodology, and included smaller woods for the first time, dropping the threshold to 0.25 from the previously mapped two hectares threshold. This has been made possible through the accessibility of historic maps, although the interpretation of historic maps must be considered as part of the methodology; especially some of the smaller woods may or may not be included on historic maps. The report outlines these in more detail in section 5.2.1.

Other parts of the country outside of the south east project may not have been reviewed since the inventory was compiled in the 1980s. Since then, technological advances in geographic information systems and the availability and understanding of historic maps and understanding of ancient woodland have all improved. A revision, including smaller sites, will increase the confidence in the data, as well as capturing losses since that time.

The update will also try to capture historic wood pasture sites, which were not included consistently on the original ancient woodland inventory. They will be captured in a separate layer. This report includes a summary of how wood pasture sites can be recognised in section 3.3.3.3 and 6.1.4.

Natural England has always acknowledged the provisional nature of the ancient woodland inventory, and will assess new evidence relating to individual woods, where challenges arise. This handbook is not aimed at outlining the process for assessing individual sites. It is targeted towards projects aimed at refining the inventory over larger areas. However, some of the information contained in chapter 6 (stage 4 of the process) and the case studies, will be useful in making such assessments. The further guidance section (3.3.3) and figure 6, contain useful examples of different depictions of woods on different maps.

This handbook should help to improve the ancient woodland inventory as a conservation tool.

Contents

1 INTRODUCTION

Natural England is keen to enhance the accuracy and precision of the Ancient Woodland Inventory (AWI) across England using new technology and a more robust evidence base than was available when the inventory was initiated. This is a large task and the validity and consistency of its outcomes will depend on certain common approaches being applied to the different wooded landscapes across the country.

1.1 WHAT IS ANCIENT WOODLAND?

English woods are today routinely grouped into two categories, 'ancient woodland' and 'recent woodland'. This distinction follows the pioneering work on historical woodland ecology by George Peterken, Oliver Rackham and others in the 1970s and 1980s. A body of research formed (and that continues to expand) which demonstrated a range of irreplaceable ecological and cultural features and processes supported by old, especially, ancient, woods and woods of long habitat continuity (as opposed to woods of more recent origin or those with weaker continuity of habitat conditions). The distinction between ancient and recent woodland is now well established as a useful one and the concept of 'ancient woodland' has come to be embedded in national forestry, planning and nature conservation policy (Goldberg *et al.* 2007, 2011, Goldberg 2015). The term 'ancient woodland' does not represent any particular type of vegetation, nor is it defined explicitly by its ecological or cultural features, but rather encapsulates a broad legacy of characteristically rich, interesting and valuable wooded habitats.

1.1.1 ANCIENT WOODLAND DEFINITIONS

The 2014 standing advice document jointly produced by Natural England and the Forestry Commission on ancient woodland and veteran trees gives the definition of ancient woodland which is now well established. Importantly, it also qualifies the scope of the term and its interpretation. Those working to update the AWI should be familiar with these key concepts and keep them in mind throughout the project (see Standing Advice on Ancient Woodland and Veteran Trees.

1.1.2 THE HISTORICAL CONTEXT

Woodland cover and composition in the British Isles has been changing continuously since the last ice age ended over 10,000 years ago. Its long-term development through human interaction with the forest environment has been reviewed by several authors (e.g. Peterken 1981, 2015, Rackham 2003, 2006, Marren 1990, Short 2000, Vera 2000) although not all details are completely understood. There are great differences in the patterns and rates of transformation between regions, even within a small country like England.

In some areas remnants of the original woodland may have survived on steep slopes, difficult soils or uncultivable terrain but ancient woodland is not limited to these places (nor are all such places wooded today). The occurrence of ancient woodland is related to prehistoric and historic patterns of settlement as well as to the root environmental constraints on farming and woodland clearance. Peterken (1981) points out that its modern distribution is 'the fossilised pattern that was produced by the time it became more economic to retain woodland than clear it'. What ancient woodland survives, and where, is influenced by a complex of interacting factors including climate and soil, topography and past land use (Peterken 2015).

As the handbook will explain, the compilation of inventories of ancient woodland must be driven by specific evidence. A general awareness of the local and wider context of long term change in woodland habitats and of the historic and prehistoric use of woods and their settings is however important as a foundation for the interpretation of that evidence.

Many counties have a published archaeological summary describing prehistoric and medieval land use, based on recorded evidence (e.g. Ashbee 2005). These will give valuable background information on the pre-Domesday environment and the evidence for how the landscape may have been used. Summaries of local woodland history found in the reports accompanying the original county-based Ancient Woodland Inventory may also provide a good starting point for users of this handbook seeking background on the historic environment.

Box 1. What is meant by 'Ancient Woodland' for the purposes of the Ancient Woodland Inventory (from Natural England/Forestry Commission England 2014)

- *Ancient woodland in England is defined as an area that has been wooded continuously since at least 1600 AD. If current woodland has been through a long phase in the last 400 years when the land was open and entirely cleared of trees, for example as grassland, heath, moor or arable, then the site is classed as recent woodland. It may still have high value for nature conservation, but it is not ancient woodland.*
- *'Continuously wooded' in the above definition does not require there to have been a continuous physical cover of trees and shrubs across the entirety of a site. Open space, both temporary and permanent, is an important component of woodlands. Habitats such as glades, deer lawns, rides, ponds and streams, as well as gaps created by natural disturbance, and normal forestry such as tree-felling and coppicing may all occur within woodland and add to its diversity. Wood-pastures, even if there is only a thin scatter of trees, can be a distinct form of ancient woodland and may be included on the ancient woodland inventory.*
- *In most, if not all ancient woods, the trees and shrubs have been cut down periodically as part of the management cycle. The time between the felling occurring and the tree canopy being re-established will vary depending on the management regime, and regrowth may be delayed by deer grazing or other factors. Provided that the area has remained as woodland, the stand is still considered ancient. Since it may have been cut over many times in the past, ancient woodland does not necessarily contain very old trees.*
- *Ancient woodland includes both ancient semi-natural woodland and plantations on ancient woodland sites:*

  ***Ancient semi-natural woodland (ASNW)** is where the stands are composed predominantly of trees and shrubs native to the site that do not obviously originate from planting. However, woodlands with small planting of trees native to the site would still be included in this category. The stands may have been managed by coppicing or pollarding in the past or the tree and shrub layer may have grown up by natural regeneration.*

  ***Plantations on ancient woodland sites (PAWS, also known as ancient replanted woodland)**. These are areas of ancient woodland where the former native tree cover has been felled and replaced by planted trees, predominantly of species not native to the site. These will include conifers such as Norway spruce or Corsican pine, and also non-native broadleaves such as sweet chestnut. These sites often retain some ancient woodland features such as soils, ground flora, fungi, and woodland archaeology – and they can respond well to restoration management.*

- *As set out in the NPPG, both ASNW and PAWS are ancient woodland, and thus both types should be treated equally in terms of the protection afforded to ancient woodland in the NPPF.*
- *Wood-pastures, often with populations of veteran trees, are typically associated with parks, areas of present or former common, upland grazed woods, and Royal Forests, or may be part of a Registered Parks and Gardens. Many have not been included on the Ancient Woodland Inventory because their low tree density meant that they did not register as woodland on the historical maps consulted. Where ancient wood-pastures are identified they should receive the same consideration as other forms of ancient woodland.*

1.2 WHAT IS THE ANCIENT WOODLAND INVENTORY?

The Ancient Woodland Inventory (AWI) is an evidence-based tool for the conservation of ancient woodland. It aims to be a "site-by-site listing of probable ancient woods" (Spencer & Kirby 1992) and by its nature is provisional. It was compiled by the NCC between 1981 and 1992 in response to the call for better information about the distribution and size of the ancient woodland resource at a time when it was coming to be acknowledged as an irreplaceable biological and cultural heritage asset. The AWI was originally produced on a county basis with reports and paper maps published as they became available. It has since been digitised to create a national dataset which has been administered by the NCC's successor bodies, English Nature and Natural England. Spencer & Kirby (1992) report on the original nationwide project and Goldberg *et al.* (2007, 2011) and Goldberg (2015) give accounts of the subsequent development of the inventory to date.

1.2.1 WHY DOES THE ANCIENT WOODLAND INVENTORY NEED TO BE UPDATED?

The compilation of the AWI was an extremely valuable process, and a landmark achievement for the conservation of British woodland. However, the work had its origins in the period before computer mapping became routinely used in planning, nature conservation and forest management and this has resulted in a widening gap between the standards of the data and the requirements of its main audience. Although the AWI has since been digitised in order to be more accessible to modern users, the process has introduced new errors and sometimes amplified existing ones. The AWI is today used for purposes that were not foreseen at the time of its original compilation such as determining the outcome of development or woodland management proposals and this can create significant problems for the authorities concerned. Shortcomings and opportunities for enhancement of the dataset can be summarised as follows:

- The availability of evidence to support ancient woodland designation has improved significantly since the 1980s (for example with the photographing of maps and digitisation of archives and their catalogues) but much of this information has yet to be incorporated into the AWI evidence base.
- Techniques for studying woodland history and approaches to the identification of ancient woodland have also developed considerably (partly as a result of the wider recognition of ancient woodland that the AWI helped bring).
- Even on sites where the designation of ancient woodland is beyond doubt the precision with which it is mapped is often insufficient to support the modern uses of the AWI where fine detail is required (e.g. development adjacent to woodland);
- Many of the finer points presented in the original AWI's individual site files were not captured in the existing digital dataset (Forrest 2001, Goldberg 2015) and retrieving the original information underlying decisions to include or exclude sites has become a cumbersome process.
- The omission of most ancient woods less than 2ha in size from the original AWI was a technical necessity rather than conservation policy. Improved mapping technology and evidence availability mean that there is now the capacity to rectify this.
- Similarly most ancient wood-pastures were omitted. Again, improved evidence availability as well as a higher level of understanding of wood-pasture ecology represent an opportunity to extend the AWI's coverage of this habitat.

Rotherham (2011) and Goldberg (2015) review and provide further details of the deficiencies of the current inventory in relation to its modern uses. A systematic review of its precision and accuracy is desirable now that the capacity to do so exists.

1.3 AIMS OF THE HANDBOOK

The handbook outlines the methodology to enable a strategic update of the ancient woodland inventory.

It gives guidance to those embarking on a revision of the AWI for a particular "study area" and a clear framework for approaching the problem, with advice on the level of work and evidence that is required. A "study area" will normally be a county or local authority district or some other sizeable area with a clear accepted boundary like a National Park or AONB. The guidance is not intended to be absolutely prescriptive, but to show what should be regarded as a general standard, based on some common inputs and outputs.

The handbook is a guide to organising and conducting a revision of the whole AWI within a given area not a guide to best practice on how to research individual woods or groups of woods. The quality of the final AWI product will depend on the quality and depth of the research and survey done on the sites considered for inclusion. The handbook should be used in conjunction with other recent guidance on the evaluation of woodland that is relevant to the decision making undertaken in the inventory building process. This is pointed out at appropriate places in the handbook.

There are endless ways of investigating woodland history and the structured guidance in this handbook is not intended to obstruct the development of further tools for more accurately identifying ancient woodland. Following the approach set out will provide a relatively efficient way to significantly improve the accuracy of the existing AWI (both by adding and removing woodland).

There is also useful information on ancient woodland and wood pasture, and interpretation of historic maps which researchers into this field may find helpful.

1.3.1 WHO IS THE HANDBOOK FOR?

The handbook is a technical guide intended to help structure the procedures for updating the AWI, in partnership with Natural England, for a defined study area, or areas, in England.

Users of the handbook should have some familiarity with working with larger datasets and GI systems as well as knowledge of woodland habitats and experience of using maps. Fieldwork should be carried out by suitably qualified surveyors. The component tasks can be divided among a team of individuals based on their personal skills and experience but it is preferable that all members of the team are aware of the processes involved in each phase of the work. Less experienced workers will be able to contribute to the process if they have suitably experienced supervision and are able to access technical support.

For the work to be carried out satisfactorily useful non-technical attributes for those involved are meticulousness, good observational skills, a methodical approach and the ability to interpret information objectively. An update of the AWI should always be evidence driven.

2 THE APPROACH TO UPDATING THE ANCIENT WOODLAND INVENTORY - AN OVERVIEW

The original inventory of ancient woodland was, unlike most inventories of other habitats, constructed along a 'top down' pathway; maps of the whole country were systematically searched for potential sites, a proportion of which were then designated based on their fulfilment of certain criteria. The criteria indicated ancientness (or did not indicate recentness) rather than proved it. Full ecological, archival or archaeological surveys of individual sites were not routinely undertaken as part of the evidence base but where such information was known or available to the compilers it was utilised, along with any other relevant information (Spencer & Kirby 1992). The updated AWI and the overall approach taken to producing it operate on broadly the same principles although the techniques used for processing the evidence, as well as the volume and nature of that information, have developed significantly.

For reasons of cost and time limitation the core method is mainly desk-based and map-based, field survey being used as a supplementary tool to bolster the evidence base in a selective and targeted way. The detailed information arising from more in-depth and multi-stranded studies of woodland origins and histories can however, where resources and/or local expertise allow, be incorporated with much added value. Similarly, where resources are available, a more extensive programme of field survey can be harnessed to the update process with profit to overall data quality.

A fundamental difference between the earlier paper-based and new electronic approaches to information processing is that there is no necessity to physically 'delete' or 'discard' candidate sites during the search for AW - essentially throwing away information. The updated digital AWI arises as the final output of a mapping, research and survey project and should be viewed as simply one dimension of a multi-faceted dataset detailing the evidence for a larger envelope of sites.

The AWI has always been regarded as ‘provisional’ - an inescapable consequence of the incompleteness of historical evidence relating to woods and of limitations on the resources available for the assessment of any one site within a dataset of national scope. Therefore, while the updating of the AWI should significantly improve both its accuracy and precision, the new dataset will retain the same caveats; the information in the inventory is based on best available evidence and is subject to review.

It is important to understand that although this work will be spoken of as an *update* or *revision* of the existing AWI, the whole dataset is being rebuilt from scratch; a revised AWI is not just the original AWI with sub 2ha sites bolted on. This ensures that common standards are applied equally to both new sites and to the sites forming the original ancient woodland designation. In fact, the guidelines set out in this and the subsequent sections of the handbook could, with minor adaptations, be used to create an AWI even if the original AWI data had been lost or destroyed. The process provides an opportunity not just to add sites to it, but to verify and refine the original AWI. In some study areas this work will represent a large proportion of the total.

Some of the work of the original AWI compilers, for example identifying and rejecting clear examples of large recent woods, will be repeated. However, the plotting of woodland boundaries will be carried out a much finer resolution and, using computer mapping techniques, relatively efficiently. At the same time a clear structured format will be created which enables the existing information (as well as any information that may come to light in the future) to be recorded in a standardised way. This gives a sound basis for reconstruction and revision of decisions leading to designation of sites on the AWI (currently a cumbersome procedure) which will be of benefit to its future users. To this end any duplication of previous effort involved is felt to be more than worthwhile (1.2.1).

2.1 THE PROCESS OF UPDATING THE ANCIENT WOODLAND INVENTORY IN SUMMARY

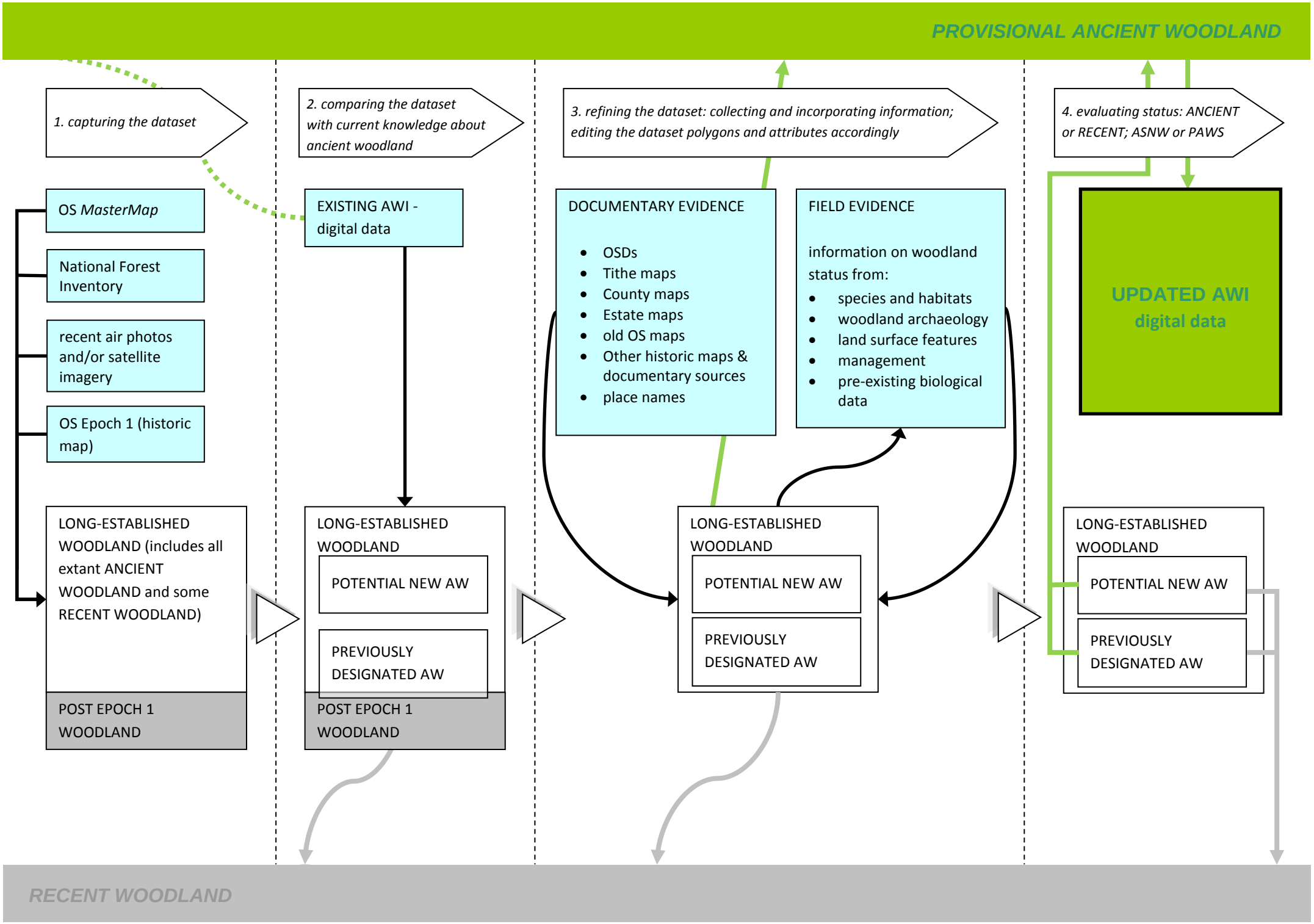
Hence, the starting point for updating the AWI is not to look at the existing AWI but to begin with a new and independent exercise in woodland mapping (see overview flow chart). **Phase 1** is to capture within a GIS a set of boundaries which reflect **long-established woodland** in the project area. In this handbook long-established woodland is defined as woodland occupying sites which were wooded (including scrub and wood-pasture) at the time of the Ordnance Survey County Series 1st edition map for England ('Epoch 1'). By definition this category includes all woodland that is pre-1600 and ancient as well as post-1600 origin woods with origins before Epoch 1.

Only after this has been accomplished is it recommended to deploy the existing AWI data, not as a base dataset but as a crucial reference (much like another historical map horizon). In **Phase 2** of the approach set out here the digital version of the existing AWI is cross referenced with the newly constructed dataset of long-established woodland. This is a key stage at which all the long-established woodland polygons are classified according to a number of key categories.

Phase 3 is the evidence gathering and integration stage. The earlier stages have built a dataset which is now ready to incorporate evidence from a variety of sources. This phase of a project to update the AWI is likely to be the most substantial. As core information is processed the dataset structure allows evidence gaps within the project area to be identified and targeted. At this stage also the 'decision making process' gets underway with preliminary decisions on ancient or recent woodland status possible for a proportion of sites (represented by green and grey arrows on the overview flowchart).

In the final major stage, **Phase 4**, the status of every site or site part (polygons in the spatial dataset) must be evaluated and recorded. This evaluation is drawn from a reasoned review of the available evidence on the history of the site, its condition and context. At this stage also any remaining dataset editing and cleaning work (which is iterative throughout all phases of the workflow) needs to be completed before preparing the data for submission to Natural England

The flowchart below models the process of updating the AWI in broad terms and is based on initiatives that have been trialled with some success in a number of projects to revise the English AWI locally, particularly in South East England. Local variations in the way the aims of each of the broad workflow stages are achieved are bound to follow from it in response to the peculiarities of different landscapes and different project structures. It is important that these are clearly recorded and communicated to Natural England so that future projects can benefit from them.


PROVISIONAL ANCIENT WOODLAND
1. capturing the dataset
2. comparing the dataset with current knowledge about ancient woodland
3. refining the dataset: collecting and incorporating information; editing the dataset polygons and attributes accordingly
4. evaluating status: ANCIENT or RECENT; ASNW or PAWS
OS MasterMap
National Forest Inventory
recent air photos and/or satellite imagery
OS Epoch 1 (historic map)
EXISTING AWI - digital data
DOCUMENTARY EVIDENCE
OSDs
Tithe maps
County maps
Estate maps
old OS maps
Other historic maps & documentary sources
place names
FIELD EVIDENCE
information on woodland status from:
species and habitats
woodland archaeology
land surface features
management
pre-existing biological data
UPDATED AWI digital data
LONG-ESTABLISHED WOODLAND (includes all extant ANCIENT WOODLAND and some RECENT WOODLAND)
POST EPOCH 1 WOODLAND
LONG-ESTABLISHED WOODLAND
POTENTIAL NEW AW
PREVIOUSLY DESIGNATED AW
POST EPOCH 1 WOODLAND
LONG-ESTABLISHED WOODLAND
POTENTIAL NEW AW
PREVIOUSLY DESIGNATED AW
LONG-ESTABLISHED WOODLAND
POTENTIAL NEW AW
PREVIOUSLY DESIGNATED AW
RECENT WOODLAND

3 PHASE 1 - CAPTURING THE DATASET

The aim of this project phase is to create a detailed base map which accurately captures the boundaries of all areas of long-established woodland for a study area. This is a first filter which eliminates woods of wholly 20th century origin (and some of later 19th century origin) and the parts of older woods or whole woods present in the late 19th century but no longer able to be classed as woodland today. The dataset being made in this phase is the foundation of the future AWI.

For the overall approach to updating the AWI to be effective this phase needs to be **systematic**, **inclusive**, efficient and relatively fast. This is in many ways the most important part of the whole operation, providing the platform for the future AWI. Speed is of essence but not at the expense of precision. Attention to detail at this stage is vital, paying dividends in stages three and four (see overview flow chart).

3.1 REQUIRED DATA

In order to begin this stage a GIS workspace should be set up that includes the two major sources of reference. These are held in raster format.

1. Recent high resolution (50cm resolution or better) geo-rectified aerial photographs. These must be catalogued or mosaicked so that they can be viewed locally as a 'seamless layer' in a GIS application. Alternatively, access to a reliable WMS[1] serving equivalent information could be sought. It is important that you are able to ascertain the date (or date range) when the images you are using were flown. Note that freely available servers of satellite imagery (e.g. ESRI World Imagery) are unlikely to be adequate; resolution needs to be sufficiently fine to clearly discern boundaries and canopies of woods down to 0.25ha in size (e.g. a 50m x 50m plot).

2. Epoch 1 (First edition of the Ordnance Survey County Series maps) prepared for viewing as a 'seamless layer' as above. The 6" to 1 mile edition of this survey is adequate to perform the task but the 25" to 1 mile version is superior. Because the scale of capture was closely comparable with the current OS data which forms the building blocks of the dataset you are working on (below) it is preferable to use the larger scale source. The smaller file sizes associated with the smaller scale version are likely to be of negligible benefit in terms of screen data loading speed with high resolution colour aerial imagery more likely to be a limiting factor

In addition to these reference layers, resources from which the new dataset can be built are needed. The building blocks of the long-established woodland dataset will be polygons derived from Ordnance Survey *MasterMap* vector data. These can be extracted either wholly from the OS *MasterMap* Topography Layer or by using the England National Forest Inventory (NFI) vector data (derived from OS *MasterMap*) in conjunction with the original OS *MasterMap* Topography Layer. The pros and cons of these alternatives are discussed in Box 2. The prerequisite vector datasets are therefore:

1. National Forest Inventory (NFI) England 2013 (or latest version to cover study area)

AND/OR

2. OS *MasterMap* Topography Layer (specifically the 'topographic area' polygon data to provide coverage for the project area)

[1] A WMS (Web Map Service) is a way of serving georeferenced map images over the Internet to a user's GIS workspace without the data being held locally. Most open source and proprietary GIS software packages now provide web map service capability.

As you progress through the task, you may also wish to employ other sources of reference to help decide which pieces of land to include (3.3.3), but not, at this stage, to interpret their history.

3.2 SUGGESTED APPROACHES TO PROCESSING THE DATA

The required output for this stage is a GIS dataset for your study area mapping all those areas of woodland (down to a nominal 0.25ha) which are common to the present day (visibly supporting woody vegetation on recent aerial photographs) and Epoch 1. For the purposes of this guidance such areas are termed 'long-established woodland'. There are various technical approaches that could be used to achieve this within a GIS but all are based on a systematic comparison of the aerial photography layer and Epoch 1 and, using *MasterMap* geometry as a standard, capturing the boundaries of wooded areas which fit the criteria.

The two broad options to choose from in order to build the map of long-established woodland are to 'distil down' or 'build-up'. In the first, polygons within a larger set of woodland and non-woodland polygons are selected and 'coded' for woodland presence or absence at the two time horizons before then exporting or copying those which fulfil the required criteria. The second works by selecting only those features which fulfil the criteria and replicating them into a new layer (i.e. copying and pasting) which will only contain long-established woodland from the outset. Which process is found to be more fluent will depend on individual preference, the type of software being used and the density and intricacy of patterning of woodland in the study area.

There are pros and cons to both, and which approach is taken is likely to depend on the density and configuration of woodland in the landscapes of your study area as well as the GIS experience of the user. The second option may give faster results in some circumstances but the first is more failsafe. The 'distil down' approach will retain a record of decisions made which can be archived, allow errors to be more easily traced and recovered if necessary and make polygons less prone to accidental movement[2] or deletion. The former is the default but may prove slower in some landscapes. The 'build-up' approach is recommended only for more experienced GIS users, accustomed to editing and processing large polygon based datasets. Below only the default approach is described although much of the detail is relevant to either approach.

[2] Throughout GIS work on the AWI update it is advisable to raise 'move tolerance' settings in your GIS software (especially if by default they are low or set to zero) so that it becomes impossible to nudge shapes out of position during editing work without having noticed. It is pointless to use OS *MasterMap* precision as the mapping standard if shapes are being inadvertently moved about within the layer during the update process.

Box 2. A note on OS MasterMap and the NFI

At the time of producing this guidance the OS *MasterMap* Topography Layer has been used as the primary resource for capturing woodland boundaries in the digital initiatives to update the AWI so far. This is an extremely feature rich dataset and requires some work to process into a useable form. Many features integral to woodland areas (trackways, narrow watercourses, small ponds etc) must be edited as part of the capture procedure. Similarly, individual parcels of woodland (i.e. areas of contiguous tree or shrub cover) are often heavily subdivided on the basis of differences in surface texture, meaning that for any one wood there are potentially numerous edits to be made in order to capture the relevant boundary or boundaries. In theory, much of this consolidation and rationalisation work has now been undertaken in the form of the recent NFI and there may be efficiency gains associated with using the more simple woodland boundaries of NFI polygons as the basic building blocks of the long-established woodland map. However, experience has also shown that *MasterMap* sub-compartments are often historically meaningful, for instance preserving the boundary between a pre-Epoch 1 wood and an adjacent area of later developed woodland or, within pre-Epoch 1 woodland, the boundaries of former fields may be retained as *MasterMap* compartments. There is a trade-off between the ease of initial processing of the simplified polygons within the NFI and the potential need to subsequently reverse edit them to capture relevant historical patterns. (Essentially *MasterMap* is more feature rich than required but the NFI data are too feature poor - so there is a trade-off between processing features and editing them). Furthermore, the NFI records polygons only as small as 0.5ha and 20m wide whereas the updated AWI requires that smaller parcel sizes and widths are considered and included where appropriate down to ~0.25ha. If using the NFI data as the primary vector resource, geometry from raw *MasterMap* data will still therefore need to be imported if you are working in any landscape with small or narrow long-established woods or woodland fragments. Another disadvantage of the NFI is that it may result in some loss of boundary precision. Linear features at the edges of woods - road verges and embankments, narrow roads, watercourses and their banks are sometimes lumped into a single woodland polygon. This runs counter to the aim of the AWI update work to improve precision in the mapping of woodland edges.

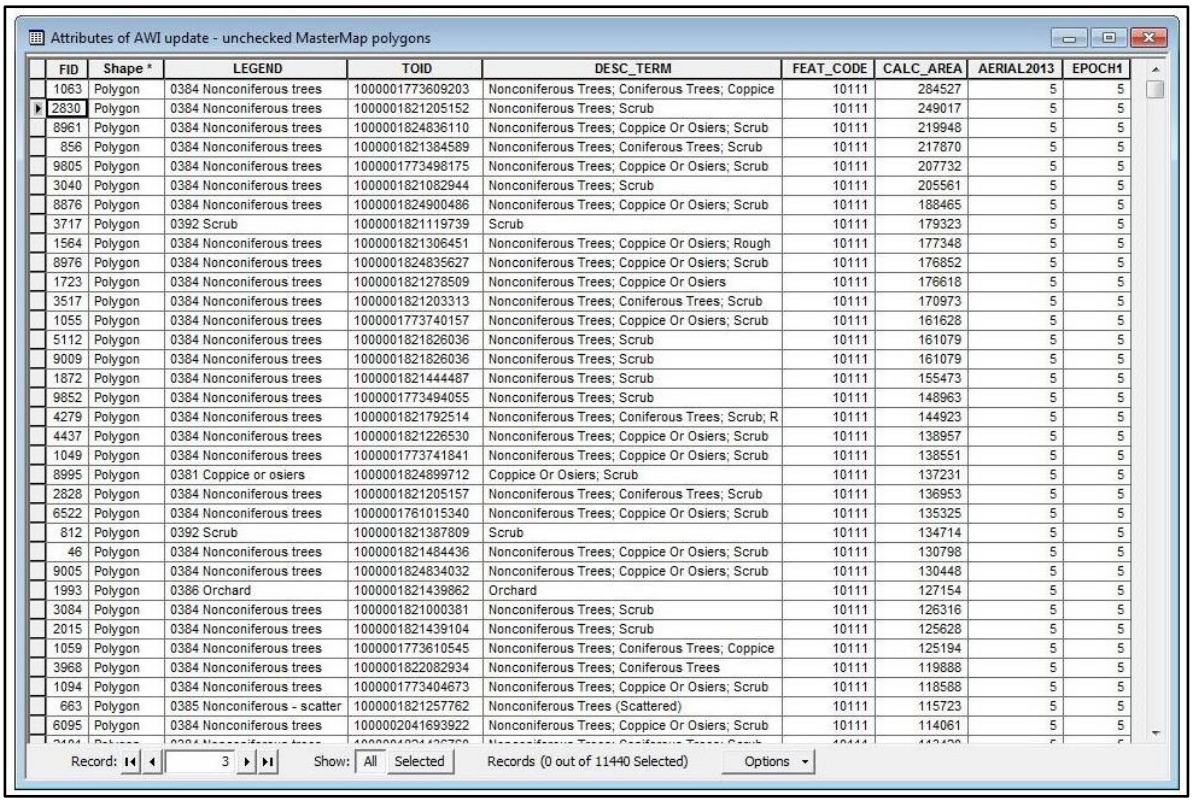
In landscapes where small woods and fragments of woods (< 0.5ha) are rare, woodland density is low and where the internal complexity of larger woods is likely to be low then use of the NFI over raw *MasterMap* polygons alone may bring efficiency gains. Otherwise a decision should be made locally about the merits of mixing the two datasets or working with *MasterMap* alone (in phase 1 of an AWI update project - NFI will still have significant value as a reference source for determining stand types at later stages in the project). This decision will depend to some extent on the GI systems proficiency of the project staff. In summary, if users feel confident that incorporation of the NFI data will be efficient and feel technically competent to do so then they should, otherwise the default and failsafe option is to use *MasterMap*. Technically it is to be preferred because it is the primary source.

3.3 DOING A FIRST SWEEP

3.3.1 PREPARATORY

Before embarking on the capture exercise - a first sweep of your project area - there are two preparatory steps.

1. To the working dataset (either an extract from *MasterMap* Topographic layer or an extract from the NFI covering your study area - see Box 2) add two short integer fields to represent the aerial photography layer and Epoch 1.



Attributes of AWI update - unchecked MasterMap polygons

FID	Shape *	LEGEND	TOID	DESC_TERM	FEAT_CODE	CALC_AREA	AERIAL2013	EPOCH1
1063	Polygon	0384 Nonconiferous trees	1000001773609203	Nonconiferous Trees; Coniferous Trees; Coppice	10111	284527	5	5
2830	Polygon	0384 Nonconiferous trees	1000001821205152	Nonconiferous Trees; Scrub	10111	249017	5	5
8961	Polygon	0384 Nonconiferous trees	1000001824836110	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	219948	5	5
856	Polygon	0384 Nonconiferous trees	1000001821384589	Nonconiferous Trees; Coniferous Trees; Scrub	10111	217870	5	5
9805	Polygon	0384 Nonconiferous trees	1000001773498175	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	207732	5	5
3040	Polygon	0384 Nonconiferous trees	1000001821082944	Nonconiferous Trees; Scrub	10111	205561	5	5
8876	Polygon	0384 Nonconiferous trees	1000001824900486	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	188465	5	5
3717	Polygon	0392 Scrub	1000001821119739	Scrub	10111	179323	5	5
1564	Polygon	0384 Nonconiferous trees	1000001821306451	Nonconiferous Trees; Coppice Or Osiers; Rough	10111	177348	5	5
8976	Polygon	0384 Nonconiferous trees	1000001824835627	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	176852	5	5
1723	Polygon	0384 Nonconiferous trees	1000001821278509	Nonconiferous Trees; Coppice Or Osiers	10111	176618	5	5
3517	Polygon	0384 Nonconiferous trees	1000001821203313	Nonconiferous Trees; Coniferous Trees; Scrub	10111	170973	5	5
1055	Polygon	0384 Nonconiferous trees	1000001773740157	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	161628	5	5
5112	Polygon	0384 Nonconiferous trees	1000001821826036	Nonconiferous Trees; Scrub	10111	161079	5	5
9009	Polygon	0384 Nonconiferous trees	1000001821826036	Nonconiferous Trees; Scrub	10111	161079	5	5
1872	Polygon	0384 Nonconiferous trees	1000001821444487	Nonconiferous Trees; Scrub	10111	155473	5	5
9852	Polygon	0384 Nonconiferous trees	1000001773494055	Nonconiferous Trees; Scrub	10111	148963	5	5
4279	Polygon	0384 Nonconiferous trees	1000001821792514	Nonconiferous Trees; Coniferous Trees; Scrub; R	10111	144923	5	5
4437	Polygon	0384 Nonconiferous trees	1000001821226530	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	138957	5	5
1049	Polygon	0384 Nonconiferous trees	1000001773741841	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	138551	5	5
8995	Polygon	0381 Coppice or osiers	1000001824899712	Coppice Or Osiers; Scrub	10111	137231	5	5
2828	Polygon	0384 Nonconiferous trees	1000001821205157	Nonconiferous Trees; Coniferous Trees; Scrub	10111	136953	5	5
6522	Polygon	0384 Nonconiferous trees	1000001761015340	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	135325	5	5
812	Polygon	0392 Scrub	1000001821387809	Scrub	10111	134714	5	5
46	Polygon	0384 Nonconiferous trees	1000001821484436	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	130798	5	5
9005	Polygon	0384 Nonconiferous trees	1000001824834032	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	130448	5	5
1993	Polygon	0386 Orchard	1000001821439862	Orchard	10111	127154	5	5
3084	Polygon	0384 Nonconiferous trees	1000001821000381	Nonconiferous Trees; Scrub	10111	126316	5	5
2015	Polygon	0384 Nonconiferous trees	1000001821439104	Nonconiferous Trees; Scrub	10111	125628	5	5
1059	Polygon	0384 Nonconiferous trees	1000001773610545	Nonconiferous Trees; Coniferous Trees; Coppice	10111	125194	5	5
3968	Polygon	0384 Nonconiferous trees	1000001822082934	Nonconiferous Trees; Coniferous Trees	10111	119888	5	5
1094	Polygon	0384 Nonconiferous trees	1000001773404673	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	118588	5	5
663	Polygon	0385 Nonconiferous - scatter	1000001821257762	Nonconiferous Trees (Scattered)	10111	115723	5	5
6095	Polygon	0384 Nonconiferous trees	1000002041693922	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	114061	5	5

Record: 3 Show: All Selected Records (0 out of 11440 Selected) Options

Figure 1. Preparing for the first stage of mapping work in the process of updating the AWI - part of the attribute table for an OS *MasterMap* derived dataset modified to enable a record of long-established woodland to be created.

In this phase of the workflow, and throughout the AWI update process, fields representing different evidence horizons are populated using a simple numeric notation which codifies the status of each polygon with respect to each horizon and records if it has been checked. In many of the pilot projects to update the AWI a convention has developed as follows and, if you intend to follow this approach it is strongly recommended to use the same codes for the sake of consistency and compatibility in the datasets NE finally receive.

0 = not shown as woodland

1 = shown as woodland or predominantly so

2 = part shown as woodland (10% – 90% of the polygon clearly not depicted as woodland of any type)

3 = inconclusive (use where map damaged, map image of insufficient quality to interpret or depiction on map ambiguous)

4 = no map coverage

5 = not assessed - the default code

6 = shown as woodland AND interpreted as consistent with wood-pasture or parkland habitat (see Box 7)

Codes 3 and 4 will rarely be used in this phase of the workflow but come into play when older and less consistent map resources are deployed at later stages (see overview flow chart).

Before going further, make sure that the two added fields are both entirely populated using the default code for 'not assessed' (see Figure 1). This is of the utmost importance as many systems will automatically populate a new field with zeros; information extracted from an incompletely prepared and stored MasterMap or NFI

based layer could potentially be misread by colleagues. It is good practice to archive a version of your primary dataset at this stage with a clear indication or metadata indicating that it is an unchecked version.

2. It is advisable to create a grid-like layer of contiguous square polygons covering the whole of your study area. This is a simple tool which will enable you to plan work through the study area and to record, visualise and monitor progress. A short numeric field (named for example 'CHECK') can be used to register whether the area corresponding to that particular square has been assessed on screen and its woodlands (if any) recorded.

The size of the grid typically used in the southeast was 500m (i.e. 25ha). This allows one whole square height to be comfortably viewed on a large desktop monitor at the original map reproduction scale. The grid size could be varied in study areas with lower woodland density but larger than 1km is not recommended, especially if mapping work is to be undertaken using a smaller screen such as on a laptop. The grid size will determine the viewing scale used for routine scanning and panning through GIS layers during Phase 1. Capture and editing of small features or intricate details will often necessitate zooming in to larger scales, and large features, or those that fall across more than one grid square will mean zooming out but it is vital that small and narrow features can readily be detected at 'panning scale'. Rendered at 1:2500, a 50m x 50m plot (i.e. a compact shaped 0.25ha piece of land) appears as a 2cm square. Bear in mind that woodland fragments will often take more convoluted forms and at smaller scales of map rendering the risk of overlooking features will be amplified.

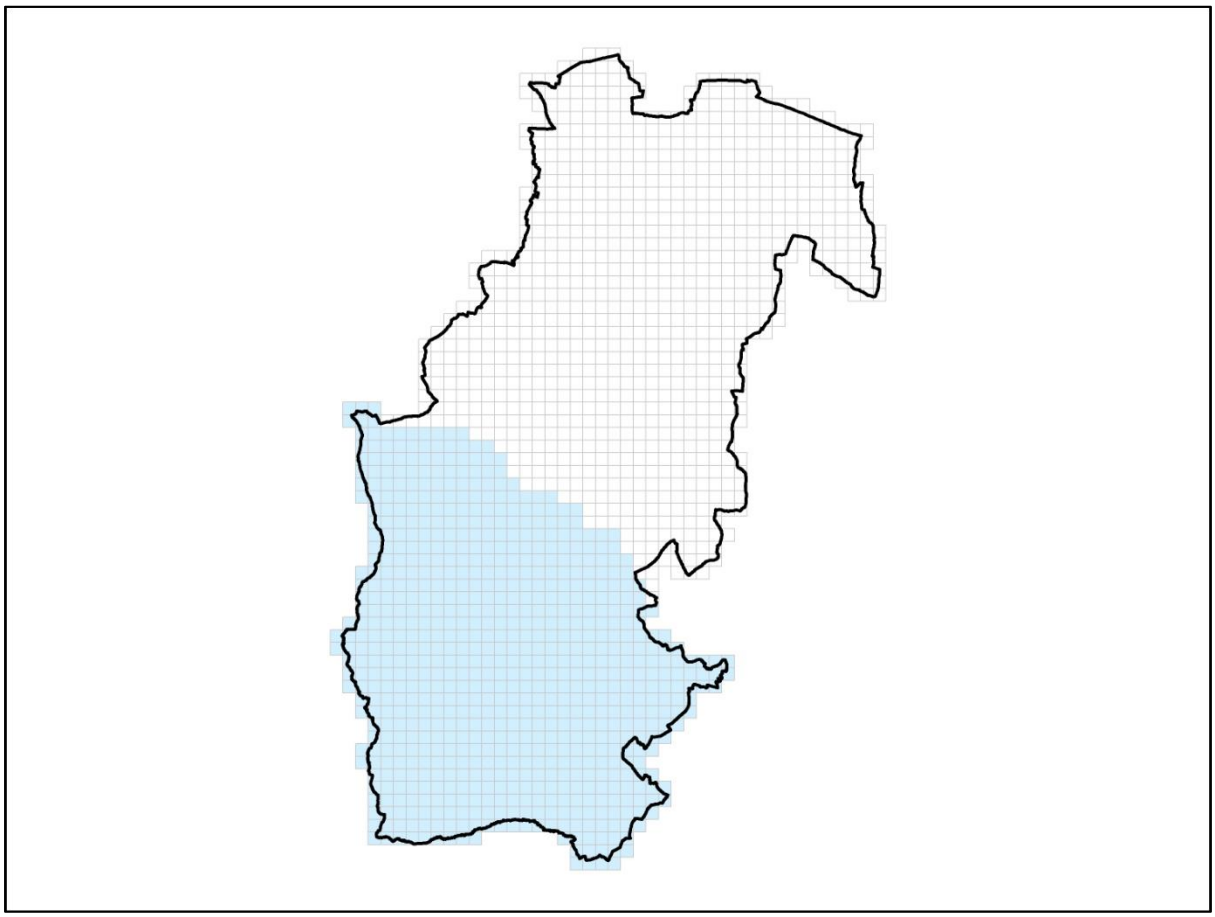


Figure 2. A project area which has been overlain with a 500m grid pattern. After capture and editing work has been undertaken for a square or group of squares the attributes of the layer can be edited using, for example a simple 0/1 notation and displayed when required to keep track of progress through the area. If working in a team on this workflow phase then use of a grid can also help clearly apportion mapping areas to different workers.

Box 3. Tips for preparing Ordnance Survey *MasterMap* data for use in an AWI update project

If you are using *MasterMap* as the primary resource for recording woodland boundaries you may find it beneficial to reduce the size of this very feature rich dataset in order to reduce bulk and improve screen loading speed. There are various things that can be done. If the study area is large or densely grained (e.g. urban or ancient landscapes) then it may be worth dividing the coverage into two or more separate chunks during this workflow stage. These can be reunited at a later point. The majority of the polygons in the layer are surplus to requirements. However, simply deleting all non woodland polygons (identifiable by running a query involving FEAT_CODE 10111) is not advisable; it will lead to gaps in the layer which you may wish to include within woodland parcels (e.g. forest trackways) and will then need to either manually digitise leading to a loss in mapping precision or fetch and copy them from the original data layer leading to a significant accumulation of lost time. A compromise is to select all woodland and scrub and buffer the selection two or three times by adding contiguous features to the selection using a spatial query, export these features and use them as your working dataset. Many of the attribute fields can also be deleted as it is only the geometry which will transfer to the final output. However it is advisable to retain 'TOID' (as a way to relate back to the original dataset if the need arises). 'CALC_AREA', 'LEGEND' and/or 'DESC_TERM', 'FEAT_CODE' also contain useful data which are worth retaining particularly if you wish to rationalise the dataset further. This may be beneficial if woodland areas appear to be very fractured – with numerous contiguous polygon components for every parcel of woodland. Investment of some time at this stage of the project may lead to smoother and more fluent processing later. For example, using the information in the 'DESC_TERM' field, different types of adjacent broadleaved woodland polygons could be dissolved into single polygons whilst retaining their boundaries with coniferous and mixed woodland polygons. Use a sequence of spatial queries to select, merge and explode the classes of polygon you wish to consolidate. (Bear in mind that the original polygon attribute data will become meaningless after processing in this way and you will have to devise a new system for recording which polygons relate to which of your chosen types e.g. 'all MasterMap broadleaved'. Beware of over simplifying the MasterMap polygon set however; many of the internal boundaries in woodland parcels are historically and ecologically meaningful and can prove valuable both in capturing boundaries in this project phase (see Box 2) and for interpreting woods and refining AW boundaries later in the workflow.

3.3.2 PROCESSING THE DATA

At this stage there are only two evidence horizons to be concerned with. Systematically sweep through the project area square by square selecting polygons which contain visible woodland on the aerial imagery - and only those - and then using a clearly defined notation change the attribute entry for both horizons (typically to 0, 1 or 6). Some guidelines on what constitutes 'woodland' for the purposes of this task follow this section but the general principle is that this early stage of the workflow should take a broad and inclusive view of woodland vegetation (see 2). As a very general guide, vegetation that would be likely to be classed as woodland (including wood-pasture) or scrub (but not as underscrub) communities in the National Vegetation Classification (Rodwell 1991) or in a basic habitat survey is eligible for inclusion.

In poorly wooded areas this work can be undertaken very rapidly whereas in areas of dense woodland or areas that have undergone much landscape change between the two horizons the procedure can seem painstakingly slow. Landscapes with more even mixtures of pre- and post-Epoch 1 woods promote concentration and make the process of checking absorbing. But in other landscapes, especially if a high proportion of current woodland sites are either present or not present at Epoch 1, the work can become monotonous. The procedure of coding of the thousands of necessary polygons can easily slip into a mechanical response at which point the risk of mistakes is heightened. Be prepared for this tendency and avoid it, or adopt a working pattern to fit your concentration span. It is even more time-consuming to have to recheck large parts of a project area if it becomes apparent you have miscoded sites.

Box 4. What should be included in the first sweep?

The guideline that has been used in the AWI updates undertaken in England to date is to include sites ≥0.25ha with at least 20% canopy or tree crown cover over 80% of the bounded area. This allows for the capture of:

- most types of woodland vegetation including, where appropriate, areas of open-land habitat that are intimately associated with the woodland but not the major component of the site
- most discrete areas of wood-pasture and treed parkland

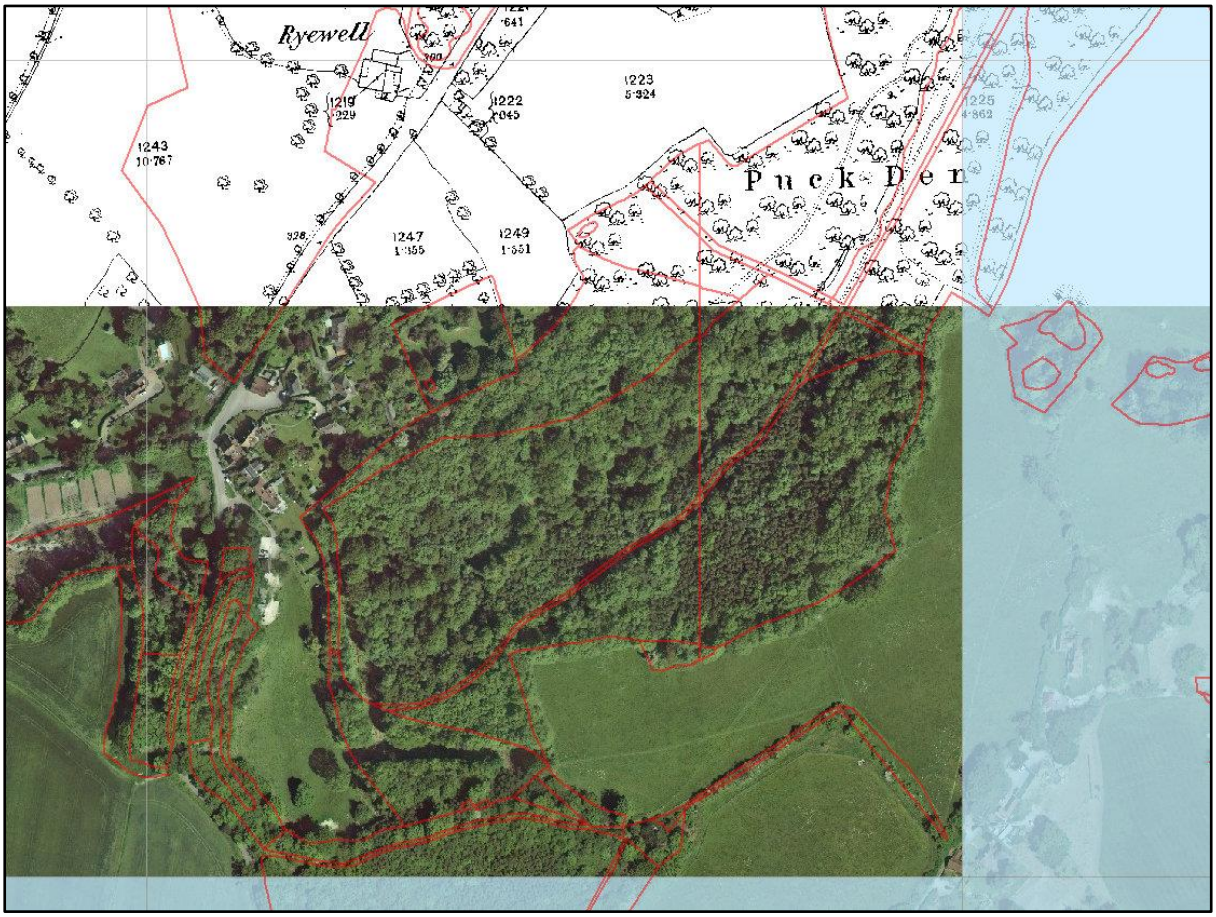
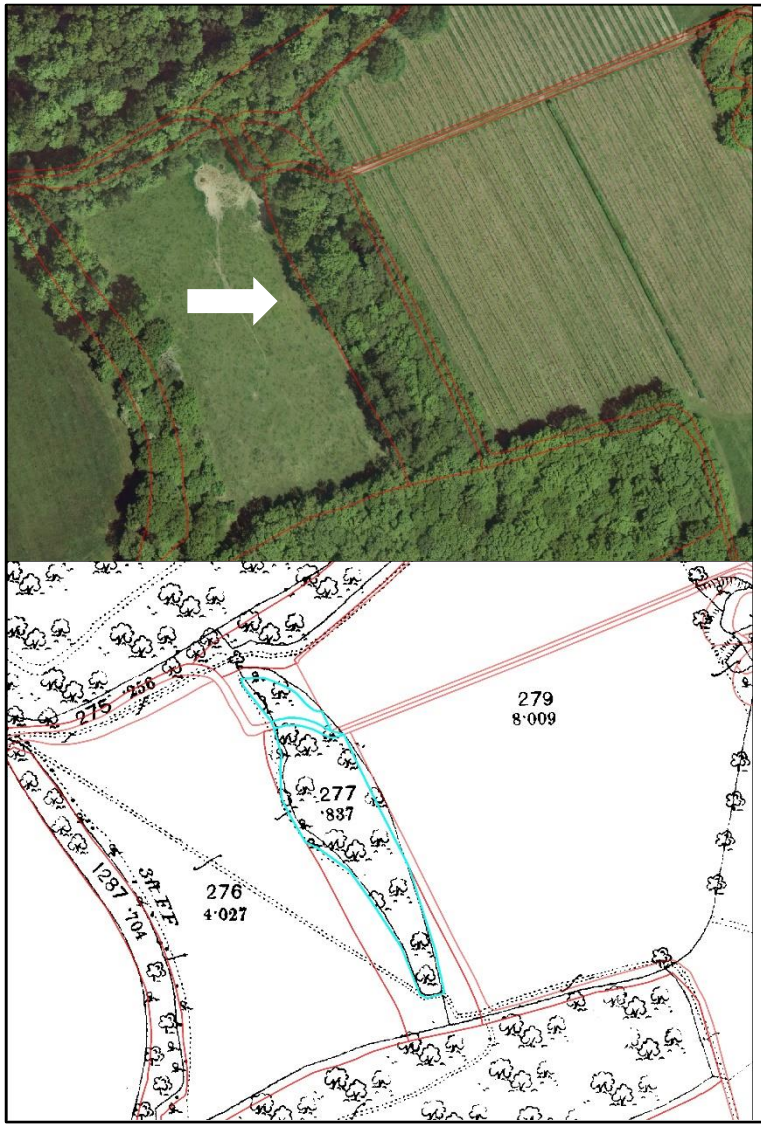


Figure 3. Screenshot showing the process of scanning through a project area at 1:2,500 to compare an aerial photograph with Epoch 1.The grid cells to the east and south have already been examined and appropriate MasterMap polygons (shown as red lines) edited. In this case a 'swipe tool' is being used. Alternatively, using raster colour properties and transparency tools carefully, Epoch 1 can be effectively superimposed on an air photo layer. When using this approach it is important to ensure that the composite image produced allows recognition of small woods on either layer when viewed at scanning scale. Depending on the degree of woodland complexity in the landscape and the software being used sometimes the two layers will need to be examined separately in turn. © 2018 Getmapping plc and Bluesky International Ltd; © Crown copyright and Landmark Information Group.

When you encounter a woodland shape for which there is no exact MasterMap (or NFI) equivalent, for example a homogenous area of woodland which is clearly shown with parts of its extent as some other land-use at Epoch 1, then it should be edited accordingly (see Figure 4). You can either interrupt the sweep to do this as and when such sites arise or use the 'partially wooded' code (2, in the notation that has developed in earlier projects - see above). This allows the sites to be identified and revisited at a future time (but the work

should be undertaken as part of the Phase 1). In landscapes where many such sites exist it can be more fluent and efficient to 'save up' several and have a dedicated edit session later (which is also a way to break up the monotony of long spells panning maps and coding polygons).



clockwise from top left:

1. a narrow belt of woodland (~0.5ha and 35m wide) joins two larger areas of woodland to its north and south. MasterMap polygons overlain in red.

2. at the time of Epoch 1 this woodland was present but is shown as a small and distinct enclosed wood and was apparently significantly smaller.

3. the main southern portion of the wood together with a trackway which runs through the wood need to be edited in order to capture the long-established woodland boundary. 'Snapping' or 'tracing' is used so that the edited line conforms to MasterMap geometry wherever possible.

4. shape editing complete, the resulting smaller polygons can now be assigned values for presence and absence in the associated data or attribute table. Here the parts that will be carried forward to a long-established woodland dataset are highlighted.

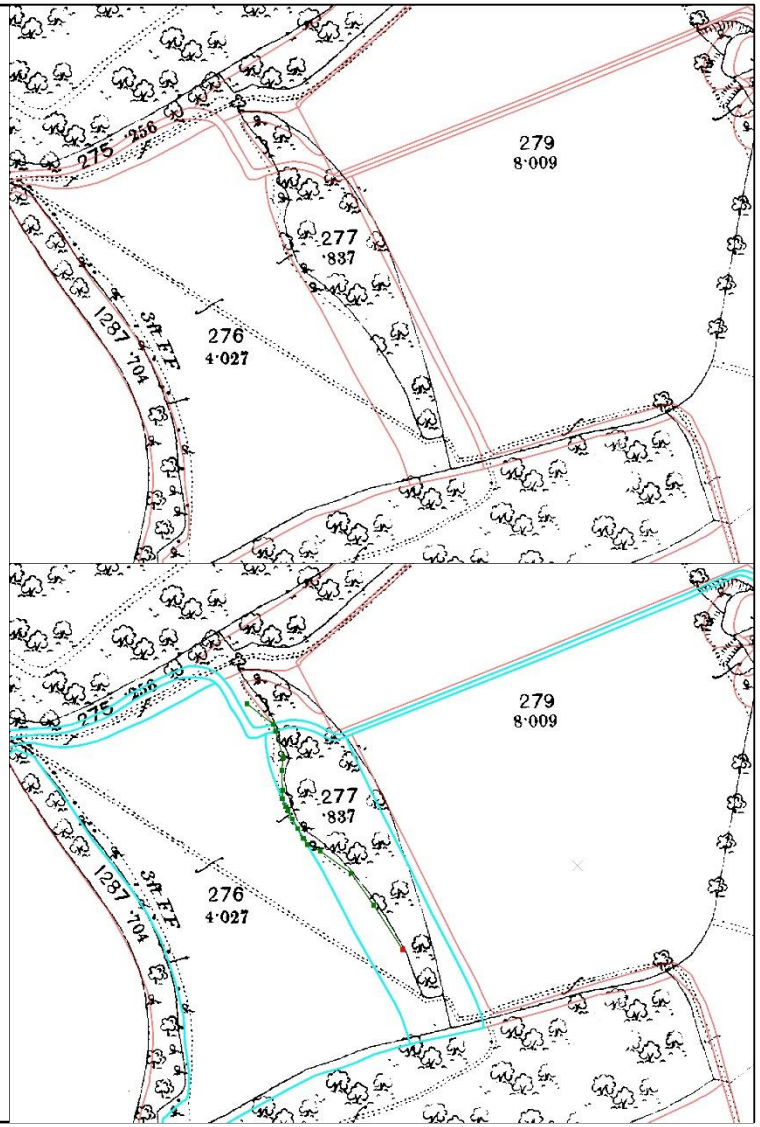


Figure 4. Dealing with uncompliant MasterMap shapes during the capture process. In this example, if the data for the trackway running through the wood had not been available the gap between the two long-established woodland elements could have been filled manually instead. © Crown copyright and Landmark Information Group.

To help visualise the typical flow of the first sweep through a project area Figure 5 gives a sequence of pictures illustrating how the process of scanning a small landscape area (c.175ha of land is shown) for woodland and editing the working dataset might proceed.

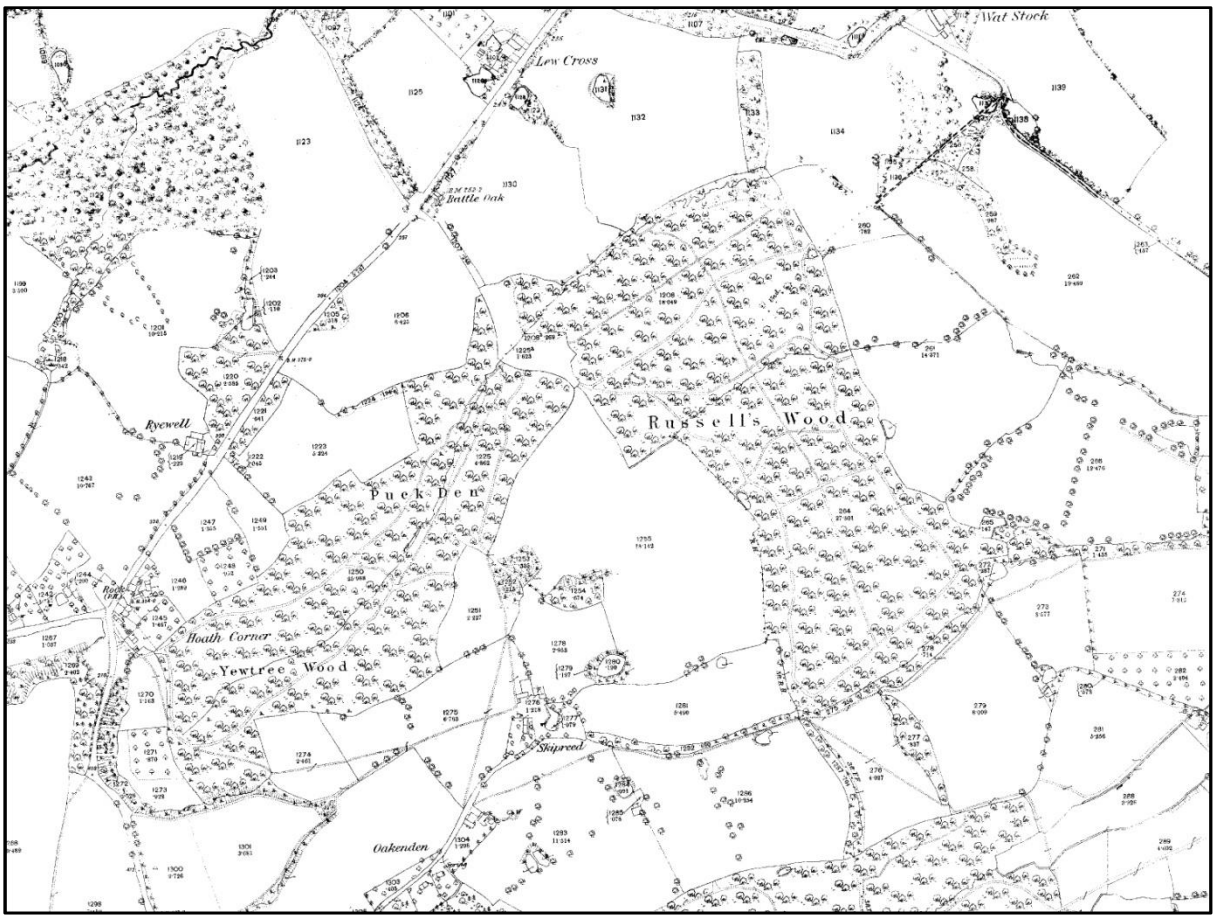
In the first two pictures an aerial image and the corresponding area on Epoch 1 are shown. The third image shows OS *MasterMap* vector data for the whole area. The fourth image shows the same information in composite form once the vector data have been processed and the fifth just the vector data. At this stage all appropriate polygons have been selected, edited if necessary (see Figure 4) and coded. Here only active polygons are shown, with the layer properties adjusted to depict long-established woodland as green and other woodland as grey (recent woodland). Other land - including areas of trees or bushes that have been assessed as 'not woodland' for the purposes of the task (e.g. some small or narrow features - see 3.3.3 for further guidance on this issue) - is not shown[3].

The last image (Figure 5.6) is of the data table corresponding to the shapes seen in the preceding five images with attribute editing in progress (cf. Figure 1). The values in the 'AERIAL2013' and 'EPOCH1' fields reflect the assortment of recent and long-established woodland as shown in the pictures. Note that there are some polygons which are not apparently woodland but which have been assigned the code '1'. These are small polygons which have deliberately been assessed as 'woodland' for the purposes of the capture exercise - parts of woods that do not themselves support woody vegetation and are separately mapped by MasterMap. The example highlighted is a small (132m^2) pond deeply embedded in an otherwise wholly woodland polygon. Note also that some rows in the table have not been assessed against Epoch 1 (the original default code is still retained). These correspond to polygons deliberately assessed as currently 'not woodland' (AERIAL2013 = 0) for the purposes of the capture exercise even though the MasterMap database registers some form of tree or shrub cover, mostly for reasons of very small size (< ~0.25ha) - an assessment of these against Epoch 1 would therefore be superfluous. Small, isolated woody polygons (i.e. that do not form parts of larger contiguous parcels of woodland) and are not in close proximity to other woodland polygons can be physically removed before the sweep begins (by using a combination of spatial and attribute based queries) but it as well to retain those which lie close to other woods as they may form parts of sites you wish to capture.

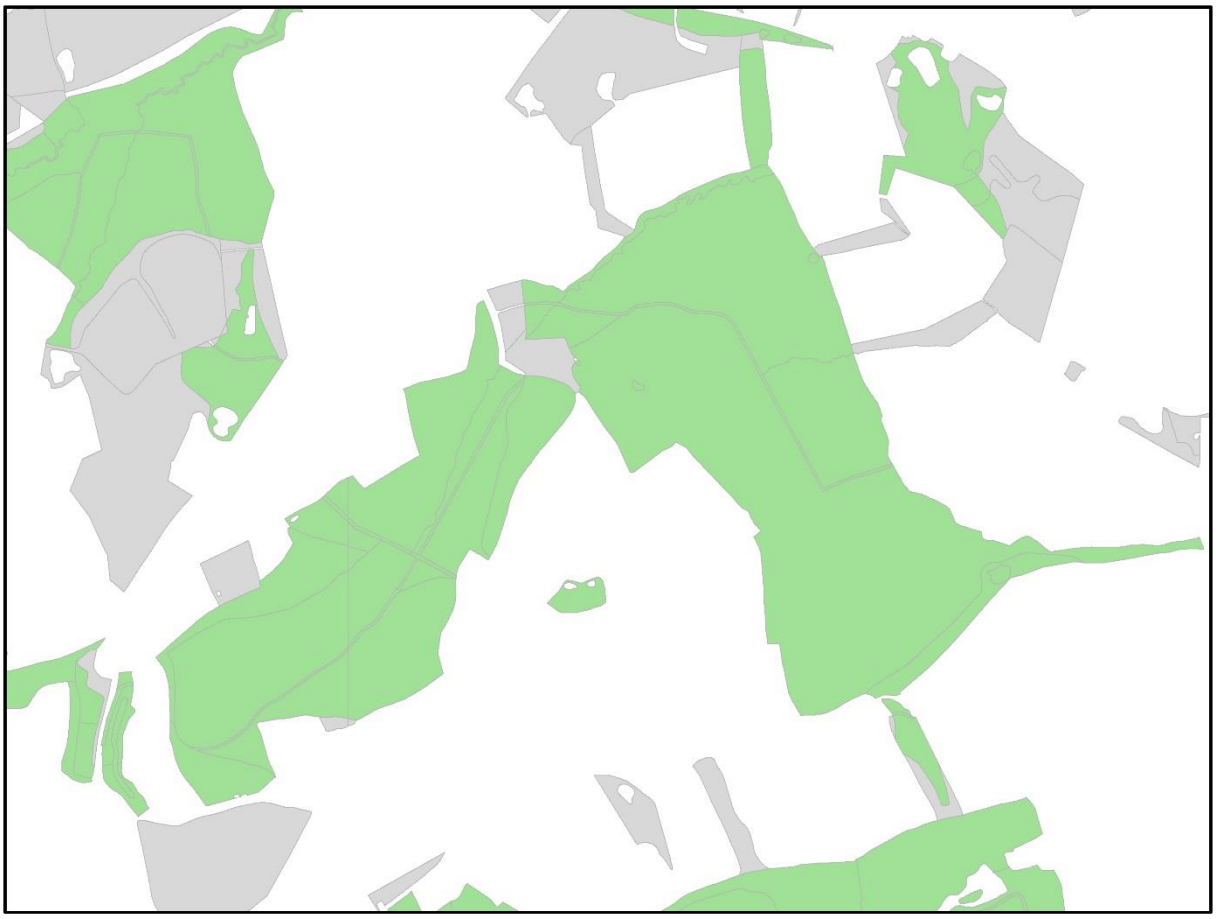
The use of NFI data instead of MasterMap in this phase of the project could eliminate the need to process small polygons (both the inclusions and exclusions outlined above) but equally any woodland areas that you wished to capture in the 0.25 to 0.5 ha range would then have to be imported from MasterMap or digitised and polygon editing of the kind illustrated in Figure 4 would be less straightforward (see also Box 2).

Hence the coding of polygons within the working dataset in Phase 1 is not simply a literal reading of woody vegetation presence but depends on an assessment of the context of each polygon, its size and whether it should be considered woodland for the purposes of the dataset or not woodland. The next section addresses some of the issues involved in making this assessment.

[3] What scheme or schemes a worker uses to display the working layer is a matter of personal choice and what is found to 'work' for the individual. It can be helpful at some stages to simply use two colours to distinguish between coded and un-coded polygons, whereas at other times it may be preferable for dead space to 'disappear' and long-established woodland polygons to look different from other woodland. A benefit of this is that your work can be easily visually checked as you go along. For example, using the scheme in Figure 5, if the layer is overlain simply on Epoch 1, any grey polygons over sites with woodland depiction on the map must have been coded in error.


Wat Stock
Low Cross
Battle Oak
Ryewell
Russell's Wood
Puck Den
Heath Corner
Yewtree Wood
Skipreed
Oakenden


Wat Stock
Lew Cross
Battle Oak
Rycwell
Russells Wood
Puck Den
Heath Corner
Yewtree Wood
Shipcord
Oakenden



Attributes of AWI update - Phase 1

FID	Shape *	LEGEND	TOID	DESC_TERM	FEAT_CODE	CALC_AREA	AERIAL2013	EPOCH1
3345	Polygon	0384 Nonconiferous trees	100000204169474	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	5868.9685	1	1
3346	Polygon	0384 Nonconiferous trees	100000204169474	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	9280.927099	1	1
3347	Polygon	0381 Coppice or osiers	100000204169473	Coppice Or Osiers; Scrub	10111	16470.51635	1	1
3348	Polygon	0384 Nonconiferous trees	100000204169473	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	2165.523338	1	1
3349	Polygon	0384 Nonconiferous trees	100000204169473	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	4007.24	1	0
3350	Polygon	0384 Nonconiferous trees	100000204169473	Nonconiferous Trees; Coniferous Trees; Scrub	10111	14990.887146	1	1
3351	Polygon	0384 Nonconiferous trees	100000204169472	Nonconiferous Trees; Coniferous Trees	10111	466.6908	1	0
3352	Polygon	0384 Nonconiferous trees	100000204169472	Nonconiferous Trees; Scrub	10172	286.5115	0	5
3353	Polygon	0384 Nonconiferous trees	100000204169471	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	4265.2308	1	1
3354	Polygon	0379 Coniferous trees	100000204169471	Coniferous Trees; Scrub	10111	1070.94908	1	1
3355	Polygon	0384 Nonconiferous trees	100000204169471	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	3658.84065	1	1
3356	Polygon	0384 Nonconiferous trees	100000204169471	Nonconiferous Trees; Coniferous Trees; Scrub	10111	6572.290856	1	0
3357	Polygon	0384 Nonconiferous trees	100000204169470	Nonconiferous Trees; Scrub	10172	1656.15115	0	5
3358	Polygon	0384 Nonconiferous trees	100000204169470	Nonconiferous Trees; Coppice Or Osiers; Scrub	10172	1152.2025	0	5
3359	Polygon	0384 Nonconiferous trees	100000204169470	Nonconiferous Trees; Scrub	10111	1049.3515	1	1
3360	Polygon	0400 Inland water	100000204169470		10089	178.0765	1	1
3361	Polygon	0384 Nonconiferous trees	100000204169469	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	3001.27	1	0
3362	Polygon	0000 Track	100000204169468	Track	10172	961.416	1	1
3363	Polygon	0400 Inland water	100000204169468		10089	479.06	1	1
3364	Polygon	0392 Scrub	100000204169468	Scrub	10111	369.869	1	0
3365	Polygon	0400 Inland water	100000204169467		10089	105.6725	1	1
3366	Polygon	0000 Track	100000204169467	Track	10172	766.7833	1	1
3367	Polygon	0384 Nonconiferous trees	100000204169467	Nonconiferous Trees; Scrub	10111	2102.5615	1	0
3368	Polygon	0400 Inland water	100000204169467		10089	132.02	1	1
3369	Polygon	0384 Nonconiferous trees	100000204169466	Nonconiferous Trees; Scrub	10111	1180.285	1	0
3370	Polygon	0392 Scrub	100000204169466	Scrub	10111	505.6925	1	0
3371	Polygon	0400 Inland water	100000204169466		10089	485.9235	0	5
3372	Polygon	0379 Coniferous trees	100000204169466	Coniferous Trees; Scrub	10111	25129.39355	1	0
3373	Polygon	0384 Nonconiferous trees	100000204169466	Nonconiferous Trees; Scrub	10111	2161.966	1	1
3374	Polygon	0384 Nonconiferous trees	100000204169466	Nonconiferous Trees; Coniferous Trees; Scrub	10111	8286.5372	1	0
3375	Polygon	0400 Inland water	100000204169466		10089	442.91	1	1
3376	Polygon	0384 Nonconiferous trees	100000204169466	Nonconiferous Trees; Scrub	10111	1635.5735	0	5
3377	Polygon	0384 Nonconiferous trees	100000204169466	Nonconiferous Trees; Scrub	10111	464.361	0	5
3378	Polygon	0400 Inland water	100000204169466		10089	121.365	1	1
3379	Polygon	0384 Nonconiferous trees	100000204169466	Nonconiferous Trees; Scrub	10111	1675.8205	1	1
3380	Polygon	0400 Inland water	100000204169466		10089	557.9725	1	1
3381	Polygon	0385 Nonconiferous - scatte	100000204169466	Nonconiferous Trees (Scattered)	10111	3093.3309	1	0
3382	Polygon	0384 Nonconiferous trees	100000204169466	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	2361.1867	1	1
3383	Polygon	0384 Nonconiferous trees	100000204169466	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	113777.264574	1	1
3384	Polygon	0379 Coniferous trees	100000204169466	Coniferous Trees; Scrub	10111	12676.179	1	0
3385	Polygon	0384 Nonconiferous trees	100000204169466	Nonconiferous Trees; Coniferous Trees	10111	4616.85955	1	0
3386	Polygon	0384 Nonconiferous trees	100000204169466	Nonconiferous Trees	10111	3528.59225	1	0
3387	Polygon	0385 Nonconiferous - scatte	100000204169466	Nonconiferous Trees (Scattered)	10111	5177.995	1	0
3388	Polygon	0384 Nonconiferous trees	100000204169466	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	1583.528	1	0
3389	Polygon	0384 Nonconiferous trees	100000204169466	Nonconiferous Trees; Coniferous Trees; Coppice Or Osiers; Scrub	10111	9803.835835	1	1
3390	Polygon	0384 Nonconiferous trees	100000204169466	Nonconiferous Trees; Scrub	10111	2834.2874	0	5
3391	Polygon	0384 Nonconiferous trees	100000204169466	Nonconiferous Trees; Coppice Or Osiers; Scrub	10111	22275.9535	1	1

Record: 1 Show: All Selected Records (1 out of 13379 Selected) Options

Figure 5. (previous pages) An example of capture work in progress. See text for explanation. © 2018 Getmapping plc and Bluesky International Ltd; © Crown copyright and Landmark Information Group. © Crown Copyright and database rights 2018. Ordinance Survey 100022021.

Box 5. Why not check multiple evidence sources at this stage instead of just aerial photographs and Epoch 1? Wouldn't this get the job done faster?

There are a number of reasons, mostly relating to efficiency but also to research objectivity, why we do not recommend consulting and recording a wider array of historical evidence horizons during the first phase of work.

- The methodology is framed in this way because we want to emphasise the primary requirement and prerequisite for ancient woodland designation is that a site has been identified as long-established by following a clear procedure using sources which are accurate and precise both spatially and temporally. This precursor dataset needs to be able to stand alone as a benchmark even if you decide to do research on other evidence sources at the early project stage.
- We have relatively high confidence about the interpretation of woodland presence and absence at these two horizons and clear information about when and at what scale the information was captured. When we move onto using older data sources the level of confidence falls (see Sources of evidence: 5.2); although some earlier maps may be very detailed for some areas, Epoch 1 is likely to be the only study area-wide source which is both comparable with modern digital mapping standards, (relatively) consistent and gives full coverage.
- An independent examination of this source in the absence of less reliable or more difficult to read sources helps avoid blurring the boundary between evidence and interpretation.
- A complete sweep at one level of historical mapping is better than a partial pass of some or selected sites at multiple levels.
- A complete sweep helps gauge the size of the task of updating the AWI for the project area near the outset of a project - something that is extremely difficult to achieve working through the whole process one wood at a time. Getting immersed in multiple evidence layers on a site by site basis from stage one is - if there are many sites to process - a recipe for running out of time to carry out the work evenly and systematically.
- The overall process works by distilling down and rationalising groups of MasterMap polygons at the first stage into smaller numbers of polygons at later stages. Editing every polygon in the raw dataset against every possible evidence source would represent a very significant loss of time versus reserving some of the workload for a later stage, within a cleaned and rationalised dataset.
- The next stage of the work - Phase 2 - will allow for prioritisation of research effort to be made. At stage 1 it is impossible to know where limited time resources will be best spent in order to perform the necessary revisions to the AWI.
- Speed - minimising the number of GIS layers that need to be loaded will increase fluency and GIS system performance during this bulk data processing work stage.
- The suggested Phase 1 sweep is a clearly defined task with a clearly defined output. It is good for working in teams, accessible to less experienced workers, and it is easy to understand and check. If personnel change or the work is shared - the Phase 1 dataset can be passed to someone else to progress with a clear notion of what has been done.
- A complete sweep gives the compiler a good overview of the whole study area and its woods as depicted on Epoch 1. This in itself is valuable preparation and training for later interpretation and evaluation work (Phases 3 & 4) involving the landscape context and earlier maps of less consistent quality.
- The reverse also applies. If each site is individually assessed in relation to a range of map evidence sources from the outset then by the time the later assessed sites are reached the compiler's thinking and interpretation is likely to have shifted and been influenced by the experience of the earlier sites. This results in an inconsistent level of expertise being applied to the historic map evidence, compromising the overall rigour of the procedure.
- This approach avoids the temptation to take shortcuts which can lead to mistakes. e.g. passing over complex-to-digitise sites that the compiler believes not to be ancient (see 3.3.3).

This is not to say that work preparing and collecting evidence for the later workflow phases cannot proceed until Phase 1 is complete - it can and should be undertaken in tandem with early mapping work.

Finally, these are guidelines only. If you feel that for your project area you can incorporate some of the tasks from the later stages (see section 2 and overview flowchart) within Phase 1 and that this would represent an efficiency gain without detracting from the objectivity of the research then it may be appropriate to do so (providing equivalent outputs are produced). The approach described in this handbook was originally developed for heavily wooded areas with very high volumes of sites and polygons to process. It should work well in other areas. However, in very sparsely wooded areas some of the efficiency concerns outlined above may be less material.

3.3.3 FURTHER GUIDANCE

The procedure detailed above (3.3.2) will seem quite straightforward. The emphasis in this phase is on rapid systematic assessment of woodland presence and absence. The main challenge, apart from the potentially large volumes of data to be processed, is on deciding what can fairly be described as 'woodland' (and therefore long-established woodland or potential AW) both now (on recent aerial photographs) and at Epoch 1 date - or more exactly, what should be considered as woodland for the purposes of the task.

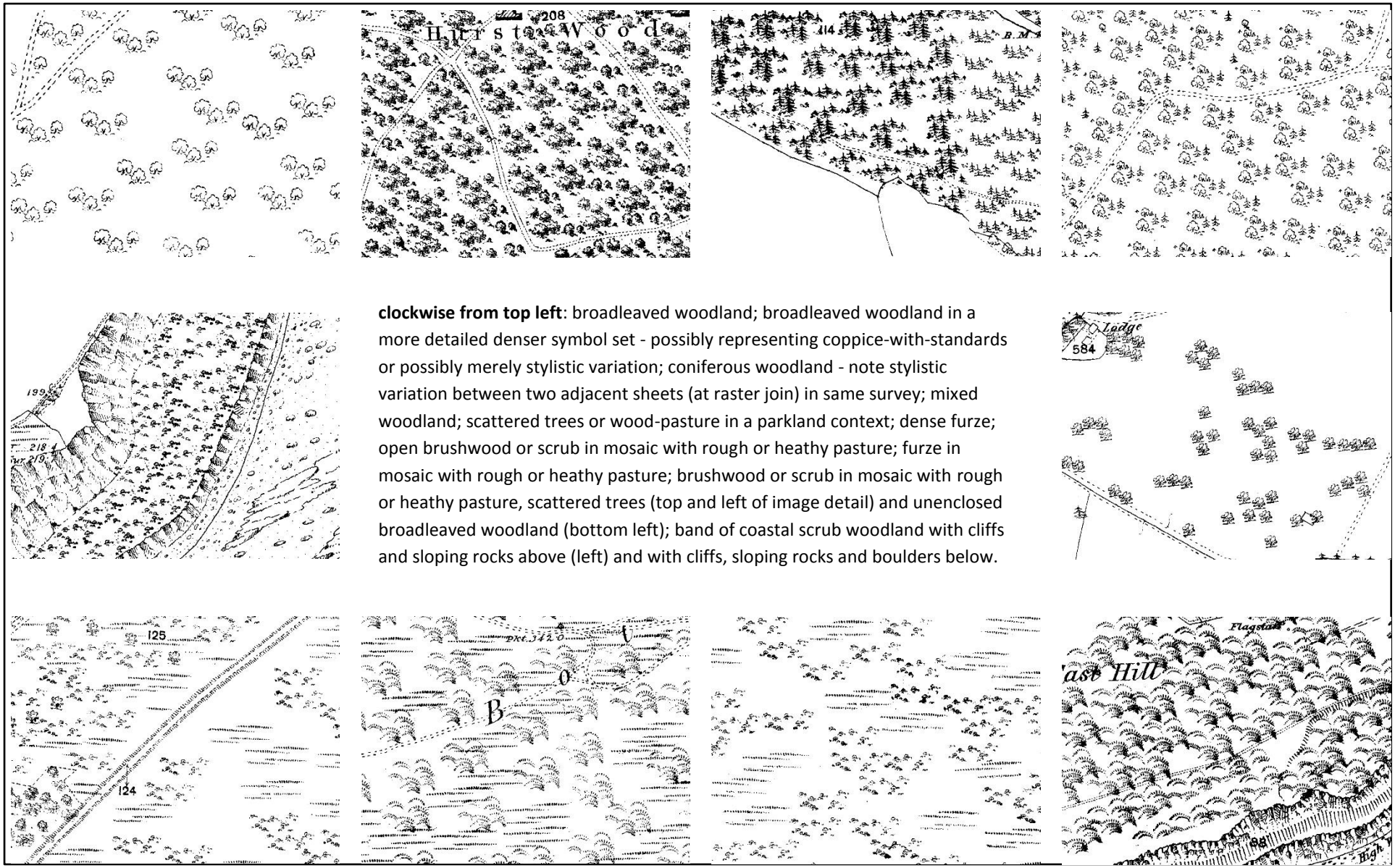
Most workers will have an intuitive sense of this but this is unlikely to be consistent across the range of handbook users. Even with guidelines there will be some sites and parts of sites that are difficult to assign confidently to either *woodland* or *not woodland*. Always bear in mind that you are not deciding what *is* ancient woodland at this stage. Resist the bias, for difficult-to-judge sites, of using the additional criterion of *thinking* an area is not *ancient* woodland to exclude it (i.e. code as '0' for one or both horizons) from the long-established woodland dataset. For the whole process to be as objective and rigorous as it can be, ambiguous sites, and all forms of long-established woodland (not just obvious AW candidates), must be included at this stage so that they can be fairly assessed later. At the same time, it is undesirable and obstructive to the later workflow phases to have large inclusions of land in the long-established woodland dataset whose status as woodland now or on Epoch 1 is very dubious.

To portray woody vegetation cover the OS County Series maps produced at the 25 inch and 6 inch scales[4] used a wide array of symbols and mixtures of symbols (Figure 6). The 1st survey (Epoch 1) and its use as an historical source for information on woodland continuity is described in a later section (5.2.1.1) but since interpretation of Epoch 1 is required from the outset of the workflow some guidelines are given here.

Box 6. What about woodland lost since Epoch 1?

It is sometimes assumed that a GIS exercise such as that in Phase 1 - comparing Epoch 1 with the present day - will inherently quantify woodland lost since the historical baseline. However the suggested methodology does not automatically achieve this and to attempt to do so could generate considerable extra work. The priority of Phase 1 of the AWI update is on mapping surviving woodlands which may potentially be ancient. Lost woodlands can easily be included in the working dataset (by editing and coding appropriate polygons AERIAL = 0, EPOCH1 = 1) but at extra cost. Performing the task systematically would require further effort still. Many lost woodlands will not correspond with any existing MasterMap geometry and therefore would need to have their boundaries manually digitised - an operation which could be very onerous or time consuming in some landscapes and moderately light in others. Mapping lost woodlands could be a valuable and interesting piece of research to inform understanding of woodland resources, history and habitat restoration in your project area but it is not an essential part of the AWI update process. Decisions about whether to go to the extra expense of undertaking this work should be made locally on a project by project basis.

[4] If your study area has gaps in 1 to 25 inch Epoch 1 map coverage refer to the 6 inch version of the survey (1st edition County Series), but where both are available use the 25 inch - it shows more boundaries and, in particular, may allow more acute captures of woodland edges where intricate mixtures of woody cover and open land habitat are found.



clockwise from top left: broadleaved woodland; broadleaved woodland in a more detailed denser symbol set - possibly representing coppice-with-standards or possibly merely stylistic variation; coniferous woodland - note stylistic variation between two adjacent sheets (at raster join) in same survey; mixed woodland; scattered trees or wood-pasture in a parkland context; dense furze; open brushwood or scrub in mosaic with rough or heathy pasture; furze in mosaic with rough or heathy pasture; brushwood or scrub in mosaic with rough or heathy pasture, scattered trees (top and left of image detail) and unenclosed broadleaved woodland (bottom left); band of coastal scrub woodland with cliffs and sloping rocks above (left) and with cliffs, sloping rocks and boulders below.

Figure 6. Some examples of the depiction of woody vegetation on the 1st Edition County Series 25 inch to 1 mile maps ('Epoch 1'). This is far from comprehensive but broadly reflects the range of symbols typically used in dryland woodland and scrub habitats. © Crown copyright and Landmark Information Group.

3.3.3.1 EPOCH 1 SYMBOLS AND VEGETATION INTERPRETATION

Precise assessment of canopy cover from pictorial symbols is not possible and deciding whether a site meets the guideline inclusion criterion of 20% cover over 80% of the area will not always be simple. Err on the side of caution and be aware that some engravers may have had a tendency to skimp on symbol density more than others. For example, what is mapped as an apparently open scrub on one sheet can appear as a dense thicket with standards on another (see Figure 7). We do not know exactly how the styles were deployed in relation to what the surveyors recorded but there was clearly variance among the different draughtsmen and engravers who interpreted their work.

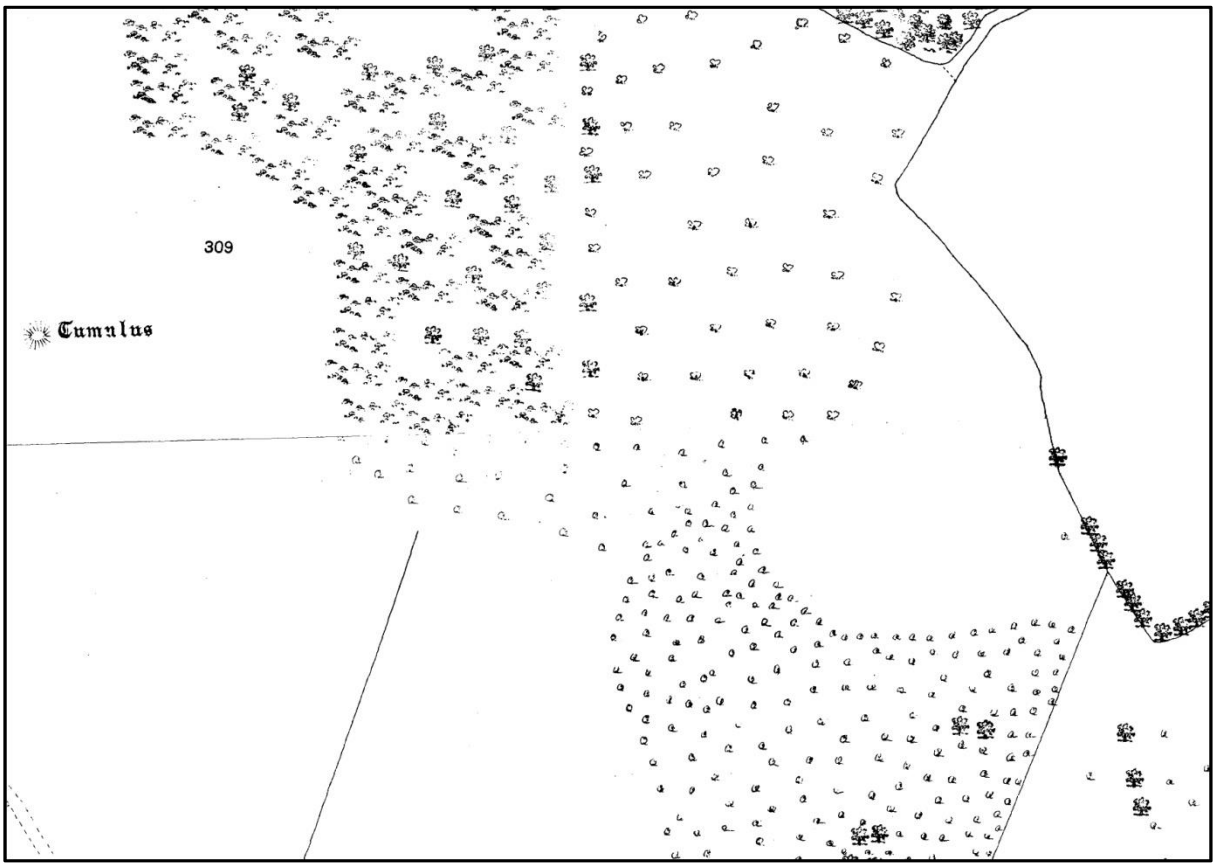


Figure 7. An area of scrub woodland or brushwood that lay across the junction of four map sheets in the original publication of the Epoch 1 historical OS maps (Sussex, all published c. 1876). Note the apparent, but probably not real, difference in vegetation structure, density and complexity between the NW sheet (dense shrubs or brushwood interspersed with large trees) and the NE and SW sheets (which use only sparse bush symbols). © Crown copyright and Landmark Information Group.

How acutely aligned the different symbols and symbol mixes were with different vegetation types on the ground we also cannot be sure. Symbols often occur in mixtures and mosaics, so that for example coppice-with-standards may appear as brushwood with deciduous tree symbols, sometimes in a repetition of a standardised group of trees and bushes but sometimes giving detail suggesting the distribution of timber amongst brushwood.

Many woods which must have been under coppice management at the time of survey are depicted without any obvious element of underwood. The safest approach at this stage of the project is to assess any areas with continuous tree or bush symbols (but see furze below) as potentially representing some form of woodland.

Osier symbols may well refer to other coppiced willows or carr woodland. Marshland vegetation can be particularly difficult to assess for woodland presence and this is compounded by the symbol for osier on some editions closely resembling that for reeds or general emergent marsh vegetation (Figure 8). Where osier beds exist in intricate mixture with other wetland vegetation, polygons captured will need to follow a best approximation of the main discrete areas that appear to contain woody components.

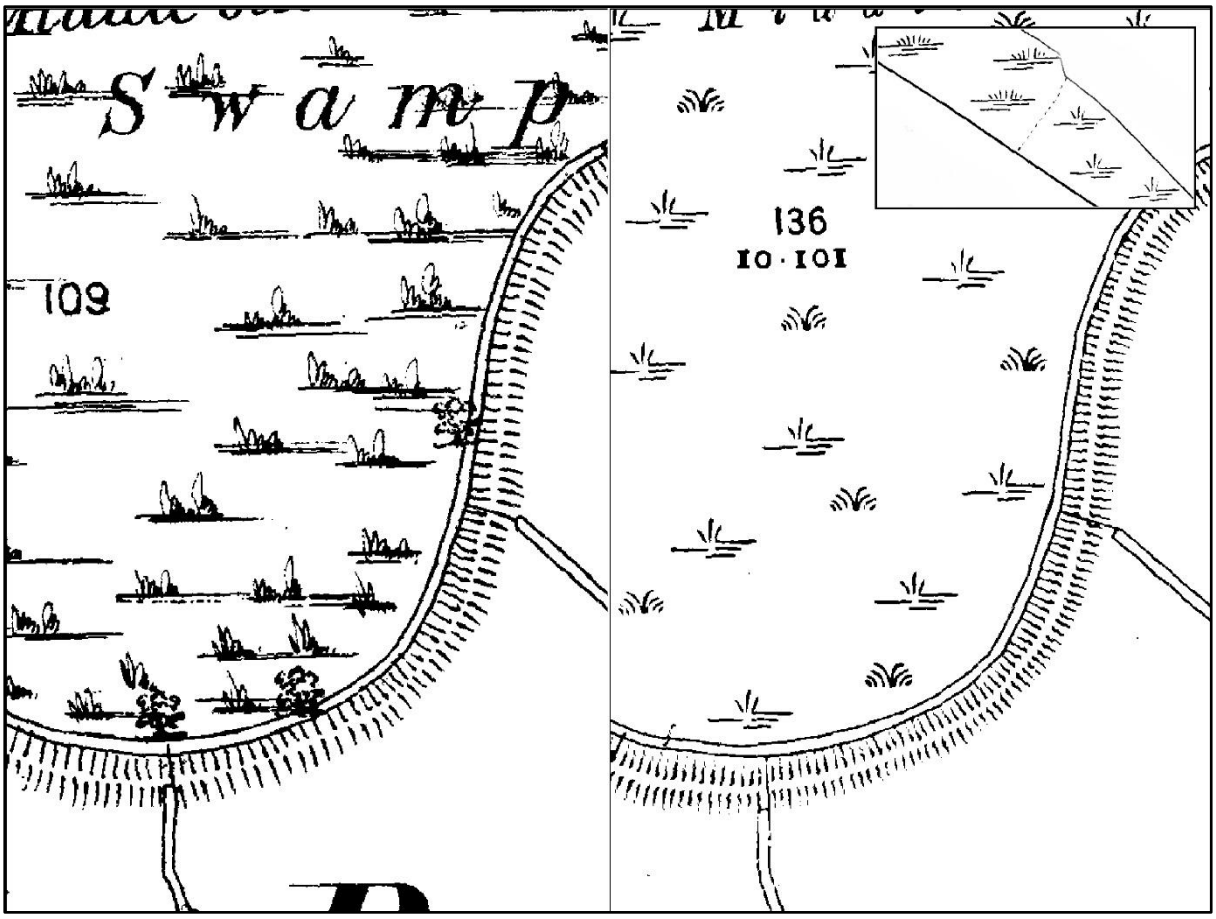


Figure 8. Osier symbols as seen on the OS County Series maps evolved through time and may not be consistent across England. Left: Osier or willow symbols used on Epoch 1 (1876) at Amberley, Sussex. Right: the same area as shown in 1910 with the symbol for 'reeds' (arching lines with no horizontals) mixed with the redesigned 'three-stemmed' Osier symbol. The inset detail shows the confusingly similar 'marshland' symbol in which the uprights are shorter and more numerous alongside the Osier symbol. These styles have been used to depict various sorts of wet woodland and scrub, not just managed Osier beds. Conversely, research on the earlier tithe maps in Kent and Sussex shows that some true Osier beds were indistinguishable from dryland broadleaved woodland on the Epoch 1 map (see Figure 6). © Crown copyright and Landmark Information Group.

If you have well documented examples of particular types of special woodland in your project area it is worth calibrating your understanding of Epoch 1 symbols by checking to see how these sites were symbolised on the maps (for example ancient carr woodland and some types of unenclosed upland ancient woodland could not always be readily identified using the methods of the original inventory (Spencer and Kirby 1992) and careful use of the Epoch 1 maps will allow some improvement on this).

Some aspects of the Epoch 1 map and corresponding aerial photograph will need somewhat more detailed scrutiny and consideration than is typical during this first boundary capturing phase. As with MasterMap derived polygons that are only partially long-established woodland (see above), if these hinder progress on the sweep they can be marked for later attention in a dedicated editing session rather than allowing too much loss of momentum. The following section gives further guidance on some of the main areas that can cause uncertainty.

3.3.3.2 SCRUB

In spite of the great range and detail of tree and shrub symbolisation in the Epoch 1 map, it is not always easy to be sure what all depictions mean. This is particularly true with the various forms of scrub, bush and brushwood symbol, sometimes pure or mixed with other tree, rough, or shrub symbols. It is unsafe to reckon on the use of these symbols being completely consistent across England.

Areas apparently consisting of bushes therefore require great care. Do not automatically assume they cannot be AW or summarily exclude them from the long-established woodland dataset. Ideas on ecological change in woodland vegetation are under continual refinement and views on the longevity and continuity of different types of vegetation vary. Areas of Victorian scrub may represent developing recent woodland but they equally may represent stands of woodland in decline, fragments of former wood-pasture systems, recently harvested woodland or even patches of semi-natural vegetation of great age and stability. If such areas overlap with woody vegetation in the present day they should be included in the long-established woodland dataset (i.e. polygons should be assessed '1' for woodland presence on both horizons in the attribute table). If the patches of vegetation do not conform within a reasonable approximation to any MasterMap or NFI polygon then subdivide polygons or digitise them manually (but make a record of any polygons captured in this way).

Rocky terrain can harbour 'hidden' stands of trees and bushes which may be depicted as scrub, and sometimes sparsely. These areas should be inspected closely because rock and scrub mixtures can easily be overlooked (even where bushes are densely marked - see Figure 6) and symbols for boulders and bushes can be very similar on some editions and sheets (it may be necessary to zoom in as far as image quality allows). Where aerial photographs and MasterMap data indicate woody cover in rocky terrain make special effort to scrutinise the map before confirming absence on Epoch 1.

Conversely, in areas of severe topography Epoch 1 may clearly indicate woodland or scrub that is obscure or invisible on aerial photographs (see Figure 9). In these scenarios use other datasets (MasterMap, NFI, recent OS maps) to determine woodland cover in the present day (or failing this, reserve judgement and make a site visit).

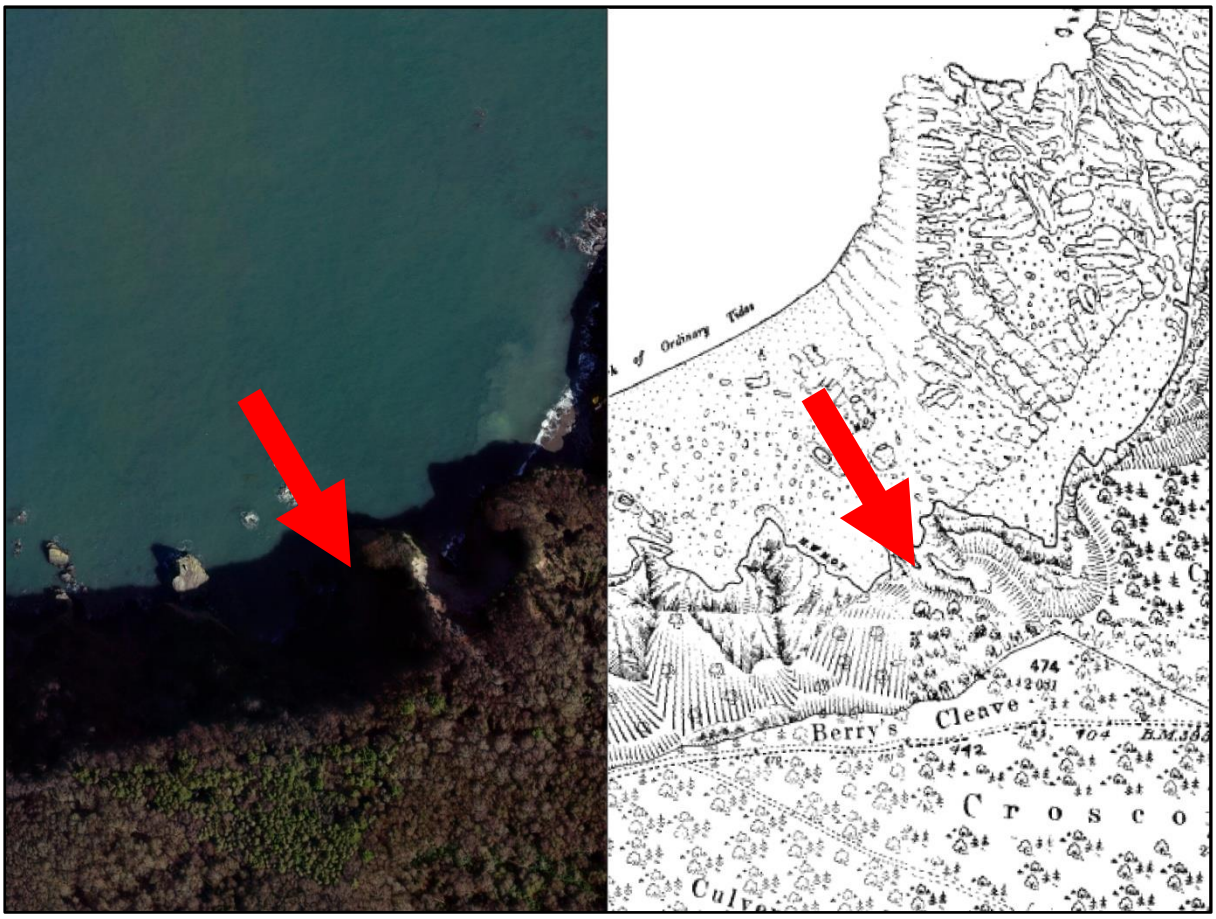


Figure 9. Woodland and scrub on coastal slopes and cliffs in north Devon. The vegetation of the steep rocks is completely obscured by shadows on recent air photos (left). The Ordnance Survey County Series 1st edition map for the same area (right) clearly shows the extent of woody vegetation below the cliff edge. Note the difference in engraving style between adjacent sheets of this map (the image shows the junction between 4 sheets), much sparser tree symbols being used on the western sheets. © 2018 Getmapping plc and Bluesky International Ltd; © Crown copyright and Landmark Information Group.

3.3.3.2.1 FURZE

Pure furze stands (see Figure 6) on Epoch 1 can generally be assessed as 'not woodland' but this does not need to be applied as a hard and fast rule and there are certain caveats. If you are working in a landscape where furze is, or was, a frequent land cover type then you will want to find some way of dealing with it consistently at this stage. Patchy gorse and broom may not have been uniformly represented - on some Epoch 1 sheets broadleaved bush symbols can be seen interspersed with the furze symbols (probably indicating presence of other species of shrub and tree), whilst in others the vegetation seems to have been depicted more cursorily. Juniper woodland as well as broom and gorse scrub may have been depicted as 'furze'. (Also beware of mistaking furze symbols for tree symbols if working at too small a display scale for the map.)

For extensive furze stands you may wish to quickly check forward and back (to any other available sources - see 5.2 - that are reasonably close in time of survey - e.g. Epoch 2) to help qualify the absence of other elements suggesting a more complex woody vegetation structure than shown by Epoch 1. Where doubt over gorse mixture with broadleaved tree or shrub symbols persists the areas should be assessed as woodland to allow further investigation at later stages.

Extensive tracts of land with loosely spread furze symbols mixed with symbols for rough grassland or heathland and lacking in tree symbols (see Figure 6) should not be assessed as woodland. Similarly, areas

dominated purely by gorse on recent aerial photographs and isolated from (i.e. not forming intimate mosaics with) other stands of woody vegetation should not be assessed as woodland for the purposes of the task.

As a component in mosaics however furze should be regarded as an integral part of a woodland area. For example, a polygon encompassing an area of scattered trees with tracts of gorse between tree crowns might be drawn to capture an area with 20% or greater tree canopy cover so that the boundary parsimoniously includes associated gorse stands rather than cutting through them unnaturally. Furze may be a qualifying component of areas captured as wood-pasture (below).

3.3.3.3 WOOD-PASTURE AND PARKLAND

Understanding of this habitat type is developing and changing and has been throughout the period since the original AWI, which generally omitted wood-pasture, was produced (see Perry 2015). Sites belonging to this habitat type (Box 7) and which conform to the definition of ancient woodland should be included on the updated AWI. (This assessment should be made independent of whether the site is currently managed as woodland, as pasture or wood-pasture.) The boundaries of potentially ancient sites therefore must be captured at this stage of the project (Figure 10).

Provisional inventories of historic wood-pasture and parkland sites have been produced (Lush 2012, Bannister 2013) and the associated spatial data can be downloaded from Natural England's website. The sites mapped are not necessarily ancient woodland or currently in a wood-pasture condition (some belong to 18th and 19th century designed landscapes, contain extensive treeless areas or currently support high forest), so the boundaries in these datasets cannot be used as a shortcut to mapping the habitat for AWI purposes.

Box 7. Wood-pasture and parkland: summary of character

Wood-pasture and parkland is a priority habitat characterised by the Joint Nature Conservation Committee as: *areas that have been managed by a long established tradition of grazing allowing, where the site is in good condition, the survival of multiple generations of trees, characteristically with at least some veteran trees or shrubs. The tree and shrub component may have been exploited in the past and can occur as scattered individuals, small groups, or as more or less complete canopy cover. Other semi-natural habitats, including grassland, heathland, scrub etc, may occur in mosaic beneath the trees. While oak, beech, alder, birch, ash, hawthorn, hazel or pine are often the dominant tree species, a wide range of other tree and shrub species may occur as part of wood pasture systems.*

See Perry (2015) and JNCC (2011)

Capturing appropriate polygons can be less straightforward than for other types of woodland due to the problem of defining the limits of open canopy areas which grade into treeless areas or closed canopy areas. The provisional inventories of historic wood-pasture and parkland may provide an additional reference (i.e. alongside recent aerial photographs and Epoch 1) to qualify decisions on what to include. Generally however, land considered for inclusion on the AWI will be more constrained and focus on identifiable stands of trees (or closely aggregated groups of stands) which broadly meet the criteria set out above (Box 2). In practice this means that some areas of very low density tree cover may be excluded even if they belong to the same land management unit as the captured stands. It is identifiable areas of wood-pasture vegetation that should be captured rather than wider expanses of pasture or extensive grazing land-use that encompass the stands.

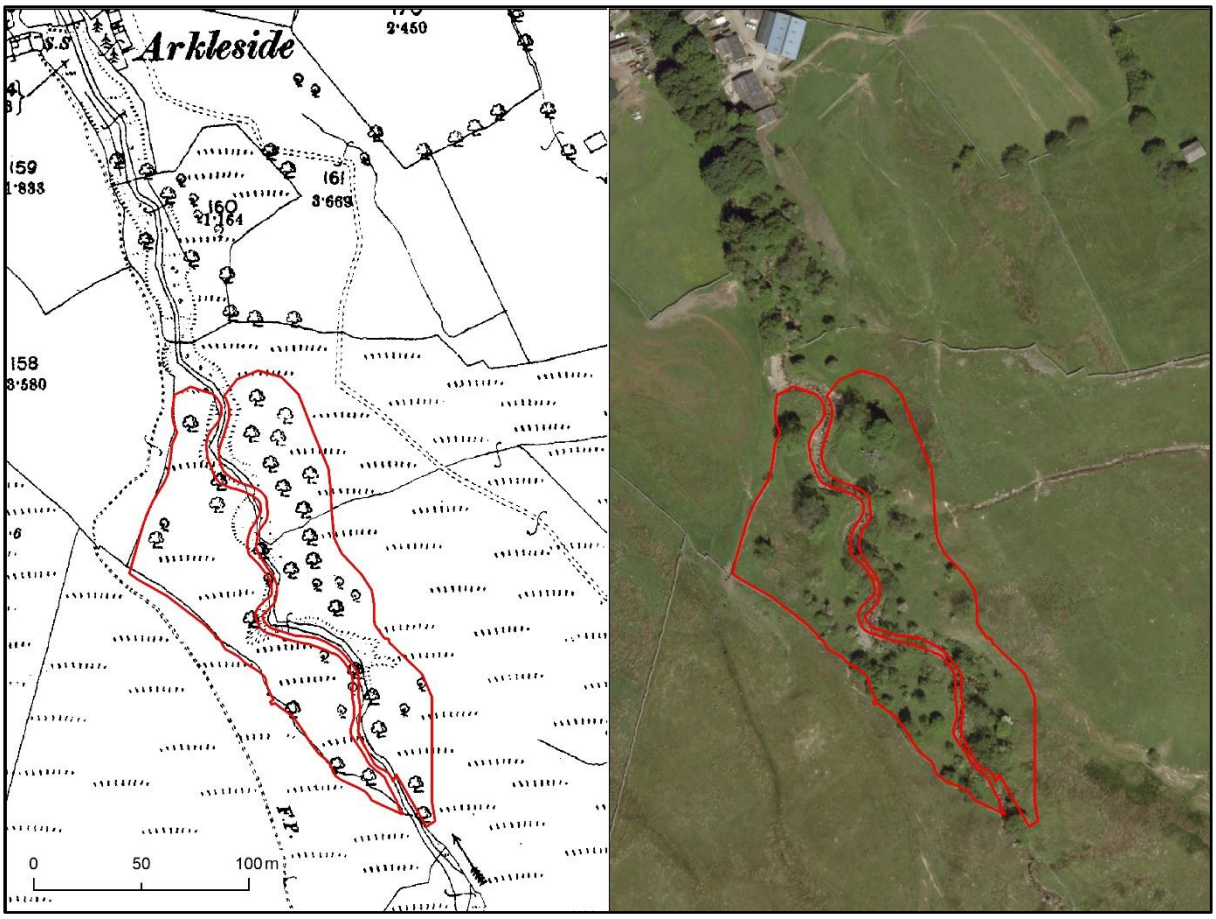


Figure 10. Part of Coverdale, North-west Yorkshire in 1890 and today. Unenclosed stands of trees with an open-structured canopy lying in wider areas of rough grazing, or around the fringes of inbye and outbye land in the uplands are likely to be semi-natural in origin but ancient wood-pasture is only one among several possible histories. These stands may be recent - developed during historical periods of reduced grazing pressure, or the chronically grazed remnants of lost woods – sometimes lacking in the features of either ancient wood-pasture or their parent ancient woodland type. In the image the polygons are approaching the limit in terms of width and canopy cover of what might be included (Box 4) in the long-established woodland dataset being built in Phase 1. © Crown copyright and Landmark Information Group; © 2018 Getmapping plc and Bluesky International Ltd.

	RECENT AERIAL IMAGE	EPOCH 1	Record in data table as: AERIAL, EPOCH1
A	interpreted as wood-pasture/parkland	interpreted as wood-pasture/parkland	6, 6
B	other type of woodland (e.g. high forest)	interpreted as wood-pasture/parkland	1, 6
C	interpreted as wood-pasture/parkland	other type of woodland (e.g. coppice-with-standards)	6, 1

Table 1. Types of long-established woodland recorded in Phase 1 that have the appearance of wood-pasture/parklland either recently or in the 19th century. A: polygons which may have moderately long continuity of wood-pasture conditions. B: wood-pastures that have been infilled or replanted. C: woodland that has opened up and possibly been cleared and pastured since Epoch 1. Like other long-established woodland areas captured in Phase 1 both A & B may later be assessed as either recent or ancient woodland. In many cases further investigation will reveal that C no longer comprises woodland habitat and is better characterised as 'pasture with trees'. C is retained in the dataset at this stage because it may include: ancient wood-pasture sites which have gone through a phase of denser canopy in the 19th century later to revert to a more open state; areas of degraded ancient woodland (not wood-pasture) which nonetheless retain conservation value and are eligible for inclusion on the AWI.

There are three basic possibilities for capture of sites that involve wood-pasture or parkland at this stage (Table 1). All three should be included for future consideration as ancient woodland sites. The use of an alternative code (6) to signify wood-pasture will allow any sites which are ultimately deemed ancient to be separately identified within the AWI.

There is much overlap between former wood-pasture sites and present closed canopy sites. Many places shown as parkland or wood-pasture in the 19th century have undergone changes in land-use such that discrete areas of the habitat in the modern landscape are no longer mappable. In some cases elements may persist in the form of isolated field, street or garden trees. These very low density relics, if the original pasture matrix has apparently been broken or destroyed outright, should not be assessed as woodland for the purposes of the AWI update.

Parcels of land where wood-pasture or parkland form mosaics with other woodland should be subdivided, but only as far as practical in order to indicate presence of both types of woodland. MasterMap will normally provide sensible boundaries to separate scattered from dense trees. Excessive editing of boundaries between woodland and wood-pasture at this stage is to be avoided. It can be wasted effort to carefully subdivide a polygon which is later found all to be recent woodland.

3.3.3.4 OPEN AREAS IN AND AROUND WOODS

Most woods contain open areas or openings. Often these should be assessed as 'woodland', that is as part of the woodland area, but some need to be excluded. Exclusions made from woods at this stage need not be final - if a site is ultimately designated AW there is an opportunity to revise a decision on say, the exclusion of a large glade from the woodland area. However, it is valuable in this phase of the workflow to get into the habit of assessing some features as 'not woodland'. This prevents gaps being subsumed into the AWI at later stages without having been properly reviewed and lessens the burden of editing work in future project phases.

Because of the broad spectrum of states of openness and vegetation patterns in English woodland strict area-based exclusion rules quickly break down in practice - a 0.5ha natural pond with semi-natural vegetation transitions embedded in a 100ha wooded area is appropriate as an included integral component of the wood. A 0.5ha excavated ornamental pond with a 1ha belt of woodland enclosing it is not - only the woodland part should be captured. These are extreme examples. Any opening in a wood larger than the minimum woodland capture size of 0.25ha calls for consideration as to whether it can be justified as part of a wood or should be treated as external. Some guiding questions to help decide on what open areas should be assessed as woodland are:

- Is it a natural surface with apparently natural or semi-natural transitions to woodland vegetation - i.e. gaps and glades?
- Is it an open space specifically associated with woodland management?
- Does it support or is it likely to support woodland vegetation (i.e. composed of characteristically woodland species) or woody vegetation (e.g. saplings, seedlings, shrubs or dwarf shrubs) in spite of lacking obvious tree cover?
- Is it a minor feature proportionally of the total woodland area?
- Does it represent a phase in a dynamic turnover of land within a woodland habitat continuum?
- Is it completely surrounded by woodland?

--

- Is the surface man-made or made ground or are permanent buildings present?
- Is the open area intensively managed as a non-woodland land use?
- Is the open area extensively managed as a non-woodland land use - e.g. a small traditional meadow surrounded by woodland?

- Is it a major feature proportionally of the site? (Would it occupy more than 10 or 20% of the site if it were included?)
- Is it a permanent or very long-established open space?
- Does it sit at the edge of a wood or occupy a transition between woodland and another land-use?

The interpreted open areas (IOAs) of the NFI can be a useful reference (or if using the NFI as your primary capture dataset - see Box 2- then IOA polygons will need to be considered in turn for assessment either as 'woodland' or not) because an independent assessment of open area character has already been made. Some IOAs, like power-line way-leaves, forest tracks and some water bodies, will typically qualify for inclusion within a woodland polygon or parcel of polygons - i.e. if that polygon or parcel were ultimately to be designated AW then the IOA would be part of the area designated and not a hole punched out of it - whilst others, like quarries and fields, will not.

Brace marks on the Epoch 1 map

The use of brace marks by the Ordnance Survey to indicate the association of a feature with a particular parcel of land can also be interpreted to help decide whether it is part of a wood or not. For example in Figure 5 a number of small ponds or pits can be seen close to the eastern edge of Russell's Wood. One of them, although tree covered and contiguous with the woodland, has been excluded from the area captured because it is shown to be coupled with the adjacent field on the Epoch 1 map.

3.3.3.5 GARDENS

Some gardens surrounded by woodland will be dealt with as exclusions (see above) but larger gardens which include treed areas can present another challenge. Small stands of trees, 0.25 to 0.5ha, within the curtilages of houses (on current aerial photographs and on OS MasterMap) should not generally be assessed as 'woodland' for the purposes of capturing the long-established woodland dataset, particularly if the site is shown in the context of a garden on Epoch 1, but there are exceptions. Sometimes these may be fragments of woodland areas which pre-date the associated house. If there is significant doubt over the sequence of development of the stands of trees, the garden and associated buildings then the treed areas, excluding any parts which are obviously under intensive garden management (good aerial photographs sometimes allow MasterMap polygons to be considerably improved upon in this respect), should be assessed as woodland to allow for further investigation in later project phases.

Indicators of garden as opposed to woodland status for this purpose include exotic trees and shrubs (e.g. coniferous or mixed on Epoch 1 or flowering trees and shrubs or those with coloured foliage; glaucous, yellow, red and purple leaved trees are often visible on aerial photographs), the presence of man-made objects, openness of structure revealing apparently mown, cultivated or made surfaces between tree stems. These often allow a reasonably safe assessment but if doubt remains over the condition of closed canopy areas, and they exceed the inclusion size threshold, then they should be assessed as 'woodland'. In other cases, gardens will be seen to bleed gradually into larger areas of adjacent long-established woodland. Here again, the abovementioned indications can often be used to improve on OS MasterMap polygons to sub-divide them into areas which may represent fragments of long-established woodland and parts - typically but not exclusively those more proximal to buildings - to be assessed as garden (i.e. 'not woodland').

3.3.3.6 ORCHARDS

If orchards occur in your study area make sure you are familiar with their appearance on Epoch 1 maps (which may vary locally) and aerial photographs so that they are not assessed as woodland. OS MasterMap includes orchards in the same feature class as woodland and scrub so this calls for alertness. On some sheets of the

(Epoch 1) maps, particularly earlier surveyed ones, orchards resemble regularly planted parkland or wood-pasture of mature broadleaved trees, the conventional and now familiar fruit or orchard tree symbols (Figure 11) not always having been consistently employed.

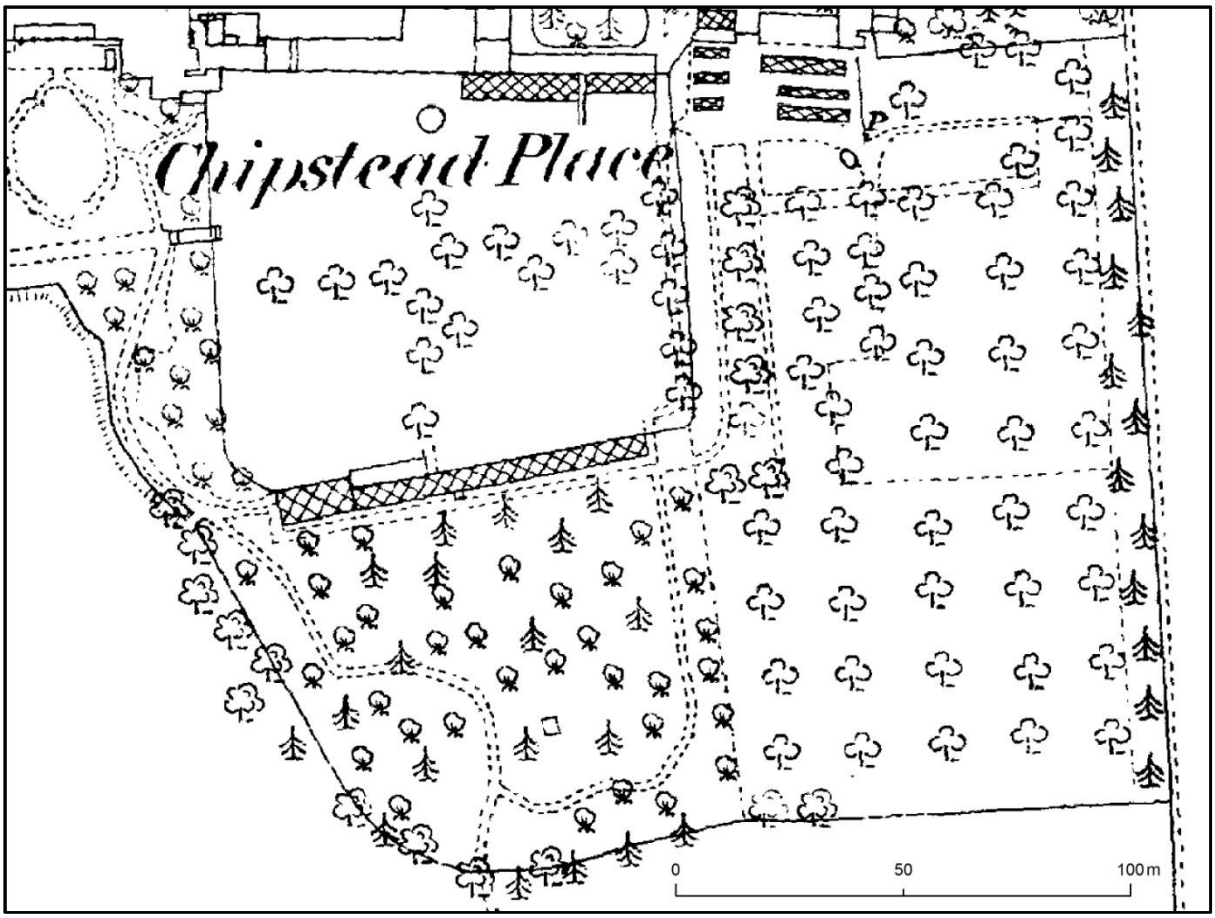


Figure 11. Non woodland woody cover on the Epoch 1 map: orchards, nurseries, arboreta and shrubberies should not typically (but see text) be assessed as 'woodland'. Occasionally a Victorian shrubbery may not be distinguishable on the map from semi-natural scrub or coppice woodland but usually the context and size will provide clear indications. © Crown copyright and Landmark Information Group.

3.3.3.7 DEGRADED WOODLAND

Woodland sites where aerial photography reveals significant areas degraded (by grazing, trampling, recreational activity, felling, removal of vegetation, waste disposal etc.) present another challenge, particularly where there appears to have been insidious long-term erosion of woodland habitat without any formal notification of land-use change having been made. Inclusion on the NFI or OS MasterMap topographic layer as some form of tree or shrub dominated vegetation is a useful indication that they may still be viewed as woodland (and therefore potentially be AW) for inventory purposes but these sites often continue to be mapped by the OS as woodland long after replacement of the vegetation and damage to soil has occurred. In some cases it will be questionable whether such sites would be defensible as ancient woodland (where the wider site context supported AW designation) and if the remote evidence clearly indicates the imposition of another land-use which would represent a break in continuity if woodland were to re-establish (i.e. irreversible vegetation change) then such areas should not be assessed as woodland.

In practice it can be very difficult to judge persistence of woodland habitat conditions from aerial photographs. These can emphasise certain types of disturbance and damage and completely conceal many others. The appearance of damage in open stands in summer-flown photos with dry soil contrasted against green tree

crowns can appear worse than actual whilst other sites may be severely degraded at surface level by activities that are hidden beneath canopy cover. A great deal of time spent deciding on exclusion or inclusion of degraded areas of woodland at this stage can be futile. Where you suspect degradation has proceeded beyond the point of being able to class a site or part of a site as woodland, but are still unsure it is recommended to assess it as woodland in this phase but create separate polygons for the damaged parts. This allows them to be separately considered as the survey and evaluation stages of the project progress. It may also be advisable to flag these polygons (e.g. using a spatial bookmark or a notation added to the polygon attributes) so that they can be quickly identified - they may become priority areas for further information in Phase 3.

3.3.3.8 LINEAR WOODY FEATURES

Many narrowly elongate wooded areas will be encountered in some landscapes and few in others. These occur both as isolated sites and as projections from the boundaries of larger woods. Most have not been included in previous versions of the AWI although some that are contiguous with woods designated on the original AWI have recently been added on subsequent MasterMap based updates. Some of these narrow wooded area sites, where the inclusion criteria are met, need to be captured at this stage so that the evidence relating to them can be properly considered in the AWI update.

Generally, however, parcels of treed land less than 10m wide at their widest (i.e. that are not spatially contiguous with any wider wooded polygons) should be treated with caution. There may be circumstances when some such polygons should be assessed as 'woodland' and retained for further study or survey - e.g. if they derive from and are the sole fragments of a larger Epoch 1 woodland area, now gone. Conversely a narrow or simple hedge show on Epoch 1 that has expanded to become a thick strip of scrub or woodland on the current aerial photograph should not be assessed as woodland for Epoch 1 (and therefore not treated as long-established woodland). Thick hedge-like features which appear to lack 'body' or have any 'interior' and that are less than 10m wide can reasonably be assessed as 'not woodland'.

An awareness of topography (consult modern OS maps or contour data, see 5.2.2) is important in helping to decide whether to consider thin strips as woodland for the purposes of the AWI update process. Parcels associated with features such as gorges, steeply incised watercourses, crags and escarpments may harbour deceptively large surface areas or arrays of niches on the ground and should not be dismissed too summarily. Other linear features which may at first sight appear to be too narrow to be 'woodland' but that should also be retained for later study are wooded lanes (if unmetalled) and holloways - technically some of these may well conform to the definition of AW although they are classed as another land-use.

The Epoch 1 map is possibly the best of all sources available for distinguishing between thick hedgerows and narrow woods. In the latter the tree or shrub symbols are usually drawn with an indication of the extent of land occupied, typically a solid or dotted line. Even very small informal patches of unenclosed scrub will often carry a brace mark which shows to which larger parcel of land they belonged. These map features are valuable for deciding on whether a linear feature should be considered as woodland or not and it pays to spend some time during the Phase 1 sweep of Epoch 1 to carefully consider linear features. Rows of single, surveyed trees (see 5.2.1.1.1), even if confined both sides by a boundary feature should not be treated as woodland. Avenues - i.e. double rows of surveyed tree symbols with or without a routeway marked in between - should be excluded except where in the context of a larger containing polygon of long-established woodland, parkland or wood-pasture (see below). In situations of remaining doubt over whether something is 'woodland or just trees' then it should be scored as woodland for the purpose of this initial 'capture' stage.

In Figure 5 there are examples of linear features extending from the eastern edge of Russell's Wood. From north to south: two features were shown as narrow (but >20m wide) woodland features on aerial photographs but not as woodland on Epoch 1 (one an un-treed hedge, fence or ditch the other a loose row of surveyed

trees), the third was clearly a field boundary and too narrow to qualify as woodland on the aerial photographs and the fourth was a distinctly bounded woodland area on both Epoch 1 and on the aerial photographs.

3.4 OUTPUTS OF PHASE 1

At the end of this sweep any polygon that has been assessed as potentially having woodland present now should also have been assessed against Epoch 1. This can be checked by querying the existence of features coded other than '5' or '0' for the aerial photograph layer but coded '5' for the Epoch 1 layer.

Other queries should be run to confirm that all necessary polygons have been coded before progressing to Phase 2. For example, you could check whether any parcels of land classified by OS MasterMap as woodland or scrub and larger than 0.25ha remain unchecked. (Note that a simple query based on polygon area attribute will not suffice as clusters of spatially contiguous polygons need to be taken into account). It is not necessary for non woodland polygons or those that have actively been assessed against aerial photographs as 'not woodland' to have been checked against Epoch 1, unless you wish to supplement the AWI update by generating data on lost woodland (see Box 6). Check for any remaining polygons recorded as partially wooded (2) and edit these accordingly before proceeding.

In order to move onto the next stage all those polygons which are coded positively for woodland presence (including wood-pasture areas) on the upper time horizon (aerial photograph) should be exported and archived as a benchmark in the workflow. A renamed version of this dataset can then be taken into Phase 2 where it will be adapted to become the working long-established woodland layer.

3.4.1 A PLATFORM FOR UPDATING THE AWI

With the completion of Phase 1 you will have created a highly accurate and precise map identifying old woodland for your study area. This provides a platform for updating the AWI. We prefer to model this as a distinct research stage (see overview flow chart) to avoid blurring the firm assessment of woodland presence or absence at Epoch 1 date with more qualitative assessments of less precise or less consistent map sources made at later stages in the workflow (see Box 5). For the purposes of this handbook we refer to the extant Epoch 1 woodland identified in Phase 1 as 'long-established woodland' (LEW). (This proceeds on a working assumption of continuity since Epoch 1; it may later transpire some sites are 'interrupted woodland'.)

Whilst this LEW resource as captured should contain nearly all ancient woodland (there may be some exceptional AW sites which are not depicted on Epoch 1 as woodland), the correlation between AW and LEW changes in complex ways across the country. In some parts of the east midlands for example a 19th century cartographic horizon may provide a close proxy for AW distribution (Peterken 1976), whereas in Surrey a map of long-established woodland based on Epoch 1 would contain masses of recent woodland arisen in the mid-19th century (Rackham 1980). In some landscapes 18th century plantations are not uncommon whereas in others they are rare. Epoch 1 is used as a baseline not because it represents any particular benchmark in the historical development of woodland resources that applies nationally but because it provides a detailed and complete cartographic coverage within a definite time frame.

Phases 2 and 3 are concerned with enabling long-established woodland areas to be investigated locally so that they can be evaluated as either recent or ancient woodland.

4 PHASE 2 - COMPARING THE DATASET WITH THE EXISTING AWI

In this project phase you will compare the data collected in Phase 1 with the existing digital version of the AWI and:

- systematically check and remove from the working dataset land identified as recent woodland
- classify areas of land identified as long-established woodland according to their status in the existing AWI
- consolidate dissected parcels of woodland - those consisting of multiple spatially contiguous polygons - into workable mapping units reflecting discrete woods or parts of woods

Depending on the complexity and size of the project area and dataset there are different approaches that may be taken to this work. In some cases it may be undertaken manually, essentially treating the original AWI as another reference layer (like Epoch 1 above) and cross referencing each of your long-established woodland polygons against it, performing edits where necessary to reflect mixed status and merging polygons into consolidated units of the same status where appropriate. Spatial queries combined with attribute queries may be used to identify the different classes of polygon in bulk. In landscapes where woodland polygons are frequent a more automated approach will probably be required based on the 'union' of shapes within the two vector datasets. The output of this GIS operation must however be manually reviewed and processed on a case by case basis. Before deciding how to proceed make a visual inspection of your new long-established woodland layer and the original AWI on screen and ask how complex is the relationship between the two.

The material that follows is generally applicable whichever approach to examining the relationship between the existing AWI and the Phase 1 output dataset is taken.

4.1 PREPARING & PROCESSING THE DATA

To the working dataset add fields suitable for storing text labelled 'CLASSIFICATION' (or similar) and a short integer field into which current AWI status (0 or 1[5]) for each long-established woodland polygon can be entered (either manually or using the results of a 'union'), for example 'NE_AWI_[download_date]'. Another text field should also be added for a unique code or 'UID' for each polygon (but do not populate it at this stage).

The objectives of the process outlined above are:

- identify and exclude from the working dataset any areas of post Epoch 1 woodland (**recent woodland**) that are not included on the existing AWI
- identify and exclude from the working dataset areas of land included on the existing AWI but not assessed as woodland in Phase 1 - **mapping errors**
- identify and classify as '**previously designated AW**' areas of long-established woodland that are effectively included on the existing AWI.
- identify and classify as **'potential new AW**' any significant areas of long-established woodland that are effectively not included on the existing AWI. Insignificant areas which are spatially contiguous with **previously designated AW**, and are negligible in areal terms relative to those areas, should be classed as **previously designated AW**. Insignificant areas are the **slivers** of land which represent artefacts of differences in mapping precision between the two datasets. They range in size from invisible (less

[5] this can be extended to include more information than just presence/absence, e.g. 1=ASNW; 2=PAWS; 0=not recorded (Miller 2014)

than a single millimetre) to 20m wide[6]. If the fringes of significant areas of **'potential new AW**' overlap with the existing AWI care is needed. These may falsely appear to be **previously designated AW**. If however they are only artefacts of changes in *MasterMap* accuracy they should be retained in the **'potential new AW**' category.

- identify any areas of land included on the existing AWI but which are apparently post Epoch 1 woodland. Any significant such areas should be mapped and classed as **designation queries** and kept for further review. Insignificant areas which are spatially contiguous with **previously designated AW** areas should be treated as recent woodland or mapping errors and excluded. Insignificant areas are **slivers** of land as described above.
- [if you have captured **lost woodland** in Phase 1 - see Box 6 - you will also be able to add a classification to identify that at this stage]

A recommended safeguard for this work when removing features from a dataset is to inspect the polygons mapped on screen before doing so - use the power of GIS to identify and select mapping errors etc but review the selection to make sure the edits are sensible before committing them. Pay particular attention to large **mapping errors** and **designation queries** and if there are suspicious polygons retain them in the dataset for further review (for instance a recently harvested wood may have been misclassed as 'not woodland' in Phase 1). Only remove that which you are confident is not long-established woodland.

Table 2 shows the relationship between woodland presence in the existing AWI and in the working dataset in relation to the classification described above and typical actions.

		Phase 1 output		
		long established woodland	woodland on aerial photographs but not on Epoch 1	not woodland
Existing AWI	included	1. PREVIOUSLY DESIGNATED AW retain for Phase 3	3. DESIGNATION QUERY check and reassign to 4 or 1	5. MAPPING ERROR delete
	not included	2. POTENTIAL NEW AW retain for Phase 3	4. RECENT WOODLAND delete	dead space delete (if present)

Table 2. Simple framework for comparing between Phase 1 outputs and the existing AWI and classifying areas of overlap and non-overlap accordingly. This can be achieved using GIS union tools or manually by cross referencing and editing polygons. This can be extended to accommodate data on lost Epoch 1 woodlands if required and on AWI status (PAWS/ASNW)

As you go about the process of editing the layer classifying polygons, removing mapping errors and reassigning slivers to be either merged or deleted as appropriate it is a good opportunity to edit and rationalise multi polygon woods into more workable mapping units. This process does not need to be pursued so that no woods are subdivided at all, just to eliminate unnecessarily fine-scale fracturing of sites. It is advisable to retain

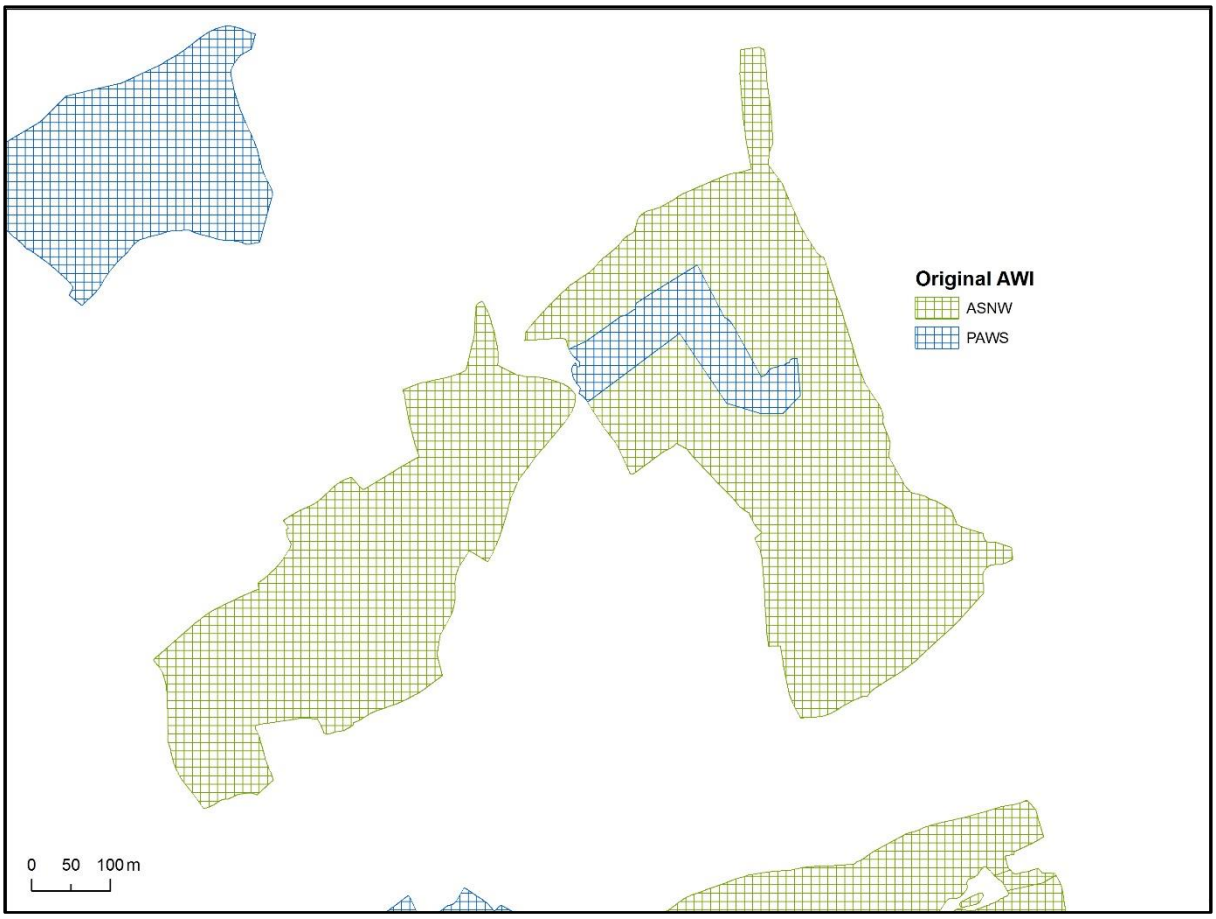
[6] Thicker slivers should always be inspected against the reference datasets to confirm that they are what they seem. As a rule of thumb only, for an area of land to be considered 'insignificant' as defined above it should be below the nominal capture size of 0.25ha (some long boundary slivers may exceed this). If it is not obvious or you are unsure if an area of woodland is a genuine difference or a mapping error after re-examining reference data then assume the former and treat it as **potential new AW** or **designation query** which needs to be assessed further. Do not waste time on long deliberation at this stage if further evidence is needed.

boundaries which mark the major lines of variation or compartmentalisation within a site as these may well turn out to be meaningful (see Box 3).

When you have progressed this as far as you wish and actioned all the editing arising from a comparison with the AWI (see Table 2 and Figure 12, Figure 13) a unique identifier (UID) should be assigned to all polygons that are to be processed further in Phase 3 (i.e. areas of long-established woodland plus 'designation query' areas you wish to retain for further examination). It is recommended to use a meaningful alphabetic character code (representing the study area) prefixing an automatically generated unique numeric code.

Figure 12 shows broadly how the work described in Phase 3 might progress on part of a phase 1 dataset (as illustrated being captured in Figure 5)

Figure 13 helps visualise the detail of the process overviewed in Figure 12 (above) for dealing with captured long-established woodland polygons that are also substantially designated on the existing AWI. Here various discrepancies of geometry are highlighted and explained using a single wood as an example. For further illustration Appendix 9.1 sets out in more detail how boundary anomalies can be understood and dealt with.


Original AWI
ASNW
PAWS
0 50 100 m


SO_2540
SO_1391
SO_2655
SO_0180
SO_1377
SO_2651
SO_0298
SO_2590
SO_0650
SO_2649
SO_1367
SO_1361
SO_1360
SO_1358
SO_0649
SO_0623
Long-established woodland
POTENTIAL NEW AW
PREVIOUSLY DESIGNATED AW
0 50 100 m

Figure 12 (previous page): 1. The original AWI; 2. the long-established woodland data from Phase 1 (see Fig. 5.5) have been incorporated with the original AWI, rationalised into solid parcels of woodland where sensible, classified according to their status on the original AWI and assigned unique reference numbers to facilitate future work. Areas of recent woodland have been removed. © Crown Copyright and database rights 2018. Ordinance Survey 100022021.

4.2 FURTHER GUIDANCE

'Designation queries' (Table 2) are polygons which appear at this stage of the workflow to be recent woodland wrongly included within the current version of the AWI. Many of these are likely to derive from imprecise mapping in the original inventory and digitisation errors in its subsequent transferral to GIS. Since this project phase is designed to clean and rationalise the dataset for further work and get rid of most of the 'chaff' it may be helpful to resolve any of these queries which are straightforward at this stage.

If it is possible to consult the paper tracings and fact sheets generated by the original AWI work in your study area these provide the best means of finding out whether a site was deliberately included or is likely to be a result of mapping imprecision or a subsequent digitising error. Queried sites can also be checked against later County Series epochs and 20th century air photos (see 5.2.2).

Small polygons that you are satisfied are genuinely post-Epoch 1 woodland can be removed from the dataset (along with 'mapping errors'). However, less straightforward decisions – for instance significant areas of apparently recent woodland included on the original AWI - can be reserved for verification with further map sources in the next project phases. A field can be added to the dataset at this stage in order to record preliminary decisions on inclusion or exclusion of doubtful sites inherited form the original AWI.

Currently unwooded areas mapped as ancient woodland on the existing version of the AWI are treated as 'Mapping errors' (Table 2) for the purposes of the update. One of the objectives of the original AWI was to provide a baseline against which future losses of ancient woodland could be assessed (Spencer & Kirby 1992). Sites will be removed from the inventory by the update process for various reasons. These include a combination of mapping precision errors and mistakes in the original AWI as well as actual destruction of designated ancient woodland (some of which may itself have been wrongly designated!). Systematically quantifying real losses of ancient woodland since the AWI was initiated is therefore not simple and not an output of the work set out in this handbook. The AWI update should be seen as a refinement of the original baseline not a re-census of the ancient woodland resource.

Nevertheless the opportunity to gain information on recent losses can be taken; original AWI polygons not shown as woodland on recent aerial photographs are clearly identified so that a dataset mapping possibly destroyed ancient woodland sites can be made and investigated further if required – a union will automatically generate the required polygons. Major clearances will tend to stand out. In some of the recent projects to revise the AWI in South East England these were collated with a little additional effort to produce useful information on the circumstances of recent losses of ancient woodland.

4.3 OUTPUTS OF PHASE 2

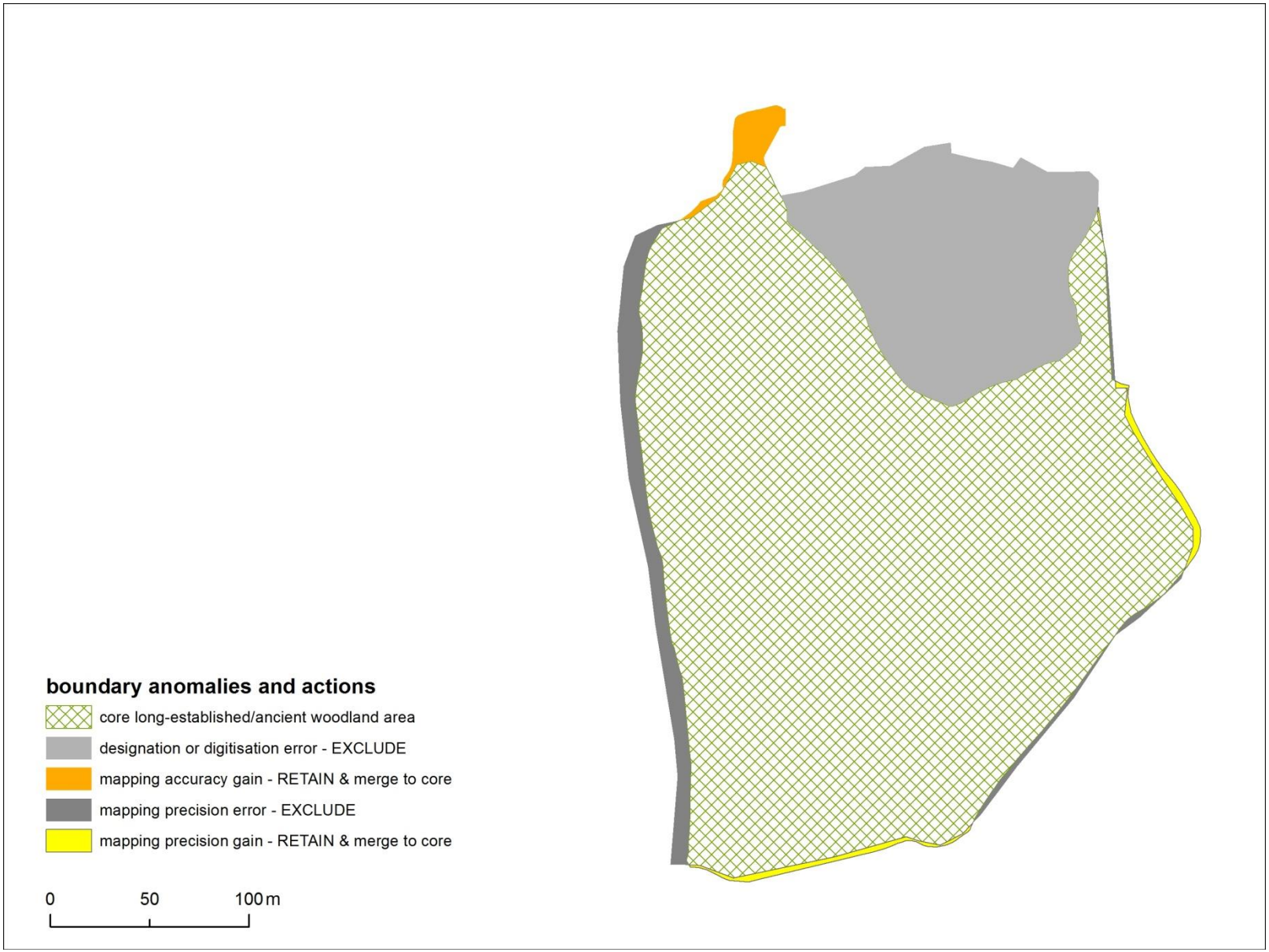
The work undertaken in this phase has:

- validated the existing AWI, identifying areas of weakness for further query and priorities for correction
- quantified the maximum extent and distribution of possible additions
- provided a first means of prioritising the resources available to complete the update of the AWI for the study area
- created a solid platform for seeking and incorporating new evidence into the long-established woodland dataset - Phase 3

At this stage the long-established woodland dataset should be exported and archived as a benchmark in the workflow. A renamed version of this dataset can then be taken forward into Phase 3.

Figure 13. (next page). A single wood as mapped in the original AWI (digital version) and as long-established woodland after a Phase 1 sweep. Note in addition to the inclusion on the AWI of a significant area of unwooded land the subtle discrepancies in boundary plotting between the two shapes. Most of these are artefacts of different levels of mapping precision (small offsets between two ± parallel lines) whereas some represent more accurate details gained from larger scale mapping (the small nodule at the northern boundary). The second image illustrates how these boundary anomalies are dealt with in the context of editing the long-established woodland dataset as part of Phase 2. **© 2018 Getmapping plc and Bluesky International Ltd. © Crown copyright and Landmark Information Group. © Crown Copyright and database rights 2018. Ordinance Survey 100022021.**


Bartlets Wood
207
8·631
214
4·043
216
6·809
211
116
213
1·687
217
·240
210
193
·112
S E D L E S C
208
8·261
209
8·087
215
15·776
Killingan Wood
233
·146
230
8·356
234
2·475
236
Original AWI
Long-established woodland
0
50
100 m


boundary anomalies and actions
core long-established/ancient woodland area
designation or digitisation error - EXCLUDE
mapping accuracy gain - RETAIN & merge to core
mapping precision error - EXCLUDE
mapping precision gain - RETAIN & merge to core
0
50
100 m

5 PHASE 3 - SEEKING FURTHER EVIDENCE & REFINING THE DATASET

In this phase of the workflow you will attempt to extend the chronological span of data and enrich the evidence base relating to each candidate site in the dataset produced in Phase 2. From the baseline of Epoch 1, earlier and later maps will be checked and map sources that bridge gaps in the cartographic record sought out. Other forms of information from the field will need to be collected as supporting evidence on some sites. Indications of recentness and non-continuity of woodland cover are just as valuable to the process of updating the AWI as evidence for ancientness (Chapter 6). All types of indication should be searched for and recorded with equal effort.

This chapter describes the key sources of evidence required to progress the dataset built in Phases 1 & 2 and how to incorporate their information in the developing dataset.

5.1 PRIORITISING SITES FOR FURTHER RESEARCH

Ideally, all of the sites in the long-established woodland dataset should be assessed using the full range of available evidence sources. However, limited resources will mean that prioritisation will often be necessary. The AWI is regarded as provisional, a 'live dataset' which can be modified as new information comes to light (Goldberg 2015). In updating the AWI it is therefore appropriate to weight some of the limited resources in the short-term towards 'critical sites' where high confidence decisions are more urgently needed. Nevertheless, certain core evidence sources should be used to validate the whole dataset (see 5.3, below).

For 'PREVIOUSLY DESIGNATED AW' polygons it may be assumed these areas were supported by evidence in the original inventory (for example, the Ordnance Survey First Series, see below, 5.2.1.1.5, or expert knowledge and experience of individual sites) and have not been successfully challenged since. Natural England hold the original paper 'fact sheets' relating to each site in the original inventory. These record the evidence for antiquity – which in some cases may be substantial – but have not been digitised. However, the depth and quality of the evidence that was used to support the original inventory and its subsequent amendments will vary between counties; more thorough reviews may be required in some study areas than in others.

Generally the greater onus on evidence gathering in the AWI update will be to support decisions on the inclusion or exclusion of 'POTENTIAL NEW AW' sites and original AWI 'designation queries' identified in Phases 1 and 2.

The planning authority or authorities in your study area should be approached to provide information on localities (if not individual woods) that may be affected by planning proposals or where a change in AWI status of woodland could affect applications already in train or land allocated for development. Targeted archival research or fieldwork may be directed to such sites where an enriched array of evidence is desirable to support the evaluation of woodland status.

As the work progresses it will become apparent that some sites are particularly under-served by map evidence or have map evidence which conflicts or is simply unclear as to the extent of a site. Resource constraints[7] may limit the number of site visits that can be made as part of an AWI update project (see 5.2.3) and in order to use

[7] If there are no such constraints then the opportunity should be taken to survey a larger and more representative sample of the woods in a study area, including those with good independent (i.e. non ecological) evidence for recentness or ancientness. This can further understanding of local woodland ecology, for example helping to refine the application of ancient woodland vascular plant lists (e.g. Gulliver 1995, Thompson *et al.* 2003, Woodland Trust 2007).

field survey capacity most efficiently these sites (or a sample of them) should also be prioritised for visits where possible (see 5.2.3).

5.2 SOURCES OF EVIDENCE

This section is for information on the characteristics of different evidence sources. Click here to skip forward to information on how to record and use the evidence in this phase of the workflow.

5.2.1 DOCUMENTARY EVIDENCE

5.2.1.1 HISTORIC MAPS

An awareness of the provenance, purpose and limitations of a map improves and qualifies its value for helping understand woodland history. Some mapmakers will have undertaken surveys whilst others will have copied earlier maps, possibly compounding errors and inconsistencies. Some maps were constructed with little concern for the depiction of woods whereas others were especially careful.

This section provides a reference guide, arranged broadly in reverse chronological order, to the core cartographic resources or types of resource (and some supplementary ones) that are likely to be consulted in Phase 3 of the workflow. It draws on the scoping exercise undertaken by LUC (2013), with further detail on map origins, depiction of woodland and trees and interpretation in each case.

What follows is not intended to be a comprehensive guide. Workers should use this as a starting point for trying to develop an appreciation of the history of map-making within their study area and a good knowledge of the range available maps. The mixture of map sources used will be unique to each project.

5.2.1.1.1 ORDNANCE SURVEY COUNTY SERIES 1ST EDITION (EPOCH 1)

Type and coverage

Referred to as 'Epoch 1' in this handbook, this was the first large scale Ordnance Survey published map compiled on a county basis for the whole of the British Isles. Some areas of military importance were mapped separately. It is a very accurate and detailed map.

Date

1846-1901 for the whole coverage. The 6” commenced in 1840 on a county by county basis followed by the more detailed 25” to the mile between 1853 and 1896.

Scale

25” to 1 mile or 1:2500 and 6” to 1 mile or 1:10560.

Origin of compilation

The Ordnance Survey evolved from military mapping and the need to map the new and evolving nation of Great Britain (See Hewitt 2010 for a detailed historical account) By the time of this series the maps were intended to serve many civilian as well as military purposes.

How surveyed if known

Surveyed by triangulation on a county by county basis. Most of England was surveyed at the detailed 1:2500 scale but two English (Lancashire and Yorkshire) and seven Scottish counties were surveyed and published at the 1:10560 scale before being replotted, when the 1:2500 mapping was adopted as standard in 1853-4. By 1896 it covered the whole of the area of cultivated Britain. (Oliver 2005, 35-41). Plates were then engraved from the final prepared drawings, for publication.

Keys and Accuracy

A very detailed map, which shows enclosed woodland annotated by tree type (conifer, broad-leaved or mixed), coppice and scrub as well as individual trees within fields and field boundaries, including boundary marker trees. Features within woodlands may be shown and the nature of external woodland boundaries – whether a formal enclosure or not – is often discernible. No keys were published on the 25" map[8] but they were illustrated by Sir Henry James in 1875 in his account of the methods and processes of the Ordnance Survey. For woodland there were the following categories: wood (coniferous or deciduous), fir, brushwood, furze and osiers (see Figure 6). Until 1888 birch woods were shown using a separate symbol from other deciduous woods, but thereafter were grouped with them. It was possible for surveyors and engravers to depict mixes of different types of woodland but the approach to symbol mixtures does not seem to have been strictly regulated and is not consistent between counties or even between sheets within a county. In other words repetition of a similar pattern in different places does not necessarily imply similar vegetation.

Larger individual trees shown in parkland and on boundaries have been shown to closely correspond to individuals on the ground. These were surveyed and plotted onto the 6" and larger scale maps up to July 1893, but from then only on 1:500 maps. Trees were shown unless they obscured boundary or other important symbols. The base of the plotted trunk marks the point of the tree to within one metre (Oliver 1993, 73).

Interpretation

The 25-inch OS of the mid- to late nineteenth century is the most detailed and accurate map of Britain ever made, especially regarding trees and woods. (Rackham 2006, 178).

For this reason it is a cornerstone of the AWI update process (Phase 1 - Capturing the dataset). Its main disadvantage when identifying pre-1600 AD woodland is the relatively late date but, as probably the best map of the country ever made, its evidence should be employed to full advantage. In spite of the 19th century date the detail provided often allows insights into the antiquity of a wood to be made. Wood boundaries and semi-natural vegetation patterns within woods may be discerned as well as possibly ancient correlations between woodland shape and topographical features like springs or crags. More recent woods can sometimes confidently be identified as regularly shaped enclosures or as having map symbols that indicate a previous non-woodland use or recent planting. However, the map does not in itself (i.e. without corroboration from other sources) give grounds for elimination of ostensibly recent sites nor for the designation of apparently ancient sites.

Due to its accuracy the absence of a wood is considered significant; no depiction is likely to represent genuine evidence of absence. This is not an absolute certainty though. Where there is earlier and later evidence for woodland on a site, if Epoch 1 depicts the woodland boundary but not tree symbols there is still scope for investigating continuity (a recently harvested wood could be omitted, but this problem appears to be rare for this particular map, as do engraving mistakes). This situation may arise where a site on the original inventory does not appear on Epoch 1 (see Table 2). Otherwise, the AWI update set out in this handbook depends on the reliability of this map and it is the case that its rare omissions of woods could transfer as errors in the AWI.

[8] A characteristics sheet for the less detailed 6" scale versions of the County Series 1st edition is available on the National Library of Scotland's website: http://maps.nls.uk/view/74477147

The subtle difference in form between a surveyed tree symbol - typically used for 'non-woodland trees' - and the tree symbol used (sometimes scattered) as a generic indication of tree presence within a bounded plot of land has great interpretative value for ancient woodland work and should be learnt.

Further information on interpretation is given under 3.3.3.

Source and Availability

Digitised by Landmark from copies held at the British Library and geo-rectified on the British National Grid. Copies are held by Natural England under licence so this map source is readily available for use in updates undertaken in partnership with Natural England.

Other notes

From 1855 until mid-1880s, acreage of fields was published in separate Books of Reference or Area Books. Before October 1879 these books included land use information for non-built up areas and between 1859 and 1869 had place-names listed. After 1879 land use information was omitted and after 1884-5 the acreage was generally printed below the field reference number on the map (Oliver 1993, 38).

The National Archives hold the Name Books and Survey Books for the Ordnance Survey (TNA OS 34 and 35). Only a few of the 1840 books survived enemy bombing in 1940 (TNA OS 34 Durham, Hampshire, Northumberland and Westmorland). The University of Newcastle are digitising the Northumberland and Hampshire ones. Subsequent name books are complete for the country but only in paper format (TNA OS 35).

Figure 14. Extract from the Ordnance Survey County Series 25" to 1 mile map showing Hatch Park, near Ashford, Kent. This is a medieval deer park and warren with woodlands designated as SSSI, unimproved grasslands and listed on the Historic England Register of Parks and Gardens. The map captures much of this information with areas of enclosed woodland, plantations, wood-pasture, orchards and rough ground all being precisely delineated. © Crown copyright and Landmark Information Group.

5.2.1.1.2 HYDROGRAPHIC MAPS

Type

Before the establishment of the Hydrographic Office and the Ordnance Survey, marine charts relied on early topographical maps, only locating navigational landmarks with any degree of accuracy. However given that much of the British Isles lies close to the coast these early marine charts can provide useful topographical information. At the same time as the land-based Ordnance Survey was surveying England and Wales, the mapping of the inland coastal waters was being undertaken, with the setting up of the Hydrographic Office in 1795.

Coverage

The whole of the inland coastal waters of the British Isles. Between 1795 and 1829 only 44 Admiralty charts were produced for home waters, from The Wash to Dover and thence to Land's End. In 1829 Francis Beaufort became head of the office and initiated the Grand Survey of Britain and Ireland. This was completed in 1855 with 255 charts and by 1860 over 300 charts were listed (Smith 2000, 139).

Origin of compilation

Early charts before the 18th century were undertaken by private individuals or by private publishers, concentrating on lengths of coastlines. In the 18th century the Admiralty commissioned individuals to undertake surveys in a more systematic approach to the home waters.

As with the Ordnance Survey, the nineteenth century hydrographic survey and mapping was in the main the response to military threat as well as for coastal navigation.

How surveyed if known

Murdoch Mackenzie was commissioned by the Admiralty in 1777 to survey the Thames Estuary and then the coast from Plymouth to Bognor, using a technique of fixing by sextant angles and plotting by station pointer (Smith, 1988, 137). Mackenzie carried out detailed topographical surveys of the coast prior to the hydrographic survey thus producing detailed maps of the coast land before the Ordnance Survey 1" maps were published.

Scale

Very variable depending on what is being surveyed - 1" to 1 mile for the more open waters to 25" to 1 mile in complex areas.

Keys and Accuracy

Woodland is only shown where it is of navigational significance and lies on the coastal margins. These maps are accurate and, as coastal waters changed rapidly, there were numerous re-surveys and updates to editions. Full details are available from the Hydrographic Office at Taunton.

Interpretation

Although these maps are detailed, navigation and military defence were the prime reasons for their survey and land based features which were not relevant for navigation were not included; absence of a coastal wood on a chart is therefore not evidence of absence of the wood at the time of survey. These maps may be useful especially for the coastlines of northern English counties to show evidence of coastal woods in the absence of OSDs (see below, 5.2.1.1.6).

Source and Availability

The maps have been photographed and are available as digital images from the Hydrographic Office, Taunton. Some of the earlier maps are now being transferred to The National Archives at Kew.

To access TNA catalogue visit www.nationalarchives.gov.uk/catalogue/search.asp. Items transferred from the UKHO have been allocated the references ADM344 to ADM356 and their former UKHO references can also be viewed on TNA catalogue.

The transfer is concentrating on surveys dated before 1830 and supporting documentation before 1950. Some items will be unavailable whilst they are being processed so to establish what is at the UKHO it may be necessary to contact the UKHO's Archive Research Section.

5.2.1.1.3 TITHE MAPS

Type

These are individual parish maps showing the land which was eligible for Tithe payments under the Tithe Commutation Act of 1836. Tithes had formerly been paid in kind representing a tenth of the gross produce of the land such as wool, corn, eggs etc. - hence for large church holdings the construction of 'tithe barns'. In the post feudal and post-industrial age, the tithes were commuted to a monetary payment based on land holding. Each parcel of land was allocated a reference number which was recorded in the Tithe Apportionment giving a description of the land, its size, owner and occupier and the amount of Tithe due. Three copies were produced. The original maps which remained with the Tithe Commissioners are now held at the National Archives. Two further copies were drawn up for the registrar of the diocese and for the parish church. These maps have now in the main been lodged at the local record offices. They are often more damaged and worn than the original due to their subsequent use and storage.

Date

The maps were mostly produced between 1837 and 1845 (but see *Origin* below).

Coverage

About 79% of the country is covered by a tithe map. Counties having relatively large areas covered by Enclosure Acts (see 5.2.1.1.4) tend to have lower rates of Tithe survey coverage (because tithes had already been clarified or commuted by parliamentary enclosure). Oxford, Rutland, Huntingdon, Bedford, the East Riding of Yorkshire, Leicester and Northampton fall in this category each having less than 50% Tithe survey coverage (Prince 1959). However, Devon, Cornwall, Kent and Shropshire have 100% coverage (Smith 1988, 63).

Origin of compilation

For the Tithe Act to be workable a prerequisite was a consensus on ownership boundaries and extents of properties. Furthermore, the actual state of cultivation of every parcel of land in each Tithe district needed to be recorded as this determined the charges due. Where land was not titheable this was either omitted or recorded in less detail. The maps provide an invaluable record of the land-use and economy of mid nineteenth century England at the local level in the way that Domesday Book does for the 11th century. The majority of Tithe maps were produced especially for submission to the Tithe commissioners. However a significant number were copied from earlier surveys, for example from manorial, estate or enclosure maps. This is usually stated on the map but it is worth checking each parish (e.g. in Kain *et al.* 1995) to ascertain the situation date.

How surveyed if known

The maps were usually prepared by triangulation by locally based surveyors who also produced the accompanying apportionments.

Scale

Maps were measured in chains and the scale varies from parish to parish. They are usually fairly large scale (roughly between 1:1000 and 1:10,000) meaning that in some cases the resulting map is the size of a small carpet.

Keys and Accuracy

Tithe maps did not usually have keys because numbered schedules identified every plot of land. However the Assistant Commissioner for Tithes, Lt. R. K Dawson RE, was appointed to superintend the surveys and endeavoured to gain some uniformity in scale and use of conventional symbols. He aspired to differentiate between, 'wood land' (apparently meaning open woodland), plantations, coppice, coppice-with-standards, parkland, orchards and osier beds in the maps (Figure 15).

Figure 15. Detail from William Dawson's proposed character sheet for Tithe maps [British Parliamentary Paper (House of Commons) 1837 XLI (ESRO PAR 324/2/2/2 part]: Conventional signs to be used in the Plans made under the Act for the Commutation of Tithes in England and Wales. Reproduced with permission of the East Sussex Record Office: PAR 324/6/2/2.

Surveys signed and sealed by the Tithe commissioners were deemed to be the most accurate and these are known as 'first class maps' (Foot 1994, 11). This seal meant that the accuracy of the map was certified and therefore admissible in courts of law. There are only 1900 of these maps (or 16% of the total); the remainder were deemed second class (Smith 1988, 63). The second class maps comprised those of variable quality including some which are only sketches. However, these have generally been deemed accurate maps, sufficient for the purposes of various administrative enquiries (Prince 1956).In reality only a fraction of the maps produced conformed to the standards for illustration (see Figure 14) set by Dawson (Kain 1974). Many maps, even 'first class' surveys, simply depict woods as accurately measured parcels of land (without tree symbols) with a textual annotation to link them to a schedule of apportionments.

Tithe maps have similar issues to the Ordnance Survey County Series First Edition, namely a high degree of accuracy and information content on the one hand but on the other, insufficient age to absolutely demonstrate woodland antiquity. They are however very useful for deepening the understanding of a site's

history and are a powerful tool (and one that was generally unavailable at the time the original AWI was compiled) for helping update the inventory.

Interpretation

Tithe maps can be a rich source of information but must be used carefully. Ideally each map should be used in conjunction with its apportionment which describes the land use for every plot (annotated on the map surface with a number, letter or alphanumeric). It should not be assumed that even 'first class maps' will always show tree symbols in areas which were assessed as woodland. However, where apportionments are unavailable or resource limitations preclude their systematic use, the maps themselves can still furnish useful information.

When cross referencing a Tithe map to a schedule and the necessary annotation cannot be fully read (because the map is damaged, the image is poor quality or the hand illegible) then use the schedule to work it out by process of elimination. Measure or estimate the area of the compartment on the map and compare this with different possibilities in the schedule. The distribution of parcels of land in relation to named farms or landowners will also help narrow down the search. Often it will be possible to deduce which entry refers to a land parcel in this way even if the plot number is completely obscure at first sight.

It is important to read the whole entry for a land plot in the apportionment, not just its name but also its state of cultivation. For example, in some schedules the names of woods are abbreviated – 'Hilly Field Wood' may appear as 'Hilly Field', its status as woodland only being revealed in the next column. In other cases, a field name recorded as woodland under 'state of cultivation' may indicate a recent secondary wood or plantation.

Where woodland was owned by the church it was not eligible for tithe and may not be shown or listed in the schedule. General exemption of woodland from tithe was also customary in some parts of the country but wooded areas may still be discernible as 'dead space' lying between titheable land parcels on the map.

The tithe maps were prepared at a time of considerable change for woodland resources and management and at a moment before the coming of the railways would alter many local rural economies. Tithe apportionment volumes will sometimes usefully distinguish between the different types of wood (plantation, coppice etc.) although in many parishes only a simple reference to 'wood' will be given. In the AWI update for Ashford District in Kent for example it was found that a substantial proportion of the potentially additional ancient woodland sites were given as plantations in the Tithe apportionments, often referring to the species planted (Sansum et. al. 2009). In concert with earlier map evidence and examination of the form and context of woodland boundaries this was often sufficient evidence to prove recent status for those sites.

A particular bias of tithe maps is their tendency to emphasise a compartmentalised view of land-use. In some landscapes this may cause a problem; in places where extensive multi-purpose land management was still being practised in the mid nineteenth century the tithe apportionments may mask traditional practices such as wood-pasturage. Field names like 'The Alders' listed as 'state of cultivation: pasture' have sometimes been shown (with reference to other maps) to have been grazed woods (or wood-pastures). In ancient landscapes with intricate mosaics of pasture, woodland and wood-pasture, plots of land recorded as 'rough pasture' should be treated circumspectly (e.g. see Lovelace 2014); these may have been pastured woods where it was the pasture component that was being assessed for tithe charges. In upland areas and in heavily wooded areas the value to a farm or estate of woodland as pasture may sometimes have been great. It is important to keep this in mind when interpreting tithe data in the context of a larger set of maps or field evidence at the evaluation stage.

Although not much earlier in date than Epoch 1 the land-use detail tithe maps give is of real benefit in assessing the nature of woods at the beginning of the Victorian period and for identifying recent woods of 19th century origin. They can also be useful sources for understanding the adjacent land-use of parcels of

woodland, helping to establish the extent of former woods and identify potential remnants in adjacent fields. Tithe maps provide a range of useful clues about landscape, land-use, ownership and place-names in a single source, all of which can be brought to bear in informing a view of the antiquity of a woodland site.

Source and Availability

There are two main sources, The National Archives and the local county record office for those local to the county. The maps held at the National Archives are nearly all available on microfilm. Some county record offices have digitised all their maps, whilst others are still in the process. Where digital tithe map images are available for a parish but no geo-rectified map exists (which is expected to be a common situation) a decision should be made based on whether the amount of woodland in the parish merits the time and effort of processing the images. In well wooded parishes, or those with many separate parcels of woodland, the effort will be repaid. If the parish has few woods then it may be simpler and quicker just to consult the map and record the relevant plot numbers or details of woodland depiction (see 5.3.1).

Apportionment data exist in various forms. In some cases they have been professionally transcribed into spreadsheets (e.g. East Sussex). This makes cross referencing woodland polygons a relatively efficient process, indeed it may be possible to relate the apportionment directly to a GIS attribute table into which the map plot numbers have been transcribed (see 5.3.1). In some counties various parishes may have had their apportionment volumes transcribed to digital text by volunteers whereas in others it may be necessary to consult the original volumes or microfilm copies of them in the relevant local record office. Clearly in this case the process of extracting information is far more time consuming. Resource constraints may demand prioritisation of those sites for which there is a critical need for information. For example, although ideal it may not be critical to check tithe schedules for woods shown both on the later Epoch 1 and on the earlier OSD maps.

Where there is not an available tithe map, it may be possible to use an enclosure map if that is available (see 5.2.1.1.4 below).

Figure 16. Comparison between the styles of two adjacent Tithe maps in Kent: Great Chart, 1839 by George Durey; Ashford, copied and corrected from a survey by James Gouge of Sittingbourne of 1818. Here a parish boundary passes through Godinton Park, an example of historic wood-pasture parkland. The 1st class map for Great Chart parish (left) shows Godinton House situated within its formal gardens, an orchard and surrounded by wood-pasture parkland. To the north is an enclosed coppice wood. On the 2nd class map of Ashford parish (right), parcels of woodland are depicted by simple green colour-wash boundaries but lack detailed illustration of woodland type and structure. In the accompanying schedules wood-pasture areas are simply assessed as 'pasture'. Reproduced by kind permission of Kent History & Library Centre. Reproduced with permission of the Kent History & Library Centre, Maidstone.

5.2.1.1.4 ENCLOSURE & PRE-ENCLOSURE MAPS

Type

There were three methods of enclosure of open land to agriculture, informal enclosure, enclosure by formal agreement (but often confirmed in a legal court) and enclosure by Private or General Act of Parliament. There was also the enclosure of open land to hunting parks. Maps were generally produced for the parliamentary enclosures.

Often two maps were prepared, one before enclosure and one showing all the allotments and sub-divisions. The maps accompany enclosure awards which describe how the unenclosed land was to be allocated to landholders. Land being enclosed was in the main open fields, common meadows, commons and greens. Enclosure maps may be useful evidence for woods in parishes which do not have a tithe map; most parishes should have either a tithe map or an enclosure map.

Date

1595 – 1918, but generally from the end of the 18th century.

Coverage

Not systematic but cover parishes or parts of parishes where land – in particular open fields – was being enclosed under the various general acts of enclosure, between 1720 and 1840. These maps particularly represent the 'planned countryside of lowland England' (Rackham 1986). There were also enclosure acts for heaths and forests. For a full list of enclosure maps of England and Wales see Kain, Chapman and Oliver (2004).

Origin of compilation

The Enclosures Acts were initially drawn up for individual parishes and as the pace of enclosure increased this became cumbersome so a series of general enclosure acts were passed in the 19th century for the enclosure of open land (arable, meadows, heaths, wooded commons and forests).

How surveyed if known

Undertaken by local surveyors often funded by the main landowners in the parish. Early surveyors prepared maps using landscape features as fixed points then straight construction lines were superimposed. The later maps were produced using the triangulation method.

Scale

Variable large scale, in chains from 1:1,000 to 1:10, 000 equivalent.

Keys and Accuracy

No standard approach to keys or annotations. Woods were not always shown. The late 18th century maps have more of an aesthetic approach but by the early 19th century, accuracy and precision prevailed (Hollowell 2000, 100).

Interpretation

These maps were primarily produced to show farmed land, rather than complete landscapes, thus the absence of woodland on a map does not necessarily mean an absence on the ground. Woods tend to be shown where they abut an area to be enclosed. Some maps however show both old and new enclosures in detail and can

provide a good means of verifying the existence of a wood in the pre-existing ancient landscape (see Figure 17); Rackham (2006) remarks how the earliest map to portray Hayley Wood (Cambridgeshire) is an 1816 enclosure map which shows it 'surrounded by ancient inclosures'. Enclosure maps are also useful pre Ordnance Survey sources for place-name information (5.2.1.2).

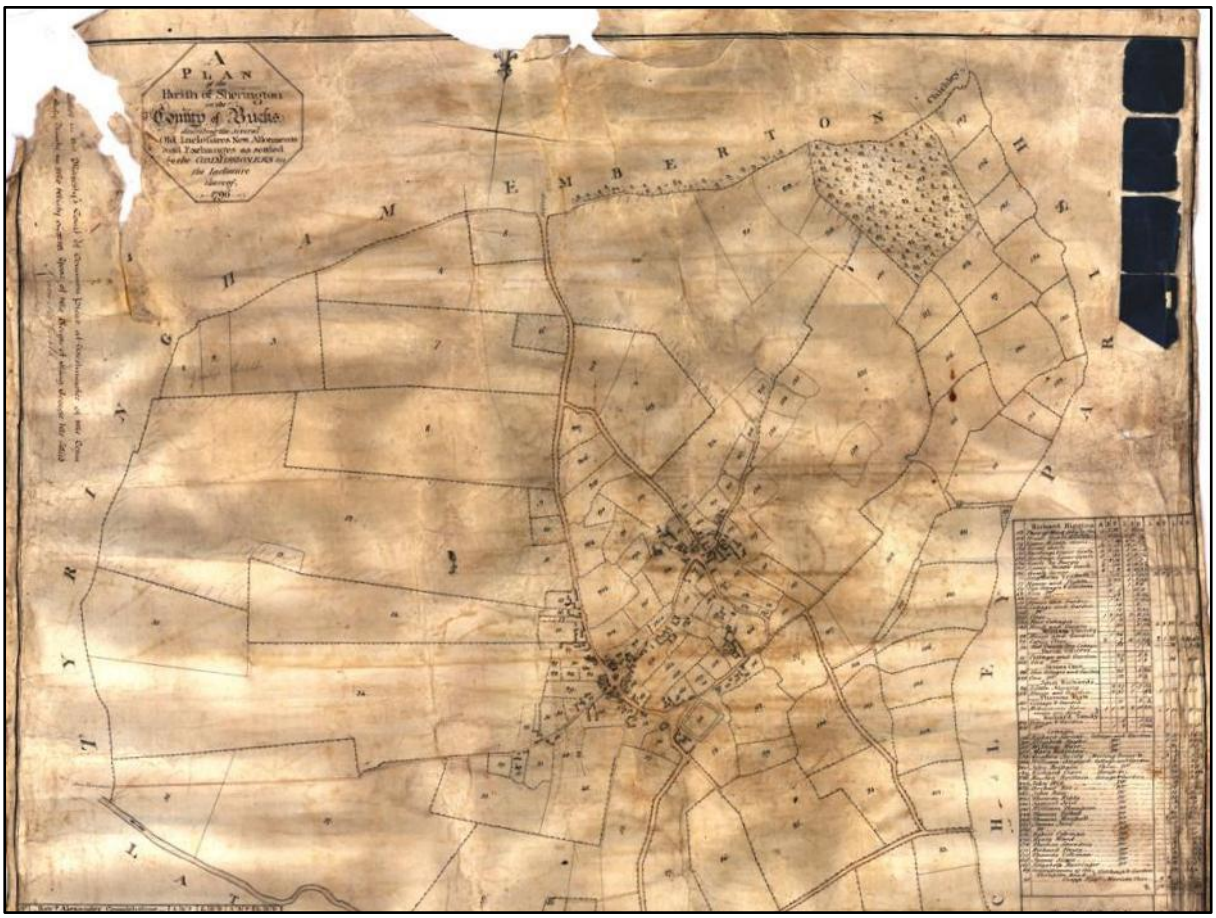


Figure 17. Part of a late eighteenth century enclosure map: Sherington, Buckinghamshire, 1796. Old enclosures, including a wood, are shown in the northeast corner of the parish with large parliamentary enclosures to the west. [A Plan of the parish of Sherington in the county of Bucks describing the several old inclosures new allotments and exchanges as settled by the Commissioners on the Inclosure thereof, 1796. Source: http://www.mkheritage.co.uk/shhs/encmap.htm

Source and Availability

Most enclosure maps are available at the county record offices. Some maps, but not necessarily the awards, may have been photographed and be available as digital images. Some record offices have put the maps online for example the Berkshire Record Office.

5.2.1.1.5 ORDNANCE SURVEY FIRST SERIES (OLD SERIES)

Type

These maps represent the first systematic and uniform scale map coverage for England and Wales.

Coverage

England and Wales with Isle of Wight

Origin of compilation

These maps were drawn up from the Ordnance Surveyors' Drawings (see below). Also termed 'The Old Series' the whole of England and Wales was covered between 1805 and 1874, with the area south of a line between Hull and Preston having been mapped before c.1840. With the exception of some areas of particular military significance (e.g. the south coast) the early surveying was mostly carried out at 2 inches to 1 mile scale. The post 1840 sheets were based on surveys at 6 inches to 1 mile or larger scale and are considered to be more accurate.

How surveyed if known

Trigonometrical survey of the British Isles using triangulation stations.

Scale

1 inch to 1 mile (or 1: 63,360) but based on surveys at varying scales.

Keys and Accuracy

There was no key given for these maps, but woods shown are usually marked with clear tree symbols whereas orchards are annotated as parallel lines of small rounded trees (Hewitt, 2010, 164). Significant woods are usually (not always) named. Parks are enclosed with palings and the interior marked with fine stipples. However, in some of the later electrotype reprintings of these maps woods can be less clearly marked, appearing as if in outline.

Interpretation

These maps are useful but they will generally shows a smaller proportion of smaller woods than the larger scale Ordnance Surveyor's drawings (OSDs) used in their production. In the process of preparing these maps from the OSDs there was a significant loss of the finer detail. Not only were smaller woods often omitted but the boundaries of woods were straightened, simplified and sometimes truncated. Intricate mosaics of woodland and open land may simply be shown as either solid woodland or as open land. However, it is important to be aware that published First Series maps may also sometimes contain details which are not shown on unpublished drawings.

The First Series maps should be used in conjunction with the OSDs (see below) or as a second resort where no drawing is available.

Source and Availability

The National Archives and county record offices. The earliest printings (which are to be preferred) have been reproduced and published as hard copies for example by Margary (http://www.harrymargary.com/). Digital format versions of First Series maps are available commercially, as the 'Old Series', from

http://www.cassinimaps.co.uk/ and from the Ordnance Survey for use with Memory-Map software: http://www.memory-map.co.uk/. Useful quality images can be downloaded free from http://www.visionofbritain.org.uk/maps/ for most of England. With all these digital sources the maps obtained will not necessarily be the earliest instances.

Other notes

The Ordnance Survey First Series was one of the main historic sources used in the construction of the original county based provisional AWI (Spencer & Kirby 1992; often referred to as 'OS 1st Edition' in AWI documentation, these are not to be confused with the OS County Series First Edition maps). Hence for a 'designation query' site access to the First Series can be valuable and may save time checking the original paper-based county AWI records. Reference to the map will often help to explain the pattern of previous ancient woodland designation and make discrepancies between the long-established woodland dataset based on Epoch 1 and the original AWI easier to understand and address.

The First Series maps were widely reissued and revised in a somewhat piecemeal way in the decades following first production. True situation dates of the many different reprintings are notoriously difficult to determine. If First Series maps are used in AWI updates ensure you have sourced the original map or are confident of the situation date before using it to argue a detailed chronology for a woodland site. Sometimes only the publication date will be determinable. Dateable features such as rail branches that appear on revisions but not originals can be useful for roughly dating a sheet but do not assume that woodland boundaries have been accurately revised just because a reprinting was issued. More details about the Old Series are available from the British Library website: http://www.bl.uk/reshelp/findhelprestype/maps/guideordsurv/smallosmaps.html

5.2.1.1.6 ORDNANCE SURVEYORS DRAWINGS

Type

Unpublished drawings made by the surveyors and draughtsmen of the Board of Ordnance. Ultimately they formed part of a corpus of material prepared from field survey which was used in the preparation of the First Series 1" to 1 mile maps (5.2.1.1.5). For detailed information about these maps see Hodson (1989).

Date

Between 1789 and 1840. Kent was the first county to be finished due to its military significance and proximity to the Continent.

Coverage

Most of England south of line between Liverpool and Hull (see http://www.bl.uk/images/maps/osdindex.jpg).

Origin of compilation

Military mapping to record the landform and features of military significance of the country, undertaken by the Board of Ordnance form which the Ordnance Survey takes its name.

How surveyed if known

The first full triangulation using trig points and surveyed by military surveyors under the guidance of experienced mapping surveyors. Individuals allocated an area undertook the survey and then drew the map.

Scale

2", 3" and 6" to the mile, depending on the military significance of the map and the date of survey.

Keys and Accuracy

No standardisation of keys or drawing. They vary in content, style, accuracy and finish. After 1820 many OSDs were revised on the ground before publication, thus for central England there are numbers of revised drawings and hill sketches (Oliver 1993, 40).

Interpretation

In the southern and eastern counties the recording of woodland was often very precise as it was seen as providing military cover. Some maps are so detailed as to show woods of an acre in size together with intricacies of boundary shape and narrow extensions. On other maps however, particularly those produced at the 3" and 2" scales, smaller woods may be missing (some sheets only omit a proportion of small woods whereas others may miss them all). In Herefordshire for example Lovelace (2014) has found that small woods are often not depicted at all on 2 inch to the mile OSDs.

Experience with the OSDs in Kent and Sussex suggests that where enclosed woodland contained significant amounts of timber these were generally shown on the maps. Small woods ('shaws') at this time often contained no timber (Roberts 1999) and recently cut coppices or areas of brushwood may have sometimes been omitted (Sansum et. al. 2009). At the time of the first Ordnance Survey a large proportion of semi-natural woods would have been actively coppiced. Thus a percentage of small woods would at any one time have been at a low or inconspicuous state of growth. These may have been omitted, either deliberately to avoid misinforming military operations in the event of invasion or because harvesting had been mistaken for clearance by surveyors (an error that may occur occasionally on OS maps of all vintages).

Physical terrain was also important militarily and in steeply sloping areas the topography sometimes took precedence over land cover; strong hachuring may obscure or replace details of woodland cover.

The OSDs generally have a reasonable level of spatial accuracy (in terms of the plotting of roads, watercourses and settlements) and compare well with modern maps once geo-rectified (there are exceptions, with some drawings little more than sketches). However, this accuracy does not always translate to the location of topographical features in the 'interior of the landscape', particularly features distant from roads. Woods are sometimes included but displaced from their true locations by considerable distances. This brings a difficulty of interpretation; workers will need to qualify if they are comparing the same wood on different maps or if the OSD depicts a different wood which no longer exists. Distinctive boundary features, estimation of size and aspect can sometimes be used to help determine the identity of a possibly displaced wood. Literal interpretations of field boundaries shown on OSDs are not to be trusted as an aid because these were often only sketched rather than surveyed (characterised by the British Library as 'diagrammatic'). Uncertainties associated with displacement of location tend to be magnified for smaller woods where the degree of displacement may exceed the extent of the wood (see Lovelace 2014 for further remarks on this issue).

These maps also record place-names. However they should be treated with caution as some surveyors may not have been able to interpret the local dialect and therefore wrote down what they 'heard'. Other surveyors researched the historical context of a name and made an informed decision (Hewitt, 2010, 161-2). Names may also migrate across the map being allocated to the 'wrong' wood or settlement.

In using these maps it should be remembered that they represent a stage in the preparation of later published maps – completeness of the information on any one sheet should not be assumed; it may have been accompanied by notes and instructions which have not survived. Indicative of the 'working' nature of the OSDs some contain pencilled annotations (which can be faint on the digital images), for example instructing an

engraver that a parcel of ground is 'wood' although there is no pictorial portrayal of trees on the drawing (Sansum *et al.* 2009).

Although the OSDs should be treated with caution they represent a key source for ascertaining presence of woodlands in the earlier nineteenth century.

Source and Availability

The British Library holds 351 of these maps which are all digitised and available online (http://www.bl.uk/onlinegallery/onlineex/ordsurvdraw/). It is possible to purchase copies of those maps for each county which could then be processed in a GIS. Low resolution but workable images are available on 'Wikimedia Commons', the free media repository.

Other notes

The OSDs were not generally available to the compilers of the original paper-based Ancient Woodland Inventory.

An 'affine' geo-rectification of the OSDs has recently been made available on the British Library website. Whilst this is useful for general landscape comparisons it will in some cases be inadequate for small woodland AWI work. For updates to the AWI in the south east for example it was necessary to use a geo-rectified versions of OSD images based on much larger numbers of control points and polynomial transformation.

Figure 18. Part of the OSD covering the area west of Horncastle in Lincolnshire. This map was produced at the scale of 2 inches to 1 mile but appears to give an accurate account of the woods present in 1819. It includes some very small copses down to below the nominal minimum capture size of 0.25ha used for the AWI update. A small number of woods appear on the later Epoch 1 map towards the blank centre of this image and these are almost certainly of mid-

nineteenth century plantation origin. Other OSDs can be much more sketchy; each one needs to be interpreted on its own merits. Draughtsman: Edward Metcalfe, pen and ink on paper ©The British Library Board, OSD 281.

5.2.1.1.7 PRE ORDNANCE SURVEY COUNTY MAPS OR ATLASES

Type

County maps produced by different cartographers in the late 18th century. Yeakell and Gardner's 'Actual Topographical Survey of Sussex' published in 1778 and 1783, set the standard for subsequent maps and is probably one of the most accurate. Yeakell and Gardner were map-makers to Charles Lennox of Goodwood Park, who was instrumental in the setting up the Ordnance Survey (Hewitt 2012, 98-99).

Coverage

These represent the earliest almost continuous coverage of England in the late 18th century. The county map was the basic unit of regional mapping, initiated by Saxton's Atlas in 1579 and continued over the next two hundred years by surveyors and mapmakers striving to improve on levels of accuracy and detail.

Origin of compilation

County maps were sponsored by major land owners and undertaken by mapmakers in partnership with specialist cartographical publishers. In 1759 the Royal Society of Arts provided the incentive of prizes for accurate surveys of any county drawn on the 1 inch scale. Yates' map of Warwickshire in 1793 was the first such county map to show precise vegetation (Smith 1988, 73).

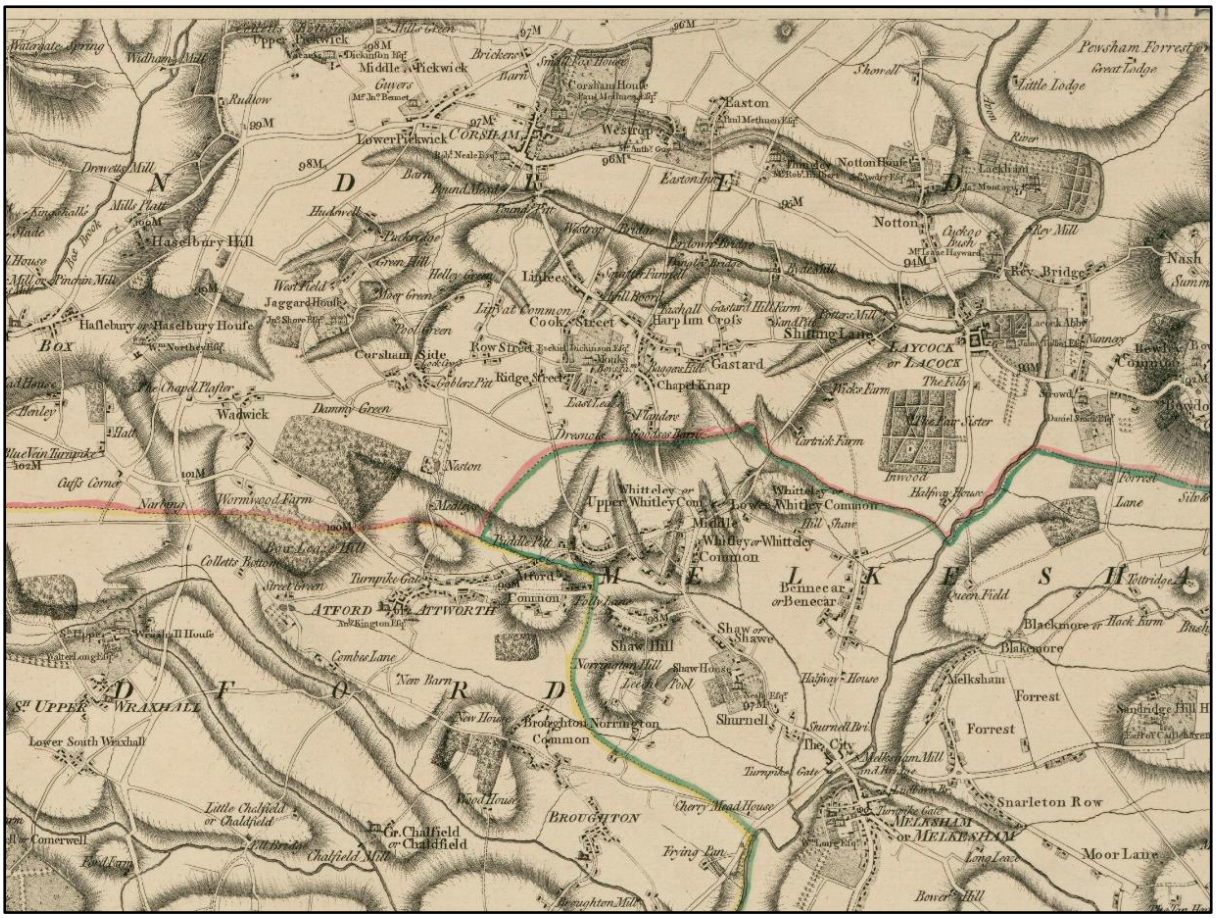


Figure 19. Detail from a 1773 county map by Andrews and Dury of the area south of Chippenham in Wiltshire. The map provides useful information on the locations of several woods. Although the extents, shapes and positions of the woods cannot be interpreted literally the mapmakers' attention to roads, topographical features and the boundaries of hundreds can allow some sites to be identified with a degree of confidence. It is typical of the work of these mapmakers that both plantations and semi-natural woods are portrayed with simple rectilinear boundaries. A Topographical Map of Wiltshire, on a Scale of 2 Inches to a Mile, from an Actual Survey by John Andrews and Andrew Dury in the Year 1773. Source: Bibliothèque nationale de France

How surveyed if known

Theodolite or plane table[9] depending on the surveyor. Often the same surveyors worked on different counties, for example John Rocque (Surrey, Shropshire), John Andrews and Andrew Dury (Kent, Hertfordshire, Wiltshire) and Jefferys (Buckinghamshire, Westmorland and Yorkshire). Some surveyors will have produced maps based on their own surveys and field work, whilst others will have copied earlier maps.

Scale

Measured in chains and variable but usually 1"- 2" to 1 mile equivalent.

[9] A portable device used in the field to plot the locations of points in the landscape using simple geometry. Paper was mounted on a horizontal surface and then sightlines made from either end of a measured baseline to a prominent feature were plotted onto it. After repeating the process several times for different features the intersections of these lines produced a basic model of the spatial relationships between the sighted features. This could then provide the template for the construction of a more detailed map.

Keys and accuracy

Each county map has its own style and key depending on the surveyor. However where the same surveyors have undertaken different counties there is a certain element of uniformity.

The distances and angles on these maps are frequently distorted and features are often displaced from their true position. This means that images taken from the maps will not always be capable of satisfactory geo-rectification; the maps need to be interpreted in respect of what they do show and the apparent configuration and interrelation of these features rather than using a literal comparison with modern maps. With care this approach can sometimes allow considerable detail to be reconstructed.

Interpretation

Users of these maps should be aware that some surveyors will have surveyed and plotted woods, whereas some will have merely sketched them in from field observation, verbal or written account. Still others plotted woods but took considerable licence with size, shape and location - presumably for reasons of map aesthetics or to emphasise or clarify some feature, whether it be a wood or something else. Furthermore, these approaches may well have been combined in the production of a single map so that some woods are accurately depicted and others omitted, inaccurately drawn or located. For example Lovelace (2014) demonstrates how Price's map of Herefordshire 1819 is inconsistent in its treatment of woods).

Where woods appear on OS Epoch 1 or OSDs these maps can sometimes confirm prior existence in the 18th century if woodland is clearly indicated in the corresponding vicinity. Scale means usually there is a bias against the depiction of smaller woods whereas significant plantations and parks may be quite elaborately illustrated (and even exaggerated). Parkland may be shown as scattered trees enclosed with a 'pale', together with elements of the designed landscape such as avenues, wildernesses and parterres. Commons, greens and wood pastures are also often named and annotated with scattered bush symbols.

Accuracy of some of these county maps has been tested, for example in the east of England by Macnair and Williamson (2011). They have found with reference to known sites of ancient woodland status that non depiction on Faden's map of Norfolk or depiction of woods with their boundaries significantly different is unreliable. Similarly in Wealden Kent, a landscape with many small woods, a relatively low proportion of woods smaller than two hectares in size are shown on the 2 inch scale map of Andrews, Dury and Herbert produced in 1769. Omission of woods can be demonstrated using contemporary estate maps.

As a general rule these maps are better for some types of land-cover than others. As Rackham (2006) noted:

Any wood that was not visible from a public road, or had recently been felled, might be omitted. County maps are often better for Forests, wooded commons or parks than for woodland; some have a special symbol for differentiating wood-pasture.

Hainhault Forest in Essex is an example. It is described by Rackham (2003, 190) as being shown accurately by Chapman and Andre in 1777, who differentiated between medieval forest (no coppices or demarcated woodlands but does show treeless plains and tracts of pollards) and other wood-pasture and enclosed woods. Today, only small parts of Hainhault Forest survive in the modern landscape.

Generally these maps were not used in the preparation of the original county based AWIs and for the revised AWI in the South East were used only as a supplementary source, sometimes being able to provide useful corroboration where other evidence was ambiguous as to the status of a site. In summary, they can be useful for indicating the presence and approximate extent of larger woods, parks, wood-pastures and commons. Apparent absence of woods (that are visible on later and larger scale surveys) on this type of map can rarely be safely interpreted as evidence of absence of the wood and should not be relied on.

Source and Availability

Most should be available from the National Archives and county record offices will hold copies of important printed maps of their county.

Many maps are available online in various states of quality. The 'Genmaps' website has a large collection of images of maps organised by county and is a useful and free reference. High resolution digital images of several of Emanuel Bowen's maps of English counties (as well as various other county maps) can be viewed on the website of the National Library of France and Cumbria County Council's Images Collection website hosts good images of maps of Cumberland and Westmoreland for example. Several of the maps for the east of England have been geo-rectified and are available online:

http://www.fadensmapofnorfolk.co.uk
http://www.hodskinsonsmapofsuffolk.co.uk/
http://www.fadensmapoflondon.co.uk/
http://www.duryandrewsmapofhertfordshire.co.uk/

Low resolution photographs of many others may be found informally published on local and community history websites; these may be suitable for making a first assessment of the value of a map for your study area.

Other notes

The privately sponsored county map making tradition of the 18th century continued into the early 19th century. The Greenwood brothers, for example, produced 1 inch maps of many English counties in the period 1817-30 and worked contemporaneously with the OS. Their surveys were independent but the maps were almost certainly influenced by OS output. Because they were in competition with the military surveyors their maps tended to rely somewhat on aesthetic appeal in order to attract patrons. Although trigonometrically accurate and superior to many 18th century county maps they often provide less information on the details of the working rural landscape than OSDs and more on the designed landscapes and layouts associated with larger houses.

5.2.1.1.8 ESTATE MAPS

Type

Detailed and usually large-scale manuscript maps of individual estates or parts of estates (sometimes maps of individual woods) produced privately on paper or parchment. Useful maps may be found scattered through various archives in estate 'wood books', rentals, title deeds, terriers and contracts and are not always easy to locate. Many public record offices however have a separate location-based referencing system for estate maps which should allow the existence of a relevant map to be checked more efficiently. For a detailed account on English Estate maps see Harvey (2010).

Dates

Estate maps span the period of interest for workers updating the AWI (from before 1600 right into the early 20th century). In some areas 19th century maps may be more frequent than earlier ones but for the present purpose maps antedating the information of the 19th century Ordnance Survey and tithe maps are the most valuable. Workers should try to ascertain at an early stage whether there are likely to be 17th and 18th century estate maps in local archives available for consultation as this source of evidence can strongly affect the planning of a project.

Coverage

Estate maps have a variable coverage across the country – for some project areas there may be hardly any available. Availability depends on a number of factors, for example, the type of owners within a county, the history of the location and the value of the estate. Larger landed estates are more likely to preserve estate maps than smaller ones and progressive landowners, interested in estate management and improvement, are more likely to have generated estate maps in the first place. If an estate changed hands frequently it might result in more maps being produced but equally it can mean that archives are scattered and poorly preserved. As important as the physical survival of such maps is their deposition in an accessible archive. Most projects updating the AWI are likely to be limited to using material catalogued in a public record office.

Origin of compilation

Estate maps were produced for a variety of purposes but often because land was changing hands, disputed or undergoing changes in management. Some maps were produced as status symbols but many were born of a utilitarian need for better information. Estate mapping developed particularly from the late 1570s when it became apparent that precise and accurate estate maps provided more information than written accounts, especially when determining legal disputes (this coincided with significant innovations in surveying techniques – see below).

How surveyed if known

Undertaken by a local surveyor and mapmaker by commission from the landowner. The use of the theodolite for triangulation from the Elizabethan period onwards (rather than the less satisfactory trigonometry produced by the 'plane table') also resulted in more accurate, and therefore useful, maps being produced. The introduction of a standard length chain in the early 17th century meant that units of measurement were increasingly becoming standardised (Hull 1973, Smith 1988, 36).

Scale

Measure in chains, acres, roods and perches but usually to a large scale.

Keys and Accuracy

Keys and explanations of annotation are generally given in a cartouche on the map. They are usually fairly accurate surveys and with the larger scales often showing gateways, boundary marker trees and other smaller landscape features. The usefulness of any particular map for evidencing potential areas of ancient woodland can only be assessed by looking at it in detail. Where multiple surveys by the same mapmakers are consulted it may be possible to gauge the reliability of the surveyors' work with respect to trees and woodland by comparison with later or contemporary maps.

There is a common but mistaken belief that early maps are too spatially inaccurate to confidently identify surviving landscape details. Tudor and Jacobean estate maps often compare favourably in quality with Victorian ones and, providing there are sufficient surviving reference points, digital images of them can be geo-rectified very satisfactorily.

Interpretation

Each map must be interpreted on its own merit and with an awareness of its possible original purpose. Where there is some ambiguity arising from later maps, the existence of an earlier estate map showing woodland especially with boundary details can be extremely useful.

As with other manuscript maps, annotations, schedules and legends can sometimes be difficult to read, making some maps seem initially inaccessible. However, it is important to study these because not all estate maps will portray woodland pictorially (see Tithe maps above) and too casual an inspection can lead to a false conclusion of 'recent woodland'. Inscriptions on maps often give details of the acreages of individual land parcels. Geo-referencing a digital image can greatly help interpretation by enabling the size of land parcels to be estimated for comparison with information inscribed on a map. Seemingly illegible details can often be deduced, deciphered and identified with a specific land-use parcel in this way.

Some repositories (see below) may be able to supply, or allow you to make, digital images of the estate maps they hold. Geo-rectifying them can however be labour intensive due to distortions in the original distances measured and angles drawn, particularly for maps produced by sketching. In some cases (e.g. for very small estates or highly altered landscapes) considerable research effort might be needed to identify the boundaries of an estate on the modern map. As with other historic maps obtained, the time spent processing an image in a GIS needs to be justified against the likely benefits to the project based on an initial visual appraisal. It is easy to consume time geo-rectifying an interesting looking map only to discover that all the woods in the estate have long ago been cleared and do not correspond with any extant areas of long-established woodland. On the other hand, seemingly unpromising maps of fields can, once processed, usefully reveal unexpected areas of recent woodland within the long-established woodland dataset. It is important not to limit the selection of maps studied to those which show woodland as this will bias the update process against the identification of recent woodland sites and their exclusion from the updated AWI.

Source and Availability

Estate maps are held in county record offices, in large libraries such as the British Library, the National Archives, the Bodleian Library Oxford, the Guildhall Library London, the historic colleges of Oxford and Cambridge, county and city museums and in the muniments of private estates.

Access to estate maps may be difficult where they remain in private hands, though some estate papers may be lodged in public record offices for safe keeping where they are viewable by permission. Depending on resources, it may be of value to approach those landowners who still hold estate archives for permission to view key maps. In areas in the north of England with no OSD coverage sourcing alternative evidence such as estate maps may be especially worthwhile.

Other notes

Estate maps were used in projects revising the AWI in the Weald and Downs of South East England (e.g. Sansum et. al. 2009, 2010). For districts in Kent and East Sussex there was a wealth of relevant estate maps held in local public record offices, many of which had been digitally photographed. The research looked at maps from 1590 to 1800, given that there were already adequate map sources for the 19th century. Where practical a systematic study of the available estate maps for a study area will be of value in finding long-established woods which have arisen on open land post 1600 as well as proving which were present in the 17th and 18th centuries. Although greater effort will be required to extract information from estate maps than from more generic surveys the process is valuable, not only in the light it sheds on specific sites but also in deepening knowledge of woodland history in general for the study area. This in turn helps build understanding useful for informing decisions on sites that are more poorly served with map evidence.

Figure 20. A seventeenth century map showing woods on the estate of an ironmaster in Mayfield, East Sussex. The furnace site is shown next to the pond in the bottom right of the image. Careful geo-rectification of this map revealed that roughly half of the woodland area shown in 1653 has been cleared. The map also provides a study in wood names. Wallis Hole, the rectangular wood at the top of the figure, is known as Ashurst Wood on later maps whilst one of the lobes of Fvrnes (Furnace) Wood on the right acquired the name, Heronry Wood. Vicredge Coppis was mostly cleared in the 20th century but before this happened variously appeared on OS maps as Kirby's Wood, Banky Wood and Brickhurst. A surviving wood which was spatially contiguous with it but on the neighbouring estate is today known as Vicarage Wood. In well wooded districts the names of ancient woods can be quite mutable and transferable. The Lands of John Baker c.1653: Reproduced by kind permission of East Sussex Record Office, ESRO AMS 5831-1.

5.2.1.1.9 OTHER HISTORIC MAPS

There are a variety of types of other historic maps that do not fall into the broad categories above and which can be used as supporting evidence in assessing the likelihood of a wood being ancient. Unless the map in question was specifically surveyed to provide details of land-use then these supplementary sources should not be taken as reliable evidence of a wood's historical absence.

Maps produced in conjunction with published works on topography or antiquities like the county historian Edward Hasted's maps of the Hundreds of Kent (1797) can be helpful.

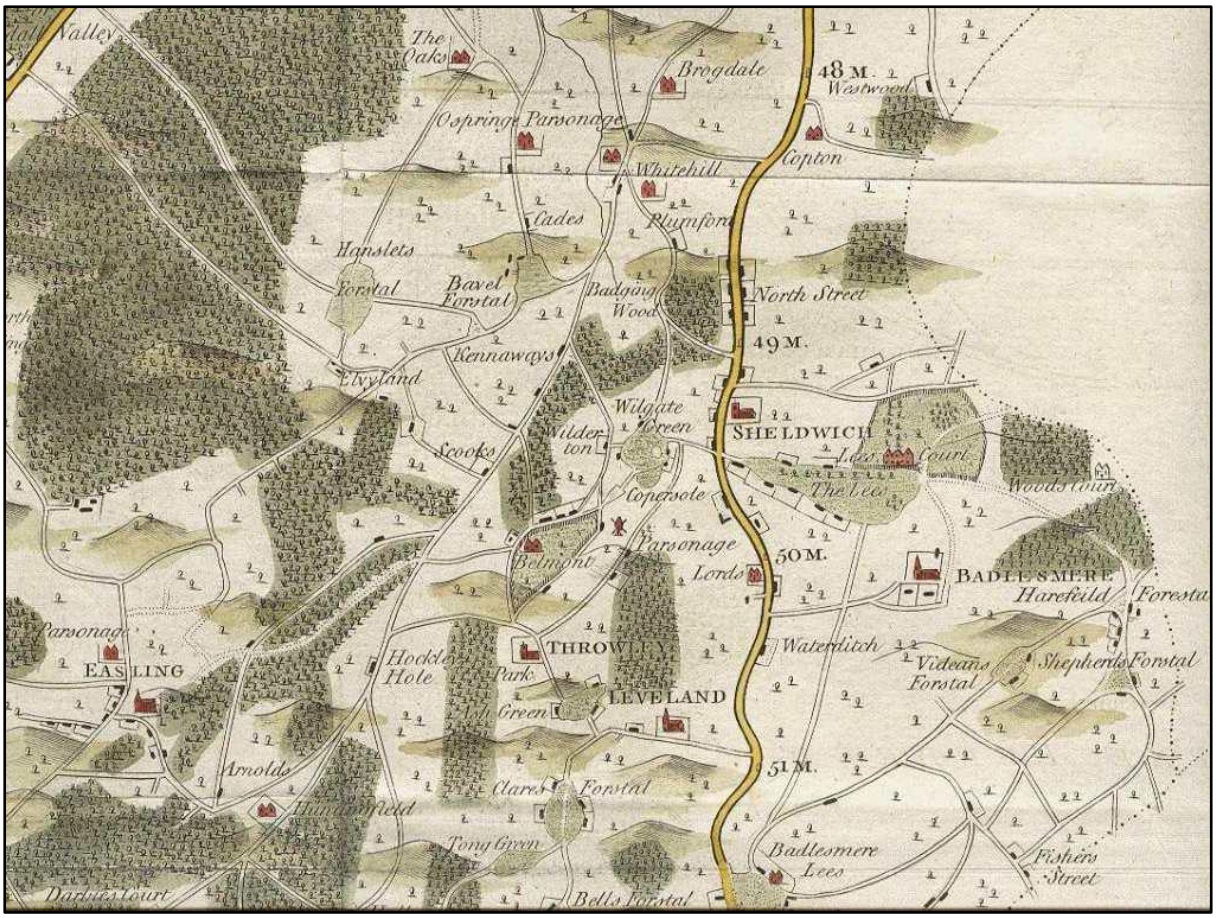


Figure 21. Extract from a map of the Hundred of Faversham, Kent engraved by William Barlow and published to accompany a printed work on county history by Edward Hasted (1798). He shows Sheldwich on the edge of the North Downs with enclosed parks, commons and larger areas of woodland. Hasted drew on the survey work of an earlier published county map but added observations of his own. Locations of woods are roughly factual, but woods may be missing and boundaries are unreliable. The addition of scattered tree symbols to the countryside appears to be decorative only. Source: http://freepages.genealogy.rootsweb.ancestry.com/~genmaps/index.html

Early road maps such as those by John Ogilby (1675), Bowen (1720) and later John Cary (1787), although of limited coverage, can sometimes provide evidence for the presence of notable woods and parks that lie close to historic roads - these were shown as landmarks and so are presumed to be at least partly factual and not wholly decorative (Figure 22). These are fascinating maps and can take the evidence base for some sites back into the 18th and 17th centuries which might otherwise not appear in the cartographic record; it is worthwhile seeing if any of the routes illustrated pass through your study area.

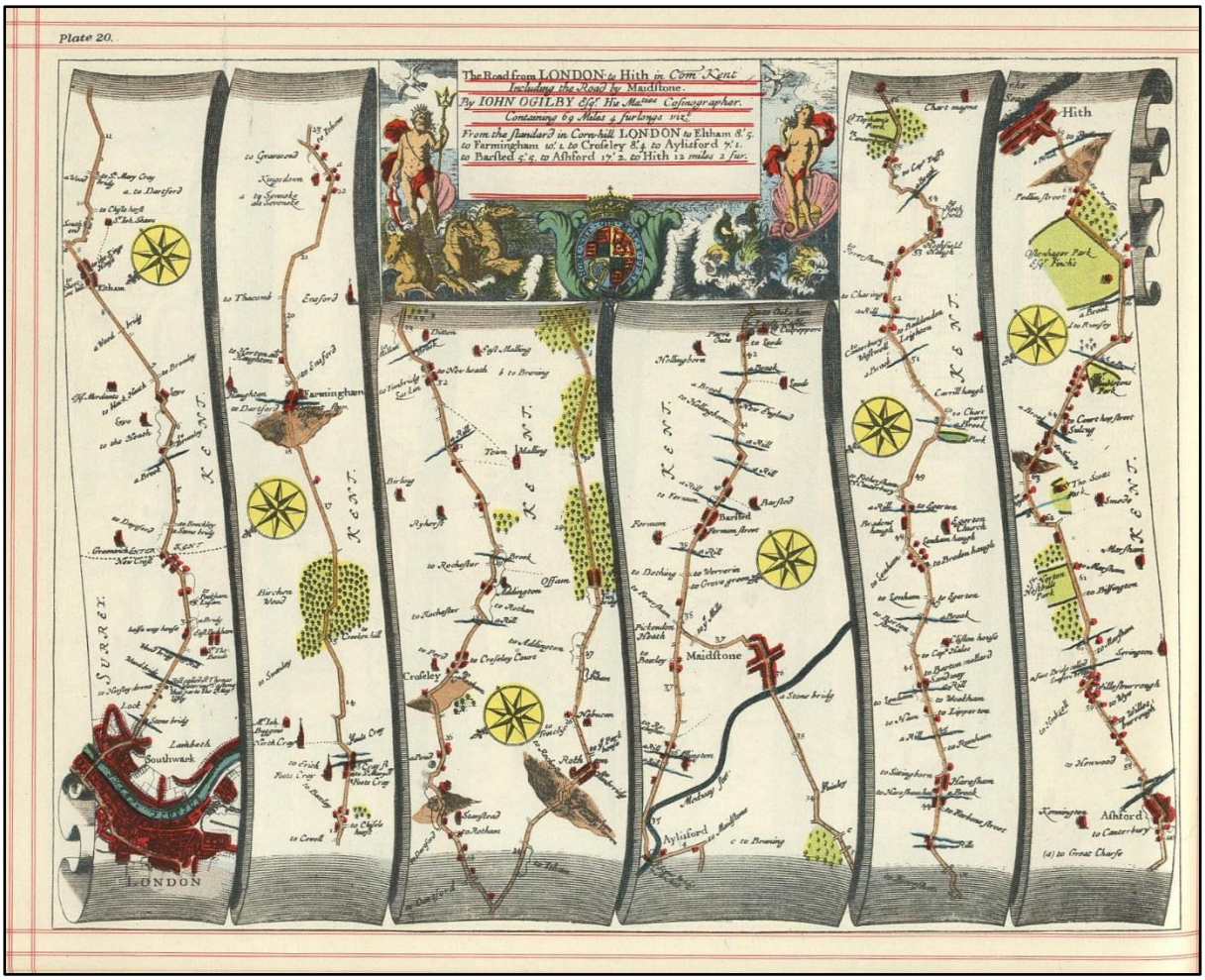


Figure 22. 'The road from London to Hythe', one of a hundred scroll maps in John Ogilby's *Britannia* (1675). Only the parts of substantial woods adjacent to the illustrated routes are shown. The mile-long 'Birchen Wood' between Farningham and Chislehurst (2nd strip from left) had disappeared by the 20th century. The chain of woods through which a traveller would have passed to reach Maidstone can still be seen today in a much reduced form and its remnants continue to be cleared. Midway along the final strip is the medieval Hatch Park with its two flanking ancient woods (see Figure 14). Source: http://www.fulltable.com/vts/m/map/ogilby/a/a.htm

There are also early county maps produced at small scale such as those by Speed, Seller and Morden (for Camden's *Britannia* in 1695). These vary greatly in quality. They were widely copied, sometimes with embellishments and omissions. Some were made using medieval approaches (features being plotted based on tradition or local knowledge rather than survey) but some, like Symonson's 1596 survey of Kent, are superior. They are generally not a strong source for ancient woodland attribution but not to be completely ignored as they may provide the earliest evidence for major woods and forests.

5.2.1.2 PLACE NAMES

The names of woodlands can be clues to their origin (such as Park Wood or Heath Plantation) and antiquity (woods with names like Spring, Coppice, Holt, Shaw, Frith, Dingle). However the study of place-names, their meaning and origin is a complex subject and fraught with difficulties when ascribing them to specific places or features. For example whilst a longstanding name may indicate continuity, it can through use 'move' around a landscape. It can become corrupted through spelling, transcription and local dialect. Nevertheless, used carefully, names can be helpful as supporting information about a particular wood where the past land use may be in question.

Each county has a volume of place-name interpretations, often on a parish by parish basis. The majority of these are published by the English Place-name Society. For each parish entry those names which appear in the earliest documentary records are listed and for each entry changes in spelling, together with a discussion on its origins and meaning are given. The origins of names in this country have four main roots, Celtic, Saxon, Scandinavian and Norman-French. It is advised that workers become familiar with the local dialect and place-names specific to their study area. For example the suffix *den* meaning 'swine pasture' is generally only found in the ancient wooded landscape of the Weald in Kent and East Sussex, the term gill (or ghyll as spelt in the 19th century) occurs in the south east and north west of England. The place names in Cornwall are strongly influenced by its Celtic past and likewise those in the north-east by Viking settlement.

Place names are useful in various ways for identifying ancient woodland.

- The name of the place or settlement with which a wood is associated may give general indications of the landscape character of its historical setting (e.g. settlements ending in -hurst, -field, -leigh or –ley (Rackham 2006, Lennon 2009)).
- The form of the wood name itself may strongly hint at great age (e.g. if it is an Anglo-Saxon name).
- The name of the wood may be continuously recorded from before 1600.
- The wood may take the name of the adjacent (dateable) settlement to which it belonged or a former tenant, owner or landowning family with a locally known history.
- The names of adjacent fields may indicate the former extent of a wood and thus help determine if fragments of it survive within that extent.

Woodland Names

Woods with irregular boundaries lying in a patch of ancient enclosures against the parish boundary are likely to be ancient, especially if they are named after the parish or manor [or] if they have a name which indicates traditional management (e.g. Spring Wood)…. (Peterken 1981, 37)

The origins of woodland names can be very ancient, like the medieval Staffhurst Wood (meaning the wood where staffs were made), or can be fairly modern, like 'Bonaparte's Plantation'. The names of woods are not necessarily fixed (see also Figure 20). Ancient woods can have recently given names and sometimes recent woods may acquire the names of older woods that were cleared. Rackham (2006) proposes that 'Hundred Acre Woods' are likely to be recent because any ancient wood of this size would have been given a more distinctive name. On the other hand 'Six Acre Wood' does not necessarily indicate recentness. If ancient woods were broken up in recent history then new (and prosaic) names may have been coined for the separate parcels of woodland formed – these may simply derive from the name of a new owner, an adjacent field name or the use of the wood. Thus, pieces of ancient woodland can acquire incongruous names like 'Pheasant Plantation' or 'Dog Kennel Wood' (e.g. 7.2) after being severed from their roots.

Ancient names can also be lost when woods are amalgamated. The name of Dering Wood in Smarden, Kent (Figure 23) dates from the mid to late 19th century and comes from its former owner Sir Edward Dering. The OS County Series 1st edition map (Epoch 1) shows an undivided irregular shaped wood with straight avenues and drives laid out through it. However, the tithe map produced just three decades earlier shows a sub-divided wood made up of numerous enclosed medieval coppices belonging to several different woodland owners. The individual names give clues to past management and ownership, for example the largest parcel, Fagotter's Wood (the earliest name, traceable to 1540), where faggots were made and Tufton Wood, from its owner Lord Tufton of Hothfield. Others of the various parcels' names relate to the underlying environment, for example Burnt Wood (derived from the word, *bourne* – stream or spring) meaning a wet wood (which it is) and Birch Wood which occupied an area of more acid soils (Bannister 2002).

Figure 23. Dering Wood, Smarden (Kent) in 1838 and 1871. The tithe map on the left shows several individual woods, some of which are further subdivided, named in the tithe apportionment: Burnt Wood; Fagotters Wood; Birch Wood; Harden Wood; Horman Wood; Tufton Wood; Valentine's Wood; Poole Wood; Pierce Wood; Five Acre Wood; Three & Two Acre Wood; Dering Wood. At this time the lot known as Dering Wood was a minor component (c. 8 acres) at the southern end of a complex of more than 400 acres extending into Frith Wood in the next parish. By 1871 (right) these were 'merged' and managed as a whole and laid out with avenues radiating from a rond-point by the Dering family which had acquired the different woodlots over a number of generations. Hereafter the old names disappeared from the map and ceased to be used (see Bannister 2002). Tithe map for Smarden, 1838 by Thomas Thurston of Ashford: Reproduced by kind permission of Kent Library & History Centre. Ordnance Survey County Series: © Crown copyright and Landmark Information Group.

Sometimes a wood may be recorded in the county place-name volume together with the first surviving recorded date. Although this will not give the boundaries to the wood it will indicate its presence in the landscape. For example in the parish of Hartfield in Sussex, Grove Wood is recorded as *le Grove* in 1623 in the Sussex Subsidy Rolls (SRS 14, 55. Mawer & Stenton 2001, 369). This kind of information can provide valid evidence for a wood being at least partly ancient in origin, often predating the earliest available map by centuries. The form and spelling of a name may change significantly. Staffhurst Wood in Limpsfield parish, Surrey has the following record (The Historical Gazetteer of England's Place-Names).

Stefhurst 1235, 1263
Staffhurst 1279
Stafhurst 1312
Stafherstwode 1312
Staffyrsteswode 1418
Staffirsteswode 1430
Staffordswood 1757

Whilst in this case there is little doubt of at least some continuity of place, in other cases there may be uncertainty if the wood mentioned in pre- and post-1600 documents is the same – the references must be tightly constrained geographically and the commoner the name the more important this is; there is no reason to believe that a Church Wood mentioned in the county of Derbyshire in 1590 is the same one as specifically being researched in 2015.

Some names may suggest a wood, or part of it, is secondary. There are numerous ancient woodlands called 'Moat Wood' for example where the remains of medieval moated settlement sites survive. On these sites the reversion to native woodland with its subsequent management might have taken place so long ago that the ancient semi-natural woodland vegetation has completely re-established itself. In Moat Wood near East Hoathly the remains of adjacent medieval field enclosures still survive in the coppice and underwood (Bannister 2006, 36). Names like 'covert', 'spinney', 'brake', 'furze', 'gorse', 'heath' may also indicate a secondary – though not necessarily recent – origin. Woods that have been planted might take the name 'Forest' in areas devoid of ancient forest land, 'Wilderness' or be named after the species planted – 'The Beeches', 'The Larches' etc.

A wood may be named after adjacent landscape features such as Pond Wood or features that lie within it. Forge Wood or Furnace Wood, for instance, may record industrial activity such as medieval ironworking either within or by a wood. In many cases the relevant historic buildings, remains (or records of their historical operation) can be dated thus giving a post-quem date for this kind of wood name; the wood may have been called something else before the development of the industrial site.

Adjacent field names obtained from the tithe apportionments or estate maps and papers can give clues to the former extent of woodland, where it has been cleared (e.g. Bannister 2004, 9-10). Furze Field, Denshire Field, Grubbed Field, Riddens or Riding are examples of names indicating clearing of woodland or rough ground. In Sussex the name Stumlets or Stumbletts Wood refers to pieces of woodland with stumps on but also, confusingly, it can relate to a measure of woodland (Mawer and Stenton, 2001, 375). These can help with identifying vestigial fragments of historically larger woods. In ancient landscapes there may be many updates to the AWI which fall into this category, i.e. < 2ha outliers of known ancient woods (sometimes only the fragments, not the main part, remain).

5.2.1.3 HISTORIC ENVIRONMENT RECORDS (HER)

Each county holds a record of the heritage features recorded through, field survey, observation, chance finds and research. Formerly known as the Sites and Monuments Record (SMR), the HER now encompasses records for buildings, historic landscapes as well as archaeological sites. In many cases the HER is also the repository for the county historic landscape characterisation (HLC - see below). Many HERs are now online in a summary form and can be accessed through county council web pages or the Heritage Gateway Portal. The data comprises points, lines or areas with a short and full monument report. Linked to the site may be what is termed 'grey literature' – the reports and documents which accompany the site. What should be remembered when looking at any county HER where there is an absence of records is that it does not necessarily mean an absence of archaeological sites, rather it reflects an absence of recording, research or survey in that area. The majority of archaeological recording now is developer-led in response to proposed new development. However other surveys are also recorded on the HER, such as woodland surveys (as part of the England Woodland Grant Scheme EWGS), historic landscape management plans (as part of the former Higher Level Stewardship HLS), together with metal-detecting finds and chance-finds.

Consulting the HER for any wood, especially those where there is an issue over deciding whether it is ancient or not, needs to be approached with care. If a woodland survey has been undertaken, the level and method of survey needs to be understood in order that the results can be interpreted correctly, for example a series of

depressions interpreted as saw pits may actually be quarry pits or military dug-outs. (See 5.2.3.3 below for more on archaeological features in woodland.) Often there may only be one record for the wood itself rather than all the features recorded within it. For full details the 'grey literature' or survey report will need to be consulted. Increasingly the HERs now offer the 'grey reports' as digital pdfs.

The whole of the landscape of England has been influenced and modified by human intervention and action which has shaped its character over the centuries, thus all landscape has historic character as perceived by individuals. In the early 1990s English Heritage together with individual counties developed a method to assess and record the historic character of the landscape in a seamless and transparent way. Key data sources such as historic maps were used to identify and map areas with similar historic attributes to identify areas of the same historic character. Historic Landscape Characterisations (HLCs) complement landscape assessments, which looked more at the physical and ecological character of landscapes. Nearly the whole of England is now covered by an HLC (with East Berkshire and parts of Wiltshire in the final stages of completion). Historic England (formerly English Heritage) is now working towards the integration of HLCs to form a national HLC for England together with a national HLC thesaurus. Most county HLCs are held as part of the county HERs and in the case of Sussex, Kent and Surrey form the historic landscape context for recorded archaeological sites.

For many HLCs, the provisional Ancient Woodland Inventory formed one of the data sources used in assessing historic character. With the Sussex HLC it was being mapped at the same time as the pilot revisions of the AWI were being undertaken, thus for West Sussex the HLC was available to the ancient woodland surveyor, whilst for districts in East Sussex, the reverse was the case with the results from the pilot informing the HLC. HLCs undertaken before 2005 tend to be more broad-brush in their approach to characterising the historic landscape, whilst HLCs undertaken post-2005 are more detailed in their mapping. This is the result of using OS MasterMap as the base map and the more sophisticated GIS programmes such as ArcMap. Thus depending on where the revision of the AWI is taking place, the county HLC should be viewed with caution and the context in which it was digitised be understood.

5.2.1.4 OTHER TYPES OF DOCUMENTARY EVIDENCE

The approach set out in the handbook for evidencing woodland sites is mainly map based (for reasons of efficient use of limited resources). However, there are of course many other types of historical document that can help reconstruct the history of a woodland site. Ongoing work to digitise public archives and the increasing ability to search online for documents (even if not digitised) is making these sources more accessible and time spent researching them more cost effective. However, as a generalisation, finding and extracting useful site-level information from these sources is more labour intensive than map work and they can require specialist training to read and interpret.

Relevant sources include perambulations, charters, leases, rentals, estate records and the printed travel literature of the 18th and 19th centuries. These sources can and should be developed to improve the evidence base where resources and expertise allow, especially in districts where reliable historic map sources are fewer. Glaves *et al.* (2009c) provide a useful tabular summary of non-map sources, their strengths and limitations. There are a number of readily available and accessibly written texts explaining how to find and use them (e.g. Rackham 2006, Rotherham *et al.* 2008, East Sussex County Council 2012a). Novel approaches to the study of woodland history have developed since the AWI was first drawn up and Watkins (2015) explores these. The use of topographical photographs and drawings, particularly in areas which were on the historic tourist itinerary (for example the Lake District), is one which might be profitably investigated in AWI work.

5.2.2 MODERN SOURCES

5.2.2.1 MAPS

The 20th century is surprisingly often an area of weakness in the cartographic record of woodland sites.

Rackham (2006) noted:

The primary material is the 6-inch or 25-inch surveys, from which other scales are derived. A 1-inch map published in the 1950s can thus show woodland as it was in the 1920s. A wood may be shown as 'rough grassland', the result of a 1920s felling, and yet long ago have reverted to being a normal wood with surviving ancient stools.

The various popular editions of larger scale OS maps if taken together (the more the better) however can be used, in addition to revisions of the OS County Series 6" and 25" maps ('Epochs 2, 3, & 4'), to check for woodland continuity where some doubt over this has been raised. War revisions, for example sometimes show *ad hoc* revisions that are not necessarily visible on other maps.

Even the later Epochs of the 6" and 25" County Series are not consistently reliable and must be treated carefully. They can present a dilemma for decision makers (see Phase 4). Apparent gaps on these maps seem to represent published and reputable evidence for non-continuity, weighing against inclusion in accordance with AW definitions (see Miller 2014). Such gaps may in fact just show recent fellings. Two maps published close together in time do not necessarily provide evidence of a break in woodland continuity and in some cases the maps may be based on the same primary survey data anyway. As with the Old Series (above) it is important to be aware of the 'situation date' as well as the publication date. Try to find out which revisions are based on resurvey and which are merely reprints with minor alterations. Also be aware of the peculiarities of different sheets within a survey (county). As with Epoch 1, woodland can be more cursorily depicted on one sheet than on its neighbour. Some sheets on wartime editions simply do not show tree symbols although woodland boundaries are plotted. In some cases this will have been purely for reasons of economy and does not always indicate woodland having been cleared or even felled.

5.2.2.2 AERIAL PHOTOS

If access to mid to late 20th century aerial photographs can be secured they provide an excellent way to bolster an evidence gap left by maps from this period.

Historic England hold a large collection of historic aerial photographs. Oblique images can be viewed online at http://www.britainfromabove.org.uk/browse but the vertical images have not been digitised (they may be viewed at Swindon). Glaves *et al.* (2009c) cite other possible repositories.

Google Earth[10] provides free access to historical aerial photographs for many areas in England for the period 1940 to 1960. In some cases the resolution may be too low to be useful but in others these may provide a valuable means of checking for woodland continuity (Figure 24).

[10] This is the free *Google Earth* programme not the *Google Maps* browser based mapping. *Google Earth* needs to be locally installed on a work station or accessed using a web browser plugin.

Figure 24. The 'view historical imagery' tool within Google Earth™ can be useful to give a mid-20th century view of sites which does not depend solely on the revisions to the OS County Series maps. The screenshot shows 1945 air photos for part of Dorset. Source: Google Earth 2018.

5.2.2.3 LIDAR

LiDAR (from 'Light Radar' or 'Light Detection and Ranging') is a way of determining three-dimensional data points using laser beams (Crutchley and Crow 2009). It was originally developed as a bathymetric technique in the 1960s to locate submarines on the sea-floor, later being applied to land based topographical survey. LiDAR is a remote-sensing system which can be used from a range of platforms, but in this instance the data is gathered through airborne survey. The method uses GPS to record the position of a laser pulse and measures the time it takes for it to be fired from a sensor, hit a surface and return to the sensor as a reflected signal – the wave form. Early LiDAR recorded the first and last return and these data could be translated to create Digital Surface Models (DSM) and Digital Terrain Models (DTM). More recent surveys record all the data from a pulse and thus are able to be analysed at varying points along the wave form (See English Heritage 2010 for an introduction to the technique, its interpretation and uses).

The Environment Agency has produced a LiDAR terrain model to predict flood risk at 2m resolution (i.e. one data point for every $2m^2$). This is considered to be too broad to capture more detailed archaeological information and now Digital Terrain Models (DTMs) for archaeological survey use point data captured at 1m resolution.

The value of LiDAR is that the laser can penetrate most types of vegetation cover to reach the ground surface (and below in some instances), so that the terrain beneath a woodland canopy can be mapped (see Figure 25). Dense stands of conifer, or heavy rhododendron undergrowth will prevent laser penetration to the ground surface and thus obscure any features, resulting in blank areas. However this technique has proved invaluable in recording the archaeological resource for large areas of wooded and forested land. On the con side, the survey is costly to implement, it requires specialists to process the data using high-power GI systems and expensive software to view and manipulate the data. Interpreting the images also requires a certain degree of

skill and experience. However, once images have been produced and geo-rectified they can be viewed using standard GIS packages such as ArcMap.

On the pro side, where LiDAR has been undertaken at the higher resolutions, it can provide valuable information on land use activities which have taken place in wooded and forested areas. Examples are the identification of previously unrecorded hill forts, burial mounds, field systems and industrial activity (e.g. Devereux *et al.* 2005).

As a tool for revision of the Ancient Woodland Inventory, ideally it should be consulted if available, especially for woods which are proving difficult to determine as being ancient or not (see 6.1). Evidence of modern land use may suggest the wood itself is post 1600 in date.

Another significant advantage of LiDAR is that it provides a three dimensional aerial view of the landscape which complements aerial photographs. This may assist workers in understanding the topographical context and internal geomorphological variation of a woodland site.

For information on where surveys have been undertaken Forest Research (http://www.forestry.gov.uk/fr/infd-8zkec4) and the Environment Agency (https://www.geomatics-group.co.uk/GeoCMS/Order.aspx) should be consulted.

Figure 25. Cliff Wood, Hawkbatch, north of Bewdley, Worcestershire. The woodland in the photograph appears on the provisional ancient woodland inventory as ASNW. The processed LiDAR hillshade image on the right allows us to 'see into the trees' and find a cratered landscape. The craters are the traces of historic coal mining, spoil having been arranged around the openings of a series of shafts. The site was worked for a relatively short period in the early part of the 17th century with the coal being transported away on the River Severn, which is just to the east of the wood (information courtesy of Adam Mindykowski, Worcestershire Archive & Archaeology Service). Aerial photograph © 2015 Getmapping plc and Bluesky International Ltd. LiDAR images © Worcestershire Archive and Archaeology Service. Based on data supplied by the Unit for Landscape Modelling and Forest Research as part of the Grow with Wyre Project. No further copies may be made.

5.2.2.4 STATUTORY INFORMATION

Woodlands can occur within nationally protected areas, such as registered parks and can also contain nationally important historic features. It is not inconceivable for an area of woodland to be ancient in origin, located within a registered park and contain a scheduled monument and a listed building.

The following describes the most relevant of the statutory listings which may cover all or part of a woodland.

Historic England's Register of Historic Parks and Gardens

Nationally important historic parks and gardens are listed in the English Heritage Register, which was set up in 1983. It identifies designed landscapes, both private and public, using explicit criteria to possess special interest (English Heritage 2012, 2). Although they are a statutory designation, there are no specific statutory controls for their management unlike scheduled monuments and listed buildings. Within the National Planning Policy Framework (NPPF), registered parks and gardens are given equal status in the planning system with listed buildings and scheduled monuments. Entries on the register include designed landscapes of all types, from medieval deer parks to modern gardens designed by nationally important designers, or with important historic plant collections. Registered parks may also include other protected sites such as SSSIs, listed buildings and scheduled ancient monuments (see below). Each site is recorded on the register with a designation description, which includes a summary of its history and the reason for the designation. This text can provide important information on the history of the designed landscape together with key reference sources and relevant maps.

Scheduled Ancient Monuments (SAMs)

Nationally important archaeological sites are designated as Scheduled Ancient Monuments under the Scheduled Monuments and Archaeological Areas Act 1976. Each site is recorded by map and with a description of the feature and the reasons for scheduling. Such monuments usually have a management plan in place for their long-term protection. There are specific statutory controls which landowners should follow.

Listed Buildings

Listed buildings are structures 'that are of special architectural or historic interest'. A listing covers the structure but not any plant or machinery within it. Those which pre-date 1700 and are in nearly their original condition are listed, most between 1700 and 1840 are listed but with some selection; those between 1840 and 1914 go through a selection process and post 1914 only those of high quality listed. There are three Grades I, II* and II of which only 2% are Grade I and II*. Of particular relevance to the revision of the ancient woodland inventory are listed structures located in woodland, especially in historic parkland, where temples, follies, grottos etc. were built as part of a wider landscape design.

Sites of Special Scientific Interest

Where woodland sites are designated as SSSIs the notification document may provide useful notes on the site's past land-use and ownership history, together with information on species and habitats which may be of significant value in informing a view on its antiquity (most woodland SSSI's are probably in part ASNW but not necessarily wholly so). Data from non woodland SSSIs in close proximity to a woodland site can also help inform a better understanding of that site's history, land-use and landscape context.

Provisional Ancient Woodland Inventory

The original paper-based AWI records woods greater than 2 ha which were deemed likely to be ancient in origin (see 1.2, above). Although not a statutory designation, like registered parks and gardens they have equal status within NPPF. Each county's inventory is accompanied by an introductory report, within which is a section on the woodland history of the county, highlighting significant trends and historical happenings which have influenced the development and management of woodland in that locality.

5.2.2.5 FOREST CENSUS DATA

Forestry Commission census data have been used to good effect (Lovelace 2014) in helping demonstrate 20th century continuity and character of woods traced on 19th century maps and on recent aerial photographs. The mid-20th century and other censuses of trees and woods (e.g. Forestry commission 1952) potentially have advantages over the later revisions of the OS County Series maps, which are not fully reliable. However, they are held at Kew and are not widely available in digital form, so that those wishing to use them would need to digitise and (if large numbers of sites were required to be checked) geo-reference the map images. Their systematic use for an AWI update project would be time-consuming relative to digitally available 20th century maps and more likely to be justifiable as part of a wider programme of woodland research, restoration or conservation (see Lovelace 2010).

5.2.2.6 SURVEY DATA

Local botanical recorders and biological record centres may be able to provide pre-existing plant records and even vegetation survey data for some of the candidate sites in your long-established woodland dataset. If there has been any significant recent botanical activity, particularly in privately accessed woods, it is worthwhile making efforts to acquire or view the data - they are a potentially invaluable decision support tool. Vice county recorders and record centres should be able to tell you if any such relevant datasets exist. For further information Forrest (2001) gives examples of the types of existing field data that were useful in updating the AWI for Dorset.

5.2.2.7 GEOLOGY & SOIL

The British Geological Survey detailed geological data are available to use as a free web map service (http://bgs.ac.uk/data/services/wms.html) supported in ArcGIS[11] and MapInfo software. Thus bedrock and drift layers can be compared within the project GIS workspace with the distribution of long-established woodland in the study area. A generalised free soil map is available online through the Cranfield Soil and AgriFood Institute (http://www.landis.org.uk/soilscapes/#) with more detailed soil data available by subscription from the same source. Both at site level and landscape level these resources can be valuable for informing a historic land-use perspective when interpreting the evidence for antiquity and continuity of woods at the evaluation stage (Phase 4).

5.2.3 FIELD EVIDENCE

In reviewing approaches to the identification of ancient woodland Glaves *et al.* (2009c) have recommended that field evidence should be used to *support* map and archive evidence. In other words, field evidence is not a substitute for documentary evidence (the best evidence for ancient woodland is 'non-ecological' because this precludes circular reasoning in ascribing status to a site). While there are circumstances where indications of antiquity visible in the field are overwhelming, generally the inclusion of a site on the AWI will have been

[11] The source to load if using ESRI software is http://maps.bgs.ac.uk/ArcGIS/services/BGS_Detailed_Geology/MapServer/WMSServer?

based on map evidence, sometimes confirmed and supported by additional field evidence. Similarly field evidence can confirm a case for exclusion of a site from the AWI.

A generally accepted principle of evaluating a wood's antiquity is that as many types of evidence as possible are drawn upon. This means that in the ideal scenario field evidence would be obtained for every long-established woodland site considered. Resource limitations and restrictions on physical access to land mean that this may not be a realistic aim in most study areas. There are four broad scenarios where an AWI update project will need to employ field evidence:

1. to determine if a site for which the map evidence is insufficient or weak possesses features characteristic of ancient woodland on the ground or if such features are absent

2. to determine the degree of degradation of a site where ancient woodland interest is already in evidence but there are questions over its inclusion on the AWI due to damage or disturbance

3. to improve the accuracy with which a known area of ancient woodland interest is mapped, for example where a boundary between ancient and recent woodland or an ancient/recent mosaic cannot be determined using only desk-based resources

4. to improve confidence in the status of a wood (by widening the evidence base to include field data) which has higher potential to be affected in the short- to medium-term future by change in management, development or other land-use change.

5.2.3.1 SITE VISITS

These goals are best fulfilled using some form of level 2 survey (Kirby 1988). Detailed guidance on planning and undertaking woodland survey work for the purposes of evaluating ancient woodland status is already widely available. Kirby (1988) reviewed the range of approaches to collecting the appropriate information from a site visit and Glaves *et al.* (2009b) discuss the pros and cons of more and less scientific sampling methods for identifying ancient woodland. These publications are recommended reading.

The quickest and most efficient kind of survey for most potentially new ancient woodland sites will be a general walk-over but with some time dedicated to searching for indications of antiquity or recentness. In the second and third scenarios above more detailed information and measurements may be required so that different parts of a site can be compared. In some circumstances this can still be achieved using a walk based survey but the route should be pre-planned with reference to map evidence and structured accordingly.

Timing

Woods can be visited at any time of year and useful information collected. The optimal time for recording woodland flora is May and June but useful data on vegetation can be gathered from about mid-April until early autumn. Archaeological features like internal banks can be much easier to detect and map (sometimes a necessary operation to evaluate the extent of ancient woodland on a site) during winter but there are disadvantages of weather and day length for efficiently organising survey work. Peak surveying activity should be planned for spring to maximise the useful outputs of surveying efforts.

Accessing sites

Organisers of surveys and surveyors are referred to Kirby's (1988) advice on arranging permission to sites. Surveyors should not expect to seek and receive permission and survey a wood on the same day. Determining the owners of small woods can be more difficult than for large. On the other hand, for small woods that require only a limited amount of time on site some owners may be more ready to allow immediate access if

assurance of quickness is given. It is worth surveyors carrying a printed information note anticipating and answering typical questions that woodland owners may have about the work being undertaken. This could also include a code of conduct for the survey which can be signed with the owner. Some owners will be interested in the findings of a survey of their woods and copies of results should be provided promptly if they have been requested or promised.

What to record

Surveys in support of revisions to the AWI can be somewhat more abbreviated than other level 2 woodland surveys because there is a specifically defined purpose. At the site level, the more detailed the information that can be generated by the project the better served the evaluation process but, at study area level this might be offset by the need to obtain information from large numbers of sites. The essential elements of any survey will normally be a species list, a description of the site and an annotated map (for example see Figure 26).

External boundaries of the wood (or the edges of the survey polygon if different) should be walked and confirmed (or amended using a sketch map) and the interior of the site traversed so that any major environmental variations as well as the general range of microhabitats present are seen.

Exactly what information is collected from a site visit will inevitably vary according to the individual circumstances of the survey, which should retain some flexibility. The following list suggests the scope of recording that should typically be undertaken (McKernan & Goldberg 2011, see also Benstead-Hume & Morris 2012: Appendix 2):

- A list of vascular plant species including an estimate of abundance for each. Separate lists should be made for any clearly observed sub sections of the site and these should be adequately delineated on a sketch map.
- Stand structure and diversity and the broad habitats or vegetation communities present.
- 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 as woodland or physical features indicating a previous agricultural land use – the description should allow a third party to discern whether the features are likely to be ancient or post-medieval.
- Historical boundary features, such as wood banks, ditches, walls, stub trees, pollards or outgrown hedges.
- The presence of streams following original courses, natural ponds and other natural topographical features within the wood or associated with its boundaries.
- Other relevant information on the character of the wood such as substrates, aspect, altitude, gradient, level of deadwood.
- Current management system if known.
- Other factors having an effect on the ecology of the site, e.g. recreation, invasive species, grazing, garden encroachment etc.
- Date, surveyor name, length of time spent on site and any other information on site coverage if this was incomplete, for instance due to access restrictions or the survey being cut short.

Subdividing survey polygons

Where clear subdivisions within a survey polygon are encountered these should be recorded if they are potentially relevant in assessing the status of the woodland concerned. The recording should be accurate enough to allow later digitisation of the dividing line (see 5.3.2, below). Examples of necessary subdivisions are:

- areas within the polygon where the distribution of AWVPs or indicators of disturbance differs
- areas demarcated by significant internal boundaries like banks or ditches
- areas within the polygon that have been destroyed and no longer conform to any woodland habitat or well-defined areas within the polygon where the level of disturbance or degradation means it should definitely not be included on the AWI
- distinct areas of semi-natural woodland and plantation within a polygon should be mapped on site if they cannot be determined from remote data sources (see also 6.2)

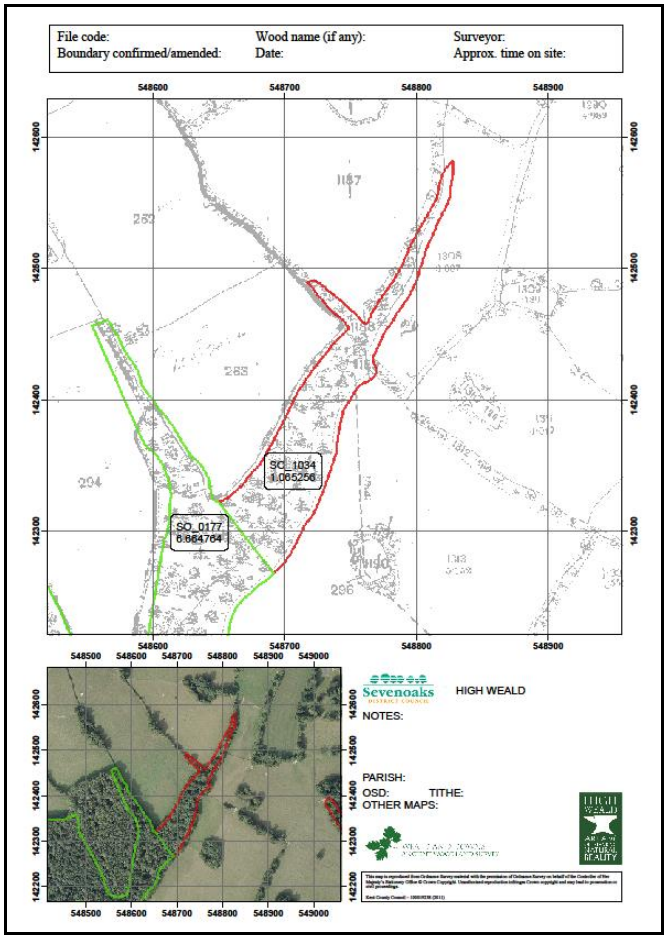
Survey materials

A field form structured for entering the details from a site visit in a standardised way will need to be designed to suit the local needs of the survey. This should prompt surveyors to include the key components of the survey (see above) in their notes and help the assessor at the evaluation stage (Phase 4) to find them.

Recent revisions of the AWI in South East England generally used a three part survey form comprising a large scale map for annotation, a structured page for surveyors' notes and a pre-printed species list (Figure 26). Here long-established woodland polygon boundaries – including their unique IDs and areas – were plotted on OS 25" Epoch 1 mapping. For general work on small (<2ha) sites this was found to be a useful base-map for annotating in the field and had the advantage of showing details of the historic landscape which could aid the recognition and recording of archaeological and boundary features. A 100m resolution version of the British National Grid was used as an overlay; in conjunction with a ruler and handheld GPS unit this allows for relatively quick and tolerably precise mapping of surveyed features. The OS data was printed in grey instead of black; this improves the clarity of pencil marks on the original and, especially, on scanned copies of surveys. A smaller plot of the polygon against an aerial photograph was included to help locate the survey site in its current landscape context. For large or complex sites plainer base-maps were used and printed on A3 paper to allow more space for sketching of features.

For the notes page a predefined shorthand was devised to represent commonly recorded features (e.g. high forest structure, grazing impacts, presence of old coppice stools, pits and banks and ditches), which could then be ticked or circled on the sheet, with descriptive noted added if required. This allowed information on physical features and non botanical observations to be later entered into a recording database in an abbreviated form (along with the biological records) if required. The species list was tailored to include the typically encountered woodland-growing vascular plants for the region, with those listed as AWVPs (Rose 1999, Glaves *et al.* 2009a) highlighted or printed in bold (again for ease of reference during the Phase 4 site evaluation stage).

In addition to site-level recording sheets, surveyors may find it very useful for planning fieldwork to have smaller scale maps (on a modern OS 1 to 50,000 or 25,000 scale) printed up with boundaries and unique ids of all polygons in the long-established woodland dataset. Experience in South East England found that this facilitated the collection of useful observations on unsurveyed sites seen 'in passing' during the course of visiting survey polygons (see below: Using other field observations).



Wood:		File code:
Recorder:	Compartment:	Date:

Site description (age structure, composition of vegetation layers, mosses/lichens dead wood etc.)

Management (circle)	HF	C	CwS	Pb	Pc	Pm	Pl	F	NA	O

Comments

Damage (circle)	Gg	Bg	Pg	Gz	Gw	Gp	Rbh	Rbl	Rc	Hd	Lc	Iv	O

Comments (details, extent)

Living features (circle)	Pollards Pld (>3m)	Stubs Stb (~1m)	Stools Stl (<0.5m)	Outgrown Hedges Ohg	Notable Trees Ntb

Comments (species, size, proximity to other features)

✓	**Archaeological**	Comments (dimensions, shape, proximity to other features)
	Depressions_DpS	
	Wg C	Dy S G
	Mounds_MdS	
	Built Structures_BtS	

✓	**Linear features**	It	By	Comments (dimensions, **sym**metrical/**asym**metrical, **sin**uous/**str**aight)
	Bank_B			
	Ditch_D			
	Bank and Ditch_BD			
	Track_T			
	Other_O			

FILECODE	DATE:				TIME:	GR:				SURVEYOR				
TREES & SHRUBS		1	2	3	4		1	2	3	4	FERNS etc	1	2	3	4
*Acer campestre**	Field Maple					*Chrysosplenium spp.*					*Athyrium filix-femina*				
Acer pseudoplatanus	Sycamore					*Circaea lutetiana*					*Blechnum spicant*				
Aesculus hippocastanum	Horse chestnut					*Conopodium majus*					*Dryopteris aemula*				
Alnus glutinosa	Alder					*Convallaria majalis**					*Dryopteris affinis*				
Betula pendula	Silver birch					*Dactylorhiza fuchsii*					*Dryopteris carthusiana*				
Betula pubescens	Downy Birch					*Daphne laureola*					*Dryopteris dilatata*				
*Carpinus betulus**	Hornbeam					*Digitalis ambigua*					*Dryopteris filix-mas*				
Castanea sativa	Sweet chestnut					*Digitalis purpurea*					*Equisetum sylvaticum*				
Cornus sanguinea	Dogwood					*Epipactis helleborine*					*Oreopteris limbosperma*				
Corylus avellana	Hazel					*Epipactis purpurata*					*Phyllitis scolopendrium**				
Crataegus laevigata	Midland hawthorn					*Euphorbia amygdaloides*					*Polypodium vulgare agg.*				
Crataegus monogyna	Hawthorn					*Filipendula ulmaria*					*Polystichum aculeatum*				
Euonymus europaeus	Spindle tree					*Galium aparine*					*Polystichum setiferum*				
Fagus sylvatica	Beech					*Galium odoratum*					*Pteridium aquilinum*				
Frangula alnus	Alder buckthorn					*Geranium robertianum*					MONOCOTS				
Fraxinus excelsior	Ash					*Geum urbanum*					*Agrostis sp.*				
Hedera helix	Ivy					*Glechoma hederacea*					*Brachypodium sylvaticum*				
Ilex aquifolium	Holly					*Helleborus viridis**					*Bromopsis ramosa*				
Lonicera periclymenum	Honeysuckle					*Heracleum sphondylium*					*Calamagrostis epigejos*				
Larix sp.	Larch					*Hyacinthoides non-scripta*					*Carex laevigata*				
Malus domestica	Apple					*Hypericum androsaemum*					*Carex pallescens*				
*Malus sylvestris**	Crab apple					*Hypericum perforatum*					*Carex pendula**				
Picea sp.	Spruce					*Hypericum pulchrum*					*Carex remota*				
Pinus sylvestris	Scots pine					*Iris foetidissima*					*Carex strigosa*				
Populus sp.	Poplar					*Lamiastrum galeobdolon*					*Carex sylvatica*				
Populus tremula	Aspen					*Lathraea squamaria*					*Deschampsia flexuosa*				
Populus x canadensis	Hybrid black poplar					*Lathyrus linifolius*					*Deschampsia cespitosa*				
Prunus avium	Wild cherry					*Lathyrus sylvestris*					*Elymus caninus*				
Prunus laurocerasus	Cherry laurel					*Lysimachia nemorum*					*Festuca gigantea*				
Prunus spinosa	Blackthorn					*Melampyrum pratense*					*Holcus mollis*				
*Quercus petraea**	Sessile oak					*Mercurialis perennis*					*Juncus effusus*				
Quercus robur	Pedunculate oak					*Moehringia trinervia*					*Lolium perenne*				
Rhamnus cathartica	Buckthorn					*Narcissus pseudonarcissus.**					*Luzula forsteri*				
Rhododendron ponticum	Rhododendron					*Neottia nidus-avis*					*Luzula pilosa*				
*Ribes nigrum**	Black currant					*Orchis mascula*					*Luzula sylvatica*				
*Ribes rubrum**	Red currant					*Orchis purpurea*					*Melica uniflora*				
Ribes uva-crispa	Gooseberry					*Oxalis acetosella*					*Milium effusum*				
Rosa arvensis	Field rose					*Paris quadrifolia*					*Poa nemoralis*				
Rosa canina	Dog rose					*Pimpinella major*					*Poa trivialis*				
Rosa sp.	Rose species					*Platanthera chlorantha*					*Scirpus sylvaticus*				
Rubus fruticosus	Bramble					*Polygonatum multiflorum*									
Ruscus aculeatus	Butcher's broom					*Potentilla sterilis*									
Salix alba	White willow					*Primula vulgaris**									
Salix caprea	Goat Willow					*Radiola linoides*									
Salix cinerea	Grey willow					*Ranunculus auricomus*									
Salix fragilis	Crack willow					*Ranunculus ficaria*									
Sambucus nigra	Elder					*Ranunculus repens*									
Sorbus aria	White beam					*Rumex obtusifolius*									
Sorbus aucuparia	Rowan					*Rumex sanguineus*									
Sorbus torminalis	Wild-service tree					*Sanicula europaea*									
Taxus baccata	Yew					*Scrophularia nodosa*									
*Tilia cordata**	Small-leaved lime					*Scutellaria minor*									
Tilia x vulgaris	Hybrid Lime					*Sedum telephium*									
Ulmus glabra	Wych elm					*Serratula tinctoria*									
Ulmus procera	English elm					*Silene dioica*									
Viburnum lantana	Wayfaring tree					*Solidago virgaurea*									
*Viburnum opulus**	Guelder rose					*Stachys officinalis*									
						Stachys sylvatica									
HERBS						*Stellaria holostea*									
Adoxa moschatellina	Moschatel					*Tamus communis*									
Ajuga reptans	Bugle					*Teucrium scorodonia*									
Allium ursinum	Ramsons					*Urtica dioica*									
Anagallis minima	Chaffweed					*Vaccinium myrtillus*									
Anemone nemorosa	Wood anemone					*Veronica chamaedrys*									
Anthriscus sylvestris	Cow parsley					*Veronica hederifolia*									
*Aquilegia vulgaris**	Columbine					*Veronica montana*									
Arum maculatum	Lords and ladies					*Vicia sepium*									
Calluna vulgaris	Ling					*Vicia sylvatica*									
Campanula trachelium	Nettle-le bellflower					*Viola palustris*									
Cardamine amara	Large bittercress					*Viola reichenbachiana*									
Cardamine bulbifera	Coralroot					*Viola riviniana*					bold=ancient woodland indicator species (*=if not planted)				
Cardamine pratensis	Cuckooflower					*Wahlenbergia hederacea*									

Figure 26. An example of survey paperwork from an update to the AWI in South East England. Using GIS digital A4 base-maps can be automatically generated for all the long-established woodland polygons in a dataset and exported to pdf so that they can be printed as and when required. This can be a considerable efficiency gain over producing a bespoke layout for each polygon individually after the decision to make a site visit has been made. A sheet for notes is structured so that the relevant features typical of the woods in the region could be recorded simply using tick-boxes but also allowed space for more descriptive notes. The species list, which can be added to, was produced with multiple columns to allow separate records to be made if a survey polygon was subdivided in the field. The designs of survey sheets can be varied to suit the needs of different project areas. Thought should be given to ease of interpretation of the information in Phase 4 as well as ease of collecting it in Phase 3. See appendix 9.2 for full size images.

Supporting information

Some authorities speak of the value of bringing in as much external information to a botanical survey of this type as possible, particularly a full awareness of historic map data and any existing archaeological or heritage records to guide the investigation of vegetation in the field. There are pros and cons to this approach and what works for a detailed site level research project might not be feasible for broader inventory work. Where surveying large sites in order to verify historic map data - for example to confirm the exclusion of a former open area within a large wood – taking historic map data into the field will be beneficial.

Often however it will be impractical for surveyors to be acquainted in detail with all the historical information pertaining to a site they visit for AWI purposes. They may be sub-contracted or be working at speed, briefly visiting large numbers of sites, some of which it may transpire will be inaccessible - so a detailed appraisal of the documentary record for every survey site may not be an efficient use of resources. There is also an argument that 'too much information' can bias (even good) surveyors to collect the data they expect – the independence of the different lines of evidence used in evaluating a site's antiquity may be compromised if surveyors are forewarned where to expect AWVPs.

Using other field observations

An important point made by Kirby (1988) which is particularly relevant to a time limited project updating the AWI is that although a standard approach to surveying sites should be adopted the flexibility to use information from unplanned or opportunistic surveys should be retained. This can be an important source of knowledge. Small woods are often difficult to secure access to but partial observations made from rights of way may still yield valuable data. Large numbers of small woods are much more time consuming to survey than the equivalent area distributed as a few large woods. Even if sites prove to be inaccessible or can only be visited briefly, or in the wrong season, or species abundance estimates cannot be made because only part of the site can be seen, a rapid assessment of sites which otherwise would not be recorded better serves the project than no data at all. Surveyors may be able to provide some information on additional sites with relatively little effort in the course of carrying out planned surveys of nearby sites. These may include observations on canopy species and structure made from a distance or more detailed observations on the habitat made from some closer vantage point (surveyors should familiarise themselves with further details in *The Woodland Survey Handbook*, available on NE's publications catalogue). This kind of opportunistically gleaned information should be seen as a bonus but clearly marked so that it is not directly compared with data derived from a standard survey and that caveats on the reduced reliability of the data are made at the evaluation stage.

5.2.3.2 BOTANICAL

Data on many different biological groups could be used to inform the decision making process but an assessment of vegetation structure and composition based around observations on vascular plant species should be the starting point and a minimum aim. Vascular plant data are the easiest to obtain and there is now an extensive literature to help with the interpretation of ancient woodland indicator species or ancient woodland vascular plants (AWVPs).

Surveyors need to be aware of the species assemblages which are considered to be indicative of ancient woodland (AWVPs) in the study area. Kirby and Goldberg (2003: Appendix 2) collate the lists of these species for 13 areas and Glaves *et al.* (2009a: Appendix 1) give further sources for regional or local AWVP lists. Whilst it is important that surveyors are familiar with AWVP species occurring in the study area (so that none are overlooked) botanical recording should not be driven solely by these plants; their information value is higher if their context within the wider flora and vegetation of the site is observed.

A full species list is much more useful for evaluation purposes than one which only records AWVPs (although this is better than nothing and may have the advantage of being quicker to obtain). For small woods it is recommended to produce as full a list as possible. In large woods there is some justification in limiting recording to woodland species (but not just ancient woodland species) as to record generalist and open ground species within the wood would result in a significantly greater investment of time in the survey. An assessment of the abundance of each species on the site using the DAFOR scale greatly enhances the interpretive value of the lists produced.

Notes and map annotations detailing any spatial patterns in the distribution of AWVPs observed (for example showing localisation of clonal species) on the site also enhance the interpretive value of the botanical data collected. The extra effort needed to capture this information should ideally be made where there is uncertainty over whether the historical status of the whole polygon is the same. For more spatially complex sites it may be appropriate for surveyors to consult any available historical documentary evidence before visiting the site[12].

The interpretation of botanical data from site visits is discussed in the next chapter (Phase 4: 6.1.3.2).

5.2.3.3 ARCHAEOLOGICAL

The study of woodland archaeology has developed into a popular branch of archaeology in the last 30 years or so inspired by the work of the late Professor Oliver Rackham. Many woods, especially in areas of ancient or woodland origin landscapes, have been researched in detail (Rackham 1986, 4). Across the country projects and schemes have been undertaken, often by volunteers led by professional and or experienced archaeologists, to identify, record and disseminate the findings of research into woodland history.

Woodlands of all types preserve evidence of past human activity whether it was the historic management of the woodland or some other land use which either took place in the wood or before it was there. Woodlands preserve archaeological features from the prehistoric period to modern times. This handbook is not the place to review all the different types of archaeological evidence to be found in woodland, rather surveyors should be aware of what the archaeological resource can inform about past land use activities within or adjacent to woods considered for inclusion on the AWI.

There are several useful and freely available guides to woodland archaeology (e.g. Bannister & Bartlett 2004, North Wessex Downs AONB 2007, Bannister 2007, Rotherham *et al.* 2008, East Sussex County Council 2012a, 2012b, 2012c). These will help with identifying features found in woods and give information on approaches to finding them. Detailed survey techniques may require training and surveyors should be prepared that not all features will be identifiable and not all features will help in the final evaluation of a wood's AWI status. Understanding the earthworks and their associations can provide information on a wood's history but may also require original research effort beyond he resources of an update project.

In carefully surveyed woods a "palimpsest of features indicating pre-1600 AD origins" may be found which provides powerful evidence of ancientness (Rotherham 2011). In the Weald for example the medieval and post-medieval iron workings have left a legacy of pits, ponds, charcoal hearths and other earthworks, but to elucidate the chronology of the development of these features further interdisciplinary work using documents and excavation might be needed. Where relevant local studies have been published (e.g. Jones 1993) these should be studied because they may show how certain recognisable archaeological features can be used as indicators of particular periods of woodland management and therefore be useful in the AWI evaluation stage (Phase 4).

[12] Ancient woodland identification is an 'interdisciplinary' process

Archaeological investigation and also the use of LiDAR imagery may reveal traces of a historical non-woodland land-use. This information only becomes useful in the context of the AWI update if it can be dated before or after 1600; the evidence of 'secondary woodland' will not always support exclusion of the site form the AWI.

For example, an area of woodland which can be dated to exist prior to 1600 AD may preserve burial mounds and field systems of Bronze Age date. Such earthworks can only have been created in a non-wooded landscape. The land was abandoned, reverted to woodland and managed over the centuries as woodland allowing what is both ancient and secondary woodland to develop. The influence of cultivation may be masked by the development of woodland soil profiles but can still be present after many centuries, even millennia, of woodland land use (Dupouey *et al.* 2002, Plue *et al.* 2008). The sites of some Iron Age hillforts lie in areas of ancient woodland and forests such as at Bigbury near Canterbury. Here the hillfort and its associated earthworks lie in an area of PAWS and Sweet chestnut coppice. On the other hand, woods which at first appear to be ancient from map evidence may contain remains of post-medieval narrow rig (ridge and furrow) cultivation strips, which can only have taken place in areas cleared of trees. The ability to investigate these hidden former land-uses is being transformed by the outputs of LiDAR survey (see above 5.2.2.3). These can both inform and target where archaeological fieldwork is undertaken and facilitate the interpretation of archaeological features found in the course of woodland surveys for the AWI update.

The term 'woodland archaeology' in practical terms often extends to the study of all physical traces of cultural heritage found in woods (including culturally modified trees), not just those of great age. In some cases recent features may obscure older ones or recent management and disturbance may obliterate them. In these circumstances the archaeological resource may not always provide straightforward evidence for AWI compilers. The remains of modern military features which can be found both in recent and ancient woods illustrate this. In modern times, national defence in part depended on concealing military activity within woodland.

Staffhurst Wood near Limpsfield in Surrey is a case in point. This is an ancient former wood-pasture common of about 50ha lying on a Saxon drove way into the Weald. It lies in the manor and parish of Limpsfield in which the Abbot of Battle had the right of 'free warren' and is recorded, as Stefhurst in 1235. The bounds of the wood are probably its medieval extent with some evidence of later assarts. It is well documented on historic maps (see Figure 27) - none of which show a break in woodland continuity - and in archives. For example the Limpsfield manor court roll of 1715-1717 records fines imposed on a Richard Wood for digging saw-pits and building lime kilns in the wood (SHC 2186/1/24). It appears that it was a common wood in 1760 and possibly still a relict wood-pasture in the end of the 18th century when John Rocque surveyed for his map of Surrey. Today, some ancient pollard oaks are located in the open areas along the drove ways but, as in other Surrey wooded commons, it appears to have long been enclosed and much of the wood-pasture replaced by coppice. The wood, designated an SSSI, is also an important ecological site for invertebrates, in particular moths.

On the ground, although the wood is enclosed by wood banks, internally there are few of the expected physical features associated with its long and apparently quite complex woodland history. Instead there are a concrete road, a water tank and some amorphous earthworks. Archival research following up on these observations has found that due to the wood's location close to important railway links between London and the coastal batteries at Dover and along the south coast, it was used as a munitions store, camouflaged amongst the trees. According to entries in the War Diaries of the 111th Command of the Royal Artillery over 200 tons of ammunition was passing through the depot in Staffhurst each day in 1941. Roads were laid out using rubble from Hyde Park and areas were cleared of bracken and other vegetation in order to store the munitions (TNA /PRO WO 166/5338).

Figure 27. Staffhurst Wood mapped for an estate sale of trees in 1768 (left) and in 1840 on the Limpsfield tithe map by Richard Dixon of Godalming. The route of the South Eastern Railway, sanctioned just a few years earlier, is seen threading under the ancient routes leading from the common at the southern end. A century later this proximity to a major transport artery from London had a major influence on the wood's use and management (see text). Detail from geo-rectified images of maps reproduced by permission of Surrey History Centre: 863/1/57 & 168/2.

In this example it is clear that in spite of the damage to ancient woodland features (both cultural and ecological) that must have occurred in the 20th century the overall historical integrity of the wood - its boundaries and its continuity as woodland habitat - has not been broken (in fact maintenance of tree cover was necessary to the operation).

This may not always be the case – some sites are better able to absorb impacts than others. In small woods where extensive internal resurfacing or reworking of soils has occurred it may have been more significantly detrimental to woodland habitat continuity. Such effects needs to be weighed against other evidence in the final evaluation (Phase 4) to decide whether a site should be included or excluded.

In view of the complex and multi-layered nature of the archaeological resource site visits undertaken for AWI evidence support will need to balance survey effort and time with potential usefulness of data collected. AWI site visits do however represent an important opportunity to contribute data to the historic environment record. Even if archaeological features found are not followed up as part of the AWI update project basic details such as an accurate grid reference and level one description could prove valuable to future researches and characterising the 'heritage value' of a wood or wider landscape.

5.3 RECORDING THE EVIDENCE BASE

As mentioned at the beginning of this section (5.1) the whole long-established woodland dataset should be validated against core evidence sources (Figure 28). These will differ between study areas but should include

the earliest reliable and large scale pre Epoch 1 maps that can give complete coverage to a project area (see 5.2.1.1, above). In which order you assess the core sources now is not critical or whether you wish to work on several sources simultaneously or one at a time. This may be influenced by external factors such as archive accessibility, progress with map geo-rectification (if this is being carried out by a third party) etc. Think about what sequence might best serve the information needs of the project. If your study area has a good quality late 18th or early 19th century map or maps providing reasonably complete coverage then it makes sense to process this first. The results of such a check will help prioritise work on other more time consuming sources such as Tithe maps (if resources are limited and a full check is not practicable) or on estate maps and help determine relatively quickly where absence of documentary evidence may call for a site visit (see 5.1).

5.3.1 ADDING AND LINKING EVIDENCE TO THE DATASET

This follows the same system as for Phase 1 for core maps with wide coverage within the study area.

0 = not shown as woodland

1 = shown as woodland or predominantly so

2 = part shown as woodland (10% – 90% of the polygon clearly not depicted as woodland of any type)

3 = inconclusive (use where map damaged, map image of insufficient quality to interpret or depiction on map ambiguous)

4 = no map coverage

5 = not assessed - the default code

6 = shown as woodland AND interpreted as consistent with wood-pasture or parkland habitat or management (Box 7)

At this stage you should add fields[13] to the long-established woodland dataset to allow information to be absorbed from the evidence sources (5.2).

Short fields for the numeric notation above can be used for most map sources but some information cannot be so easily codified. Longer text fields should be added to the dataset to receive information such as the repositories and archival references of estate maps, tithe map data on name and state of cultivation , wood names (if you are particularly studying these you may wish to insert a range of fields to record changes in wood name over time - other workers may use the comments field to do this); surveyor name and date (serves also to indicate if site has been surveyed).

It is advisable to include a field to hold the name of the historical parish (or parishes) for each site. This will aid finding historical evidence in archives which is often indexed and organised by parish. (Awareness of the locations of parish boundaries in relation to the dataset is also needed for evaluating whether a wood is ancient or recent).

A free text field for **comments** and another for recording **preliminary decisions** (indicated by grey arrows leading to recent woodland or provisional ancient woodland on overview flowchart) on AWI inclusion or exclusion should now also be added (if this was not done at Phase 2 – see 4.2). The comments field can be used to add notes to sites that could be useful for evaluation but that do not fit into any other fields.

[13] If you are working on a particular data source and have many fields in the attribute table it may be helpful to temporarily 'turn off' or 'hide' some of the other fields.

Field survey data

Field survey data can be incorporated into the attribute table but this is likely to make it unwieldy. A minimum requirement is that the existence of any survey that has been undertaken is apparent in the GIS dataset (otherwise such details may be forgotten after completion of the project). Field surveys should be referenced, manually or digitally, to the GIS dataset using the UID of the site. Compilers may however find it useful to include relevant summary notes (e.g. 'no significant earthworks', 'canopy spp. poor', 'ground flora only 3 AWVPs') on the results of surveys within a text field in the GIS dataset or, as a means of quick reference, to include a field specifically in which to enter the number of AWVPs recorded from surveyed sites.

Full digitisation of the survey data is encouraged but may require resources beyond the budget of some projects. Ultimately some users of the AWI and the wider long-established woodland dataset may wish to develop a digital link between survey data (species recorded and abundance etc.) and the GIS (Mitchel 2009). Records centres may be able to advise on the best technical approach to this.

5.3.2 USING EVIDENCE TO REFINE POLYGON BOUNDARIES

Where possible any observed differences in historical land-use or woodland condition within an area of long-established woodland should be represented by splitting polygons in the developing dataset (Figure 28).

In many cases a historic map will indicate that only part of a wood was woodland at the time of survey. If that map is accurate and precise then incorporating this information into the dataset as a spatial edit is the best approach to capturing this information. For example, if part of a wood is given as an open field on a reliably geo-referenced and accurate tithe map but the rest of the wood is shown as woodland then the polygon should be split. If the division conforms to an existing feature in OS *MasterMap* then this geometry should be used to edit the polygon. Miller (2014) suggests a confidence hierarchy of maps that can be used to reference a new line. The correct attribute can then be entered for each polygon in its corresponding data field (e.g. 'TITHE' = 0 for the field polygon).

If however, the source gives insufficient confidence to draw the line (because of poor spatial precision, distortion or georeferencing or suspect accuracy) then there are different options. Sometimes a number of different evidence sources can be consulted together in order to determine a boundary. These might include, for example, an internal linear feature shown on an old map but imprecisely located, GPS field data plotting the line of a vegetation boundary or earthwork (or an accurately made annotation to a large scale field survey map) and an aerial photograph indicating some corresponding difference in canopy structure or composition. If it is suspected that a map shows a significant part of a polygon as a non-woodland land-use but there is no way to capture this with tolerable accuracy in the GIS then record this information by placing a '2' entry in the relevant field for that source. Polygons thus marked may feed back into the process of choosing which sites to visit (see 5.1 & 5.2.3.1) as part of an ongoing field survey programme and will be easily refound for further scrutiny in Phase 4.

Some discipline is required in maintaining unique ids for all polygons in this phase of the project. Get into the habit of routinely assigning newly created polygons with new codes at the same time as editing (these can be changed later if necessary) and periodically check for uniqueness (e.g. by filtering or searching a list of UIDs to find any duplicates). New polygons arising from the splitting of woods should be given unique codes that reflect their origin, for example by using the parent polygon UID with the addition of a suffix.

Figure 28. The process of cross referencing the long-established woodland dataset against historic maps. Map imagery can be displayed at a smaller scale than when capturing woodland boundaries in the earlier phases of the work and several polygons might be selected simultaneously in order to edit a shared attribute. In the image a complex of previously designated ancient woodland (green) and potential additions (red) is shown. A polygon on the left hand side of the image has already been edited (using a larger scale map for reference) to show that parts of the area differ in their ecological history. ©The British Library Board, OSD 120.

5.4 OUTPUTS OF PHASE 3

At the end of this project phase the long-established woodland dataset should contain several layers of information on each site, including its status on the original ancient woodland inventory and condition on a range of historical map sources.

- All polygons should have been assigned a unique file code or identifier (UID).
- Each polygon should have been cross-referenced with the core map evidence sources available in the study area.
- Field data will have been obtained for a proportion of sites and the existence of a survey should be indicated in the attributes of the appropriate polygons (any field data held on sites should be clearly marked with the correct UID for ease of matching surveys to the spatial dataset at the evaluation stage - Phase 4).
- Where evidence has emerged for long-established woodland sites that have mixed land-use histories, polygons will have been subdivided to separately map those parts of the sites which are likely to be recent woodland.

- For a proportion of sites preliminary decisions on whether to include them on the updated AWI will have been made and recorded. The number and distribution of sites requiring further evaluation should be easily determinable by querying the dataset.

As with previous milestones it is recommended that a copy of the long-established woodland dataset at this juncture is archived as a benchmark in the workflow.

6 PHASE 4 - EVALUATING WOODLAND STATUS

In this phase of the project the status of every site or site part (polygons in the spatial dataset) must be evaluated and recorded. There is a binary choice between including a polygon and excluding it and this should be clearly recorded in a 'decision' field with one of two options (e.g. YES/NO, INCLUDE/EXCLUDE). Those which are put forward for inclusion on the AWI should also be assessed for naturalness (PAWS or ASNW) and for the presence of wood-pasture or parkland habitat of ancient origin.

6.1 DECIDING WHICH SITES TO INCLUDE AND WHICH TO EXCLUDE

The evidence collected and recorded in Phase 3 is re-examined for each polygon to consider if it supports both antiquity and continuity and conforms to the definition of ancient woodland (see **Error! Reference source not found.**). The general principles for deciding whether a site should be provisionally treated as ancient woodland remain the same as followed in the original inventory (Spencer & Kirby 1992) but usually the amount and quality of evidence drawn upon will be considerably higher. Glaves *et al.* (2009c) expand on these principles.

The designation of a site does not imply absolute certainty but should be the best assessment at the time made by drawing on the current evidence base. The attribute data for every polygon should reference all the information that was used in reaching a decision. Where the decision reached involved a complex or finely balanced judgement the 'Comments' field should briefly recapitulate the reasoning used. At this stage fields should also be added to the dataset to record the assessor and the date of a decision being made. This means that if information about a site is presented to NE by another party in the future (e.g. in support of a request to add or remove a wood from the AWI) it can be clearly related to the state of the evidence base at the time of the AWI update.

In some of the original paper-based AWI datasets a confidence grading for the sites included was given, often based on a relatively small number of sources. However, there is currently no method to derive an index of confidence that could be applied consistently at national scale within the AWI. Instead, in the updated AWI there is a transparent listing of the information sources consulted (Phase 3) embedded within the digital dataset submitted to Natural England. This gives an abbreviated evidence trail which allows the depth and strength of support attaching to a particular site to be directly assessed (this is not possible with the existing digital version of the AWI which includes only a limited set of attributes for each wood). In performing evaluations in Phase 4 workers may optionally devise a grading system for their study area to aid in the decision making process (e.g. Miller 2014) or use a grid 'scoring' each site for pros and cons (Rotherham 2011). This may be particularly beneficial on complex sites.

Keeping an open mind and judging the evidence on its own merit rather than falling into the trap of fitting observations to expectation is vital in this project phase. As Rotherham (2011) and others (Glaves *et al.*, 2009a, b, & c) point out, a great deal of what is known about ancient woodland in England, and what has fed into the standard diagnostic toolkit for ancient woodland identification, comes from observations on enclosed medieval or industrial coppices, and generally on larger woods. When the AWI is updated to include <2ha sites there will be found to be candidates which do not conform to the template and have different historical and ecological attributes. Tests that work in larger woods with 'typical' management histories may be valuable but should not be transferred uncritically onto different types of site. An independent appraisal of continuity is what is required.

6.1.1 INTEGRATING THE EVIDENCE

The evaluation should be based on a reasoned review of all the available information on the history of the site, its condition and context. It is a central tenet of assessing the evidence for or against antiquity that sources are

not judged in isolation and that designations are not made on the basis of a single fact. An holistic approach is required and a decision reached based on the balance of probability. The more pieces of evidence used and the higher the quality of the individual pieces of evidence the more robust the evaluation. In effect each site is a mini historical-ecological study though for many there may be an incomplete record. The process can be seen as 'building a case' for or against continuity and ancientness.

Where there are contrary indications within the evidence base for a site then the reliability of each source must be carefully considered and the most likely and most defensible explanation for the whole evidence base determined. Inevitably situations do arise where indications of antiquity and counter indications are too finely balanced to judge beyond doubt and then the precautionary principle must be applied pending further evidence.

6.1.2 CONSTRUCTING A CHRONOLOGY AND ASSESSING CONTINUITY FROM MAP DATA

At this stage a clear narrative will emerge from the assembled map dataset for some sites which points strongly either to a lack of historical continuity (and therefore probable recent woodland status) or continuity across the evidence base (and therefore provisional AW status). The sequence in which the sites are reviewed is open to variation. Starting with easier-to-judge sites is advisable. Continuity and antiquity can frequently be disproved whereas absolute proof that a wood is ancient is more difficult to produce.

A suggested course of action is to use GIS to query the dataset and identify sites that are unlikely to be ancient (those with many 0s across the range of map sources consulted). This subset of polygons can then be reviewed on a site by site basis marking polygons for exclusion where there is positive evidence of another land-use being maintained on the site post 1600 (clear examples are arable land recorded in tithe data, or a sustained clearance during the 20th century evidenced by air photos and good maps). The process can then be repeated for strong candidates (those with many 1s across a range of map sources and few or no 0s) entering 'retain' in the decision field for polygons where woodland is consistently recorded on pre Epoch 1 maps, where the record spans an appreciable portion of the post 1600 period and where other available indications are all consistent with ancient woodland (see below 6.1.2.1).

Throughout this process make notes on undecided sites, recording strengths and weaknesses in arguments for or against ancient woodland, and on why you are undecided. The residue of sites for which the historic map evidence is less clear-cut will have to be repeatedly sorted through and critical examinations of apparent discrepancies in the cartographic record made.

At this stage non-core map sources that were not assessed in Phase 3 (5.3) for every site may be revisited for specific polygons in order to bridge gaps or resolve uncertainties in the record arising from the core sources. With each iteration it should be possible to enter decisions for another tranche of sites for which a reasonable and well supported argument for one or other status emerges.

During this stage of the work an understanding of the relationship between woodland depiction on the maps used and evidence of historical absence or presence of woodland needs to be sharpened. There are a few particular issues to be considered.

Independence of map sources

Sometimes it will be necessary to weigh the evidence of a number of maps which show a wood against a number which do not. In this scenario it is essential to know something of the relationships between the maps. It is pointless to cite four maps all derived from the same survey data and published within the same few decades as outweighing three maps produced by different surveyors in three separate centuries – derivative data and secondary sources (e.g. copied maps) should be assigned less weight than independent sources when

balancing evidence. The misassumption that a map is independently produced from another one that is also being used in evidence may give false strength to an argument of woodland continuity or woodland absence. The copying of information from an existing map was an important aspect of historical mapmaking.

Survey dates

Uncritical acceptance of map publication dates as approximate 'situation dates' can lead to false chronologies and false arguments. The date of gathering of the information shown on a map may pre-date publication by many years or decades and in some cases other surveys may have been independently undertaken and published in the interim.

Systematic omission of woods

Some maps do not show woodland comprehensively – the accurate depiction of land-use or topography was not the concern of every type of mapmaker. Workers should try to attune themselves to the reliability of each map used by assessing it against any other contemporary sources available. A sense of how much weight to afford to the absence of a wood on a particular map can then be brought to the evaluation process. As a general rule smaller scale maps are less likely to show small woods than larger scale maps, though the purpose of the survey must also be considered. Private estate maps and localised surveys of land-utilisation are more likely to detail woodland resources than maps made for general sale to those wishing to know the geography of a county. Some maps do not show woods below a certain threshold size or width, others do not show copses or wood-pastures and some only depict those woods which were significant landmarks or were associated with the mapmaker's patrons. Without becoming aware of the idiosyncrasies of different maps misinterpretations are likely to be made.

The power of GIS means that the dataset populated in Phase 3 can be easily queried to reveal patterns in the depiction of woods and these can provide a valuable decision support tool. Are woods smaller than 5 acres and away from houses and roads typically shown? Are narrow upland ravine woods typically shown? If not then the absence of such a wood from the map does not contribute much to a case for recent woodland. Conversely the non-depiction of a wood in a well cultivated valley where normally the few woods are carefully shown might be understood as a more persuasive indication of a later origin.

Occasional omission of woods

Mapmakers often treated woodland as they did parks: ancient sites of some size might not be shown if they had recently been coppiced or their timber clear-felled (Roberts 1999)

Even very detailed topographic maps (such as the larger scale OSDs - see 5.2.1.1.6) may fail to show a significant minority of the woods that were in existence when they were surveyed. This has been demonstrated by research on contemporary estate maps and there are various possible reasons for non-depiction of woods. In the military mapmaking that pioneered the development of OS maps "attention was paid to woods that could provide cover for ambush" (see British Library curator's introduction to the OSDs). It is to be expected that small and shorter rotation coppice woods and belts of open wood-pasture would sometimes be deliberately omitted.

For this reason it is not prudent to conclude a site is recent woodland based on absence from a single historic map (or from a single historic map and its derivatives – note that the OSDs were the basis for a number of printed OS maps published throughout the 19th century). The approach reported by Spencer and Kirby (1992) for the original AWI is equally valid now:

Sites absent from any of the older map series [i.e. maps produced before the OS First Series 1 inch maps] *were deleted from the inventory only where there was a clearly depicted alternative land use on an historical map, or supporting evidence for a recent origin from other sources.*

It is pertinent to note the need for supporting evidence; this might take the form of a later map showing hallmarks of recent woodland, a documentary record of planting on untreed ground or field evidence of vegetation characteristic of recent secondary woodland for example.

Lack of depth in the map record

As mentioned above a robust evidence base draws on a range of sources. For some woods however there inevitably will be a paucity of early maps covering the site – this is the nature of the documentary record. The worst case scenario is that there is no trustworthy map available before OS Epoch 1 and it may be common for polygons to exhibit a continuous record of woodland cover from the early to mid-19th century onwards but have little reliable earlier map evidence. When the earliest map coverage for a site comes from a relatively recent (e.g. 1850) survey this does not of course constitute evidence of its being recent woodland. Ideally, sites under-served by map evidence will have been targeted during Phase 3 with efforts to seek other evidence. If this has been unfruitful it is especially important to realise the full interpretative potential of those maps that are in place.

The AWI has sometimes been criticised for overreliance on maps produced much later than the 1600 date that formally defines the resource. A point surprisingly often missed is that historic maps carefully interpreted (the historic maps section of the handbook provides more detailed guidance on interpretation) give information about the period before they were made, not just the moment of being surveyed.

In ancient countryside “the infrastructure, including the woods, changed little from 1598 to 1844” and in planned countryside “the woods usually survived even if the infrastructure did not” (Rackham 2006). The superior detailed County Series OS maps of the mid-nineteenth century can therefore give the best picture of the medieval landscape as a historian is likely to find. Another pioneer of the historical ecology of woodland in Britain remarked on the power of 19th century OS maps to show ancient woods in their original form before modern agricultural improvements – with attendant shrinking and straightening of wood boundaries - had been carried out (Peterken 1981). Thus, it is better to depend on detailed, accurate maps even if they are relatively recent than on older maps if they are imprecise and do not reliably show woodland.

6.1.2.1 LANDSCAPE - SEEING THE WIDER CONTEXT

Even where there is a dearth of historic maps for an individual site, examination of the wood’s setting on more recent maps can inform the evaluation process. Instead of seeing the site as an insular information vacuum its relationship to the wider landscape should be read for other clues.

In order to identify where ancient woodland may survive, it is important to consider its importance as a resource for the human population within the historic environment. Woodland and wood products were a vital part of the local and regional economy in Saxon, medieval and early post-medieval periods. By the 19th century the demand for wood was in overall decline as tools and domestic goods were increasingly made from metal, or imported and wood fuel was replaced by fossil fuel. Thus many smaller enclosed woods were grubbed for farming and wood-pasture on commons and in forests enclosed to fields or allowed to infill with woodland and scrub. Survival of woodland relates to the value of its site for other purposes versus the perceived value of retaining it, and this is location dependent. Woods may have been actively conserved in the 19th and 20th centuries for shooting, shelter, amenity or landscape value whilst others survive only because the effort of clearing would not have been repaid. Of course some ancient woods, do exist purely by chance of history, or due to the singular attitudes and actions of particular decision makers.

All landscapes have a unique multi-facetted character but some general themes and patterns can be determined. The English lowlands can be divided into ancient (or wooded landscapes) and planned or champion landscapes, based on a long recognised distinction elaborated by Oliver Rackham (1986) and others in research on historic settlement patterns (e.g. Roberts and Wrathmell 2002).

Ancient landscapes originated from forest clearance especially during the medieval period. The Wyre Forest, the Forest of Arden and the Forest of Dean (*forest* in the medieval sense of the word) are examples. Here early settlement is characterised by scattered farmsteads and hamlets in a mixture of fields and woods. The Anglo-Saxon word '*wald*' means 'woodland or 'forest' as in the *Weald* of Kent, Surrey and Sussex. In these 'Ancient' landscapes there are likely to be more areas of ancient woodland remaining (and a high proportion of the current woodland resource is likely to be ancient) though there are exceptions. In the *wolds* of Lincolnshire and Yorkshire for example woodland clearance has been so extensive that few enclosed woods now remain, except on the heavier clay soils (Williams 2012, 25).

Planned landscapes are those with a centralised village surrounded by farmland and woodland beyond. In a theoretical model of historic settlement and land use, woodland occupied the periphery of the farmed land on the poorer, less easily worked soils – land which was not enclosed for farming. Also as woodland only needed to be managed on a long term rotation and hence was not visited frequently it could be at some distance from the settlement, in most cases the lord's manor. Some smaller areas of enclosed woodland would be located nearer to settlement as a source of fuel etc. (Aston 1985, 103). Whilst this might be seen as a simplistic view of the historic landscape, many areas of ancient woodland do straddle or are adjacent to historic ecclesiastical parish boundaries. Even in 'ancient' landscapes large areas of woodland are found on parish boundaries.

The names of other landscape features than woods themselves (5.2.1.2) can sometimes provide useful information when interpreted in the context of the historic landscape. A wood lying amongst ancient enclosures against the parish boundary and linked to the settlement by 'Wood Lane' is likely to be ancient (Peterken 1981).

Soil conditions, topography and geology play a major role in determining the spatial distribution of woodland and should all be considered alongside historical evidence when attempting to identify areas of recent and ancient woodland. Steep valley slopes which are not suitable for cultivation or even for grazing may preserve ancient woodland (possibly including pockets of primary woodland) such as the gill woodlands of the Weald or the beech hangers of Hampshire. Areas of heavy soils, such as formed over boulder clays, or poorer sandy soils or those which are seasonally water-logged, are more likely to preserve remnants of ancient woodland compared with fertile, easily worked loam soils. Sizeable long-established woods which occupy situations in the landscape where historical cultivation would have been expected should therefore be treated with caution as this may indicate post-medieval origins.

6.1.3 KEY INDICATORS OF WOODLAND AGE USED WHERE MAP EVIDENCE IS SPARSE

The best type of evidence for assigning a wood to the provisionally ancient woodland category is a strong, site-level cartographic record that demonstrates long continuity with no evidence, actual or suggested, for an alternative land-use since 1600 (Peterken 1981). Where the cartographic record is weak, incomplete or ambiguous there are a range of clues typically used to help determine the most likely status of a site. These are well described elsewhere (e.g. Peterken 1981, Marren 1990, Spencer 1990, Rackham 2006 and see references in 5.2.2 & 5.2.3). The following sections of the handbook give some additional advice with particular reference to small long-established woods (since these were not included in the original AWI much of the evaluation effort in the AWI update work is likely to revolve around smaller sites) and other less typical situations.

6.1.3.1 SHAPE & BOUNDARY FORM

Ancient woods are often irregular in outline with sinuous boundaries, which in the field may be marked by a wood bank or some other semi-permanent linear feature (Szabó 2009) and recent woods are often straight-sided, angular enclosures. Larger medieval forests, wooded commons and heaths tend to have concave outlines with funnel shaped entrances, sometimes called 'gates' or 'hatches'. Ancient deer parks may have compact forms with rounded angles (this has been ascribed both to the ecological origins of the areas enclosed and to minimization of the perimeter length which needed to be enclosed with an expensive pale). However, these are generalisations rather than reliable diagnostic tests. Medieval boundary features have not always survived even where medieval woodland did and in other cases they may never have been there - for example, ancient woods derived from parts of lost commons (Figure 29). The presence of wood banks in particular has come to be popularly used as a key non biological field indicator of ancientness, with some surveyors and consultants attaching great weight to a recorded absence of these features. Whilst medieval banks and ditches can be a powerful indications of antiquity, their absence is not a failsafe shortcut to assigning recent status to a wood.

Wood banks may be more characteristic of ancient woodland in some regions than others. In England they are more common in the south-east than in the north-west (Spencer & Kirby 1992). Whereas in south Yorkshire they are important indicators (Jones 1993), in the north-east of the county a study by Gulliver (1995) found wood banks were not frequent enough to be useful for the recognition of most of the ancient woodland in that area. Even in regions where wood-banks are common, not all ancient woods have them. When AWI update work is undertaken, the character of boundary features associated with small (<2ha) sites may be found to differ from what has previously been observed in large woods. In East Sussex for example (Sansum *et al.* 2010), small copses known from maps to have been present in the 1600s that were historically managed as farm resources in a small-scale pastoral economy often lack the massive boundary earthworks associated with large manorial woods nearby. They may be marked instead by a simple ditch, lynchet or fence line. Some caveats about wood banks and interpreting boundaries are appropriate.

- Some ancient woods may be contained by natural boundaries such as streams and springs or occupy gorges. These may completely lack man-made perimeters. In some landscapes this kind of site may be rare, in others, the norm.
- Other woods may have had recognisably modern fences imposed on them 'late in life' as part of post-medieval estate management and agricultural improvement. In some landscapes certain ancient woods, particularly small ones, remote upland ones and those traditionally used for pasturage and livestock shelter, may have only been enclosed temporarily during the periods of greatest value for woodland produce; fences may come and go through history. The enclosure of woods and imposition of a coppicing regime is by no means a universally pre-1600 phenomenon – in some regions unenclosed tracts of anciently wooded land persisted into the 18th and 19th centuries (Peterken 2015).
- Core areas of ancient woodland may sometimes be surrounded by fluctuating mantles of scrub and secondary woodland on adjacent marginal land with no clear physical delineations. In these circumstances careful consideration of topography, gradient and the distribution of woodland plants may be needed to determine where an ancient woodland boundary should be plotted for AWI purposes. Notation on the most detailed OS maps may allow these less formal and less fixed boundaries to be distinguished from long standing enclosures (dashed or dotted lines versus solid).
- Some smaller woods – remnants of larger areas of ancient woodland or forest – may have straight, un-banked edges, where their current boundaries are the result of chasing back by expansion of modern agriculture or development (see 7.2).
- Similarly, secondary ancient woods developed on marginal land before 1600 but continuously maintained since may lack significant earthworks. It is important that the form taken by a wood's boundary is read in the context of its landscape and knowledge of local woodland history.
- Research on woodland boundaries in diverse parts of Europe shows that post-medieval wood-banks are not uncommon, some being associated with 18th and 19th century estate improvements (the

woods they enclose may be either ancient or recent!). They are often straighter and less substantial than their ancient counterparts.

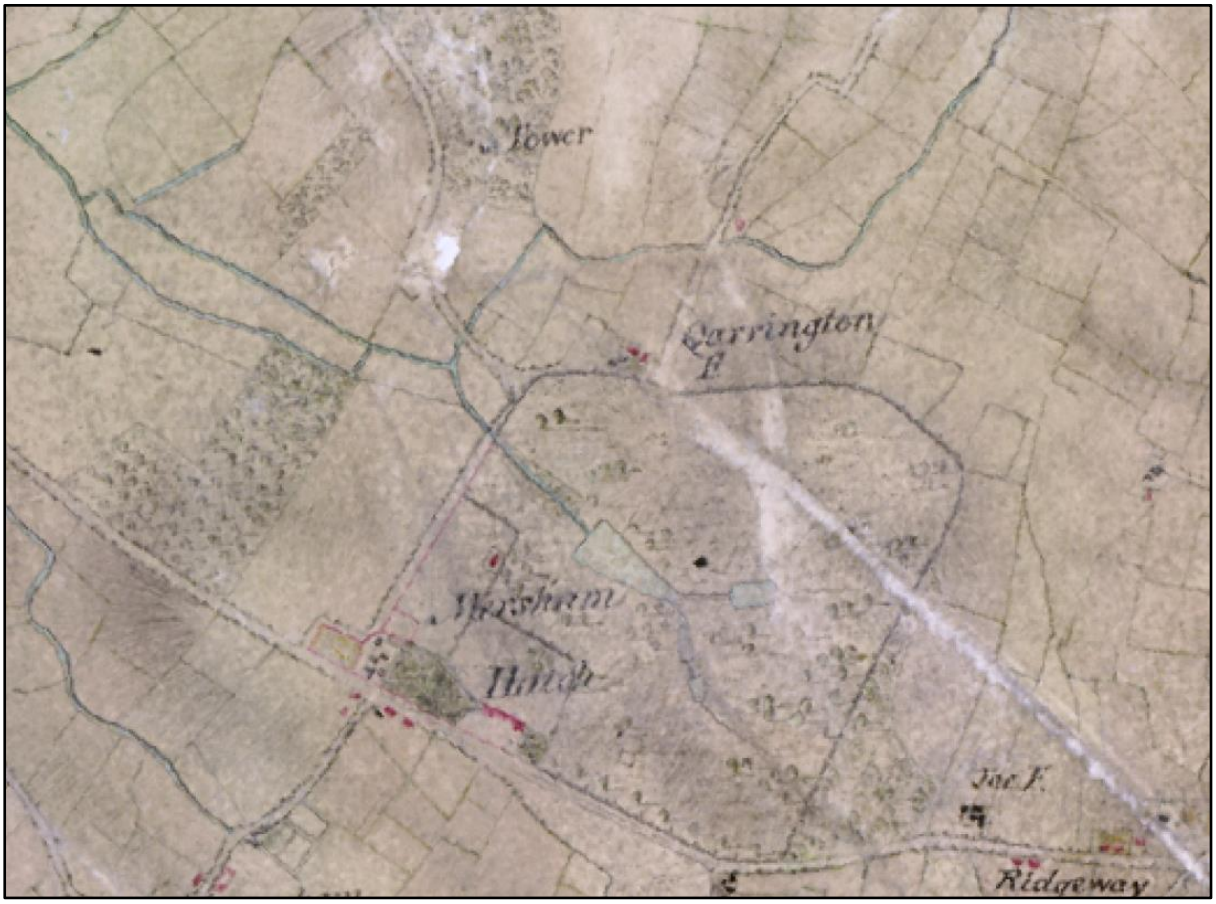


Figure 29. Hatch Park, Mersham in Kent was formed from a former wood-pasture and later post-medieval additions to the park were enclosed from common ground. The detail from the worn OSD shows its appearance in the late 18th century after probable modifications in the preceding decades. To the west is Bockhanger Wood (SSSI), shown as lines of mature, apparently planted, trees in a rectilinear enclosure. On the ground this wood comprises ancient hornbeam pollards over-planted with conifers and sycamore. Extract from the Hythe OSD produced at 3 inches to 1 mile, 1797 ©The British Library Board, OSD 105.

6.1.3.2 ANCIENT WOODLAND VASCULAR PLANTS OR ANCIENT WOODLAND INDICATOR SPECIES

The indicator species (AWVP) tool is inexact but simple: the more species recorded on the site, the more likely that site is to be ancient (the presence of AWVPs does not prove a wood is ancient and neither does their absence prove recentness). However, there is no linear relationship between the precise degree of likelihood and the number of species present that can be routinely applied at site-level. There is no threshold species count above or below which the status of a wood becomes a certainty. For this reason AWVP information should be used as a supporting part of the wider investigation (see Rose 1999, Peterken 2000 and Glaves *et al.* 2009a for further practical remarks on this). Where low numbers of AWVP species accompany other evidence consistent with recent woodland this strengthens a case for exclusion of the site. Where high numbers accompany historical evidence that is finely balanced, ambiguous or sparse then the case for designating the site ancient becomes more robust.

In the classic studies of ancient and recent woods in central Lincolnshire by G. F. Peterken and colleagues (summarised in Peterken 2000) the number of indicator species in ancient woods ranged from an average of

15% of a list of 80 species in sites under 5ha in size to 38% in those larger than 20ha. A 10ha wood on average contained 20 species (25% of the list). The mean number present in the recent woods ranged between 3% and 6% of the list. In the 1980s in southern England woods that had more than about 20 of the 113 species (c.18%) then considered by NCC scientists to be either 'strongly associated with' or 'typical components of' botanically rich ancient woodland communities (Hornby & Rose 1986) were characterised by Marren (1990) as "nearly always interesting places with a past" (i.e. likely to be ancient woodland). In south Yorkshire Jones (1993) suggests woods with more than 10 species from the list of 48 species he published (c.20%) are likely to be ancient. Thompson *et al.* (2003) found in Somerset that a threshold of 5 species from their list of 36 empirically derived AWVPs (i.e. 14%) would have correctly classified 85% of their sample sites. The misidentifications would have been evenly split between (vascular plant) species-poor ancient woods and the few non ancient woods with more than 5 species (known recent woods had between 0 and 8 AWVPs).

These percentages are not intended to set down rules but to show what might be expected in a suite of ancient woodland species; any one ancient wood typically has a small proportion – perhaps 15-25% – of the species considered to be indicative of ancient woodland in its given district. Only a tiny minority of sites - the most species-rich known - have more than 50% and these are almost always very large woods or woodland complexes, greater than 100ha in extent (Hornby & Rose 1986, and see Rose 1999). Furthermore, not all AWVPs are equal, some having only a relatively weak affinity and some exhibiting high fidelity to ancient woodland sites (see Peterken & Game 1984). A modest suite of the latter may carry greater weight than one that only contains weaker ancient woodland indicators. The behaviour of each species may vary geographically, even within the regions covered by currently published AWVP lists. Local expertise and experience may further enhance the interpretive value of botanical survey data and inform the interpretation of the assemblages of woodland species recorded.

In reality there are many factors besides woodland antiquity which influence the number and nature of AWVPs present on a site. The interpretation of lists of AWVPs does therefore require care. What is regarded as a 'high' or 'low' species count should be done in cognisance of other site parameters; the suite of AWVPs recorded should, like an ancient tree or a wood-bank, be considered in the context of the unique attributes of the site. Key considerations are: the size of the area surveyed; its proximity to potential sources of colonisation; the possibility that AWVPs were present on the site before it was woodland; the heterogeneity of conditions on the site (including management factors).

6.1.3.2.1 SIZE

From the work outlined above we can surmise that an observed suite of AWVPs in excess of about 15 or 20% of the locally defined AWVP list provides significant support to a case for ancient woodland. The general principle of species-area relationships must be taken into account however. All other things being equal, it must be assumed that smaller ancient woodland sites are likely to hold commensurately fewer AWVPs. In central Lincolnshire Peterken found that "on average a 1ha wood contained 5 species" (Peterken 2000). Rackham (2006) encapsulated this issue as follows:

No plant is an infallible indicator of ancient woodland... The test is whether a wood contains a suite of ancient-woodland plants, the number varying with the size of the wood. An ancient wood of 5 acres (2 ha), for example, might be expected to have about one-tenth of the regional list of indicator species, rising to between one-third and one-half of the list for a wood of 100 acres (40 ha).

At the lower end of the woodland size distribution there is greater overlap in the range of AWVP species encountered in ancient and recent woods; the botanical evidence is harder to weigh up for some sites. This does not mean that it is not worth surveying small woods. First, species counts for small ancient woods may

often exceed the average expectation[14] in which cases the botanical evidence can be compelling. Additionally, there are layers of information to be read from the botanical data beyond a simple count.

The composition of the vegetation and the spatial distribution of the AWVP species diversity must also be considered (see Peterken & Game 1984, Peterken 2000). For example, five AWVPs collectively forming the bulk of the ground flora across the interior of a small wood might be interpreted as more powerful evidence of antiquity than if there were six present as very small populations and all localised in one or two small parts of the woodland edge. Similarly, 20 AWVPs scattered thinly in a large wood where the vegetation is overwhelmingly composed of woodland generalist species and the canopy has a young, uniform structure may be less convincing an indication of antiquity than a dozen frequent or abundant AWVP species accompanied by centuries-old coppice stools.

6.1.3.2.2 PROXIMITY, COLONISATION & PERSISTENCE

There is body of scientific evidence from studies in the cultural landscapes of Europe to support the intuitive notion that recent woods standing closer to ancient woods acquire AWVP species more quickly (e.g. Dzwonko 1993, Grashof-Bokdam & Geertsema 1998). In areas with high levels of woodland cover the general degree of ecological isolation is less and conditions are generally more favourable for woodland specialist species. Therefore new woods can more readily be colonised. The importance of this landscape connectivity has been proposed to be higher in lowland Britain than in upland Britain where habitat quality may exert a greater influence on AWVP distribution than proximity to woodland (Petit *et al.* 2004). For these reasons AWVPs may 'work' better in landscapes with lower woodland cover and where the environmental conditions outside woodland are more hostile to the persistence or migration of woodland plants (e.g. fewer historic hedges, lanes and small watercourses, continental climate, intensive agriculture).

Proximity to another wood or some 'semi-woodland' feature is thought to be the main reason, in the lowlands at least, why some recent woods contain numbers of AWVPs approaching (occasionally exceeding) those in their neighbouring ancient woodland sites. Alternatively, a recent wood with many AWVPs might result from the persistence of woodland species through historic periods of lost woodland cover. These explanations should always be considered where there appears to be a mismatch between species richness and indications of recentness from other evidence. Clues that the AWVPs observed might not be part of a stable long established ancient woodland community are excessive localisation, absence from the interior of the wood, obvious 'wave fronts' or colonies which appear to be in the process of establishment. True ancient woodland vegetation often involves wide carpets of AWVP species that have formed by long periods of gradual vegetative spread.

It should also be remembered that the sources of colonisation may not be functioning or even present in the modern landscape. Woods, hedges and the ghosts of historical ancient woods that carried the species into recent woods may be long gone. Review historic maps where colonisation rather than ancientness seems to be a better explanation for a site's AWVP assemblage to see if there was a plausible source.

On very small sites colonisation rates as well as sources should be given special consideration. Whereas high cover of slow spreading plants across the expanse of a large ancient wood strongly support ancient status it may also be the case that comparable levels of abundance or dominance have been attained in small areas of recent woodland, where the distances covered are short. Occasionally AWI designations have been challenged on the basis of similar arguments (see Goldberg 2015). At present empirical data on the rates of spread of different AWVPs under different conditions are generally too inexact to properly test such arguments.

[14] In some regions the species-area relationship can be offset somewhat. Small woods may be less likely to have been altered from their traditional semi-natural species composition than larger woods which are more likely to have been managed under modern estate-forestry regimes.

Nevertheless, an awareness of the issue is important where small long-established woods stand close to other woods. Workers should take any opportunities afforded by the AWI update process to get information on rates of AWVP spread into recent woodland in their study area as it may be valuable in this evaluation phase. Data could come from surveys of long-established woods that have firm historical attestation of their dates of origin.

6.1.3.2.3 SITE CONDITIONS

At the first level the basic quality of the substrate will control the species diversity to be expected on any site. Ancient woods on acidic sands, although they may contain important specialities, are inclined to be poorer in AWVPs than woods on limestone (possibly even recent ones). At a more detailed level the surveyor should ask how many niches there are available on the site. Low levels of the underlying environmental variability that drives species diversity will naturally tend to result in lower numbers of AWVPs, regardless of woodland age.

An ancient wood that occupies a very uniform site may be rather species-poor, especially if it is small or overlies acidic parent material. When evaluating small uniform sites consideration should be given to the contribution of AWVPs to the vegetation and overall diversity of the site not just to the species total. In assessing whether the diversity of a <2ha site is consistent with it being ancient woodland it may pay to picture it as a stand within a larger ancient wood on similar substrates and ask whether it would still appear species-poor in that context. Abundance of two or three AWVPs over 0.25 ha of ground or more, with other species thinly scattered, may be typical of the ASNW vegetation in some situations. While such a site cannot be classed as botanically rich it may still be a good representative example of the ancient woodland vegetation and habitat of its geographical setting (and collectively a suite of such sites can exceed the diversity of their equivalent aggregate area in large woods).

Suppression of ground flora diversity due to the structure of the wood and its management should also be considered. Ecologists have come to expect dense PAWS to exhibit reduced ground flora diversity but this may also be a feature of ASNW. Where dominance by clonal or gregarious species is expressed the AWVP diversity may be naturally low. Such dominance may be temporary or recently established and may involve both AWVPs and more generalist species. A neglected stand of hornbeam (itself an AWVP) coppice for instance may effectively prevent all but a narrow range of the more shade tolerant herbaceous AWVPs native to the site from being observed. Vigorous and extensive stands of bracken or bramble – important constituents of the vegetation in many semi-natural woodland types – potentially weaken populations of more specialist ground flora species (if not actually depress diversity of AWVPs). On smaller sites such ‘extensive stands’ will have a proportionally greater impact on the flora of the whole wood. Recent papers by Keith *et al.* (2009), Marrs *et al.* (2013) and Kirby (2015) provide details that may help workers develop their view on these issues.

Variety of aspect, soil moisture and surface topography and presence of springs, crags, streams and gullies will greatly enhance AWVP diversity in an ancient wood. Conversely, on the occasions where recent woods occupy sites that are environmentally heterogeneous the narrowness of the range of species encountered may sometimes be striking – as if the vegetation composition has had insufficient time to equilibrate with the range of possibilities offered by the site. A lack of common moisture loving woodland species on a small streamside embedded in the wood for instance, can be as telling an indication of recentness as low numbers of AWVPs *per se*. In woodland vegetation of recent origin slight differences in habitat are less likely to be picked out and exploited by specialists. The locally characteristic associations of herbs of small well drained mounds and banks or minor damp depressions may be substituted for a continuation of the same blanket of generalist species that prevails elsewhere across the woodland floor.

The edges of intact ancient woods often support a disproportionately large number of the whole AWVP assemblage of the site. Where woods are surveyed whose original boundaries have been destroyed in recent

history (see section **Error! Reference source not found.**) this is another potential cause of reduced AWVP diversity. Some small long-established woods essentially represent fragments of the interior of larger woods and their species assemblages should be interpreted accordingly. On the other hand, small woods with intact ancient boundaries may deliver unexpectedly high AWVP totals because they have above average ratios of perimeter to area and good complements of both edge and interior species wrapped into a compact parcel.

The same high ratios of perimeter to interior habitat in small woods can also mean that where negative 'edge-effects' occur they have a disproportionate effect on the vegetation of the whole site. Disturbance and eutrophication of ancient woodland sites can cause AWVP rich vegetation to be displaced by invasion of species more typical of recent woodland (see 6.1.3.3.1 below). As with the impact of mono-dominance being potentially greater in small woods (above) this can be the case with these effects. Some small ancient woods are likely to have been significantly degraded by chemical edge-effects from herbicide and fertiliser spray (Gove *et al.* 2007) in recent history. In narrow linear woods even the inner parts of the site may be influenced by spray drift, 'edge-effects' effectively joined in the middle. Where the damage is severe and irreversible, affecting the whole site, such cases should be considered for exclusion from the AWI.

6.1.3.3 OTHER ASPECTS OF THE VEGETATION

It is not only the AWVP species assemblage that is of interpretative value, the distribution of other species on the site can also give clues to a wood's history. Obviously, the presence of ancient coppice stools in significant numbers, regardless of the species, almost proves a wood is ancient but less obvious signs may also point to the degree of habitat continuity or longevity.

As already mentioned, recent woodland vegetation may be more coarsely structured than in ancient woodland relative to the underlying environmental gradients of the site. This more finely resolved patterning in long lived semi-natural vegetation communities can be a useful adjunct indicator of woodland antiquity. Small populations of common, but habitat-specific, woodland species can contribute to the field evidence to support an ancient relationship between woodland and the site. The presence of old alder trees and associated herbs in places of higher moisture or humidity within a wood for example, although not AWVPs, can nevertheless be indicative of long woodland habitat continuity as can small patches of acidophilous vegetation picking out suitable enclaves within woods that are predominantly basiphilous (or vice versa). These are hints that the habitats observed have had significant periods of time during which the available species pool in the landscape has 'equilibrated' itself with the range of on-site conditions. In younger woods many different niches may be occupied by a relatively narrow spectrum of more generalist species. Look for environmental heterogeneity within the site and ask if it is matched by a corresponding array of species or habitats. If a site is ancient woodland the answer will often be yes, even if that site is not spectacularly species rich.

Even if not specifically identified in the survey the presence of extensive mats of slow-growing pleurocarpous woodland mosses or large foliose lichens may be excellent clues to long periods of habitat continuity in some regions. Rose (1992) provided a list of bryophytes he associated with ancient woodland, many of which are species which can be identified by the non-specialist.

6.1.3.3.1 SPECIES INDICATIVE OF RECENT WOODLAND

There has been less formal work done to qualify which species may signal recent woodland in different regions; these tend to be more 'generalist' in their ecological requirements and, by definition, of poorer indicative value. Nevertheless it is appropriate to look within the botanical information collected for positive indications of recently formed woodland vegetation (not just absence of AWVPs). Species may flourish in recent woodland for a variety of reasons: they may be specialists of woodland but efficient dispersers and quick to colonise, they may be generalist or woodland edge plants only able to prevail more widely in the

absence of competition from specialist old woodland species or they may be species that have responded to recent disturbance or that demand different soil conditions than are typical in ancient woodland.

Marren (1990) describes recent secondary woods as often containing "a jumble of colonist plants like ivy [*Hedera helix*], nettles [*Urtica dioica*], elder [*Sambucus nigra*], goose-grass [*Galium aparine*] and sycamore [*Acer pseudoplatanus*]". Other typically early colonists of woodland are *Arum maculatum*, *Brachypodium sylvaticum*, *Poa trivialis*, *Stachys sylvatica*, *Anthriscus sylvestris*, *Alliaria petiolata* and *Viola odorata* (Rackham 2003). All of these species of course can be present in semi-natural woodland of any age but a preponderance may point to a recently developed vegetation and may also indicate the influence of improved, non-woodland soils. Peterken and Game's (1984) work teased out different levels of ancient and recent woodland affinity within the woodland flora in Lincolnshire. Their lists of shade tolerant species frequent in secondary woods but not in ancient woods and of early-to-colonise species which are equally frequent across the divide are informative and useful. However, a few of the latter group of species behave differently and show mild affinity with ancient woodland away from eastern England. Species which seem to function as ancient woodland indicators (e.g. *Euphorbia amygdaloides*, *Mercurialis perennis*, *Daphne laureola*, *Sanicula europaea*, *Schedonorus giganteus*) in one region may be relatively rapid colonists of recent woodland in others (Hornby & Rose 1986).

6.1.4 RECORDING WOOD-PASTURE/PARKLAND PRIORITY HABITAT WITHIN THE AWI

Although wood-pasture was recognised at the time of the compilation of the original AWI as an important type of ancient woodland many of its sites were not included because the historic map evidence available was insufficiently detailed to define boundaries, which are by their nature often nebulous, or did not show low density woodland at all. Now the use of large scale Ordnance Survey County Series maps in Phase 1 means that even quite small areas of open-structured, unenclosed and grazed woodland can be mapped with tolerable precision.

Wood-pasture and parkland areas which conform to descriptions of the priority habitat (Box 7) and are likely to have ancient continuity of the defining characteristics should be identifiable on the AWI. The approach to this in revisions in South East England has been to include a field in which to record 'habitat type' (if known) within the updated AWI polygon attributes[15]. This attribute should be entered in addition to the status of each polygon as either ASNW or PAWS (6.2, below).

Types of site which would be included at Phase 1 for consideration as possible ancient wood-pasture or parkland were mentioned at 3.3.3.3. However, the challenge of determining which of these candidate sites are likely to be ancient woodland (i.e. ancient wood-pasture or parkland) remains (see Figure 30). Approaches to qualifying antiquity used in other types of woodland (discussed above, 6.1.2 & 6.1.3) may be ineffective for wood-pasture sites.

The obstacles are best seen in the context of the history of wood-pasturage as a practice and the resulting habitats.

6.1.4.1 BRIEF HISTORY OF ANCIENT WOOD-PASTURE

Most ancient wood-pastures probably developed from natural or semi-natural woodland whereby prehistoric and later communities either modified or exploited existing vegetation patterns to encourage large herbivores.

[15] This approach could be usefully extended to other priority types such as wet woodland where sufficient data are available, for instance by intersecting NVC survey data available in a spatial format with the AWI to identify common areas.

In some areas a sustainable system evolved with trees cut or pollarded above browze height to harvest the wood whilst enabling grazing animals to feed.

By the Saxon period wood-pasture was a well-established system. Rackham has identified three broad types - wooded commons - where common rights for people (commoners) enabled the grazing of beasts and the harvesting of wood, parkland or private wood-pasture for the management of deer and Forests - where common rights existed along with the King's right to manage deer (Rackham 1994, 9). Wooded commons are more likely to be Saxon or even earlier in origin and were most frequent in the post-Roman centuries. Private wood-pasture for deer is only first recorded in 1045 for Great Ongar Park in Essex (Rackham 1994, 12). Forests were a post-Saxon phenomenon established by the Norman kings for keeping and hunting deer. They did not necessarily consist of woodland but were defined areas governed by Forest Law in which wood-pasture would often have been one of the components in a mosaic of vegetation types. The New Forest comprises high-forest, wood-pasture and open pasture, with enclosed fields. Ashdown Forest in Sussex comprises mostly rough pasture, scrub and woodland but probably had more managed trees in the medieval period.

These broad types represent the heartland of wood-pasture habitats but pasturage generally has been a widespread element in the history of diverse kinds of woodland in Britain, especially in the uplands. The division between wood-pasture and other traditional forms of woodland management may have been overemphasised in the past (Kirby and Goldberg 2003, Peterken 2015). Historically, many woods have seen phases of intensive wood production interspersed with phases where grazing or stock shelter may have been the more significant land-use. For AWI purposes the interest in wood-pasture is in identifying sites where the current vegetation conforms to the priority habitat characteristics and is likely to have significant depth of continuity (see Box 7) but in making judgements on this it will be helpful to recognise the historical dynamism of structure and composition that many woods have experienced.

6.1.4.2 CHALLENGES TO IDENTIFYING ANCIENT WOOD-PASTURE SITES

Assessing historical continuity and antiquity using pre-Epoch 1 maps may not be feasible for many sites. Larger deer parks are often shown on early county maps when other woods are not and estate maps may sometimes provide detailed information right down to small groups of trees, but for small traditionally grazed woods, particularly in the upland zone, map evidence may be especially poor, with ground-truthing the only viable way to confidently determine habitat continuity (Whittet *et al.* 2015). A valuable resource is the tree map being developed by the Ancient Tree Hunt. Although incomplete (the data come from volunteer tree recorders and will vary with survey effort), for many sites this may potentially be a means of vicariously confirming the presence of veteran or ancient trees (see Case Studies & examples, 7.1). Data within the HER, Register of Historic Parks and Gardens, Natural England's Provisional inventories of historic wood-pasture and parkland and independent studies of parkland (e.g. see Rotherham 2007) may all give relevant information on site histories that cannot be obtained from map sources.


Foster Crags
Wood
Low Huller Stones
0 50 100m
Moor
Craig Ho.
Shell Gill
Gill Wood
Moor

Figure 30. Long-established woodland of an open character in a moorland valley on the Millstone Grit, North Yorkshire. The first two images show detail from the Ordnance Survey County Series 25 inch map, produced in 1890 and a recent air photo. The woodland - which does not currently feature in the AWI - occupies a steep valley slope with crags, springs and gill streams but also with disused quarries and mine workings. The third image shows the Ordnance Survey First Series 1 inch map of 1859 (the rectangle indicates the extent shown in the first two images). This series was the most commonly available historic OS map available when the original AWI was compiled. Although it does show the wood, the relevant detail is almost obscured by slope hachuring and the small scale would not permit the historic woodland extent to be accurately captured. © Crown copyright and Landmark Information Group; © 2015 Getmapping plc and Bluesky International Ltd.

Separating ancient and recent wood-pasture

As Peterken (1981) points out, many landscape parks 'can be regarded ecologically as recent, secondary wood pasture' because they are known to have been created (by Capability Brown, Humphrey Repton and others) *de novo* on agricultural land. Other parks may have specifically incorporated pre-existing tree-scapes into their designs by retaining prominent hedgerow trees, thinning woods or clearing copses to retain selected standard trees – whilst these may contain valuable populations of veteran trees generally they will not conform to the definition of ancient woodland.

The historical development of seemingly recent (post-medieval) wood-pasture areas both in designed landscapes and in less formal ornamental parkland however can be complex. Some of these areas may show localised continuity of pre-existing wood-pasture habitat.

Medieval and Tudor deer parks were either dis-emparked and enclosed or became incorporated into post-medieval designed landscapes. For example, the veteran oak pollards in Chatsworth 'Old Park' and the remains of the former medieval deer park became part of the wider 'Capability' Brown landscape around 1760 and this process occurred for many such post-medieval designed landscapes. Some deer parks were themselves derived from the impalement of areas of pre-existing wood-pasture on commons and Forests. Multiple phases of historical development may sometimes obscure the evidence for ancient continuity of wood-pasture habitats. Whilst the most significant sites in well-known parks may be on record (as sizeable populations of veteran trees tend to be noted) there is scope for smaller and subtler remnants to have been overlooked.

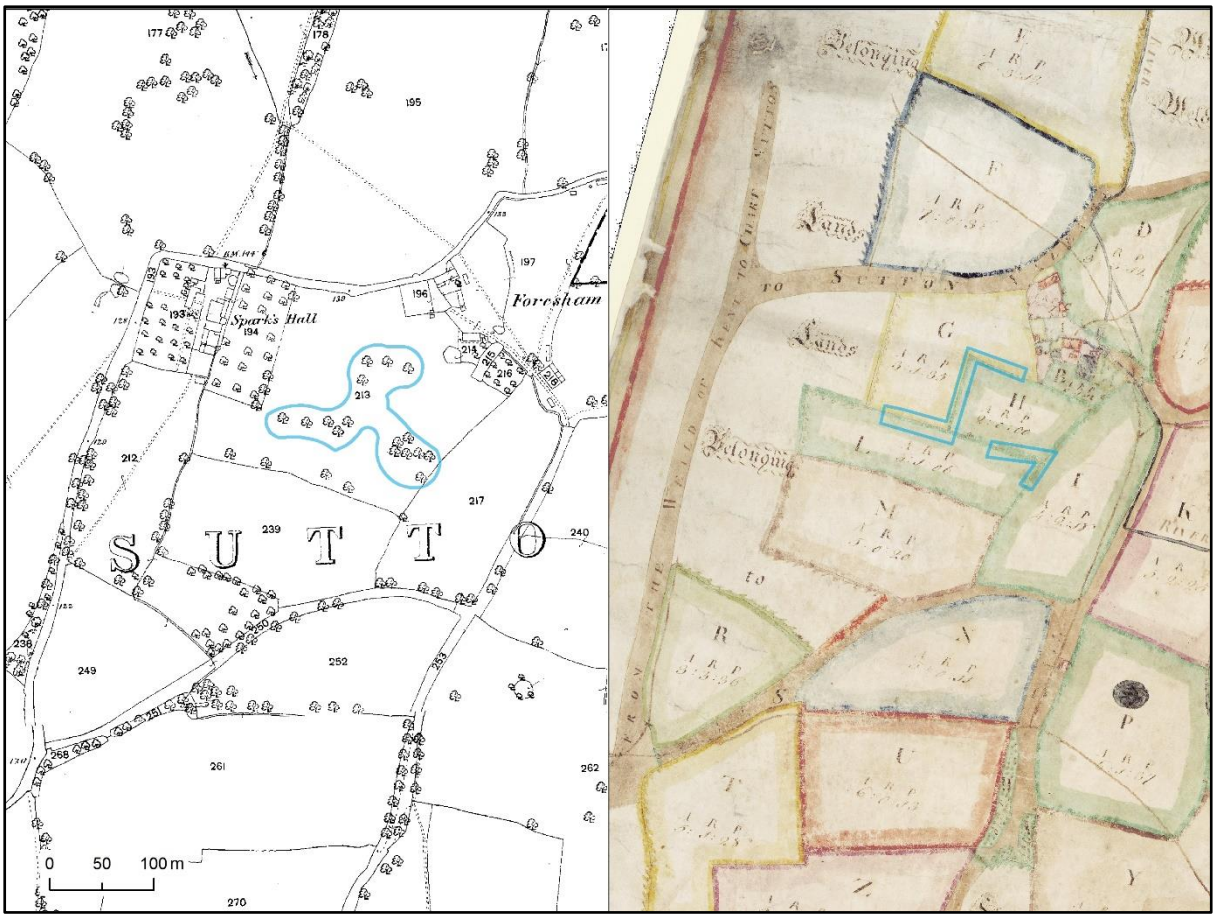


Figure 31. A scatter of mature trees visible on the OS Epoch 1 map of 1868 (left) are shown by the georectification of an estate map produced a century earlier to be the remains of boundaries of lost fields. Small areas of informal parkland or 'pasture with trees' will often be of recent origin. They may support veteran trees and the information should be shared with relevant interest groups. Sutton Valence, Kent. lhs: © Crown copyright and Landmark Information Group rhs: detail from *The description of the manor or farm called Forsham by Ben. Bottle of Harrietsham 1765*. © Crown copyright and Landmark Information Group; U120 P25 - Reproduced courtesy of the Kent History and Library Centre, Maidstone.

Whilst it is may often be difficult to positively demonstrate continuity of wood-pasture stands much before the 19th century using desk-based resources it is possible to dismiss many candidate sites as recent using a combination of map evidence and other information on the development of the setting (for instance using the HER and Historic England's Register of Historic Parks and Gardens).

It has been said elsewhere in the handbook that the OS Epoch 1 map contains information about the period before it was made. The vivid detail with which vegetation is sometimes depicted on this map, although it cannot prove antiquity, can provide a strong basis for judging naturalness and identifying the types of complex structured woodland which are more likely to be ancient.

Intricate mosaics of open space, mature trees (sometimes individually plotted) and stands of scrub, furze and regenerating trees in the locale of known forest or common land or in the context of a topographical setting that would tend to preserve unenclosed woodland can be seen as stronger candidates. In upland areas, where remnant wood-pasture survives, a probably ancient and natural pattern has been noted whereby groups of trees are associated with surface outcrops of bedrock (or moraine) with grassland or heath occupying intervening areas of deeper soil (Quelch 1997, 2001, Rackham 2006). At the other extreme are obviously modern enclosures containing mixed, and evenly spaced, planting. The better tithe maps can perform a similar function but the poorer ones can mislead; a complex Epoch 1 site – as outlined above – that registers on an earlier parish tithe map simply as 'pasture' or 'rough pasture' should not too hastily be excluded from the AWI.

Hidden wood-pasture remnants

Active wood-pasture management occurs on relative few of ancient wood-pasture sites as part of nature conservation programmes or where common rights are still practised such as the New Forest.

As a result many wood-pastures have in-filled with recent growth or developed a high forest structure (woods apparently open structured on Epoch 1 or earlier large-scale maps may appear closed on current maps and air photos – see Table 1). Sometimes woodland developed from wood-pasture can be identified by names like 'green', 'shrubs' etc. Although this may be difficult to ascertain, where the pre-existing pollards or open grown trees are still a significant presence on the site these areas should be identified as wood-pasture and ASNW within the AWI. Similarly, where an open structured ancient wood-pasture has been infilled by planting but significant remnants of the wood-pasture trees persist such areas should be recorded as PAWS and as wood-pasture. Where the original wood-pasture interest is known to have been wholly replaced by the more recent stands of trees a decision must be made on the merits of the individual site whether it should be classed as ancient woodland or not; in some cases there will be an argument for habitat continuity as woodland even if the wood-pasture element of that continuity has been broken.

It is not expected that the data collected during an update project will always be sufficient to distinguish every area of ancient wood-pasture in a study area from other ancient woodland habitat types but where the information is clear it is important that this should be available to future AWI users.

6.1.5 FURTHER GUIDANCE ON DIFFICULT DECISIONS

Having interrogated the evidence base for the whole study area and reviewed all the long-established woodland polygons in the dataset there may be a residue of sites on which decisions could not be reached – either the evidence seemed insufficient to judge or multiple evidence layers pulled in different directions.

If the list of problem sites is of a manageable size, then seeking further evidence may be the best course of action – for example by organising additional site visits to check for features pre-dating the oldest map evidence or to confirm a suspicion that a wood is recent by making a record of its vegetation.

Sites which initially seemed opaque, when revisited and reassessed can sometimes be satisfactorily concluded by building on the experience of other more straightforward sites. The power of GIS should be harnessed to make the best of your evidence at project area level. Although no two sites are identical it will sometimes be possible to find in the dataset historical-ecological analogues of the difficult site that are better evidenced and can inform the decision making process.

Conferring with colleagues can be a good way to build confidence in a decision. It may be worth organising a workshop where the evidence for several problem sites is aired in a group before trying to reach a 'unanimous verdict'.

Inevitably some sites will remain ambiguous due to a lack of evidence, contradictory evidence or because the wood does not fully conform to the definition of either ancient or recent woodland. However, the process described in the handbook should have helped to minimize the numbers of such doubtful sites.

Ultimately, the same precautions as employed in the methodology of the original AWI (Goodfellow & Peterken 1981) should be taken.

"Throughout the country, where it is uncertain whether a site is ancient or recent it has been classed as ancient. In the areas where the difference between ancient and recent woodland is unclear we have still tried

to make the distinction, but the proportion of sites included on the inventory whose origin is uncertain is likely to be higher." (Spencer & Kirby 1992)

6.2 ASSESSING THE NATURALNESS OF WOODLAND IN THE UPDATED AWI

All sites included on the AWI should be classified either as ASNW or PAWS (see **Error! Reference source not found.**). A field, 'STATUS', should be included in the GIS attributes for this purpose.

The category of PAWS is used within the AWI where semi-natural woodland structure, composition and ecology are known to have been replaced and transformed wholesale by plantation management. It was devised to allow sites which had been clear-felled and replanted to be identified as at threat and where a case for restoration to an earlier condition could therefore be made.

ASNW is the default category for broad-leaved woodland of native species in England and, following the approach taken in the original AWI (Spencer & Kirby 1992), where it is not possible to determine from the currently available information sources (see below) whether a polygon should be regarded as re-planted or semi-natural it should be placed in the ASNW category pending further information (or if resources allow, a site visit could be arranged).

Clearly it is common for a wood to exhibit an intermediate position between purely semi-natural and wholly planted and each site must be judged individually as to which category is more appropriate.

Where data from AWI site visits or other recent field data which describe woodland composition are available these will give the most reliable means of assessing naturalness. In situations where canopy and/or understorey species composition are complex, or semi-natural and replanted characteristics are finely balanced across a site it is appropriate to take into account field observations on the ground flora in making the assessment (Spencer & Kirby 1992). However, in many cases it will be necessary to draw on less direct interpretation.

6.2.1 INFORMATION SOURCES

There are a range of desk-based sources for making the assessment. In the compilation of the original AWI these included aerial photographs, forest management data (for instance FC stocking maps), vegetation survey data and other information provided by woodland owners and managers. Recent local revisions of the AWI have also made use of the Forestry Commission's NIWT datasets and OS *MasterMap* data, as well as referring to the stand classifications used in original AWI.

The approach adopted in the update in Buckinghamshire and Oxfordshire (Miller 2014) - taking advantage of the recently published NFI data - will provide a good framework in most areas and is recommended. Provisional ancient woodland areas with the 'Interpreted Forest Types' (IFTs) *Conifer*, *Mixed - predominately conifer*, *Felled* and *Ground prepared for planting* were considered likely to be PAWS whilst *Broadleaf*, *Mixed - predominately broadleaf*, *Coppice*, *Coppice with standards* and *Shrub* were considered likely to be ASNW. In areas where native Yew or Juniper woodland occurs however, care should be taken to avoid automatically assigning PAWS status based on conifer presence without checking other sources. Open areas (IOAs) should be individually assessed using air photos taking into account the assessed ASNW/PAWS status of adjacent ancient woodland.

The NFI should provide a common basis and reference for assessing status in forthcoming AWI updates. Further refinements should be made where possible using the other sources mentioned. These should be appraised to determine where the most reliable and up-to-date information on woodland composition lies for a given study area.

The 'DESC_TERM' field of the OS *MasterMap* Topography layer (see 3.1) can provide an independent appraisal of the condition of vegetation - usually based on photographic evidence - and this has a much smaller grain size than the NFI. For example a polygon recorded as 'Nonconiferous Trees; Coniferous Trees; Scrub' indicates an area of mixed woodland in which deciduous vegetation predominates whereas 'Coniferous Trees; Scrub; Rough Grassland' suggests the reverse. For small woods which are not included on the NFI (<0.5ha), *MasterMap* will also provide an alternative.

As an ideal, where a sizeable area is being assigned PAWS status based on interpreted or derived vector datasets (e.g. PAWS status in original AWI, *Conifer* on NFI or *Coniferous Trees* MasterMap) workers should check that this is consistent with recent aerial photos or with any other locally derived information for the site in question.

6.2.2 POSSIBLE SOURCES OF INACCURACY

Reliance on remote sources means that ancient woods replanted with broadleaved crop species will tend to be classified as ASNW (because species composition and planted structure are not easily discerned from air photos). In some cases this may be inappropriate and therefore result in underestimating the extent of PAWS, for instance beech plantations outside the native range of the species. However, mature stands of site-native species should usually be treated as semi-natural (Spencer & Kirby 1992).

Many replanted ancient woods have undergone varying degrees of ecological restoration in the past 20 years. Because this is a gradual process – and because some areas of ancient woodland will continue to be managed as non-native plantations – it will often be uncertain from aerial photographs and forest inventory data whether areas actively undergoing managed change should be classed as ASNW. Areas of even-aged young trees (NFI IFT = *Young trees*), for instance, may need to be followed up to find out whether they reflect natural regeneration, restocking or restoration. Similarly, areas classed as *Assumed woodland* on the NFI map will need to be investigated on a polygon by polygon basis as these may include a range of potential woodland types (see Forestry Commission 2011). Data from the original AWI may be useful in these situations but if is used as an aid to distinguishing between PAWS and ASNW it is advisable to check digital data against the original 1:50,000 scale paper maps published with the county reports; in some areas of the country some data fields were corrupted during one of the historical digitisations of the dataset meaning that ASNW and PAWS status were inverted on some sites.

Sites should not be assigned to the PAWS category simply because of the presence of non-native species or because planting within the wood is evident as part of its management. Underplanting does not normally merit classification of a site as PAWS except where it has been so extensive as to suppress or destroy most semi-natural features. Sweet Chestnut coppices on ancient woodland sites in southern England are examples of non-native and planted stands which simultaneously often support a high degree of naturalness (for instance retaining typical ASNW ground floras and overstoreys of native species timber). Recognising the 'honorary native' status that has often been conferred upon this species (Rackham 2003) such stands were classed as ASNW for the purposes of an inventory of ancient woodland on the Forestry Commission estate (Spencer 2002):

Sweet chestnut coppice is a long-established and cherished part of the woodland landscape in southern England, notably in Kent and Sussex. In these areas it is regarded as part of the historic variation found within ancient woods. In this survey it has been recognised and mapped separately. They have not been regarded as PAWS in this survey, given that there is no intention to change their character and composition other than to accept any native species diversification that may arise naturally.

In recent revisions of the AWI in Kent and Sussex (e.g. Sansum *et al.* 2009, Hume *et al.* 2010) a similar approach has been followed but with some flexibility built in. If extreme examples of planted coppices were

observed in which a dense, monocultural, simple coppice (i.e. with no or few native standard trees remaining) where semi-natural woodland features were rare or damaged and ground vegetation was species-poor (relative to that expected for ASNW on the prevailing soil conditions of the site) a 'replanted' assessment was deemed appropriate.

Many large areas of PAWS will contain within them localised semi-natural woodland areas. Where these can be mapped with confidence – for example drawing on fieldwork or basing boundaries on existing *MasterMap* polygon boundaries – this could be valuable but the process has to be balanced against available resources. Mapping very fine detail within large tracts of forestry may be unrealistic, especially as the status of polygons in these areas can be dynamic. The goal of the ASNW/PAWS assessment should be to capture the major lines of division within the resource.

6.2.3 IMPROVING ON THE BINARY CLASSIFICATION

One of the deficiencies of the current AWI system of classing woods simply as semi-natural or re-planted is that it provides users no detailed information on the condition of woods. This means the AWI is of limited value as a tool for managing and maintaining the condition of ancient woodland (Goldberg *et al.* 2007).

Natural England would like to introduce the capacity to record categories expressing the 'retained or recovering semi-naturalness' of PAWS sites based on the proportion of site native species present.

The ability to do this will depend on the local availability of - or capacity to obtain – stand level inventory data.

The Forestry Commission established a basis from which to monitor progressive change in the restoration of PAWS to native woodland (Spencer 2002). Where feasible it should be followed. In this system polygons would be assigned to one of four classes which can be recorded in an additional field, alias 'Semi-natural Class'.

Class 1	Semi-natural Woodland	Includes native coppice woodland and high forest or site-native plantation with a relatively high percentage of native self-sown or coppice understorey.
Class 2	Reasserting Semi-natural woodland	Plantation or ex-plantation with 50-80% site-native species. Includes coppice regeneration and/or strong natural regeneration amongst planted trees.
Class 3	Plantation	Plantation with 20-30% site native trees under established plantation stands. Includes plantation mixtures that contain site-native species, e.g. Norway spruce/oak on clay soils and/or plantations with intruding native species.
Class 4	Plantation	Plantation with less than 20% site-native species. This category also includes all non-native broadleaves and beech planted outside its natural range in England.

Table 3. Classes for recording the current degree of naturalness of ancient woodland stands on the Forestry Commission estate (after Spencer 2002). Where suitable information is available or PAWS surveys are undertaken this information should be placed on the wider AWI.

In many study areas it may be unrealistic to determine the appropriate class for all sites on the inventory but the inclusion of an additional 'Semi-natural Class' field in the dataset will be valuable even if it is not fully populated (the Status field recording PAWS or ASNW should be fully populated as a minimum). For example, if data on the major PAWS sites in the study area can be classified at this level of detail it would represent a valuable improvement on the current situation.

6.3 EDITING POLYGONS & ASSIGNING WOOD NAMES

Many polygons will need to be subdivided during this phase of the project to reflect parts of woods to be retained on the AWI and parts to be excluded and to capture compartments of woods with different states of 'naturalness'. The approach to splitting polygons and uniquely identifying descendants is the same as used in Phase 3 (5.3.2) for capturing the different evidence status of different parts of the same wood. When spatial editing is complete the calculated areas of all polygons should be updated.

The AWI does not aim to provide a definitive listing of woodland names but for those polygons which have been marked for retention on the updated AWI it is valuable to record a name where possible. A dedicated text field should be included in the dataset (5.3.1) where this can be entered. Note that a single polygon may have two or more names if two or more woods are coterminous and 'share' a polygon (compilers may wish to minimize this by subdividing woods if there are reliable data on which parts of a parcel belong to which wood – this is not always easy to ascertain). Two or more different polygons may also have the same name (e.g. PAWS and ASNW sections of the same site). For sites that were designated on the original AWI the names as recorded in that dataset can be retained (if correct). For additional sites with a name shown on current OS maps this can be used. For woods with no current name a historical name discovered by the research of Phase 3 could be resurrected. Where multiple sources of names are being used there is value in including an auxiliary field which explains the source of the name (e.g. OS, tithe map, 'unofficial' name used in local community).

6.4 OUTPUTS OF PHASE 4

At the end of Phase 4 each polygon of the long-established woodland dataset must:

- be identified by a unique file code or identifier (UID); the dataset should be checked at this stage to confirm there are no false UIDs.
- be clearly marked with an attribute identifying whether it is proposed for inclusion on the updated AWI or not (there should be no unresolved polygons).
- be registered against a range of evidence sources – it must be clear in the data table associated with the polygons exactly which sources have been used in relation to each site and whether the evidence was positive or negative. If from these attributes the reasons for a site being proposed for inclusion or exclusion on the updated AWI are not obvious then a summary explanation should also be given in the 'comments' field.

For those that are proposed for inclusion on the updated AWI:

- every polygon must have an attribute identifying it as either ASNW or PAWS, and if more detailed information on its condition has been obtained this should be represented by a second attribute giving its naturalness class (Table 3).
- if the polygon is judged to be ancient wood-pasture (or treed parkland) this should be registered in a specific field.
- if the site has an accepted or known name this should be included in a 'name' field.

When this has been thoroughly checked the dataset should be archived and new versions created in preparation for submission to Natural England (below).

6.4.1 SUBMISSION OF OUTPUTS TO NATURAL ENGLAND

Natural England is keen to maintain information on the long-established woodland resource as a whole and to have access to information on sites which were considered for inclusion on the AWI but rejected. Hence two versions of the dataset should be prepared. The first should contain only the polygons which have been identified as likely to be ancient woodland (this dataset will subsequently be reviewed by NE as a recommended replacement for the existing AWI polygons within the bounds of your study area). The other version should contain all the long-established polygons researched and be given a name which makes this clear.

The geometry of the polygons should be inspected and cleaned to ensure the whole dataset complies with Natural England's digitising standards (appended).

GIS attribute tables tend to expand organically in the course of a project of this nature, with various fields sometimes created purely for research and processing purposes. At this stage the fields should be reviewed and rationalised, restructuring the dataset if necessary to give a logical sequence of attributes and removing any fields that do not hold information relevant to the final dataset.

A hypothetical example of a range of fields included in a final dataset is appended for information (this is presented in the form required by Natural England's 'Attribute Information Metadata' form (see below). This is based on recently revised study areas in South East England and is not intended as a template. Different study areas will generate unique arrays of evidence sources. However, the approach to capturing the information should be standardised as far as possible with the common elements of different study areas' evidence bases being treated similarly.

The dataset submission process is covered by existing Operational Guidance documentation (appended).

When submitting a new spatial dataset to Natural England, the following files need to be provided.

- ***Spatial Dataset*** (either ESRI Shapefile, Geodatabase or MapInfo Tab files will be accepted).
- A completed ***'Dataset Metadata'*** tab on the "Metadata Template for New Datasets" (mandatory).
- A completed ***'Attribute Information Metadata'*** tab on the "Metadata Template for New Datasets" (mandatory).
- Any ***Reports*** that give fuller, more detailed information on creation of the dataset, if it exists (optional).

The "Metadata Template for New Datasets" together with guidance should be requested from the Natural England GI Data Management Team.

6.4.2 REPORTING

The production of a written project report will make the findings of the AWI update known. Local stakeholders are likely to value information on how the extent and distribution of ancient woodland has 'changed' as a result of the update process and this is more effectively communicated in a report than by simply issuing the dataset as a GIS layer. Reports should include photographs, maps and statistics illustrating the ancient woodland resource and its condition within the study area and aim to be attractive and accessible (e.g. Davies *et al.* 2011, Benstead-Hume & Morris 2012, Miller 2014). Such publications are also an effective way of raising awareness and engaging people at a local and personal level with ancient woodland and the issues around its conservation.

7 CASE STUDIES & EXAMPLES

This section of the handbook gives a small set of visual examples which illustrate some of the types of revision to the AWI that might be made in an AWI update and some of the issues encountered in assessing woodland antiquity and continuity from map evidence. It supplements the information and figures given in the chapters describing Phases 3 & 4 of the workflow.

The examples are not detailed historical or ecological accounts of the woods involved nor are they intended to give a complete set of models for woodland mapping across the country (they are drawn from recent work in southern England) but they do underline some general points and may help inform the decision making process taken in AWI update projects.

Users of this handbook should also familiarise themselves with other illustrative examples of revisions and map interpretation made in previous local projects. For example Forrest (2001), Westaway (2006) and Miller (2014) provide case studies in appendices to the project reports for AWI revision work in Dorset, Wealden in East Sussex and Oxfordshire and Buckinghamshire respectively. A valuable set of images illustrating issues and limitations in the AWI dataset in Herefordshire is provided online by David Lovelace.

In the following examples, if images are shown with GIS polygons overlain the notation used is as follows, unless otherwise stated:

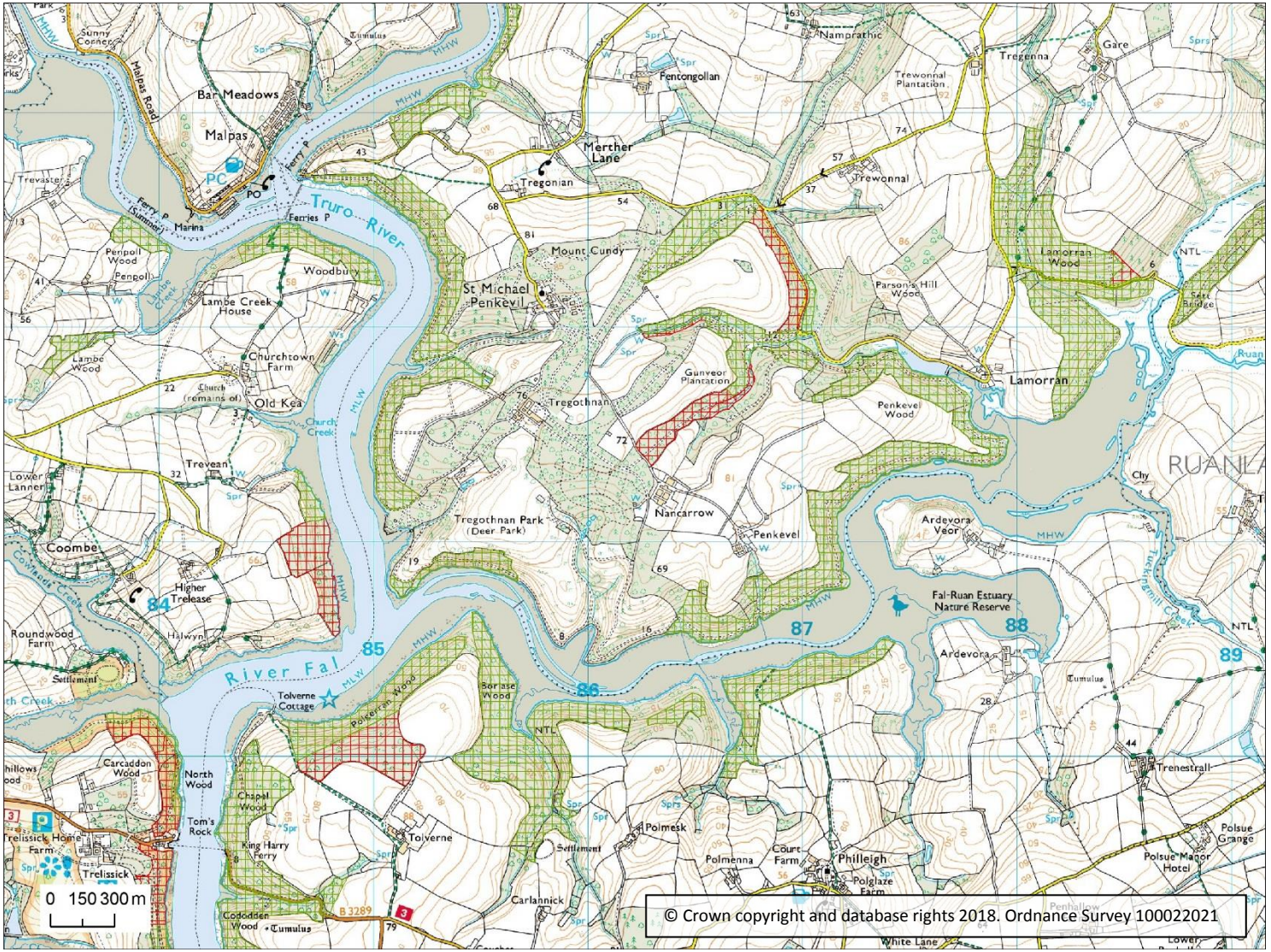
- Existing AWI - ASNW
- Existing AWI - PAWS
- long-established woodland for evaluation (FORMERLY DESIGNATED AW)
- long-established woodland for evaluation (POTENTIAL NEW AW)
- long-established woodland to be excluded from updated AWI
- long-established woodland to be included on updated AWI (FORMERLY DESIGNATED AW)
- long-established woodland to be included on updated AWI (POTENTIAL NEW AW)

7.1 THE CARRICK ROADS - EXAMPLE OUTLINING OPPORTUNITIES AND EVIDENCE SOURCES FOR UPDATING THE AWI

This series of images illustrates how the large scale historic maps now available for research digitally can supplement more generic map evidence sources including those used in the original compilation of the ancient woodland inventories. This is not a 'worked example'; it provides an introduction and overview to the general types of documentary evidence used in revising the AWI by showing the current AWI dataset followed by various other maps. The handbook goes into more detail about how this kind of information can be processed to update the inventory locally.

The area centres on the Tregothnan Park Estate in Cornwall, part of the country where the AWI has not been systematically updated. Across the country, especially in landscapes with intricate mosaics of woodland and open land, an examination of the existing AWI in a GIS shows how in the original exercise significant areas of woodland may have been excluded due to the lack of large scale maps and computer mapping capability.

This is a private working estate where the archives have not been deposited with the county record office. Thus there are no publicly available 18th century estate maps to view. This may often be the case for large, private estates with long-established and ancient woodland that will be mapped in the course of updating an AWI. In these circumstances workers need to take care in interpreting areas of potential ancient woodland, providing caveats of where further archives may be held.



© Crown copyright and database rights 2018. Ordnance Survey 100022021

Woods around steep maritime slopes in an area of Cornwall with a complex incised coastline - a recent OS map is overlain with the national digital version of the AWI.

The AWI for Cornwall has not yet been updated. Much of the woodland along the sides of the river and estuary seen here is provisionally designated as ancient woodland but re-examination of the modern map alongside sources now available digitally would reveal opportunities for improvement.

A systematic comparison of the current woodland resource with historic maps as described in this handbook would be likely to identify incorrectly designated areas of woodland, improve the accuracy with which the correctly designated woods' boundaries are mapped and find areas of ancient woodland not currently included on the AWI.

Source: http://www.visionofbritain.org.uk/

The Ordnance Survey First Series maps (this sheet published in 1856, based on earlier surveys) were a key source for the listing of sites on the original county based ancient woodland inventories.

This map would have enabled the compilers of the original AWI for Cornwall to identify the general distribution of historic woods. The details of their boundaries could not have been precisely discerned however. Likewise, small ancient woods and wood-pasture areas could not have been clearly recognised.

Ancient woods shown on the current AWI (above), although appearing to be mapped at a high level of precision, may often be identified from generalised maps similar to this, the boundaries having been later adapted to recent OS data without corroboration from more detailed evidence sources.

An earlier (1811) Ordnance Surveyors' Drawing for the area survives. This was produced at a slightly larger scale of 2 inches to 1 mile.

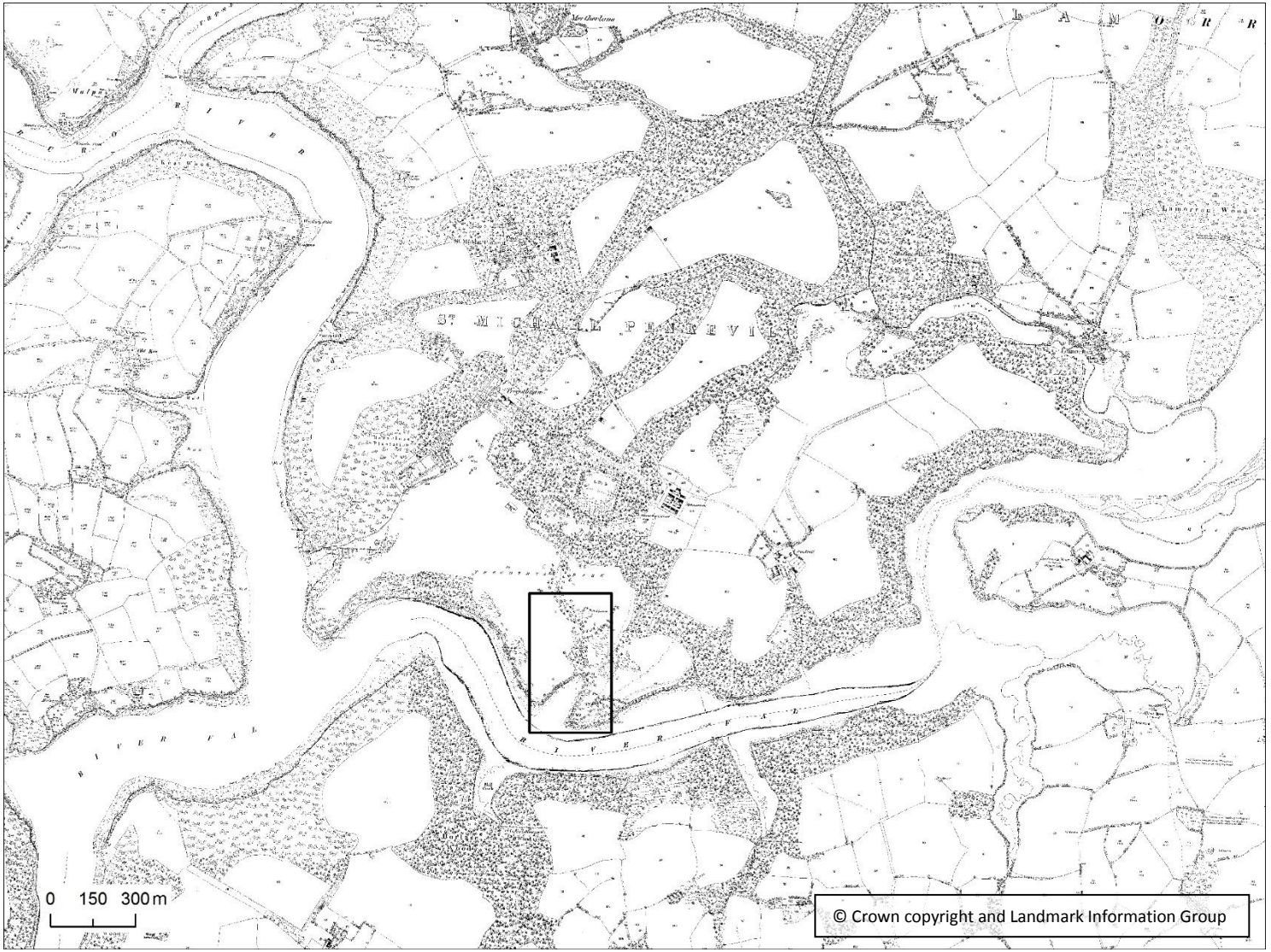
Whereas in some parts of the country these drawings provide valuable details of woodland coverage and land-use (that the published First Series maps omitted), in this case the condition of the manuscript is poor and its relatively small scale mean that accurate determination of site-level details is difficult.

The map is useful in confirming the presence of almost continuous strips of enclosed woodland edging the estuary and river valleys in the pre-Victorian period. These woods can be meaningfully related to woods mapped in greater detail on the OS Epoch 1 map; surviving areas of these would be captured in Phase 1 of the AWI update process.

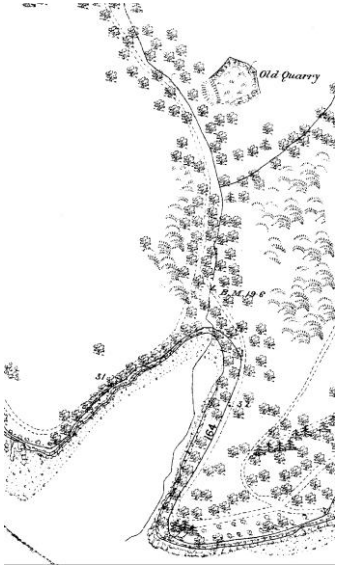
An eighteenth century county map produced at c. 1 inch to 1 mile shows woodland along the edges of some of the waterways. Tregothnan Park is also seen enclosed with a pale. Notably, woodland appears to be symbolised by a few trees around the mouth of the inlet at the southeast corner of the deer park.

This gives useful corroboration of the historic nature of the riverine and coastal woodland landscape seen on modern maps. However, it would be unsafe to rely solely on this source for assessing the antiquity of individual woods. For instance, the absence of tree symbols from much of the north shore of 'Lamoran Creek' is of uncertain accuracy.

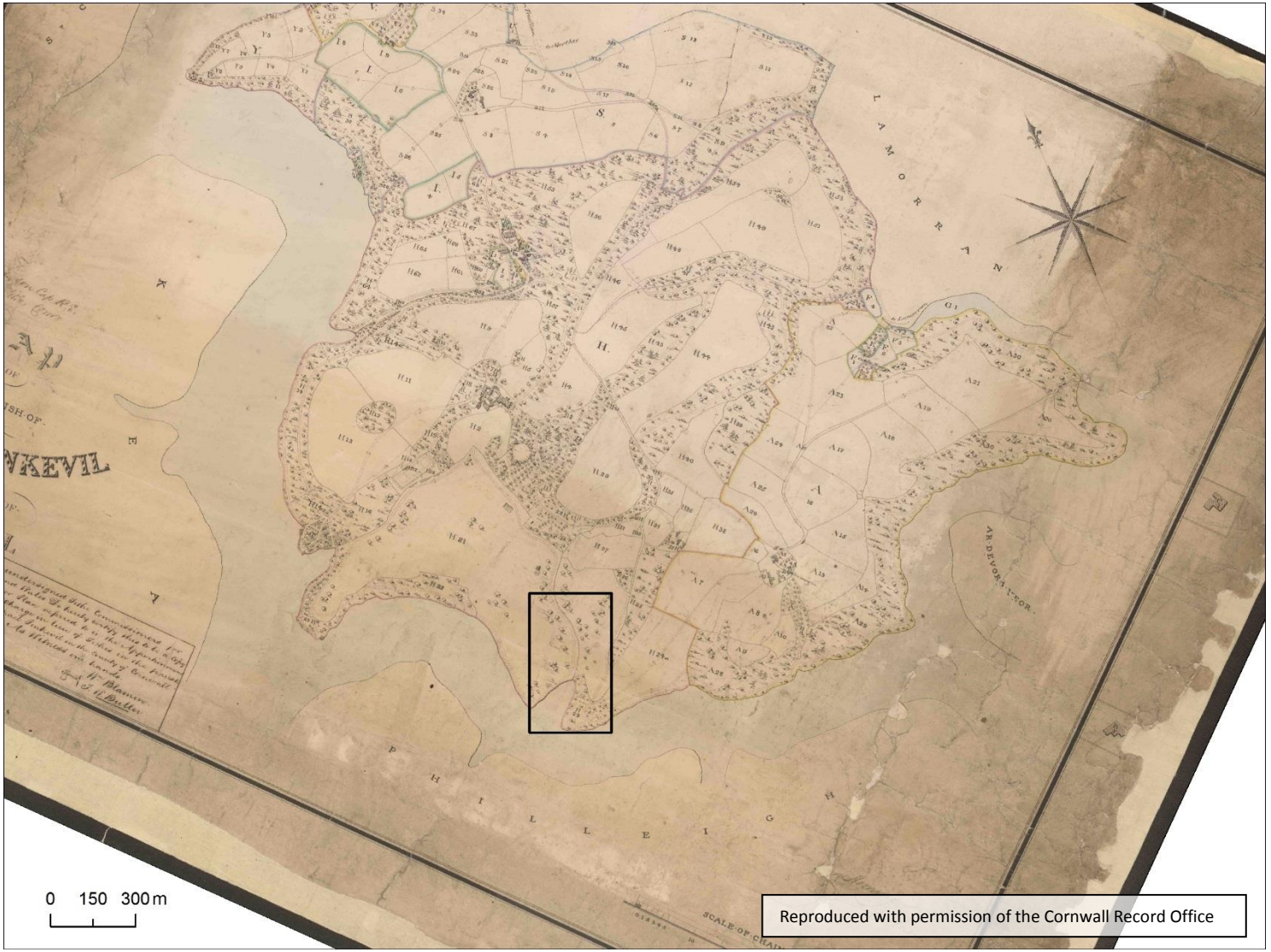
[Image shows detail from *A New and Accurate Map of the County of Cornwall* by Thomas Martyn, 1748.]



Important AWI revisions that large scale maps used in a GIS facilitate are small woods and wood-pasture areas.



Scattered trees and scrub are accurately depicted on the OS County Series 1st edition 25 inch map (1879). There appears to be agreement with the 1748 map, suggesting a small potentially ancient wood-pasture site associated with the valley and bay on the east side of the deer park.



An earlier tithe map (1840) also shows unenclosed trees arrayed along the sides of the watercourse.

Additionally an enclosure is shown on one side of the bay, H24. Reference to the apportionment schedule for this map could be made to help unravel the history of the woodland on site (no enclosure is apparent on the 1879 map above).

If the AWI for this district were being actively updated workers would attempt to corroborate significant amendments to the dataset.

For example, in the case of the possible ancient wood-pasture area highlighted above further information in the form of a field survey and/or pre 1800 estate map ideally would be sought but this might not always be possible.

In this image NE's Wood-pasture and Parkland BAP Priority Habitat Inventory for England (blue outline) is shown over the Woodland Trust's ancient tree map. Both are freely available datasets. The BAP data indicate the presence of wood-pasture in the area of interest and the tree map indicates the presence of ancient trees. Taken with the other maps and natural topography this would lend support to assigning ancient woodland (wood-pasture) status to part of the site.

7.2 DOG KENNEL WOOD - EXAMPLE OF AN ANCIENT WOOD WITH STRAIGHTENED BOUNDARIES & MODERN NAME

This example of a revision to the AWI shows a wood which, although likely to be ancient woodland, exhibits some of the popularly used indicators of recent woodland status. It demonstrates the importance of interpreting the whole evidence set in its landscape and historical context rather than relying on shortcuts to the identification of ancient woodland.

Some of the smaller long-established woods detected using the approach described in the handbook may be fragments of ancient woods in historically unstable landscapes. The classic diagnostic features of ancient woodland - like sinuous boundaries and ancient-sounding names on maps – are useful to look for but apply best to large intact woods embedded in ancient countryside. The obvious cartographic signals may sometimes be absent whilst on the ground ancient woodland habitat is present.

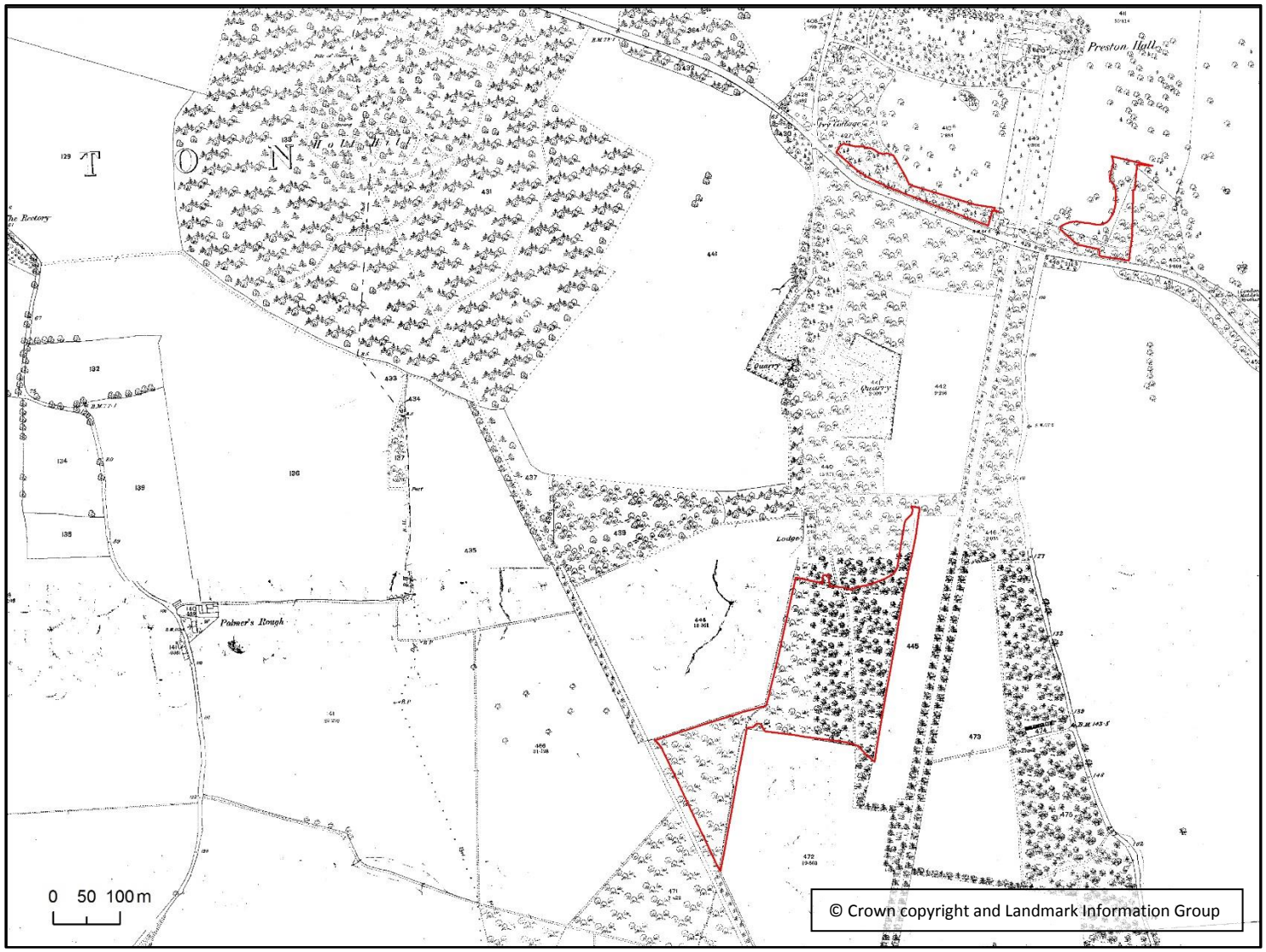
The area shown in the following images lies at the interface of an urban district in the Medway valley (Kent) and land of high agricultural value on the Greensand Ridge above it (the principal wood sits between an industrial estate and an area of commercial fruit growing). Since the 1800s the landscape has been the subject of dramatic reorganisation with conversion of woodland, heathland and old field patterns to intensive fruit production and urban expansion, but vestiges of the pre-existing medieval landscape do persist.

The image shows three polygons identified as 'long-established woodland' by a Phase 1 sweep. The main polygon is larger than 2ha in size but was not included on the original AWI (Phase 2).

The shape of this wood is very regular and it is in an area of urbanisation and intensive agriculture (fruit growing). Immediately to the north is an industrial estate.

The historical character of the landscape here however was heavily wooded. The image above shows the site located on a heavily wooded ridge slope as depicted on a small-scale pre-1600 map.

[Image above: detail from *A New Description of Kent* by Philip Symonson, 1596]

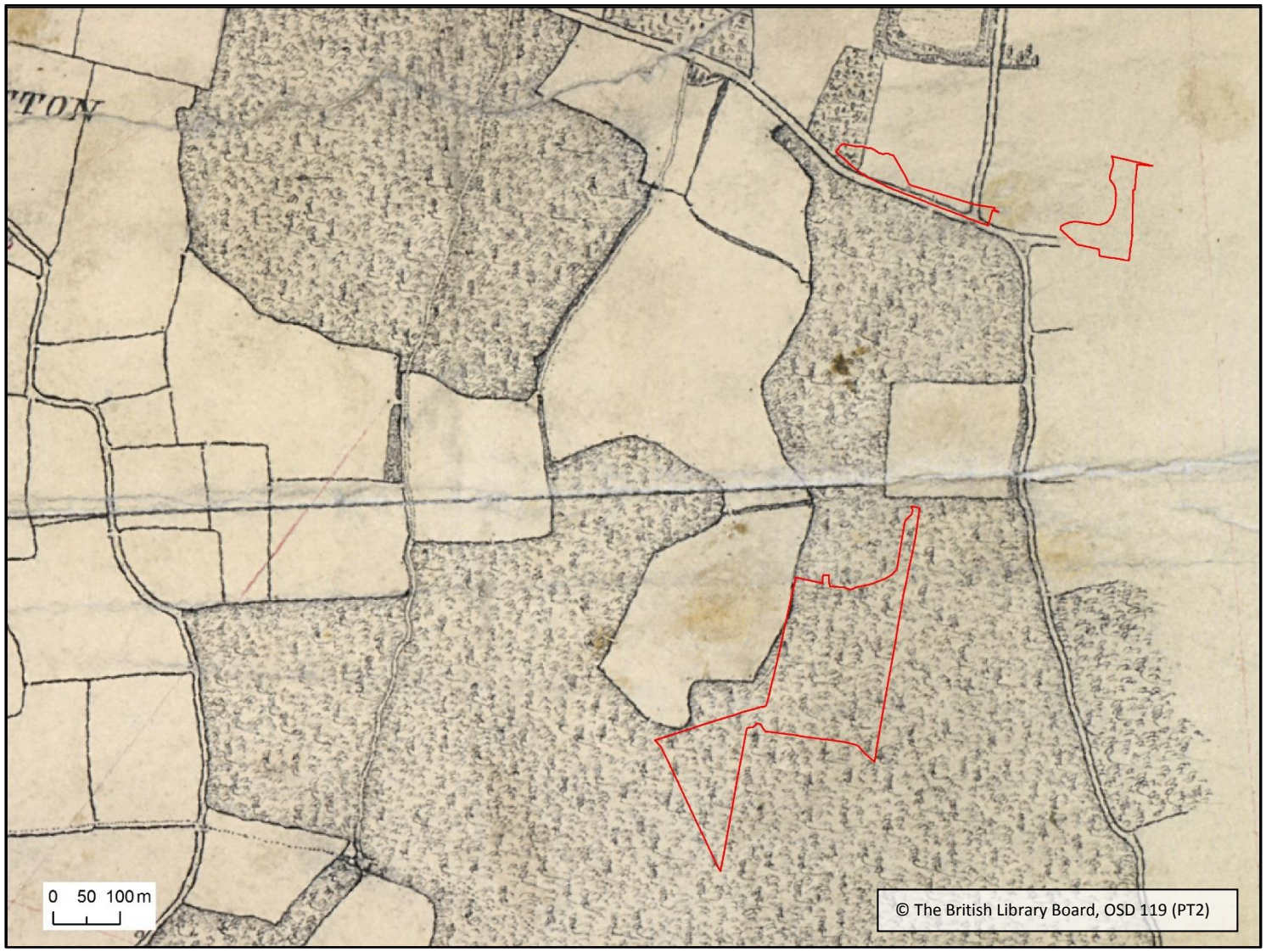


150 years ago at the time the Epoch 1 map was produced (c.1865) the wood also had a regular boundary. It is depicted as a nameless straight-sided block of trees.

However, it is shown to have been joined to a more extensive network of woodland in the nearby landscape, most of which has since been cleared.

Regular shaped enclosures and a dead straight carriageway leading to Preston Hall (top right) are seen to the east of the main polygon; these do not appear ancient. The two smaller polygons apparently belonged at this time to a designed landscape associated with the same house.

[Observations of the 25" Epoch 1 map will often be needed at the Phase 4 site evaluation stage as well as during Phase 1 when long-established woods are being searched for.]

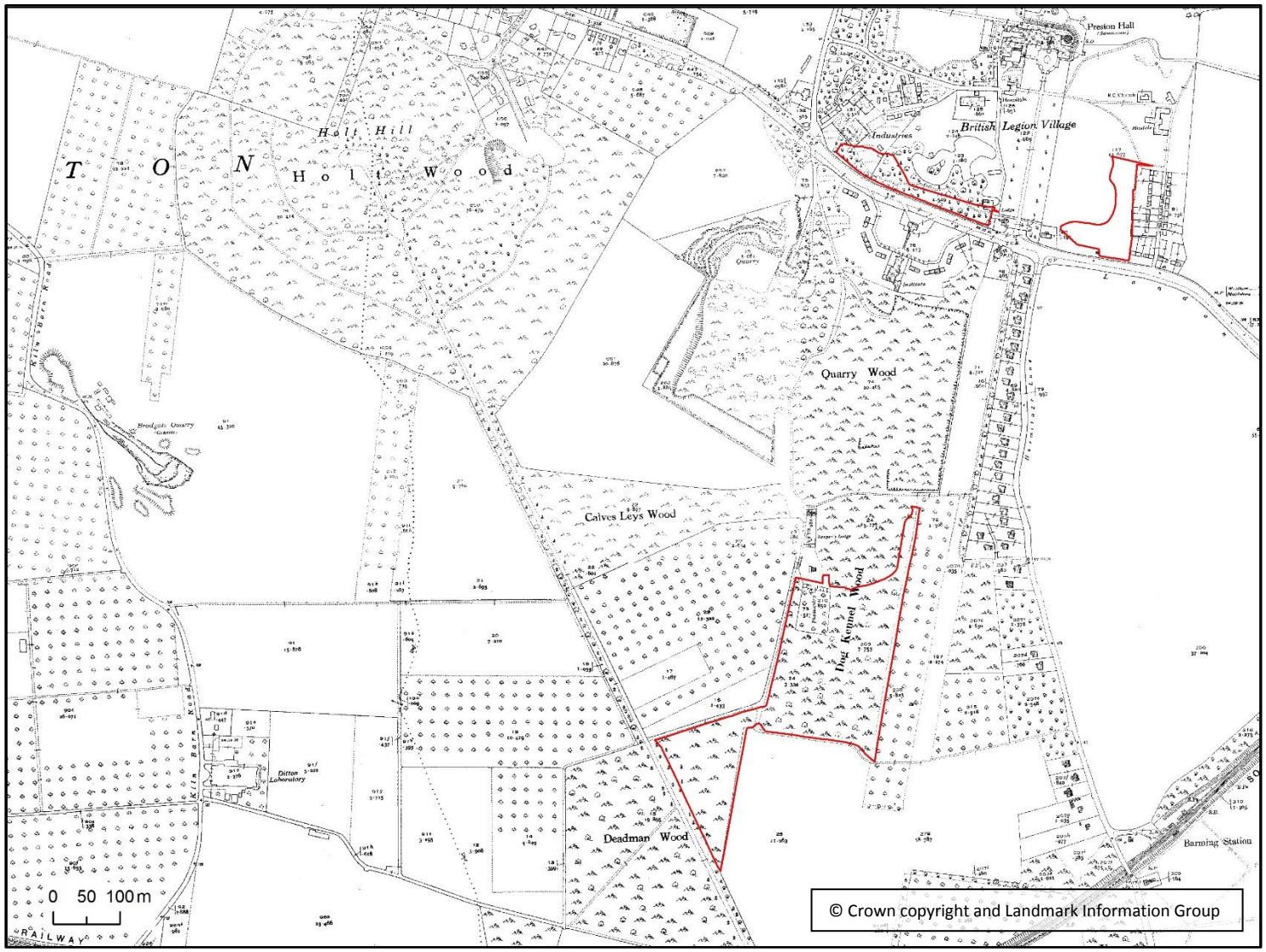


A high quality OSD produced at 6 inches to 1 mile in 1789 survives for this area. It is a detailed and accurate map which could be geo-rectified with negligible distortion.

This provides evidence that the straight boundaries of the long-established woodland polygon are an artefact of 19th century clearance of a larger historic wood and associated agricultural improvement.

Only a short piece of the current wood's perimeter aligns with the 18th century woodland boundary (a search for wood-banks on the ground would be fruitless).

The manors which occupy this area in Domesday Book are known to have entailed significant woodlands. The large wooded enclosure on this map was probably an ancient coppice derived from the extensive Greensand Ridge medieval woods which historical geographers know as the 'Chart Forest'.

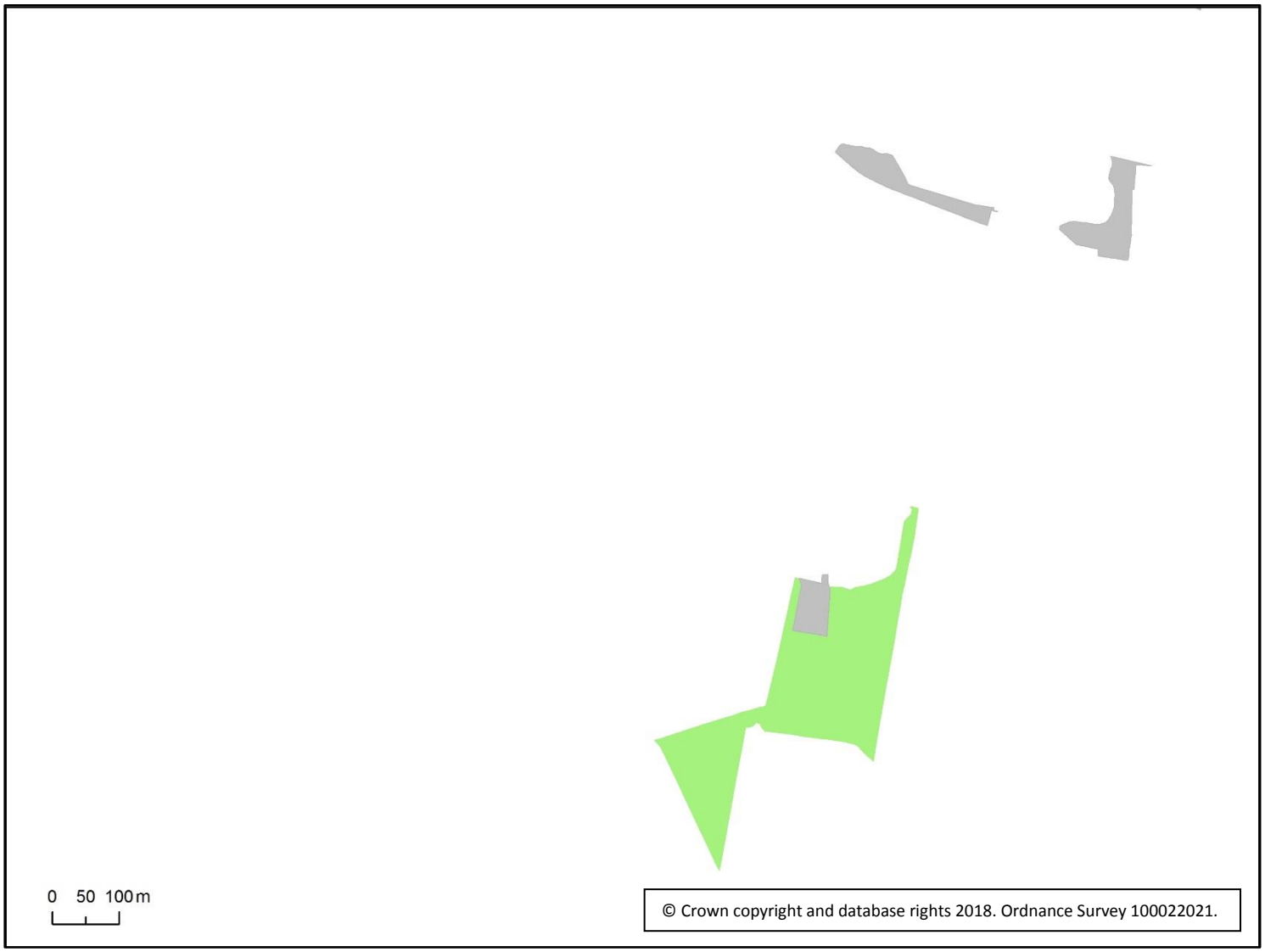


Having established that the 19th century wood had a good chance of continuity with medieval woodland a check of OS County Series maps was made to assess continuity in the period after the Epoch 1 map used in Phase 1.

These indicated that a portion of the polygon in the northwest corner had been cleared and used during the 20th century to house dog kennels and a 'pheasantry' but that otherwise, wooded conditions had been maintained.

On these maps, unlike Epoch 1 (shown above), the various fragments of the 1789 wood are given names.

Additionally, one of the maps (a 1938 edition, 'Epoch 4' shown here) did not depict one of the smaller northern polygons as woodland.



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The image shows the updated AWI; the bulk of the main polygon has provisionally been designated as ancient woodland.

In spite of initial appearances (suggesting a recent origin) there is concrete evidence for woodland continuity on the site from the time of the earliest available large-scale map (1789). There is also circumstantial evidence - from the form of the woodland boundary shown on that map, a small-scale pre-1600 map and local history - to support a medieval origin.

Conversely, the two smaller polygons have been excluded from the AWI; these were judged to have developed as ornamental features within an area of parkland established on former farmland. A tithe map (not shown) supported this conclusion and neither of the polygons showed continuity across all the maps consulted.

7.3 SMALL LINEAR WOODS – AN EXAMPLE OF THE EFFECT OF HISTORICAL ROAD STRAIGHTENING

This set of images provides a second example of how the historical reorganisation of a landscape can have a misleading effect on the interpretation of woodland antiquity.

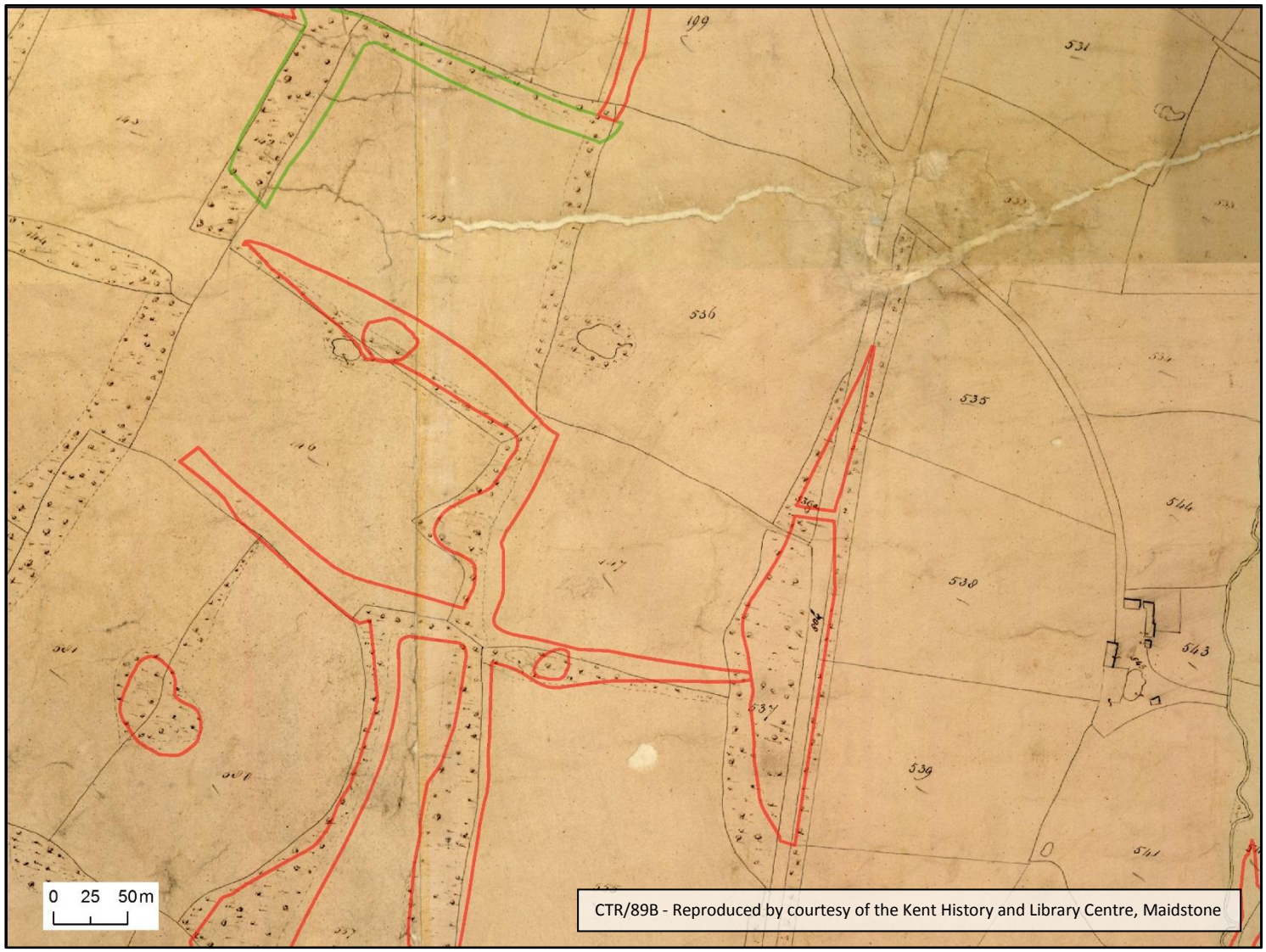
In this case a small 19th century wood in the Weald of Kent shows some of the typical features of the linear ancient woodland networks associated with historic field patterns in its district, but on closer examination it is found to be recent woodland.

The air photo image shows a network of irregular, linear field boundary woodlands in Chiddingstone in the Low Weald of Kent. Small interconnected woods are typical of the ancient woodland resource in this landscape.

The areas with a polygon overlay were identified as long-established woodland by a Phase 1 exercise comparing OS Epoch 1 maps with recent aerial photographs.

Part of the area (top left, which is contiguous with a larger block of woodland not visible to the north) was designated as ancient woodland on the original inventory.

All the polygons require further investigation before deciding how to update the AWI for this area.



A tithe map for the parish of Chiddingstone made in 1841 pre-dates the OS Epoch 1 used in Phase 1 by a few decades and confirms most of the woodland was present in the earlier nineteenth century.

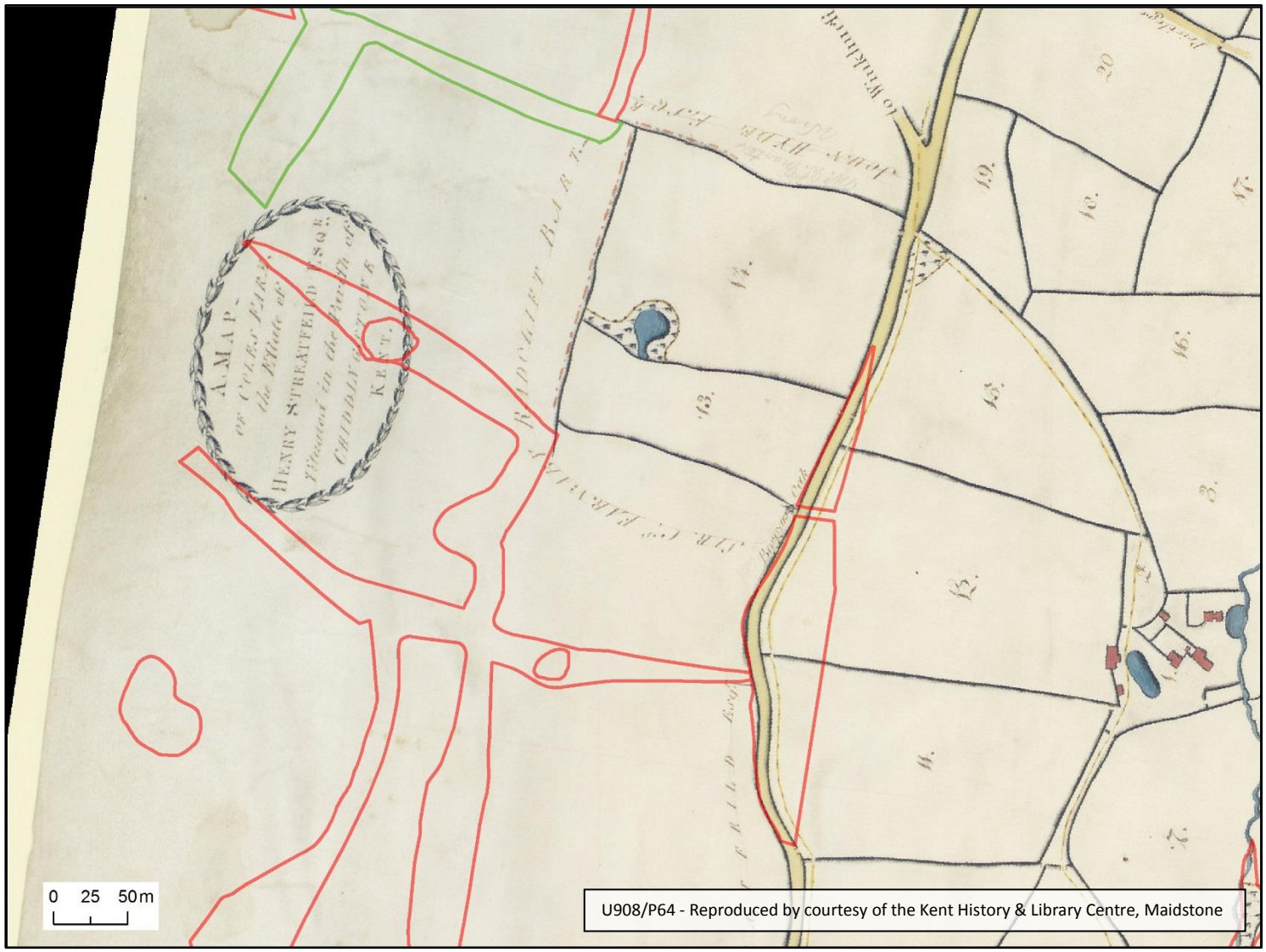
Many of the linear woods shown are not given plot numbers and are not figured in the accompanying apportionment to the map – they were taken as coupled to the field system and, in this region, were customarily exempt from tithe rent charges.

Some are shown as separate enclosures however. The eastern strip alongside a road for example has the name, Beggars Oak Shaw, entered in the map's schedule, an observation which may indicate a different origin than the other field boundary strips shown in the image.

Regressing further to 1799, an OSD confirms the eighteenth century presence of a network of linear woods associated with the field system. However, this map also suggests that the easternmost strip may occupy land which was unwooded at that time. The road apparently lay to the west of these two polygons, not to the east as today (above).

This map is not completely reliable though and, according to the British Library, is an “intermediate version rather than a completed drawing”. Even if the road has been straightened it is possible that the draughtsman omitted field boundary woods east of the road.

Confirmation of the apparent recent woodland status of the polygon from other maps or fieldwork is desirable in this kind of situation.

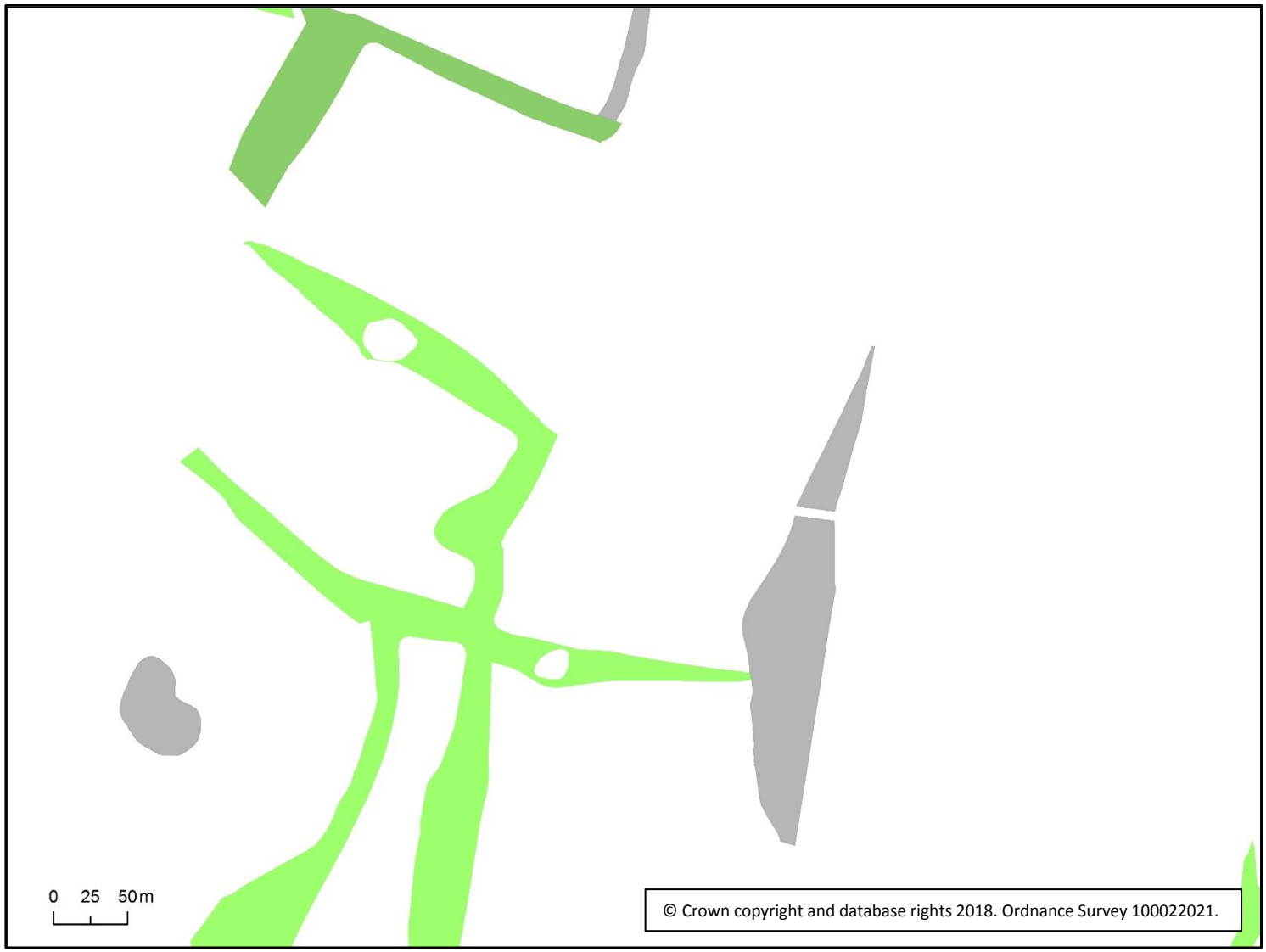


For this particular site a detailed estate map contemporary with the OSD (above), and independently surveyed, was geo-rectified and used to verify the recent status of the roadside woods.

Realignment of the road in the early nineteenth century evidently cut off a c. 1ha strip of land which is described in the schedule (not shown) to this map as arable. This, and part of the former road surface, subsequently became wooded and is now spatially connected to older woods to the west.

(Note that the other polygons shown lay outside the estate mapped.)

Detail from: *A map of Coles Farm, the estate of Henry Streatfeild, by William & Edward Peckham, Seal, Kent, 1798.*



The updated AWI (green) and excluded areas of long-established woodland captured in Phase 1 of the update workflow (grey): the recent roadside strip of woodland has been rejected.

A narrow piece (top) for which evidence of historical continuity was poor was also rejected. A small stand of trees (bottom left) which was found to be less than 0.25ha in size was rejected after examining aerial photographs to assess the condition of the site.

A further refinement to the final dataset could be to include the smaller of the two embedded ponds within the provisionally designated ancient woodland polygon.

Realignment of roads (or a new road or railway line) often gives rise to fragments of farmland that become unviable and develop into secondary woodland.

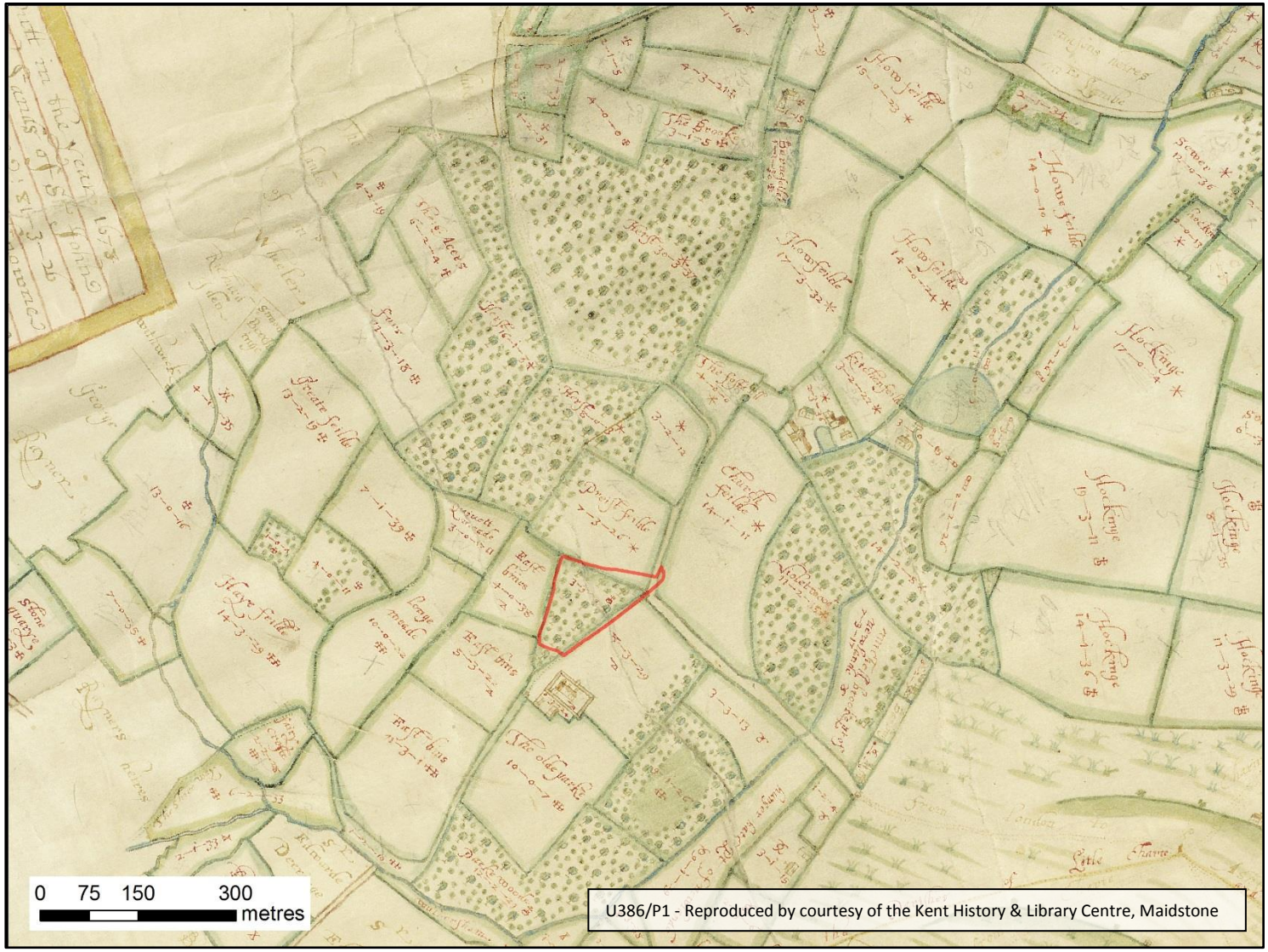
7.4 FORSTAL SHAW - EXAMPLE OF THE VALUE OF DETAILED LAND-USE DATA IN EVALUATING THE STATUS OF SMALL LONG-ESTABLISHED WOODS

This example shows a small (< 2ha) long-established woodland site identified by a search of air photos and OS County Series maps (Phase 1, as described in the handbook).

The site was subsequently classed as 'Potential New AW' (Phase 2); it did not appear on the digital version of the original AWI for Kent.

In Phase 3 four different types of pre Epoch 1 map were used to further build an evidence base for the site. These are shown in chronological sequence. The images demonstrate the value of assembling a range of sources to support evaluation of woodland status (Phase 4). The quality of each of the different sources should be assessed and understood before conclusions are drawn.

In this case, reliance on generic map sources without employing the precautionary principle would have led to a misevaluation of the site. Non depiction of woods on maps must be interpreted in the light of knowledge about the quality and scale of those maps.



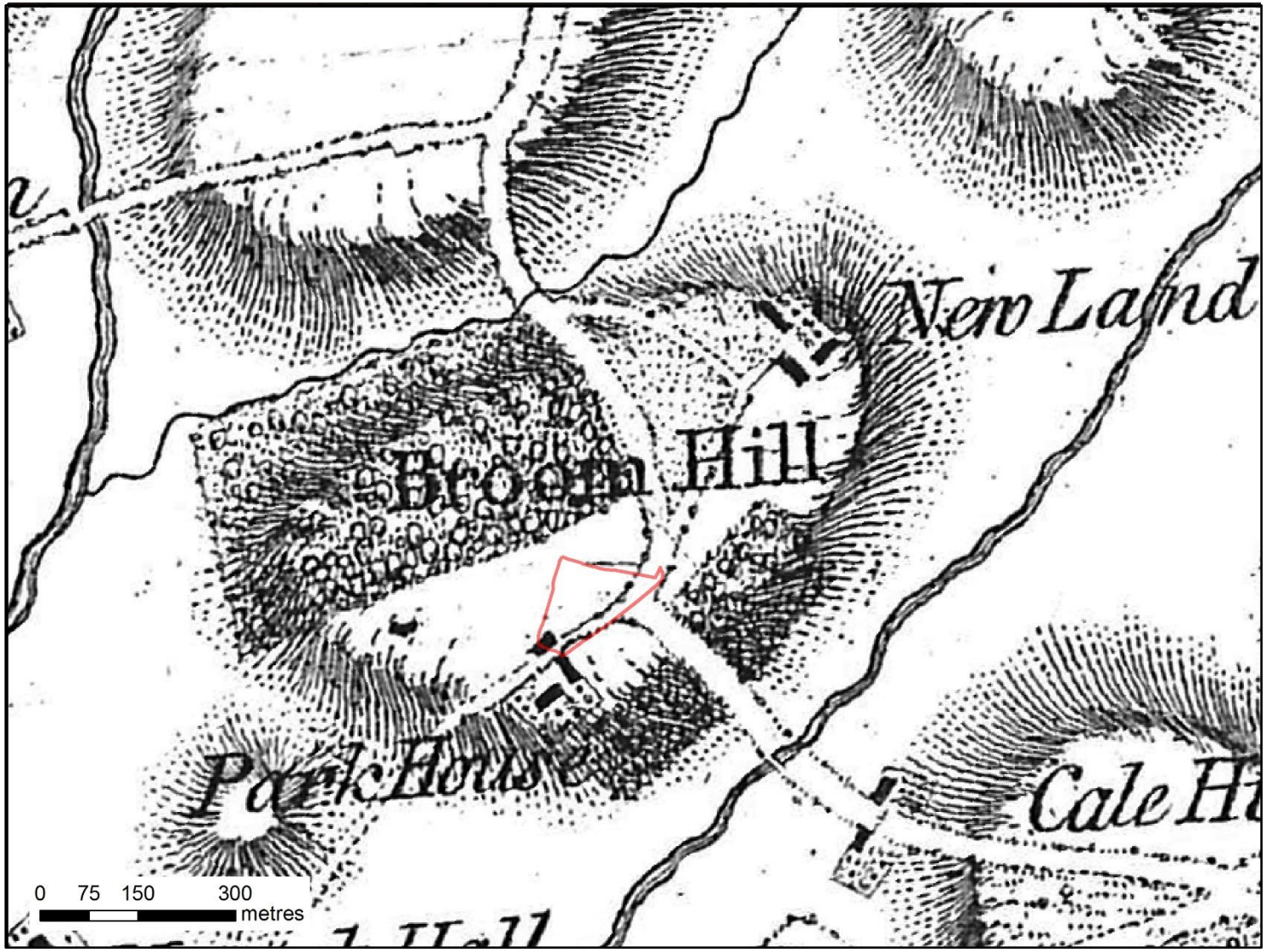
U386/P1 - Reproduced by courtesy of the Kent History & Library Centre, Maidstone

Output from Phases 1 and 2 is shown with a geo-rectified estate map made in 1639. This is a detailed survey on the large scale of approximately 13 inches to 1 mile showing names of occupiers, field names and land utilisation details (including enclosed and unenclosed woodland).

The modern wood occupies the same parcel of land as did a wood in the early 17th century. (The fact that the polygon had already been classified as 'Potential New AW' means that the site was also wooded c.230 years after this estate map was produced, at the time of Epoch 1).

In the absence of any further evidence the site would be provisionally taken as ancient woodland.

Detail from: *A map and description of the mannor of Calehill* by William Boycot, 1639



A county map produced at a scale of 2 inches to the mile in 1769 does not show the small wood.

This map, in common with many county maps of its type and period, is imprecise and unreliable for woodland depiction; small woods are often omitted and larger ones are only schematically shown.

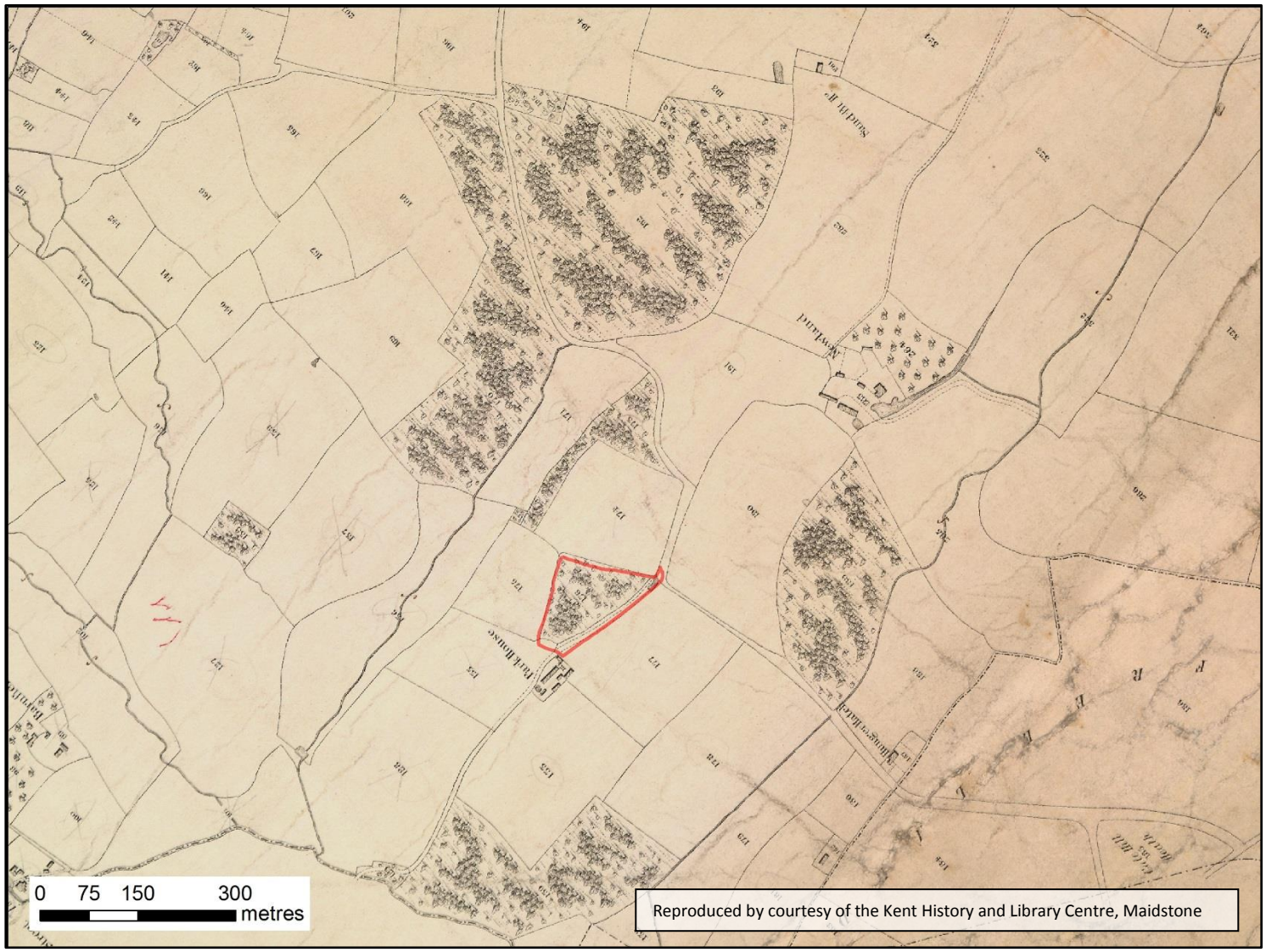
The apparent absence of the wood should not be ignored but in assessing its antiquity and continuity the evidence of this map cannot be given equal weight to that of a large scale survey; it does not constitute evidence of absence. This particular map shows very few woods less than 5 acres in size (even though such small woods are known to have been frequent) whereas this site is 3.7 acres (c.1.5 ha).

Detail from: *A topographical map of the county of Kent* by Andrews, Dury and Herbert, 1769.

The Ordnance Surveyors' Drawing covering this area (produced at 3 inches to 1 mile scale in 1789) provides much more detail than Andrews, Dury & Herbert (above) and is clearly more spatially accurate. The enclosure which corresponds to the boundary of Forstal Shaw is mapped, but the land use is not.

In these drawings, small and thin coppices, or those recently cut, are known sometimes not to be depicted with tree symbols even when their enclosures are tolerably well surveyed (see handbook: Historic Maps).

Whilst the absence of tree symbols weighs against the case for ancient woodland, again it cannot be taken as concrete evidence of woodland absence.



Reproduced by courtesy of the Kent History and Library Centre, Maidstone

The wood is shown in 1840 on the tithe map for Charing, a detailed survey produced at the same scale (6 chains to 1 inch) as the 1639 estate map .

The apportionment to this map identifies some plantations in the parish but classes this site as a wood with a name ('Fostall Shaw'); this goes against any notion that the wood may have been planted in the 50 years elapsed since the OSD (above.

On the evidence shown in this example the site should provisionally be included on the AWI. Where detailed historical land-use data are available they show woodland. That two more generalised 18th century maps omit it is inconclusive. Even if those are taken at face value they only indicate an absence of trees in the period 1769-1789. However, the most parsimonious explanation of the whole dataset is that woodland conditions have been continuous since before 1639.

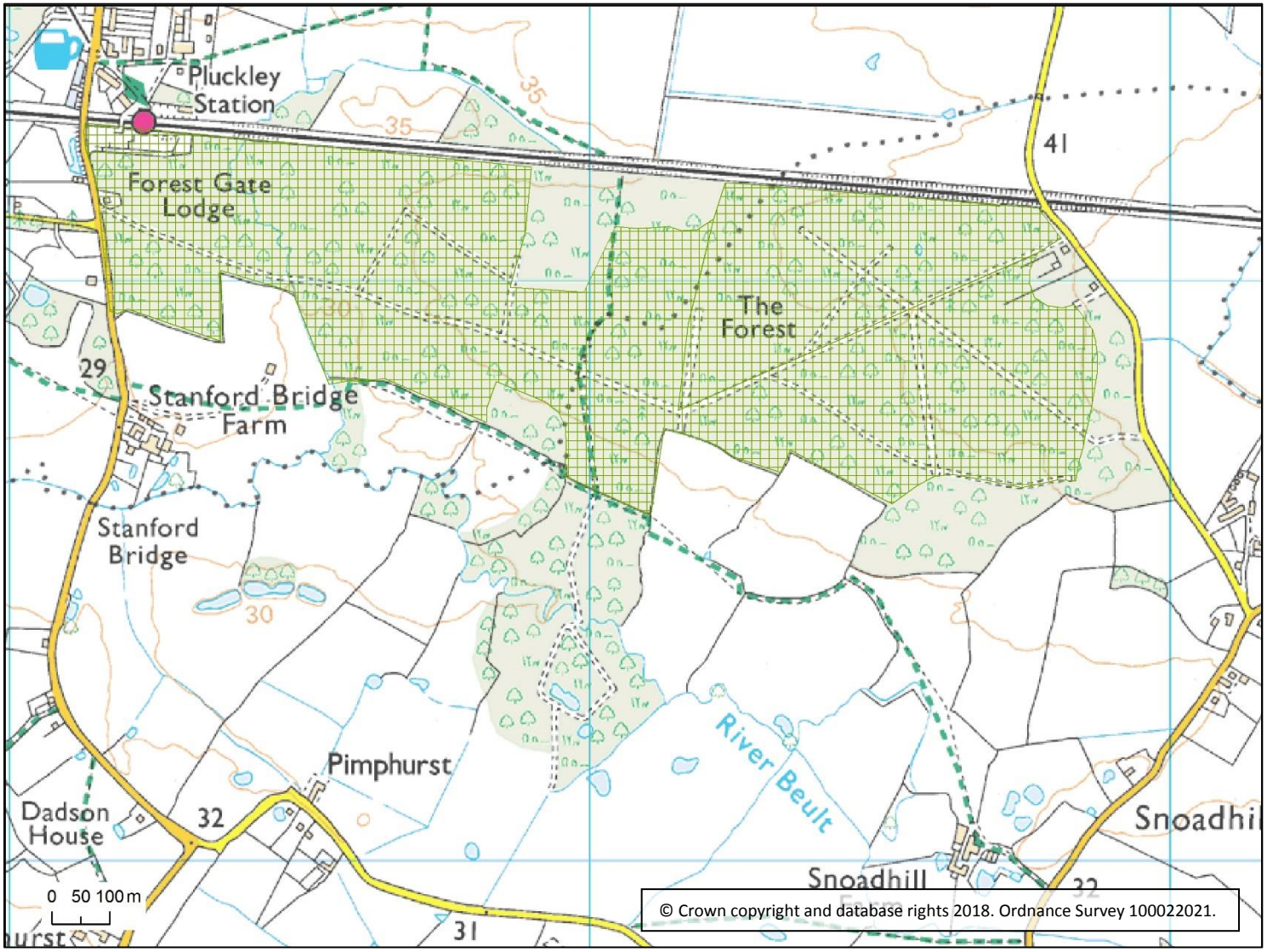
7.5 THE FOREST – AN EXAMPLE OF USING PHYSICAL FEATURES SUCH AS WOOD BANKS TO REFINE THE CAPTURE OF ANCIENT WOODLAND BOUNDARIES WITHIN THE INVENTORY

The Forest is a large block of broadleaved woodland over Weald Clay all of which was shown on the OS Epoch 1 map of 1870. The major part of it was included on the original county ancient woodland inventory for Kent.

The oldest available useful cartographic source at the time of work undertaken to update the AWI in this area was an OSD produced in 1789. Although this map clearly showed woodland in part of the area the 18th century boundaries appeared quite different from those drawn in the AWI and there was clearly scope for significant improvement in the accuracy of the designation.

However, the OSD for this area was distorted and did not georectify well; it would have been impossible to accurately determine the locations of older wood boundaries solely from desk-based evidence. In this case the often informative OS Epoch 1 map provided little information on the old woodland boundaries either – they had already been obscured by new woodland in 1870 and the distinction between pre-existing and new woodland was scarcely apparent in the symbols used.

In this example multiple evidence sources are brought together to refine information on the extent of ancient woodland on the site. It is entirely possible that further evidence could led to further refinement. This example also illustrates how sizeable areas of woodland may sometimes need to be removed from the AWI as part of the update process. Mosaics of ancient and recent woodland forming solid parcels of woodland are not uncommon in some landscapes and the small-scale historic maps used in evidence for the original AWI will often have been insufficiently reliable for disentangling the two.



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The Forest is an extensive area of woodland on Weald Clay straddling a parish boundary in the Low Weald of Kent.

Surveys by the NCC in the 1980s identified ancient woodland interest on the site but concluded that only relatively small parts of it constituted ancient woodland.

The inclusion of most of the site on the original AWI (green hatching) was an 'envelope designation' aiming to capture and help protect the interest rather than map it precisely.

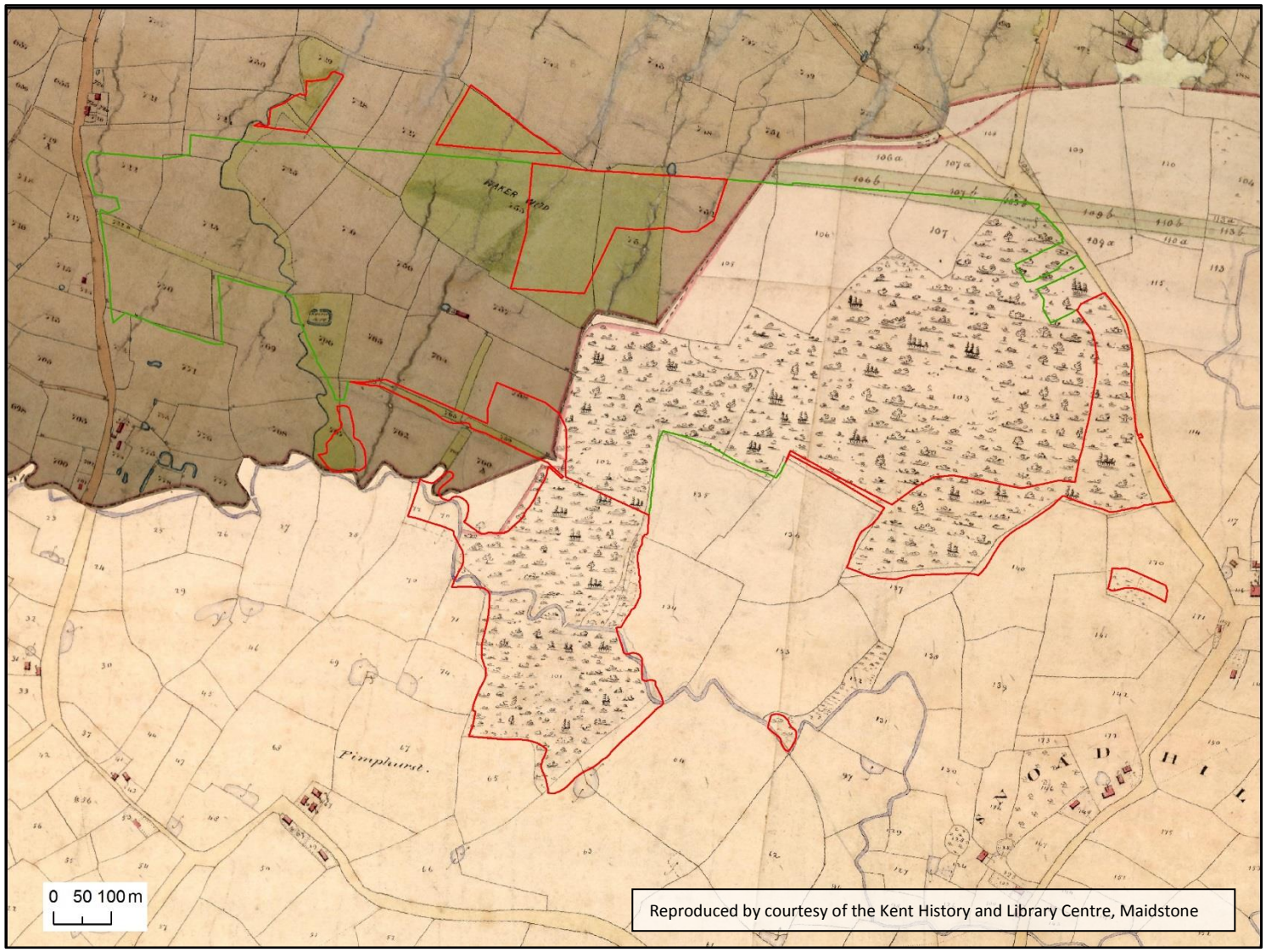
Although non-ancient woodland associated with ancient woodland can be of high nature conservation value, ancient woodland designation boundaries which include significant areas of recent woodland are increasingly challenged and untenable in the modern planning context.

© The British Library Board, OSD 6.

A Phase 1 mapping exercise for this area revealed significant areas of long-established woodland (red outline) were not included in the original AWI designation.

When these data were compared with the OSDs for the relevant area it suggested that some of the undesignated long-established woodland areas could be ancient. At the same time it appeared to indicate that significant parts of the existing designation were not ancient and probably covered woodland of 19th century origin.

The OSD pictured (produced in 1789) was insufficiently precise to redraw ancient woodland boundaries accurately. In addition there were some doubts over the map's accuracy. An earlier OS field sketch also exists covering the area concerned. The sketch shows some of the empty linear enclosures seen here filled with tree symbols.

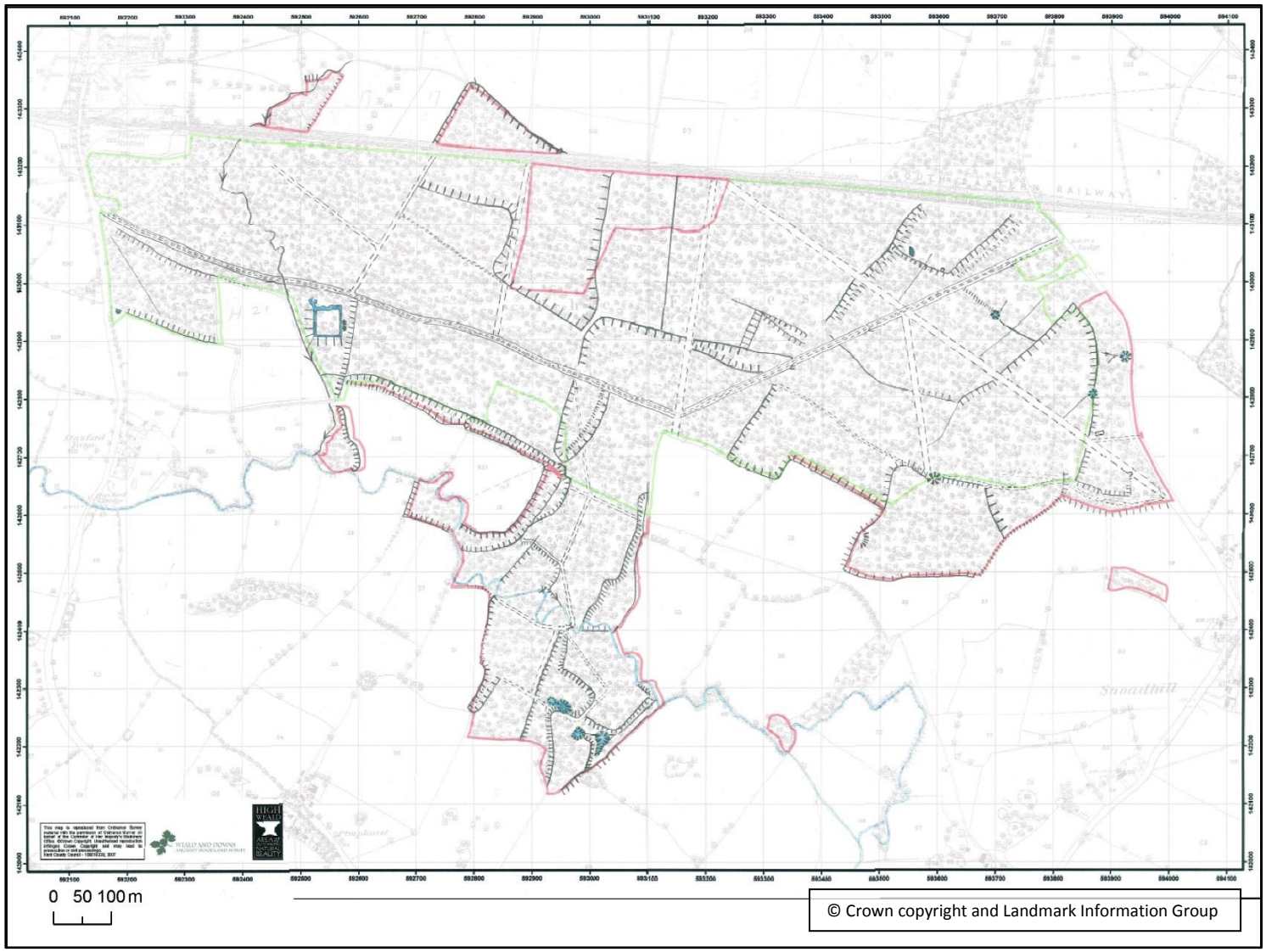


This image shows a composite of the tithe maps for the parishes of Pluckley (1838) and Bethersden (1839).

The schedules to these maps reveal that 150 years ago the area now under 'The Forest' was a mixture of established woodland, recent (at that time) plantation, arable fields, meadowland and pasture. The larger woods were named: Waker Wood and Great Waker Wood

When compared with the OSD the wooded area seems to have increased since 1789 yet was still less than the current extent of long-established woodland on the site (shown by the polygon outlines). The available map evidence therefore indicated that a network of historic woods had been infilled by phases of woodland establishment on open land.

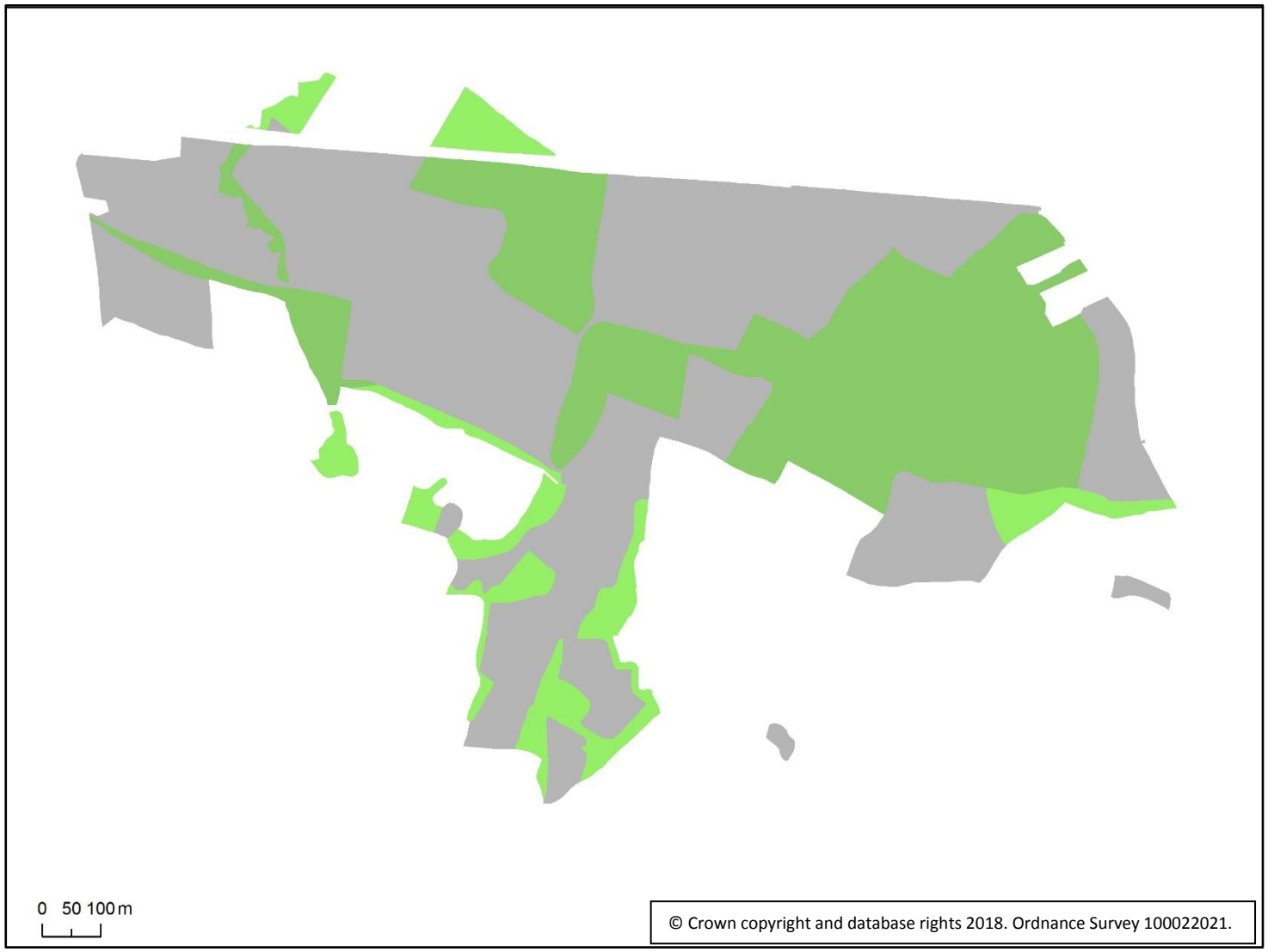
However, this still did not permit the extent of any ancient woodland present to be accurately plotted.



To investigate further site visits were made with a particular view to trace pre-19th century boundaries on the ground that could then be related to the history of woodland expansion.

The wood was found to have many banks, ditches and trackways suggesting a complex history. These were mapped using GPS, a gridded map and ruler.

Identifiable enclosures within 'The Forest' generally correlated well with the distribution of AWVPs. The named woods in the tithe apportionments contained old Hornbeam coppice and carpets of Wood Anemone with other AWVPs as did many of the various smaller linear enclosures. The former fields supported mixtures of semi-natural Ash and Birch woodland and planted Pedunculate and Turkey Oaks over Hazel. In these areas a much sparser and less diverse AWVP cover was recorded.



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The image shows the updated AWI (green) and excluded areas of long-established woodland (grey).

Field data and historic map evidence were pieced together in order to produce a more realistic ancient woodland boundary.

Some areas of plantation that abutted the pre-existing woods were simply treated as part of them and not separately captured by the tithe survey. Small linear ancient woods (shaws) in Bethersden (the parish to the east and south) were subsumed into areas of 19th century plantation, their boundaries becoming redundant in the new 'Forest'. These stands could only be identified by field observation.

The extent of land included on the AWI has been reduced but the accuracy and precision with which the boundaries are captured has increased.

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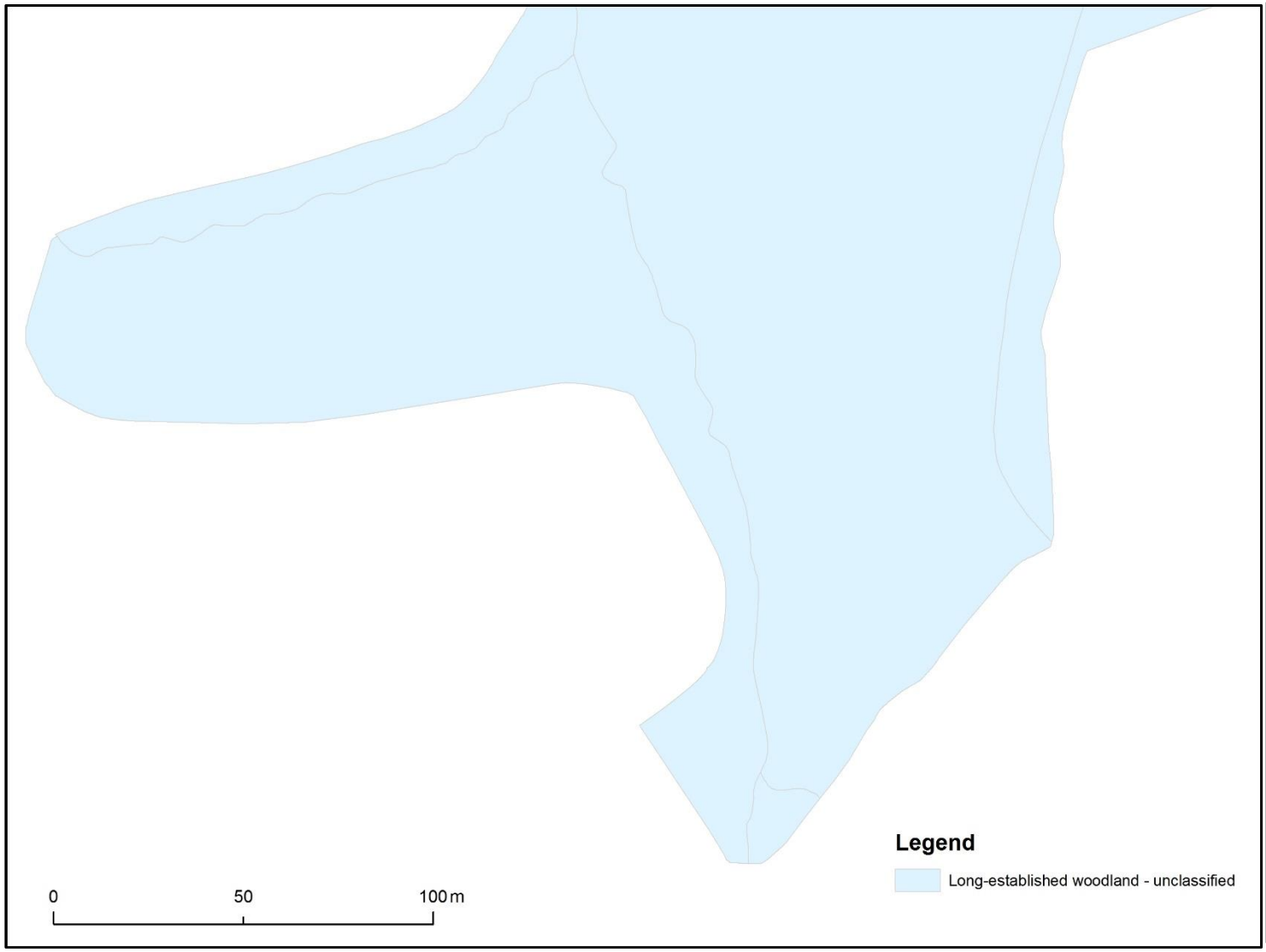
9 APPENDICES

9.1 WORKED EXAMPLE SHOWING DETAIL OF PHASE 2 OPERATIONS - A GIS UNION BETWEEN THE EXISTING AWI AND THE LONG-ESTABLISHED WOODLAND DATASET.

The following series of images shows a detailed comparison between the original AWI and the OS *MasterMap* derived long-established woodland dataset (produced in Phase 1 of the workflow) for part of a large wood.

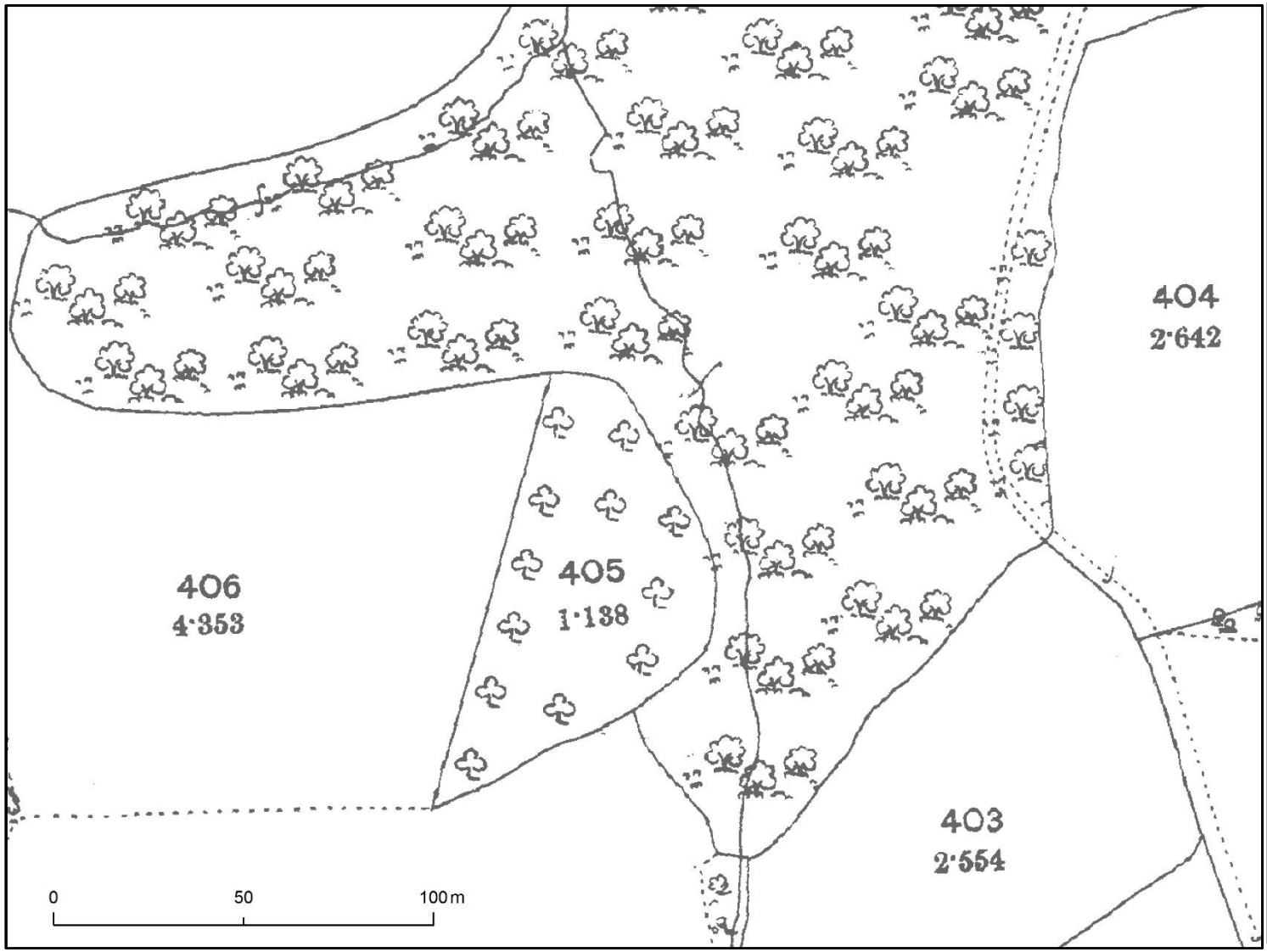
Although the original AWI was adjusted to *MasterMap* when it was digitised there are still discrepancies between the two layers. Some of these are due to recent improvements made by the OS in *MasterMap* accuracy. Others are artefacts of differences between the precision of OS *MasterMap*/Epoch 1 and the information that was used to capture the original AWI. Others still are genuine differences in the woodland area that is being mapped in each of the two datasets. The images illustrate how these features can be disentangled.



A small area of long-established woodland in west Kent digitally captured.

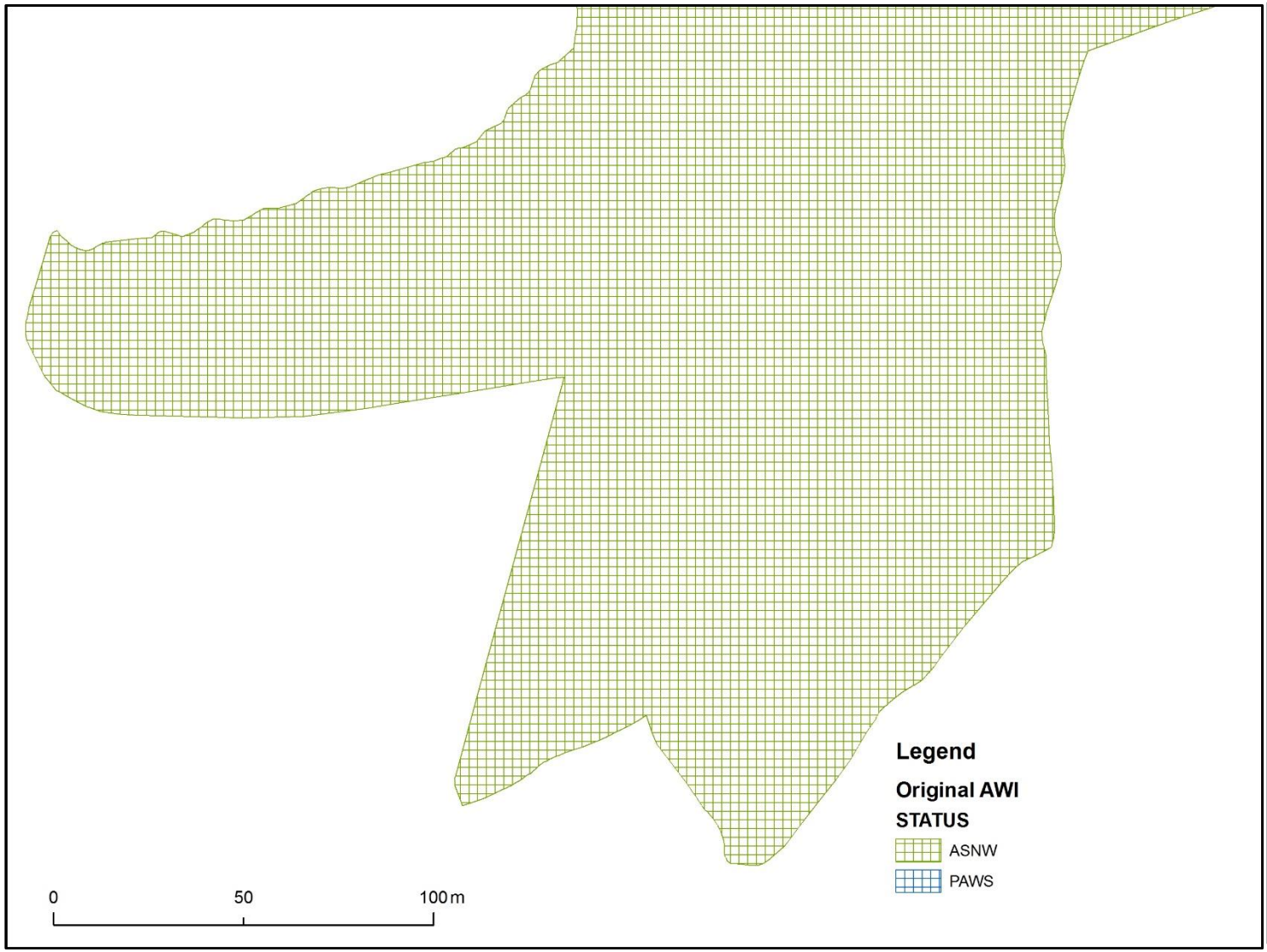
The image shown represents detail of the Phase 1 output layer (as described in this handbook).

The site is made up of five contiguous OS *MasterMap* polygons.



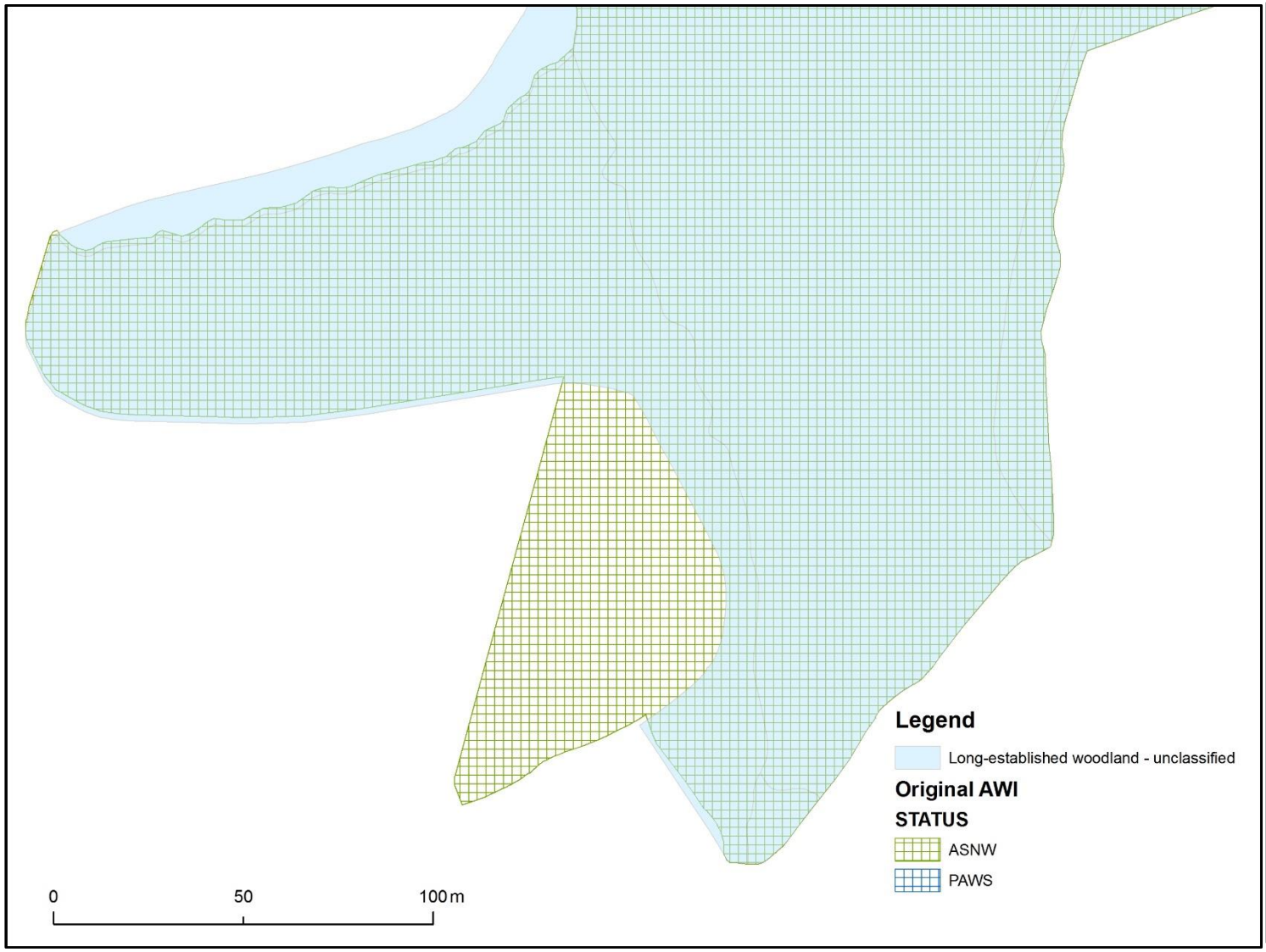
Detail from one of the revisions to the OS County Series maps helps us visualise the site.

The OS *MasterMap* polygon boundaries reflect streams and trackways etcetera within the wood.



The same area as depicted on the pre-existing AWI.

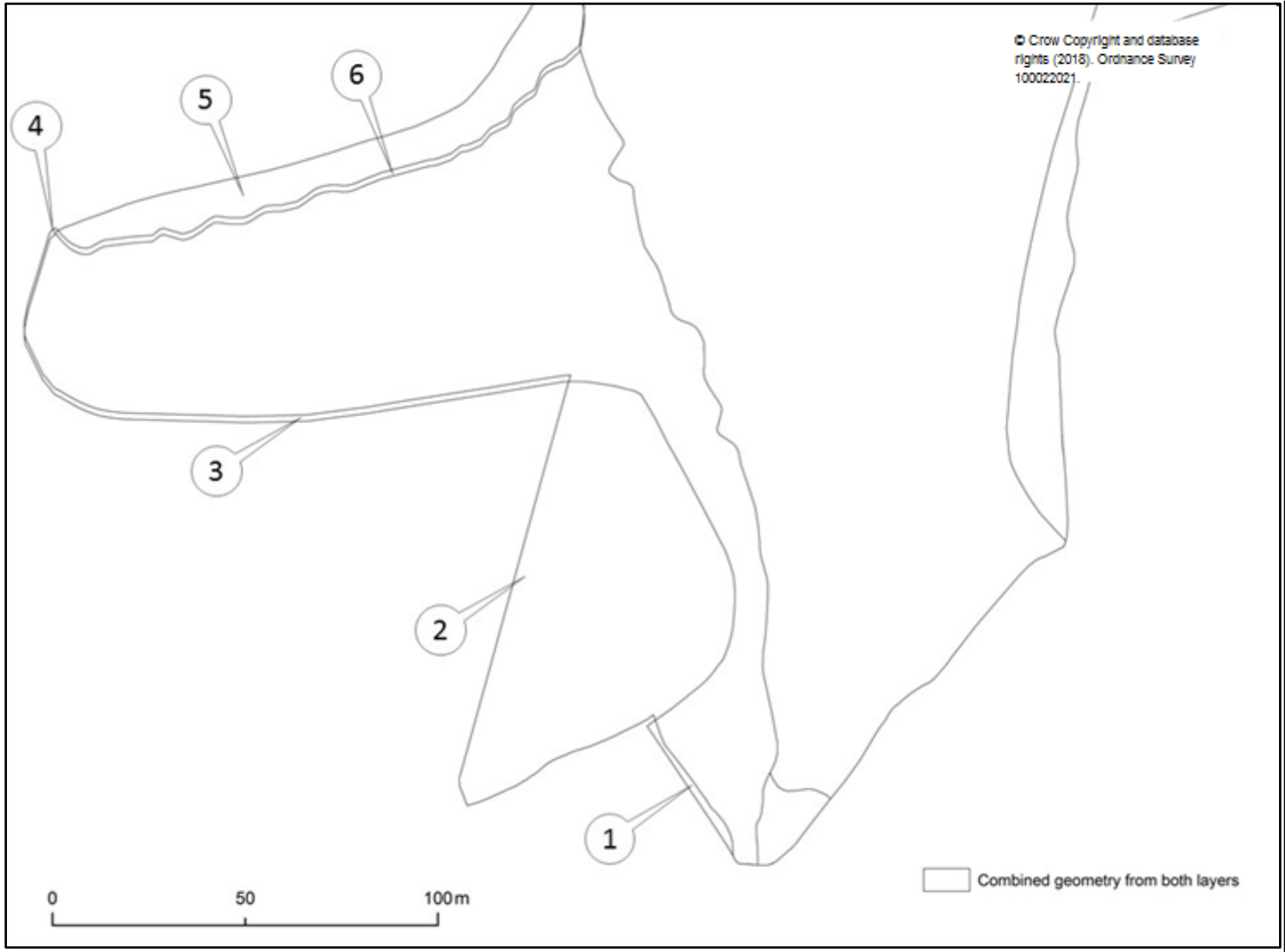
Woodland outside the northern stream is excluded whilst a former orchard (which has since been cleared) adjacent to the wood is included.



This image shows the long-established woodland layer and the pre-existing AWI compared visually.

There are various discrepancies. Some of these are real differences in the amount of land encompassed. Others are either minor artefacts of changes in OS mapping precision between the digitisation of the two datasets or the result of slight digitising errors in the AWI dataset.

The final image (next page) shows how a geometric union of the two datasets allows the anomalies to be clearly mapped. In some situations this will be the most reliable way to process the long-established woodland dataset through Phase 2 and maintain accuracy of the dataset conforming to current OS *MasterMap* geometry.



1 should be treated as 'PREVIOUSLY DESIGNATED AW' - even though geometrically it lies marginally outside the original AWI, in material terms it is part of the same mapped feature. Any difference form the historically mapped boundary is very negligible; the current MasterMap boundary is therefore adopted (as per NE's Digitisation standards).

2 is a designation query which, subject to confirmation, is likely to be removed from the AWI

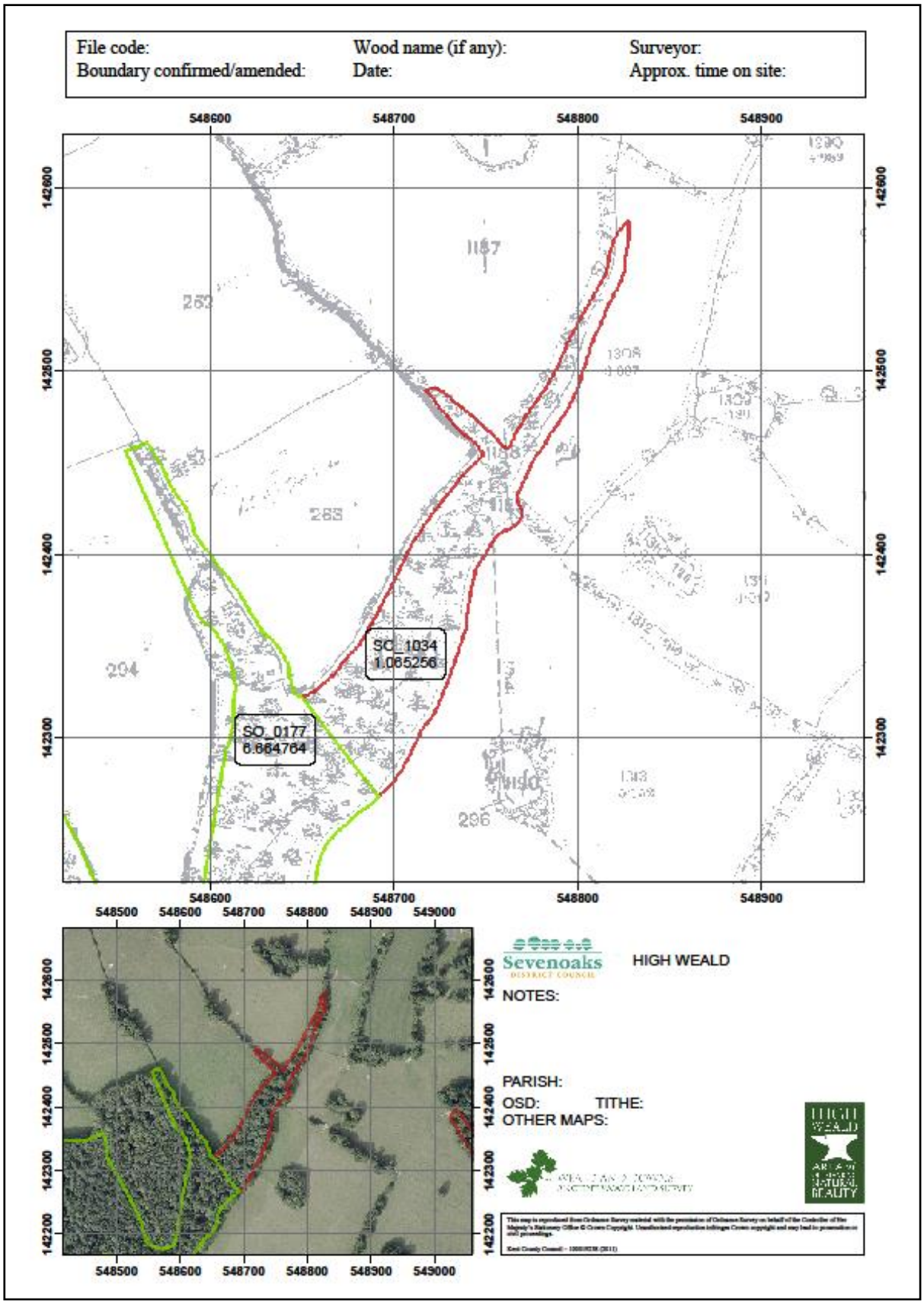
3 should be treated as 'PREVIOUSLY DESIGNATED AW' (for the same reasons as 1, above)

4 should be removed from the dataset as a mapping error caused by a minor shift in *MasterMap* accuracy since the original AWI was digitised.

5 should be classed as 'POTENTIAL NEW AW' (which subject to further work may be added to the AWI)

6 should also be treated as 'POTENTIAL NEW AW'; in real terms this belongs to 5 (above) because it is north of the stream and would be merged with it.

9.2 EXAMPLE OF PRE-PRINTED FIELD SURVEY MAPS AND FORMS USED IN AWI UPDATE WORK IN SOUTH EAST ENGLAND



Wood:		File code:
Recorder:	Compartment:	Date:

Site description (age structure, composition of vegetation layers, mosses/lichens dead wood etc)

Management (circle)	HF	C	CwS	Pb	Pc	Pm	Pl	F	NA	O

Comments

Damage (circle)	Gg	Bg	Pg	Gz	Gw	Gp	Rbh	Rbl	Rc	Hd	Lc	Iv	O

Comments (details, extent)

Living features (circle)	Pollards_Pld (>3m)	Stubs_Stb (~1m)	Stools_Stl (<0.5m)	Outgrown Hedges_Ohg	Notable Trees_Ntb

Comments (species, size, proximity to other features)

✓	**Archaeological**	Comments (dimensions, shape, proximity to other features)
	Depressions_DpS Wg | Dy C | S | G	
	Mounds_MdS	
	Built Structures_BtS	

✓	**Linear features**	It	By	Comments (dimensions, **sym**metrical/**asym**metrical, **sin**uous/**stra**ight)
	Bank_B			
	Ditch_D			
	Bank and Ditch_BD			
	Track_T			
	Other_O			

FILECODE	DATE:					TIME:	GR:					SURVEYOR				
TREES & SHRUBS		1	2	3	4			1	2	3	4	FERNS etc	1	2	3	4
Acer campestre*	Field Maple					Chrysosplenium opp.	Opp lv gldn-saxifrage					Athyrium filix-femina				
Acer pseudoplatanus	Sycamore					Circaea lutetiana	Enchanter's nightshade					Blechnum spicant				
Aesculus hippocastanum	Horse chestnut					Conopodium majus	Pignut					Dryopteris aemula				
Alnus glutinosa	Alder					Convallaria majalis*	Lily of the valley					Dryopteris affinis				
Betula pendula	Silver birch					Dactylorhiza fuchsii	Common spotted orchid					Dryopteris carthusiana				
Betula pubescens	Downy Birch					Daphne laureola	Spurge laurel					Dryopteris dilatata				
Carpinus betulus*	Hornbeam					Dipsacus pilosus	Small teasel					Dryopteris filix-mas				
Castanea sativa	Sweet chestnut					Digitalis purpurea	Foxglove					Equisetum sylvaticum				
Cornus sanguinea	Dogwood					Epipactis helleborine	Broad lv helleborine					Oreopteris limbosperma				
Corylus avellana	Hazel					Epipactis purpurata	Violet helleborine					Phyllitis scolopendrium*				
Crataegus laevigata	Midland hawthorn					Euphorbia amygdaloides	Wood spurge					Polypodium vulgare agg.				
Crataegus monogyna	Hawthorn					Filipendula ulmaria	Meadowsweet					Polystichum aculeatum				
Euonymus europaeus	Spindle tree					Galium aparine	Cleavers					Polystichum setiferum				
Fagus sylvatica	Beech					Galium odoratum	Woodruff					Pteridium aquilinum				
Frangula alnus	Alder buckthorn					Geranium robertianum	Herb Robert					MONOCOTS				
Fraxinus excelsior	Ash					Geum urbanum	Wood avens					Agrostis sp.				
Hedera helix	Ivy					Glechoma hederacea	Ground-ivy					Brachypodium sylvaticum				
Ilex aquifolium	Holly					Helleborus viridis*	Green hellebore					Bromopsis ramosa				
Lonicera periclymenum	Honeysuckle					Heracleum sphondylium	Hogweed					Calamagrostis epigejos				
Larix sp.	Larch					Hyacinthoides non-scripta	Bluebell					Carex laevigata				
Malus domestica	Apple					Hypericum androsaemum	Tutsan					Carex pallescens				
Malus sylvestris*	Crab apple					Hypericum montanum	Pale St John's-wort					Carex pendula*				
Picea sp.	Spruce					Hypericum pulchrum	Sldr St John's-wort					Carex remota				
Pinus sylvestris	Scots pine					Iris foetidissima	Stinking Iris					Carex strigosa				
Populus sp.	Poplar					Lamiastrum galeobdolon	Yellow archangel					Carex sylvatica				
Populus tremula	Aspen					Lathraea squamaria	Toothwort					Deschampsia flexuosa				
Populus x canadensis	Hybrid black poplar					Lathyrus linifolius	Bitter vetch					Deschampsia cespitosa				
Prunus avium	Wild cherry					Lathyrus sylvestris	Nrw lv everlasting pea					Elymus caninus				
Prunus laurocerasus	Cherry laurel					Lysimachia nemorum	Yellow pimpernel					Festuca gigantea				
Prunus spinosa	Blackthorn					Melampyrum pratense	Cow wheat					Holcus mollis				
Quercus petraea*	Sessile oak					Mercurialis perennis	Dogs mercury					Juncus effusus				
Quercus robur	Pendunculate oak					Moehringia trinervia	3-veined sandwort					Lolium perenne				
Rhamnus cathartica	Buckthorn					Narcissus pseudonarcissa.*	Wild daffodil					Luzula forsteri				
Rhododendron ponticum	Rhododendron					Neottia nidus-avis	Birds-nest orchid					Luzula pilosa				
Ribes nigrum*	Black current					Orchis mascula	Early purple orchid					Luzula sylvatica				
Ribes rubrum*	Red current					Orchis purpurea	Lady orchid					Melica uniflora				
Ribes uva-crispa	Gooseberry					Oxalis acetosella	Wood-sorrel					Milium effusum				
Rosa arvensis	Field rose					Paris quadrifolia	Herb Paris					Poa nemoralis				
Rosa canina	Dog rose					Pimpinella major	Grtr burnet-saxifrage					Poa trivialis				
Rosa sp.	Rose species					Platanthera chlorantha	Grtr butterfly orch.					Scirpus sylvaticus				
Rubus fruticosus	Bramble					Polygonatum multiflorum	Solomon's-seal									
Ruscus aculeatus	Butcher's broom					Potentilla sterilis	Barren strawberry									
Salix alba	White willow					Primula vulgaris*	Primrose									
Salix caprea	Goat Willow					Radiola linoides	Allseed									
Salix cinerea	Grey willow					Ranunculus auricomus	Goldilocks buttercup									
Salix fragilis	Crack willow					Ranunculus ficaria	Lesser celandine									
Sambucus nigra	Elder					Ranunculus repens	Creeping buttercup									
Sorbus aria	White beam					Rumex obtusifolius	Broad-leaved dock									
Sorbus aucuparia	Rowan					Rumex sanguineus	Wood dock									
Sorbus torminalis	Wild-service tree					Sanicula europaea	Sanicle									
Taxus baccata	Yew					Scrophularia nodosa	Common figwort									
Tilia cordata*	Small-leaved lime					Scutellaria minor	Lesser skullcap									
Tilia x vulgaris	Hybrid Lime					Sedum telephium	Orpine									
Ulmus glabra	Wych elm					Serratula tinctoria	Saw-wort									
Ulmus procera	English elm					Silene dioica	Red campion									
Viburnum lantana	Wayfaring tree					Solidago virgaurea	Golden-rod									
Viburnum opulus*	Guelder rose					Stachys officinalis	Betony									
						Stachys sylvatica	Hedge woundwort									
HERBS						Stellaria holostea	Greater stitchwort									
Adoxa moschatellina	Moschatel					Tamus communis	Black bryony									
Ajuga reptans	Bugle					Teucrium scorodonia	Wood sage									
Allium ursinum	Ramsons					Urtica dioica	Nettle									
Anagallis minima	Chaffweed					Vaccinium myrtillus	Bilberry									
Anemone nemorosa	Wood anemone					Veronica chamaedrys	Germander speedwell									
Anthriscus sylvestris	Cow parsley					Veronica hederifolia	Ivy lvd speedwell									
Aquilegia vulgaris*	Columbine					Veronica montana	Wood speedwell									
Arum maculatum	Lords and ladies					Vicia sepium	Bush vetch									
Calluna vulgaris	Ling					Vicia sylvatica	Wood vetch									
Campanula trachelium	Nettle-lv bellflower					Viola palustris	Marsh violet									
Cardamine amara	Large bittercress					Viola reichenbechiana	Early dog violet									
Cardamine bulbifera	Coralroot					Viola riviniana	Common dog violet					bold=ancient woodland indicator species (*=if not planted)				
Cardamine pratensis	Cuckooflower					Wahlenbergia hederacea	Ivy-lv bellflower									

9.3 NATURAL ENGLAND'S DIGITISING STANDARDS FOR ANCIENT WOODLAND (AUGUST 2017)

1. General Digitising Guidelines

1.1 Where a boundary follows an OS MasterMap feature the OS MasterMap feature should be copied so that the habitat feature uses its geometry.

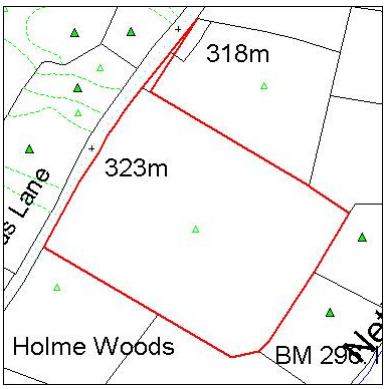
1.2 Where a boundary follows part of an OS MasterMap feature the digital boundary should be snapped along the OS MasterMap feature so that the digitised boundary and OS MasterMap feature both share the same geometry where appropriate.

1.3 Where a boundary does not follow an OS MasterMap feature, such as where the boundary follows a feature on an aerial photograph, scanned and geo-rectified map (maybe field or historical), the digitised boundary should be captured with sufficient nodes that the digitised feature takes on the shape of the feature on the source material at a scale of 1:2500.

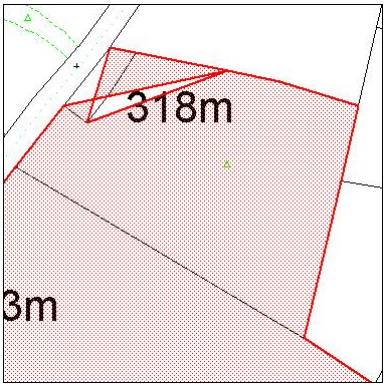
1.4 Where a boundary is shared between two polygons the boundaries must share the exact same geometry. There should be no slivers or gaps between polygons with shared boundaries.

1.5 Features should not be "stream" digitised. Stream digitising is the process of manual digitising, of lines or regions, where nodes are automatically placed at preset intervals based upon distance or time.

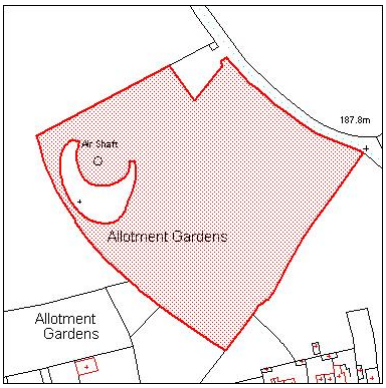
1.6 Polygons should not contain inappropriate "spikes". In the figure below the digitised field has an inappropriate spike.



1.7 Polygons must not self-intersect (aka "bowties"). Polygons must not intersect or cross themselves. In the figure below the digitised field has a bowtie caused by a polygon crossing itself.



1.8 Holes in polygons (aka “Doughnuts”) should be appropriately "punched". Where there is a hole in a polygon this should be digitised as a hole as shown below.



2. Ancient Woodland Specific Digitising Guidelines

2.1 All data within the Ancient Woodland Inventory should be mapped as polygons.

2.2 No polygons of Ancient Woodland are to be mapped that fall below the defined Minimum Mapping Unit (0.25ha), **unless** they are part of a larger contiguous area divided by a linear feature such as a metalled road and would not meet the MMU if counted as a single polygon (see section 2.7).

2.3 There is no maximum polygon size. Digitise large polygons as large polygons. The size of each polygon is determined by the extent of the contiguous patch of PAWS or ASNW Ancient Woodland. There should be no artificial limiting of polygon size to match an existing GIS dataset, (E.g. Designation site boundaries).

2.4 Polygons should not be mapped as multi-part polygons.

2.5 When undertaking work for a specific geographic area such as a county, the digitising should yield 100% coverage of the project area. If a parcel of ancient woodland falls across the boundary of the area being updated then the polygon should not be split and the full polygon supplied. Any overlaps will then be corrected when inventories are collated into the national inventory by Natural England.

2.6 There must not be any overlaps between parcels of ancient woodland. Boundaries between ancient woodland areas must share the same geometry.

2.7 Polygons must not cross roads (as defined with metaling on the OS MasterMap data), currently active railway lines or any watercourses that are mapped as polygons in OS MasterMap. If subdividing an otherwise contiguous area of ancient woodland with a road, railway line or watercourse causes a polygon to fall below the designated MMU then it may be included within the inventory even if below the ascribed MMU.

2.8 Hedgerows should not normally subdivide an otherwise continuous area of ancient woodland.

2.8 As soon as a feature has been captured its mandatory attributes should normally be added before further features are captured.

3. Data Outputs

3.1 Any data created must be supplied to Natural England either as ESRI Shapefiles or ESRI File Geodatabases.

3.2 Make sure that both the spatial and attribute data have been quality checked before submission.

3.3 The geometry of the data must be checked and corrected before submission. Within ESRI ArcGIS this can be accomplished using the “Check Geometry” and the “Repair Geometry” tools.

3.4 Data can be sent to Natural England either on CD/DVD or via a file transfer site.

3.5 When supplying the final submission, please also complete and supply the metadata template (see Appendix 9.4)

3.6 The final submission should also include the shapefile of the boundary of the geographic area used to update the ancient woodland (e.g. County boundary).

9.4 NATURAL ENGLAND OPERATIONAL GUIDANCE FOR GEOGRAPHIC DATA AND GIS: METADATA TEMPLATE GUIDANCE

Operational guidance for geographic data and GIS

Metadata Template Guidance

Overview

Natural England is a geographically literate organisation. We apply geography to support the delivery of the organisation's strategic outcomes. Geographic literacy is facilitated by the skills, services, data and systems which allow us to use geography.

This document is part of a series of operational guidance to help people use our geographic data and GIS. The full suite of guidance can be found on the Operational Guidance Catalogue under the 'Geographic Services' Topic.

This document describes the importance and procedures of metadata creation for new spatial datasets. This can retrospectively applied to existing datasets.

Contents

Stage 1: Process for Submitting New Datasets

All Natural England spatial datasets are held within a central repository managed by the GI Data Management Team.

New spatial datasets, either produced internally within NE or those externally submitted by contractors and other organisations must be sent to the Data Management Team (Natural England GI Data Managers). The GI Data Management team store and manage this data in a central repository, enabling all staff to access it.

When submitting a new spatial dataset to the GI Data Management Team, the following files need to be submitted.

- ***Spatial Dataset*** (either ESRI Shapefile, Geodatabase or MapInfo Tab files will be accepted).
- A completed ***'Dataset Metadata'*** tab on the "Metadata Template for New Datasets" (mandatory). For creation of dataset metadata, see Stage 3.

- A completed ***'Attribute Information Metadata'*** tab on the "Metadata Template for New Datasets" (mandatory). For creation of attribute information metadata, see Stage 4.
- Any ***Reports*** that give fuller, more detailed information on creation of the dataset, if it exists (optional).

  Submit all of the above to the Data ManagermentTeam at:
  NaturalEnglandGIDataManagers@naturalengland.org.uk

Stage 2: What You Need

You will need:

- The "Metadata Template"

For the latest version of the metadata template guidance, please email the Natural England Data Services Team – data.services@naturalengland.org.uk

Metadata Template.xls

Stage 3: Complete the Dataset Metadata

Metadata is a document that explains the content of an item such as a dataset, image or another document. In this case it explains the content of a spatial dataset and gives information such as the dataset title, how it was created, how often the dataset is updated and who has responsibility. It must also be INSPIRE compliant (for more information on how to be INSPIRE compliant, see GEMINI V2.2 document in the Annex 1 table). Simply completing the template accomplishes this for anyone wishing to submit INSPIRE compliant metadata.

The Dataset Metadata is on tab 1 of the "Metadata Template" spreadsheet.

There are four columns in the Dataset Metadata tab, they are explained below, you need to complete column 4:

1st column	- The INSPIRE Category, explained in full in the GEMINI V2.2 document in Annex 1.
2nd column	- A brief explanation of what is being asked in the INSPIRE category (for fuller description see the GEMINI v2.2 document in Annex 1).
3rd column	- An example of what is being asked by the INSPIRE category.
4th column	- Column to be completed by user. Please note those cells marked in red are mandatory.

Stage 4: Complete the Attribute Information Metadata

An Attribute Information Metadata document is required to explain the content of the attribute information that forms part of the spatial dataset. Attribute columns within datasets are often abbreviated or use aliases which need further explanation.

The Attribute Information Metadata is on tab 2 of the "Metadata Template" spreadsheet.

Examples are given in the first 6 lines of the tab, please fill out the attribute details starting in cell A9, below the grey line.

Please complete a row for ***each*** heading/column within the dataset.

An example of an Attribute Information Metadata could look like this:

Column Heading	Full Name	Format	Description
Sitename	Site Name	Character (100)	Name of site/description of site
Srvydate	Survey Date	Date	Date the survey was carried out
SiteLat	Site Latitude	Character (12)	Specified as OSGB36
Eastings	Eastings	Interger	Easting of centroid of the site (metres)
Ha	Hectares	Double (6,2)	Size of site in hectares (Ha).
SPSAPBEETL	Sap Beetles	Character (100)	Sap Beetle count per square metre.

There is no restriction on how many columns can be used in order to explain the attribute information. If more columns are required to explain the attribute information then please add more columns after the 'Description' column.

Stage 5: Licencing

Contact the Natural England GI Data Managers to arrange licencing for the dataset.

Stage 6: Completing the Process - Checklist

To complete the process the following should be submitted to the Natural England GI Data Managers

a). The completed "Metadata Template" (from Stages 3 and 4)
b). Dataset
c). Additional reports

Annex 1

INSPIRE document, GEMINI V2.2:


GEMINI2.2.pdf

Further information

Contacts
For further information on this guidance or other Geographic Information Data Management issues, please contact one of the Evidence Unit – Geographic Services Team Leaders.

Document Management

Author: Sarah Hammonds

Contributors: n/a

Version Control:

Version	Date	Comments	Reviewers (if applic.)
Metadata Template v1.0	10/12/2014		

9.5 THE DATASET METADATA FORM FROM NATURAL ENGLAND'S METADATA TEMPLATE SPREADSHEET.

This is a requirement for a submitted dataset to be 'INSPIRE compliant' (see 9.4)

For the latest version of the metadata template, please email the Natural England Data Services Team – data.services@naturalengland.org.uk

Metadata Categories (* mandatory)	*Explanation*	*Example*	Metadata for new and updated datasets to go onto the M-drives, please complete GREEN and YELLOW fields. For the open data project complete YELLOW fields only.
Metadata Elements			
Title *	*Name given to data*	*Blanket Bog Priority Habitat Inventory for England*	
Alternative Title	*Alternative name*	*Single Habitat Layer*	
Dataset Language *	*Language used in data*	*eng*	
Abstract *	*Brief narrative summary of data (free text)*	*This is a spatial dataset that describes the geographic extent and location of Natural Environment and Rural Communities Act (2006) Section 41 habitats of principal importance. The standalone Blanket Bog Inventory has been extracted from Natural England's Priority Habitats Inventory v2.1. These earlier inventories were produced from 1999 onwards and derived from habitat datasets collated from across the country, prioritising areas outside of designated sites.*	
Resource Locator	*Location for on-line access using a URL address*	*http://www.gis.naturalengland.org.uk/pubs/gis/GIS_register.asp*	
Data Format	*Format in which the digital data can be provided*	*shapfile*	
Resource Type	*Scope to which metadata applies*	*dataset*	
Unique Resource Identifier	*Value uniquely identifying the data*	*1*	
Why is it important that NE publishes this data?	*This is information to help with comms about this data. We frequently tweet or blog about new data published as open data; any information provided here will form the starting point for this process.*	*Large sites of blanket bog are of European importance as a resource. They are promoted through UK Biodiversity Action Plans and agri-environment schemes. They support a wide variety of species; and can preserve information from the past in the form of pollen, seeds, organic remains and evidence of long ago human occupation.*	
Classification of Spatial Data & Services			
Topic Category *	*Main theme of the data*	*biota*	
INSPIRE Themes	*Topic of the content of the data*	*Habitats and biotopes*	

Spatial Data Service Type	*Is it provided as a service such downloadable or within a viewing mapping service. Not applicable to datasets or dataset series.*	*n/a*	
Coupled Resource	*Identifier of datasets that the service operates on. Not applicable to datasets or dataset series.*	*n/a*	

Keyword

Keyword	*Keyword to identify data*	*Geographic Information*	
Originating Controlled Vocabulary	*Where does the keyword originate from.*	*Natural England Controlled Vocabulary*	

Geographic Location

Extent *	*Coverage of data, eg, Herefordshire, eg. England*	*England*	
West Bound Longitude *	*West coordinates of data coverage*	*-7.05*	
East Bound Longitude *	*East coordinates of data coverage*	*2.07*	
North Bound Latitude *	*North coordinates of data coverage*	*55.81*	
South Bound Latitude *	*South coordinates of data coverage*	*49.86*	
Vertical Minimum Extent	*Vertical extent is significant, such as with geology, mining, meteorology*	*20m*	
Vertical Maximum Extent	*Vertical extent is significant, such as with geology, mining, meteorology*	*100m*	
Spatial Reference System *	*Coordinates, geographic identifiers used in data*	*British National Grid*	

Temporal Reference

Temporal Extent - Start Date of Data Capture *	*Start date for the content of the data. YYYY-MM-DD*	*1966-06-01*	
Temporal Extent - End Date of Data Capture *	*End date for the content of the data. YYYY-MM-DD*	*1999-10-21*	
Date of Creation *	*Date the dataset was created. YYYY-MM-DD*	*2001-01-02*	

Date of Last Revision *	*Date when dataset was last revised (if at all). YYYY-MM-DD*	*2001-02-14*	
Dataset Reference Date *	*Date of publication. YYYY-MM-DD*	*2001-02-14*	
Dataset Reference Type *	*Is this a new dataset, has it been updated.*	*revision*	

Quality & Validity

Lineage *	*Information about the events or source data used in the construction of the data. Free text*	*eg. Source material, processes used to create data, method of updating, quality control porcesses etc*	
Spatial Resolution	*Measurement if granularity of data (in metres)*	*0*	
Additional Information Source	*Any other descriptive information about the data. (Any other descriptive information about the data, website url, references to additional documents etc). Free text*		
Frequency of Update *	*Frequency with which modications & deletions are made to the data*	*not Planned*	
Equivalent Scale	*Where the data is captured from a map, the scale of that map should be recorded*		

Conformity

Specification	*Degree of conformity with the product specification or user requirement against which the data is being evaluated*		
Degree		*conformant*	
Explanation		*free text*	

Constraints Related To Access & Use

Use Constraints *	*Restrictions & legal restraints on using the data*	*No Conditions Apply*	
	If you stated 'other' to the above, clarify what use constraints are needed here	*free text*	
Limitations on Public Use *	*Restrictions imposed on the data for security & other reasons*	*Publicly accessible NE OGL*	
Licence*	*Licence for dataset*	*Open Government Licence*	

	If you stated 'other' to the above, clarify what licence is needed here	*free text*	
Copyright*	*What copyright text/statement(s) is required for this data?*	Copyright statements need to include: "Contains data supplied by Natural Environment Research Council" and "© Natural England"	

Responsible Organisation

Contact Title *	*Details of the organisation(s) responsible for the establishment, management, maintenance & distribution of the data.*	*Habitat Inventory Team*	
Organisation Name *		*Natural England*	
Postal Address *		*Parkside Court, Hall Park Way, Telford, TF3 4LR*	
Tel No:		*0300 060 ******	
E-Mail: *		*habitat.inventories@naturalengland.org.uk*	
Web URL:		*www.naturalengland.org.uk*	
Responsible Party Role *		*custodian*	

Metadata on Metadata

Metadata Point of Contact *	*Details of the organisation(s) responsible for the establishment, management, maintenance & distribution of the data.*	*Habitat Inventory Team*	
Organisation Name *		*Natural England*	
Postal Address *		*Parkside Court, Hall Park Way, Telford, TF3 4LR*	
Tel No:		*0300 060 ******	
E-Mail: *		*habitat.inventories@naturalengland.org.uk*	
Web URL:		*www.naturalengland.org.uk*	
Responsible Party Role *		*custodian*	
Metadata Date *	*Date on which the metadata was last updated or created.YYYY-MM-DD*	*2013-10-06*	
Metadata Language *	*Language used for documenting the metadata*	*eng*	

9.6 THE ATTRIBUTE INFORMATION METADATA FORM FROM NATURAL ENGLAND'S METADATA TEMPLATE SPREADSHEET (SHOWING HYPOTHETICAL FIELDS FROM AN AWI UPDATE DATASET).

Column Heading	Full Name	Format	Description	Notation or qualification
UID	Unique file code	Character (12)	Unique identifier per polygon. Required for cross referencing to any externally held information from surveys and archival research.	
DISTRICT	Local authority	Char (30)	Local planning authority area in which polygon located.	
CRTD_DATE	Date created	Date	Date polygon captured	dd/mm/yyyy
CRTD_BY	Created by	Char (50)	Name of individual capturing data	
AWI_2012	Former AWI status	Integer	Status of polygon on AWI as published on www.magic.gov.uk at date update work commenced	0 = not included, 1 = included and ASNW, 2 = included and PAWS
NAME	Wood name	Char (100)	Name of wood to which polygon belongs. Can be derived from multiple sources.	May be unpopulated if no data.
NAME_SRC	Name source	Char (25)	Indicates the origin of the name given in the NAME field	
STATUS	Status	Char (4)	Basic condition of polygons proposed for inclusion on updated AWI(Ancient Semi-natural Woodland or Replanted Ancient Woodland)	Value is one of: ASNW; PAWS
SN_CLASS	Semi-natural class	Char (8)	Records retained or recovering semi-naturalness of PAWS sites based on the proportion of site native species present	Value is one of: Class 1; Class 2; Class 3; Class 4 (Spencer 2002)
TYPE	BAP priority habitat	Char (50)	Indicates if polygons are likely to be 'Wood-pasture & Parkland' priority habitat. *Field may be populated with information on BAP priority habitat type of non-wood-pasture polygons if data available.*	Value is: 'Wood-pasture and Parkland' or blank
HA	Area	Double (6,2)	Size of polygon in hectares (ha)	
PARISH	Historical parish	Char (25)	Name of polygon's historical parish (or parishes if straddles boundary)	
AP_2012	Aerial photo	Integer	Condition of polygon as assessed on recent dated air photo images	Field must have a value: 0 = not shown as woodland; 1 = shown as woodland or predominantly so; 2 = part shown as woodland (10% – 90% of the polygon clearly not depicted as woodland of any type); **5 = DEFAULT VALUE - not assessed**; 6 = shown as woodland AND interpreted as consistent with wood-pasture or parkland BAP Priority habitat. (In a submitted dataset typically there should be no polygons with the default entry still in place.)

Column Heading	Full Name	Format	Description	Notation or qualification
EPOCH_1	OS Epoch 1	Integer	Condition of polygon as assessed on Ordnance Survey County Series 1st Edition 25 inch to 1 mile or 6 inch to 1 mile maps	Field must have a value: 0 = not shown as woodland; 1 = shown as woodland or predominantly so; 2 = part shown as woodland (10% – 90% of the polygon clearly not depicted as woodland of any type); 3 = inconclusive (map damaged, map image of insufficient quality to interpret or depiction on map ambiguous); 4 = no map coverage; **5 = DEFAULT VALUE - not assessed**; 6 = shown as woodland AND interpreted as consistent with wood-pasture or parkland BAP Priority habitat. (In a submitted dataset typically there should be no polygons with the default entry still in place.)
EPOCH_2	OS Epoch 2	Integer	Condition of polygon as assessed on dated revision to Ordnance Survey County Series 25 inch to 1 mile or 6 inch to 1 mile maps	notation as for EPOCH_1 (but default value possible if source not used)
EPOCH_3	OS Epoch 3	Integer	Condition of polygon as assessed on dated revision to Ordnance Survey County Series 25 inch to 1 mile or 6 inch to 1 mile maps	notation as for EPOCH_1 (but default value possible if source not used)
EPOCH_4	OS Epoch 4	Integer	Condition of polygon as assessed on dated revision to Ordnance Survey County Series 25 inch to 1 mile or 6 inch to 1 mile maps	notation as for EPOCH_1 (but default value possible if source not used)
TITHE	Tithe map	Integer	Condition of polygon as assessed on parish tithe maps produced from the 1830s to 1840s	notation as for EPOCH_1 (but default value possible if source not used)
TITHE_CODE	Tithe map plot	Char (30)	Auxiliary field to the TITHE field - records land plot notation corresponding to the polygon on tithe map.	information as transcribed from tithe map (may be multiple)
TITHE_DATA	Tithe apportionment data	Char (200)	Auxiliary field to the TITHE field - records plot name/s and state of cultivation of the plots in the TITHE_CODE field.	Generally in the form: Smith's Wood – wood; Church Field – arable (Name of land parcel – state of cultivation). Data may be abbreviated relative to original manuscript.
OS_1ST_SER	OS First Series	Integer	Status of polygon as assessed on dated Ordnance Survey 1st Series or Old Series 1 inch to 1 mile maps.	notation as for EPOCH_1 (but default value possible if source not used)
OSD	OS Drawing	Integer	Status of polygon as assessed on dated Ordnance Survey Drawing.	notation as for EPOCH_1 (but default value possible if source not used)
1765_CM	1765 County map	Integer	Status of polygon as assessed on named 18th century county map.	notation as for EPOCH_1 (but default value possible if source not used)
C18_EM	18th century estate map	Integer	Status of polygon as assessed on estate map if available	notation as for EPOCH_1 (but default value possible if source not used)

Column Heading	Full Name	Format	Description	Notation or qualification
C17_EM	17th century estate map	Integer	Status of polygon as assessed on estate map if available	notation as for EPOCH_1 (but default value possible if source not used)
C16_EM	16th century estate map	Integer	Status of polygon as assessed on estate map if available	notation as for EPOCH_1 (but default value possible if source not used)
ARCHIV_REF	Archival reference	Char (50)	Dates, repositories and shelfmarks or catalogue numbers of estate maps or details of any other supplementary information relevant to the status of the polygon (e.g. a published work).	
SVY_DATE	Survey date	Date	Indicates if the polygon has been surveyed and date of survey	dd/mm/yyyy (blank if polygon not surveyed)
SVY_BY	Surveyor name	Char (50)	Name of surveyor	
COMMENTS	Comments	Char (100)	Comments on evidence base and evaluation including reason for ACTION if not clear from the other attributes in dataset	
ACTION	Action	Char (8)	Decision on provisional status of polygon in updated AWI	Value is one of: INCLUDE; EXCLUDE (or equivalent)