Capacity for change: new woodland creation and historic landscape character in Oxfordshire

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1 Introduction

Forest: land predominantly covered by trees, with a minimum of 20% canopy cover. This can be in large tracts, typically referred to as 'forests', or in smaller areas, such as woods, copses, spinneys.[1]

In 1992, the United Nations Conference on Environment and Development agreed three legally binding conventions on climate change, biological diversity, and to combat desertification, all of which require the sustainable management of the Earth's forests.[2] The sixth session of the United Nations Forum on Forests in 2006 further emphasised the importance of our forests, agreeing four global objectives, including to "reverse the loss of forest cover worldwide through sustainable forest management, including protection, restoration, afforestation and reforestation, and increase efforts to prevent forest degradation".[3] Significantly, this placed a responsibility on governments around the world to afforest and reforest. These new forests have implications for the historic environment: upstanding remains, sub-surface deposits, and the character of the historic landscape. This case study seeks to assess these implications and to map the historic landscape of Oxfordshire's capacity for new small tracts of forest, from herein referred to as 'woodland'.

Approximately three million hectares of the United Kingdom in 2015 was covered by forest, amounting to 13% of the total land area. This is significantly less than the 31% of France, 33% of Germany, 37% of Spain, and 68% of Sweden. The financial year 2013-2014 saw the highest levels of planting in the UK in the last five years with 12,900 hectares of new forest created, 3,300 hectares of which were in England. The following year the rate of planting had dropped and just 5,500 hectares of new forest were created across the whole country.[4] In England this was entirely comprised of broadleaf tree species; in fact, between 2012 and 2016 only 100 hectares of coniferous woodland were planted in England.[5] Despite the apparent downturn in the rate of growth of the UK's forests, the increase in tree cover remains a priority and applications for the change of use of land to forest continue to be made across the country.

The most recent Forestry Commission's Inventory for Oxfordshire records 23,724.85 hectares of woodland across 7,273 separate woods.[6] These are predominantly broadleaf woods, but there are coniferous and mixed examples as well (Table 1).

Woodland Type	Hectares	% of Woodland
Broadleaved	16748.16	70.59
Conifer	3573.99	15.06
Young trees	1686.69	7.11
Mixed mainly conifer	525.95	2.22
Assumed woodland	423.65	1.79
Mixed mainly broadleaved	367.03	1.55
Ground prep	219.66	0.93
Low density	78.13	0.33
Shrub	51.57	0.22

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[1] Forestry Commission. 2017. United Kingdom Forestry Standard. Fourth Edition. p3.
[2] Forestry Commission. 2017. United Kingdom Forestry Standard. Fourth Edition. p5.
[3] Ibid
[4] Forestry Commission. 2016. Forestry Facts & Figures 2016.
[5] Ibid
[6] Forestry Commission Inventory for Oxfordshire. 2017.

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Felled	42.42	0.18
Coppice with standards	4.03	0.02
Coppice	3.58	0.02

Table 1 The types of woodland recorded in Oxfordshire by the Forestry Commission Inventory in 2017.

Each year the amount of woodland in Oxfordshire grows. It has not been possible to ascertain the exact amount of new woodland as data on natural woodland regeneration and trees planted by private individuals, particularly on a small scale, have not been captured by Oxfordshire County Council. Information is, however, available on the amount of land approved for new planting in the county under the Forestry Commission's Woodland Grant Scheme (WGS) and the English Woodland Grant Scheme (EWGS): between 1994 and 2003 the WGS saw 1,381.9 hectares of land approved and between 2004 and 2014 the EWGS saw a further 412.9 hectares.[7]

With this information it is clear that a not insignificant part of Oxfordshire is being converted to woodland each year. Thankfully, for landowners who apply for woodland grants through the Forestry Commission's schemes, there are a number of guidelines and recommendations set out which directly relate to the historic environment and historic landscape character (Table 2).

This case study provides information for any landowner planning new woodland in Oxfordshire and can be used as an evidence base for those wishing to meet the Forestry Commission's requirements. It can also be used by those who are not applying for Forestry Commission funding to inform the setting, scale, and design of new woodland. This tool allows better judgements regarding the positioning of new woodland and the accompanying notes can be used to inform better site preparation, species selection, and layout in respect of the historic landscape.

The resultant dataset is a baseline upon which to build detailed site assessment, it is not a substitute for consulting the HER or the Local Authority archaeologists. The tool is designed to help developers or landscape managers establish the risks and thus the potential constraints and costs when dealing with aspects of the historic environment and the landscape.

An Operational Guide has been produced to accompany this report. The guide is designed for applicants for new woodland and describes four steps on how to use the data produced by this research.

UK Forestry Standard (2017) requirements, guidelines, and recommendations	
General Good Forestry Practice requirement 18	New forests and woodlands should be located and designed to maintain or enhance the visual, cultural and ecological value and character of the landscape
Historic Environment Legal requirement 1	Scheduled Monuments must not be damaged and consent must be obtained from the relevant historic environment authority for any works that have the potential to damage the monument
Historic Environment Legal requirement 2	The local historic environment authority must be informed if objects are found that come within the scope of the law covering archaeological finds. Metal detectors must not be used where legally restricted or on a Scheduled Monument site
Historic Environment Legal requirement 3	Listed building consent must be obtained from the local authority or relevant historic environment authority to demolish a listed building or structure or any part of it, or to alter it in any way which would affect its character, inside or out
Historic Environment Good Forestry	Forests should be designed and managed to take account of the

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[7] Ibid

Practice requirement 1	historical character and cultural values of the landscape
Historic Environment Good Forestry Practice requirement 2	Forests should be designed and managed to take account of policies associated with historic landscapes, battlefield sites, historic parks and gardens, and designed landscapes of historic interest
Historic Environment Good Forestry Practice requirement 3	Steps should be taken to ensure that historic features, which may be adversely affected by forestry, are known and evaluated on an individual site basis, taking advice from the local historic environment services
Historic Environment Good Forestry Practice requirement 4	Forest management plans and operational plans should set out how important historic environment features, including veteran trees, are to be protected and managed
Landscape Good Forestry Practice requirement 2	Forests should be designed and managed to take account of landscape designations, designed landscapes, historic landscapes and the various policies that apply
Landscape Good Forestry Practice recommendation 10	Consider the impacts of forestry on the historical context and landscape character in forest management plans; consider opportunities to complement, enhance or re-create landscapes of historic interest
Landscape Good Forestry Practice recommendation 13	Analyse the main landscape influences and base forest shapes on either the landform or the enclosure pattern
Landscape Good Forestry Practice recommendation 14	If the enclosure pattern is dominant, use the field pattern and links to existing hedges and woodlands to guide the design of forest shapes

Table 2 UK Forestry Standard 2017 guidelines and recommendations relating to the historic environment and historic landscape character

2 Methodology

To assess the capacity for new woodland in Oxfordshire, five stages were defined: scenario; assessing vulnerability and capacity of the historic landscape; assessing significance of HLC types; capacity modelling and mapping; and additional constraints.

This methodology has been influenced by work in Cornwall and by a current review being conducted by Historic England with regards to assessing sensitivity to change.[8] The data compiled is presented in the accompanying Data Table.

2.1 Stage 1: Scenario

The creation of new woodland with an area in excess of two hectares and comprised of mixed broadleaf tree species.

Potential impacts of new woodland

Category	Potential impacts of new woodland[9]	
Site Preparation	Cultivation	- Land clearance and earthmoving to prepare a site for planting may remove traces of the historic landscape, historic built structures, and archaeological remains. - Typically carried out by heavy machinery which may disturb or damage the historic landscape, historic built structures, or archaeological remains.
	Drainage	- Earthmoving (as above). - Heavy machinery (as above). - Changes to the water table which may affect the preservation of waterlogged archaeological deposits.
	Species selection	- Different species have different rooting characteristics, some of which will have more of an impact on sub-surface archaeological remains. - Different species will be more or less appropriate for local historic character.
	Planting	- There is relatively minor soil disturbance caused by planting and the impact on archaeological remains should be low. - Nursery grown stock are typically undercut or transplanted to encourage lateral root growth. This may have less of an effect on buried archaeological remains than natural tree regrowth.
Root Action	Physical	- Some localised impact on buried archaeological remains and historic built structures from root activity.
	Chemical	- Mineral weathering of buried archaeological remains caused by root activity which alters the soil environment.
Hydrological and Faunal Change	Throughfall	- Increased interception of rainfall may positively affect the preservation of historic built structures and above and below-ground archaeological remains by reducing chemical dissolution and freeze-thaw weathering.

[8] Cornwall Council. 2010. Historic Landscape Character and sensitivity mapping for Photo-Voltaic (Solar Farms) installations in Cornwall; Herring, P. & McOmish, D. forthcoming. Using Historic Landscape Characterisation when assessing sensitivity to change. Historic England.

[9] After Forestry Commission. 2017. United Kingdom Forestry Standard. Fourth Edition. pp. 88-94 and Crow, P. 2004. Trees and Forestry on Archaeological Sites in the UK: A review document. Forest Research. pp. 7-35

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	Water uptake	-	The uptake of water from the soil by trees may affect the water table (see above).
	Soil fauna	-	Fauna supported by trees will vary between species and differ from that sustained by pasture or crops. This may have an impact on archaeological remains. For example, increased or decreased worm or ant activity.
Forestry Operations	Thinning	- -	Heavy machinery (as above). Potential for increasing the risk of windthrow (trees blown down in the wind), which can significantly damage both sub-surface and above ground archaeology and historic built structures.
	Felling	- -	Heavy machinery (as above). Potential for increasing windthrow (as above).
	Processing	- -	Heavy machinery (as above). Processing site clearance and earthmoving (as above).
	Extraction	- -	Heavy machinery (as above). Access route site clearance and earthmoving (as above).
Windthrow	Below-ground	-	The roots of wind thrown trees may damage buried archaeological remains when they are upturned.
	Above-ground	-	Wind thrown trees may fall on and damage above-ground remains, historic built structures, and remains of the historic landscape.
Preservation and restoration	Bank stabilisation	-	Roots can stabilise banks, such as those associated with archaeological remains and historic landscape features.
	Physical barrier	-	Tree cover can act as a physical barrier preserving historic built structures and archaeological remains from other types of development or agricultural practices.
	Reforestation	-	New woodland can be created on the site of former woodland, restoring the historic landscape.
	Restoring historic boundaries and landscape morphology	-	New woodland can be created on the line of historic boundaries or on former boundaries, restoring the shape of the historic landscape.
	Afforestation	-	New woodland can be created within existing boundaries, preserving their shape and enhancing the legibility of the historic landscape.

Table 3 The potential impacts of new woodland creation

2.2 Stage 2: Assessing potential impact on the Historic Landscape

Having identified ways in which the creation of new woodland might have an effect on historic landscape character, the potential impact on each HLC Type was assessed. It must be emphasised that this assessment was based on sites in Oxfordshire and nowhere else. For example, judgements about the HLC Type Prison were based upon examples of prisons in Oxfordshire and would not, necessarily, be the same judgements as those made about prisons in London or Nottinghamshire.

Impact values were assigned a weighted score which ranged between -0.5/-1 and -2/-4, reflecting varying degrees of impact: -0.5/-1 = little or no impact; -2 = likely high impact on character which can add historic value (landscapes which have environmental or aesthetic qualities which may derive from or enhance a historic landscape); -4 = likely high impact on historically important landscapes (Table 4).

Potential Impact of new woodland on historic landscape character		Weighted Score
Effect on Legibility and Readability of Time Depth How likely is the scenario to change the ability to read or see a landscape's history?	Removal of hedgerows or boundaries defining historic fields Loss of Ancient Woodland or landscape types with long histories Loss of landscape types with perceived historical value	-1 to -4
Impact on Archaeological Remains How likely is the scenario to disturb known or predicted archaeological remains?	Removal of / damage to archaeological remains through: • site preparation, cultivation, and planting • root action • hydrological and faunal change • forestry operations, thinning, felling, processing, and extracting • windthrow	-1 to -4
Impact on Historic Built Structures How likely is the scenario to disturb historic built structures?	Removal of / damage to historic built structures through: • site preparation, cultivation, and planting • root action • hydrological change • forestry operations, thinning, felling, processing, and extracting • windthrow	-1 to -4
Change in Landscape Character How likely is the scenario to affect how the historic landscape contributes to the overall landscape?	Removal or loss of landscapes characteristic of an area Removal or loss of historic landscapes which are now rare in an area Truncation or disruption of landscapes characteristic of an area	-1 to -4
Effect on Semi-Natural Components How likely is the scenario to disturb historically significant ecosystems or landforms?	Loss of / damage to biodiversity Loss of Ancient Woodland through deforestation Loss of Rough Ground through afforestation or reforestation Loss of old hedgerows through removal or obscuring Disruption to widespread historic ecosystems	-0.5 to -2
Effect on Amenity How likely is the scenario to affect amenity activity?	Loss of places of communal importance Reduction in landscape diversity Loss of Aesthetically and Environmentally important places Change of public access routes	-0.5 to -2

Table 4 Impact values: how the historic landscape may be affected by new woodland creation

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A further step was added to this stage to explore ways in which simple adaptations to the design of a new woodland proposal might mitigate the impact on historic landscape character, thus increasing the capacity of an HLC Type.

Possible adaptations were:[10]
- No site levelling
- Selection of shallower rooting species
- Bespoke planting plan (in respect of on-site features)
- Preservation of historic boundaries
- Restoration of historic boundaries
- Maintenance of existing landscape form
- Preservation of rights of way
- Preservation of historic structures
- Bank stabilisation
- Preservation of historically important ecosystems
- Restoration of (former) woodland
- Planting of large wooded tracts (akin to historic woodland)

Each suggested adaptation was afforded a value of one and added to the total impact value, creating an 'adjusted impact value'.

2.3 Stage 3: Assessing Historic Significance of HLC Types

Historic significance was suggested using two methods. The first used data from the HLC project to determine the occurrence, trajectory of change, biodiversity potential, and period of origin for each HLC type. The second used the results of two surveys: archaeological potential was assigned by the Oxfordshire Archaeological Team and historic, aesthetic, and communal value was assigned using the results of a public survey.[11]

N.B. Types which were only used within Oxford City could not be assigned a Trajectory of Change Value, so it was not possible to assign these types a historic significance value. As a consequence, it was not possible to model these types' capacity for new woodland. Their urban context, however, makes them unlikely candidates for new woodland creation and their absence from the modelling is, therefore, though to be of only limited concern.

Weighting
As with the generation of impact values, historic significance values were weighted, this was to reflect the likely effect on the *historic* aspect of the landscape. These weighted scores ranged from 1 to 7, with one signalling common, rapidly increasing, low biodiversity and archaeological potential, and modern types with low historic, aesthetic and communal value (Table 5).

Occurrence: to differentiate between Very Rare Modern types, which have less of an impact on the historic character of a landscape, and Very Rare Medieval types which would be of more significance, the Occurrence value was further adjusted according to the Period of each type. This was done using the following formula: (Occurrence Value x Period Value)/5. The value was divided by five to give a number between 0 and 6, in line with the other values used.

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[10] This is not an exhaustive list and serves only to highlight the sort of steps which could be taken to reduce the impact of new woodland on the historic character of the landscape. Other adaptations will exist.
[11] For further information on these surveys, see Chapter 5.1.7 of the Oxfordshire HLC Final Report.

Archaeological Potential and Historical Value: to reflect the importance of these values for historic character of a landscape, these values were weighted more heavily than Biodiversity Potential and Aesthetic/Communal Value. These were valued at 1 (low), 3 (medium), or 6 (high).

Significance	Criteria	Weighted Score
Occurrence	How rare or commonplace is an HLC type?	0 (Low) to 6 (High)
Trajectory of Change	Is an HLC Type decreasing or increasing?	1 to 7
Biodiversity Potential	What is an HLC type's potential for biodiversity?	1 to 5
Archaeological Potential	What is an HLC type's potential for preserved archaeological or historic building remains?	1 to 6
Period of Origin	What period does an HLC type tend to date to?	1 to 6
Historical Value	How well does an HLC type link people to the past?	1 to 6
Aesthetic Value	How attractive or inspiring is an HLC Type?	1 to 3
Communal Value	How important is an HLC Type to a community?	1 to 3

Table 5 Significance values: how valuable is a historic landscape type?

2.4 Stage 4: Capacity Modelling and Mapping

The impact value was multiplied by the historic significance value to give an indicator of the capacity for new woodland an HLC Type might or might not have. For the scenario of new woodland creation an adjusted capacity value was calculated using the adjusted impact value multiplied by the total historic significance value.

Impact Value x Historic Significance Value = Capacity for New Woodland Value
Adjusted Impact Value x Historic Significance Value = Adjusted Capacity for New Woodland Value

These two sets of capacity values were divided into quintiles – High, Medium-High, Medium, Low-Medium, and Low – and then mapped. This resulted in two maps of Oxfordshire: *Capacity for New Woodland* and *Adjusted Capacity for New Woodland*.

2.5 Stage 5: Additional Constraints

To these two maps a capacity constraints layer was added which shows parts of Oxfordshire where a designation applies which needs to be taken into consideration in any application for the creation of new woodland (Table 6). It is anticipated that these designations will not necessarily preclude any change of land use to woodland; their presence, however, should form part of any assessment of the suitability of the land and the impact of the proposed application.

Designation (Map key)	Description
World Heritage Site (WHS)	One World Heritage site covering 930 hectares: Blenheim Palace
Scheduled Monument (SM)	291 Scheduled Monuments covering 1,540 hectares
Registered Parks and Gardens (RPaG)	56 Parks and Gardens covering 5,111 hectares
Registered Battlefield (RB)	Two Battlefields covering 339 hectares: Chalgrove (1643) and Cropredy (1644)
Area of Outstanding Natural Beauty (AONB)	Three AONBs covering 66,733 hectares: Cotswold Hills, Chiltern Hills, and the North Wessex Downs
Site of Special Scientific Interest (SSSI)	161 sites covering 4,472 hectares

Table 6 Designated land superimposed on the capacity mapping

Conservation Areas, Archaeological Notification Areas, and Listed Buildings and non-designated Monuments should also be considered when assessing proposals for the creation of new woodland. These were not, however, mapped. Firstly, Oxfordshire County Council only holds information on the Conservation Areas in Cherwell and South Oxfordshire Districts; no mapping was available for the purposes of this study for the districts of West Oxfordshire, Oxford City, and the Vale of the White Horse. Secondly, the Archaeological Notification Areas previously used by the Archaeology Team were only used to indicate where the team would like to be consulted on planning applications and did not directly equate to areas of known heritage assets of importance or areas with the potential for important archaeological deposits. Furthermore, these areas are no longer used or distributed and, consequently, hold little relevance to this analysis. Finally, Listed Buildings and non-designated monuments (heritage assets) recorded by the HER were not mapped as there are too many to display at a county-wide scale: there are 12,113 Listed Buildings and 24,955 heritage assets. It is recommended that people consult the HER directly when considering a proposal and use the data provided by that service alongside this evidence base.

3 Results

HLC Types were initially divided equally between five capacity categories, with 20 or 19 types assigned to each. When the adjusted HLC capacity values were created, however, the established value ranges for each capacity category were maintained, so the number of HLC Types in each category altered, with fewer Types assigned to Capacity Category 1 and more in Category 2 (Table 7).

The HLC Types in each Capacity Category are shown below in Table 8 and the raw data with Impact Values, Historic Significance Values, and Capacity Values are stored in the accompanying Data Table.

Capacity Category	Capacity Value	# HLC Types	# HLC Types when Adjusted
1 – Low	-682.5 to -465	20	6
2	-465 to -216	20	29
3	-216 to -117	20	21
4	-117 to -60	20	20
5 – High	-60 to -39	19	23

Table 7 The number of HLC Types in each Capacity Category

Capacity Category	1 – Low	2	3	4	5 – High
HLC Types	Military – Castle	Rural – Country House	Recreation – Public Park	Rural – Caravan/Chalet/ Camping site	Communication – Main Road
	Military – Hillfort	Rural – Hamlet	Civil Provision – Educational Facility	Reorganised Enclosures	Industry –Energy Industry
	Open Field System	Piecemeal Enclosure	Urban – Town	Prairie / Amalgamated Enclosure	Industry –Extractive Works
	Communication – Ridgeway	Woodland – Woodland Pasture	Recreation – Golf Course	Orchard and Hort – Vineyard	Military – Communications
	Urban – Historic Urban Core	Communication – Canals and Locks	Urban – City	Woodland – Plantation	Commercial- Road Side Service Centre
	Orn –Deer Park	Orchard and Hort – Orchard	Urban – Market	Civic Amenities – Reservoir	Communication – Telecommunications
	Managed Archaeological Site	Rural – Village	Urban – Dwelling	Industry – Manufacturing	Recreation – Hunting Site
	Unenclosed – Rough Ground	Woodland – Secondary Woodland	Enclosure – Paddocks and Stables	Industry – Flooded Extractive pits	Civil Provision – Park and Ride
	Woodland – Ancient Woodland	Planned Enclosure	Recreation –Sports Facilities	Commercial – Fish Farm	Commercial – Shopping Centre
	Orn-Parkland / Designed Landscape	Rural –Farmstead	Military – Shooting Range	Urban – Hotel	Communication – Major Road Junction
	Closes	Orchard and Hort – Allotment	Rural – Dwelling	Civil Provision – Police station	Communication – Motorways
	Crofts (medieval & Post Medieval)	Industry –Mill / Mill Complex	Urban – Public House	Urban – Caravan and Camp site/ chalet site	Commercial –Retail park
	Civil Provision – Religious and Funerary	Recreation – Nature Reserve	Military base	Enclosure – Reclaimed land	Civic Amenities – Waste Disposal
	Assarted Enclosure	Water – Water Meadow	Communication – Airfield (Commercial)	Industry – Processing industry	Civil Provision – Immigration Detention Centre
	Water – River	Communication – Rail transport sites	Orchard and Hort – Nursery/ Garden Centre	Civic Amenities – Sewerage Treatment Works	Commercial – Business Park
	Ancient Enclosure	Water – Watercress Beds	Recreation – Racing Sports Sites	Civil Provision – Prison	Industry – Depot
	Orn –Ornamental water body	Water – Fresh Water Body	Civil Provision – Gov Office and Civic Centre	Civic Amenities – Utilities	Industry –Scrap Yard
	Ladder Field System	Communication – Bike Path/ bridleway	Military – Military Airfield	Military – Barracks	Industry –Timber Yard
	Squatter Enclosure	Orn –Domestic Garden	Civil Provision – Health Care Facility	Recreation – Other Leisure facilities	Industry –Industrial Estate
	Unenclosed – Green	Recreation – Country Park	Rural – Hotel	Recreation – Community Centre	

Table 8 HLC Types in each Capacity Category using the Capacity for New Woodland Value

3.1 Capacity Category 1: Low

HLC Types included in this category are those with the lowest capacity for new woodland; types whose historic character would be most affected by the change of land use to woodland. For example, this might be because a type has good historic legibility which would be obscured by the planting of trees or is typically associated with high archaeological potential which might be susceptible to damage. Types in this category include some of the most historic parts of the county: Castle, Hillfort, Ridgeway, and Historic Urban Core. These types have structures or highly visible features which clearly demonstrate links to the past – the post medieval, medieval, and prehistoric periods – and it is these that are vulnerable to new woodland. A number of enclosure types are also included within this category – Open Field System, Closes, Crofts, Assarted Enclosure, Ancient Enclosure, Ladder Field System, and Squatter Enclosure. These are typically not as old as the types mentioned above, but they frequently date to the post medieval period and, given the large areas they cover, are important for preserving the historic legibility and historic coherence of our landscape.

3.2 Capacity Category 2: Low-Medium

The twenty HLC Types in this category have slightly more capacity for new woodland than those in Category 1, but they are still vulnerable to some of the changes which might be brought about. These types are typically post-medieval in date, but may have seen some adaptation over time which would reduce the potential impact of new woodland. For example, Piecemeal and Planned Enclosure and Secondary Woodland. Types in this category also often cover smaller areas than those in Category 1, so have less of a contribution to local or regional character. This means that a proposed change in land use would potentially have less of an effect. Allotments, Orchards, and Woodland Pasture are good examples.

3.3 Capacity Category 3: Medium

Types in this category often incorporate buildings, such as Educational Facility, Urban and Rural Dwelling, Town and City. These have been assigned a higher capacity for new woodland as the change of land use may be perceived as an improvement to aesthetic and environmental quality. Many of these building related types, however, might be of post-medieval date and preserve some historic structures and legibility, so they have not been assigned to a higher capacity category. Other types are modern, like Sports Facilities and Shooting Range, and are less likely to contribute to historic legibility or preserve archaeological remains or historic structures. Their communal, aesthetic, and environmental value, however, has reduced their capacity for change. There are some non-built types included within this category which cover very large areas and which consequently dominate local character – namely Airfields and Paddocks. Despite being modern types some archaeological potential may remain and some historic buildings may exist. Combined with their dominance, this reduces their capacity for new woodland.

3.4 Capacity Category 4: Medium-High

Types in this category tend to be modern with little historic significance. However, the communal, aesthetic, and/or environmental qualities of these types have reduced their capacity for change. Types include: Reservoir, Hotel, Reclaimed Land, and Police Station. The types Manufacturing and Processing are also included here as they can have some historic value, the Jam Factory and University Press in Oxford, for example. Modern types which often cover large areas and which,

therefore, contribute to local or regional character can also be found in this category – Prairie/ Amalgamated Enclosure and Flooded Extractive Pits are good examples.

3.5 Capacity Category 5: High

Types in this category have the highest capacity for new woodland as they rarely preserve historic legibility or archaeological potential, are not often associated with historic buildings, frequently contribute little to local character, and have been assigned low communal, aesthetic, and/or environmental value. Whilst these types may have a high capacity they might not necessarily be suitable for new woodland. Modern infrastructure types, for example, feature largely in this category – Main Road, Motorway, Major Road Junction, Road Side Service Centre, Communications, and Telecommunications. Industrial and Commercial types may be more appropriate – Extractive Works, Industrial Estates, former Retail and Business Parks, Timber and Scrap Yards – but site preparation may not be cost effective. However, these are the types which have been found the most suitable from the point of view of the preservation of the historic landscape for new woodland.

3.6 Adjusted Capacity Values

Mitigation strategies to increase the capacity for new woodland were, where relevant, suggested for each HLC Type. These strategies comprised a series of simple adaptations which could be applied to any proposals for new woodland to better manage and preserve historic landscape character.

Suggested adaptations were:
- No site levelling
- Selection of shallower rooting species
- Bespoke planting plan (in respect of on-site features)
- Preservation of historic boundaries
- Restoration of historic boundaries
- Maintenance of existing landscape form
- Preservation of rights of way
- Preservation of historic structures
- Bank stabilisation
- Preservation of historically important ecosystems
- Restoration of (former) woodland
- Planting of large wooded tracts (akin to historic woodland)

Where an adaptation could be applied the capacity value was increased by one. For example, where a proposal for new woodland affected an Ancient Enclosure, the following simple steps could be taken to account for the historic landscape properties of the current land use:
- Preservation of historic boundaries – to maintain historic legibility
- Maintenance of existing landscape form – to maintain historic legibility
- Selection of shallower rooting species – to reduce impact on any buried archaeological remains

Thus, with three possible adaptations, the capacity value for Ancient Enclosure could be increased from -489.6 (-16 x 30.6) to -397.8 (-13 x 30.6), taking this HLC Type from Category 1 (Low) to Category 2 (Low-Medium).

The new division of HLC Types between the five capacity categories is shown below in Table 9 and the raw data showing the Adjusted Impact Values, Historic Significance Values, and Adjusted Capacity Values are stored in Appendix 1.

Adjusted Capacity Category	1 – Low	2	3	4	5 – High
HLC Types	Military – Castle	Rural – Hamlet	Water – Watercress Beds	Rural – Caravan/Chalet/ Camping site	Industry – Processing industry
	Urban – Historic Urban Core	Communication – Ridgeway	Civil Provision – Educational Facility	Reorganised Enclosures	Industry –Energy Industry
	Military – Hillfort	Managed Archaeological Site	Urban – Town	Orchard and Hort – Nursery/ Garden Centre	Civic Amenities – Utilities
	Civil Provision – Religious and Funerary	Rural – Village	Water – Water Meadow	Orchard and Hort – Vineyard	Military – Communications
	Water – River	Unenclosed – Rough Ground	Urban – City	Woodland – Plantation	Military – Barracks
	Open Field System	Closes	Urban – Market	Civic Amenities – Reservoir	Commercial- Road Side Service Centre
		Crofts (medieval & Post Medieval)	Recreation – Country Park	Military base	Communication – Telecommunications
		Woodland – Ancient Woodland	Urban – Dwelling	Prairie / Amalgamated Enclosure	Recreation – Hunting Site
		Ancient Enclosure	Communication – Bike Path/ bridleway	Urban – Hotel	Communication – Main Road
		Ladder Field System	Orn –Domestic Garden	Civil Provision – Police station	Civil Provision – Park and Ride
		Squatter Enclosure	Recreation – Public Park	Communication – Airfield (Commercial)	Commercial – Shopping Centre
		Orn –Ornamental water body	Military – Shooting Range	Industry – Manufacturing	Communication – Major Road Junction
		Assarted Enclosure	Rural – Dwelling	Military – Military Airfield	Communication – Motorways
		Rural – Country House	Enclosure – Paddocks and Stables	Urban – Caravan and Camp site/ chalet site	Civic Amenities – Sewerage Treatment Works
		Communication – Canals and Locks	Urban – Public House	Industry – Flooded Extractive pits	Industry –Extractive Works
		Unenclosed – Green	Recreation –Sports Facilities	Commercial – Fish Farm	Commercial –Retail park
		Orchard and Hort – Orchard	Recreation – Golf Course	Enclosure – Reclaimed land	Civil Provision – Immigration Detention Centre
		Piecemeal Enclosure	Recreation – Racing Sports Sites	Civil Provision – Prison	Commercial – Business Park
		Orn –Deer Park	Civil Provision – Gov Office and Civic Centre	Recreation – Other Leisure facilities	Industry – Depot

Orn-Parkland / Designed Landscape	Civil Provision – Health Care Facility	Recreation – Community Centre	Industry –Scrap Yard
Woodland – Woodland Pasture	Rural – Hotel		Industry –Timber Yard
Industry –Mill / Mill Complex			Industry –Industrial Estate
Planned Enclosure			Civic Amenities – Waste Disposal
Orchard and Hort – Allotment			
Rural –Farmstead			
Recreation – Nature Reserve			
Woodland – Secondary Woodland			
Water – Fresh Water Body			
Communication – Rail transport sites			

Table 9 HLC Types in each Capacity Category using the Adjusted Capacity for New Woodland Value

3.7 Mapping Capacity for New Woodland

Using an Attribute query in MapInfo it was possible to append the Capacity Category and the Adjusted Capacity Category to the HLC table using the HLC Type, thus linking these categories to each and every polygon in Oxfordshire. The table below (Table 10) shows how many polygons were assigned to each category, with Category 2 (Low-Medium) and Category 4 (Medium-High) being the most common.

The table also shows how, by taking into account some possible adaptations to new woodland proposals, far fewer polygons have been categorised as Category 1 (Low Capacity) and slightly more polygons have been categorised as Category 5 (High Capacity).
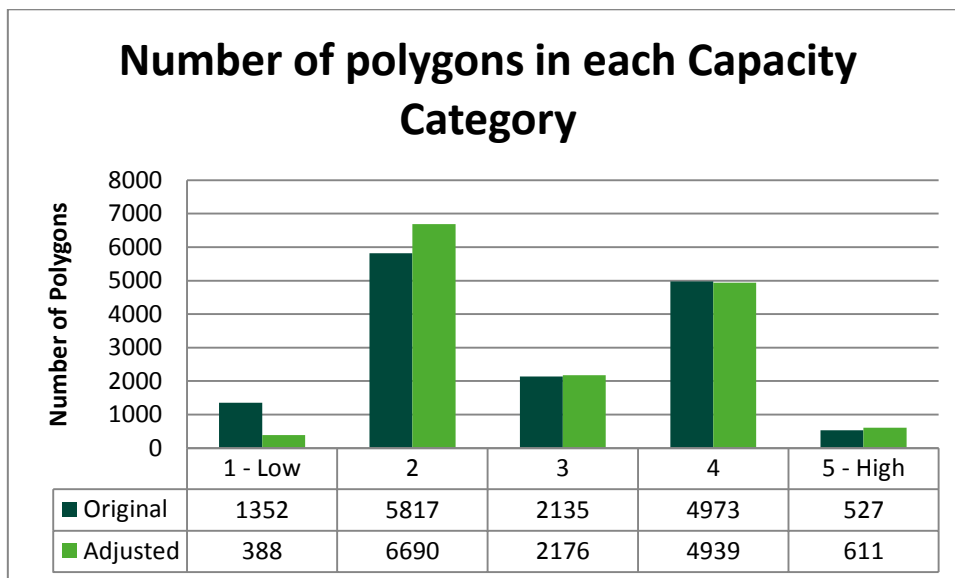

Number of polygons in each Capacity Category

	1 - Low	2	3	4	5 - High
Original	1352	5817	2135	4973	527
Adjusted	388	6690	2176	4939	611

Table 10 The number of polygons assigned to each Capacity Category and each Adjusted Capacity Category

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Using the updated HLC table it was possible to map the distribution of capacity for new woodland. When the total area of Oxfordshire covered by each Capacity Category was analysed, it showed very similar results to Table 10, with Categories 2 and 4 being the most common (Table 11). This table also shows how, by making simple adjustments, 20,476 hectares of Oxfordshire could be moved from Category 1, which has the lowest capacity for new woodland, to Category 2, which has a higher capacity. It also shows how 475 additional hectares could be categorised with the highest capacity, just by making a few simple adjustments to the proposed development.

Area of Oxfordshire covered by each Capacity Category

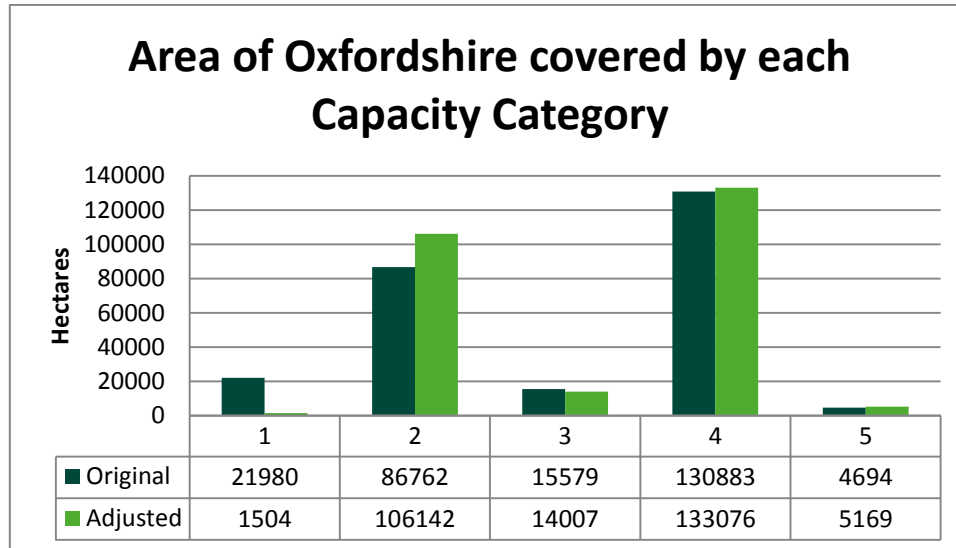|	1	2	3	4	5
Original	21980	86762	15579	130883	4694
Adjusted	1504	106142	14007	133076	5169

Table 11 Total Area of Oxfordshire covered by each Capacity Category and each Adjusted Capacity Category

Two maps were produced which show how the capacity for new woodland varies across the county, the first using the original Capacity Categories and the second using the adjusted categories. These maps show constraint layer overlays to identify World Heritage Sites, Scheduled Monuments, Register Parks and Gardens, Registered Battlefields, Areas of Outstanding Natural Beauty, and Sites of Specific Scientific Interest.

The capacity for new woodland in Oxfordshire maps are available as pdfs and as GIS shapefiles, both available from the project archive. The GIS shapefiles contain information on both the original and adjusted Capacity Categories. It is also possible to explore an interactive map online here.

It should be emphasised that these maps represent a snapshot point in time. Landscape change is a continuous process and, therefore, these maps should be seen as a guide for what might be achieved with this data. When considering an application for new woodland or identifying a potential site, the current land use should be established and then located within the accompanying Data Table, where information on how new woodland might affect aspects of historic character, the Capacity Category, and steps which could be taken to improve capacity are stored for each HLC Type.

3.7.1 Capacity Map

Figure 1[12] suggests that the areas around the Chiltern Hills and Cotswold AONBs and in the northern part of the county have the lowest capacity for new woodland. This is due to the concentration of a series of HLC Types with Low or Low-Medium capacity, including: Ancient Woodland, Ancient Enclosure, Parkland, and Planned and Piecemeal Enclosures. Areas with the highest capacity include

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[12] A larger version of this map is reproduced in the accompanying map tiff file.

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large parts of the Vale of the White Horse in the southwest of the county, land around the villages north of the Chiltern Hills, and a corridor between Bicester and Oxford. These parts of the landscape have seen a high degree of change and comprise typically modern HLC Types which are less sensitive to new woodland. Typically, in these areas, these are Reorganised Enclosures and Prairie/Amalgamated Enclosures.

This map also shows some correspondence between areas of low capacity and designated landscapes included within the constraints layer. Register Parks and Gardens, for example, directly relate to the HLC Types Parkland and Deer Park, both of which are categorised as having a low capacity. The only World Heritage Site in Oxfordshire, Blenheim Park, is also characterised as the type Parkland and is consequently also afforded a low capacity for new woodland. Other features which appear on the constraints layer are found within areas thought to have a higher capacity for new woodland. Scheduled Monuments, in particular, are often found within Reorganised or Prairie/Amalgamated Enclosures. This is due to HLC Types deriving from dominant landscape character and many SMs not being large enough to affect character or indeed be captured by the HLC project, which used a digitisation minimum of two hectares. Additionally some designated features do not affect landscape character, battlefields and buried archaeological sites, for example.

These distinctions between the datasets serve to show how important it is to consider other aspects which might affect capacity for change, not just historic landscape character. These constraints along with historic landscape character do not serve as a barrier to new woodland, but should be considered in any application in order that important heritage assets and landscapes of environmental and historical importance are better managed for future generations.
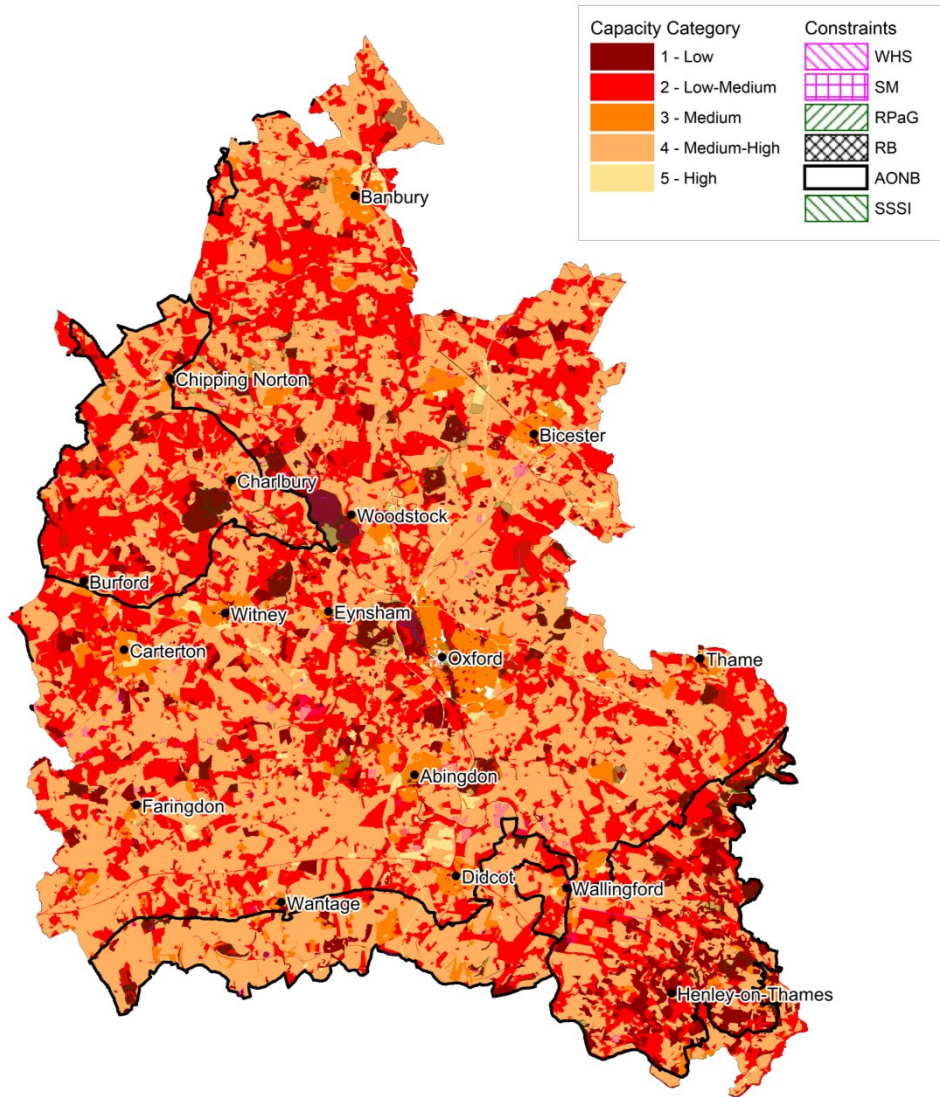
Figure 1 Capacity for New Woodland in Oxfordshire

3.7.2 Adjusted Capacity Map

Through applying a few examples of possible adaptations to new woodland design proposals, Figure 2[13] was created using an Adjusted Capacity Category. This shows just how much of a positive impact some careful design updates could have and how capacity for new woodland might be increased. Those geographic areas with the highest and lowest capacity remain broadly the same, but the overall impact on historic landscape character has been reduced, with many Category 1 HLC Types having been promoted to Category 2 and many Category 3 types moving to Category 4.
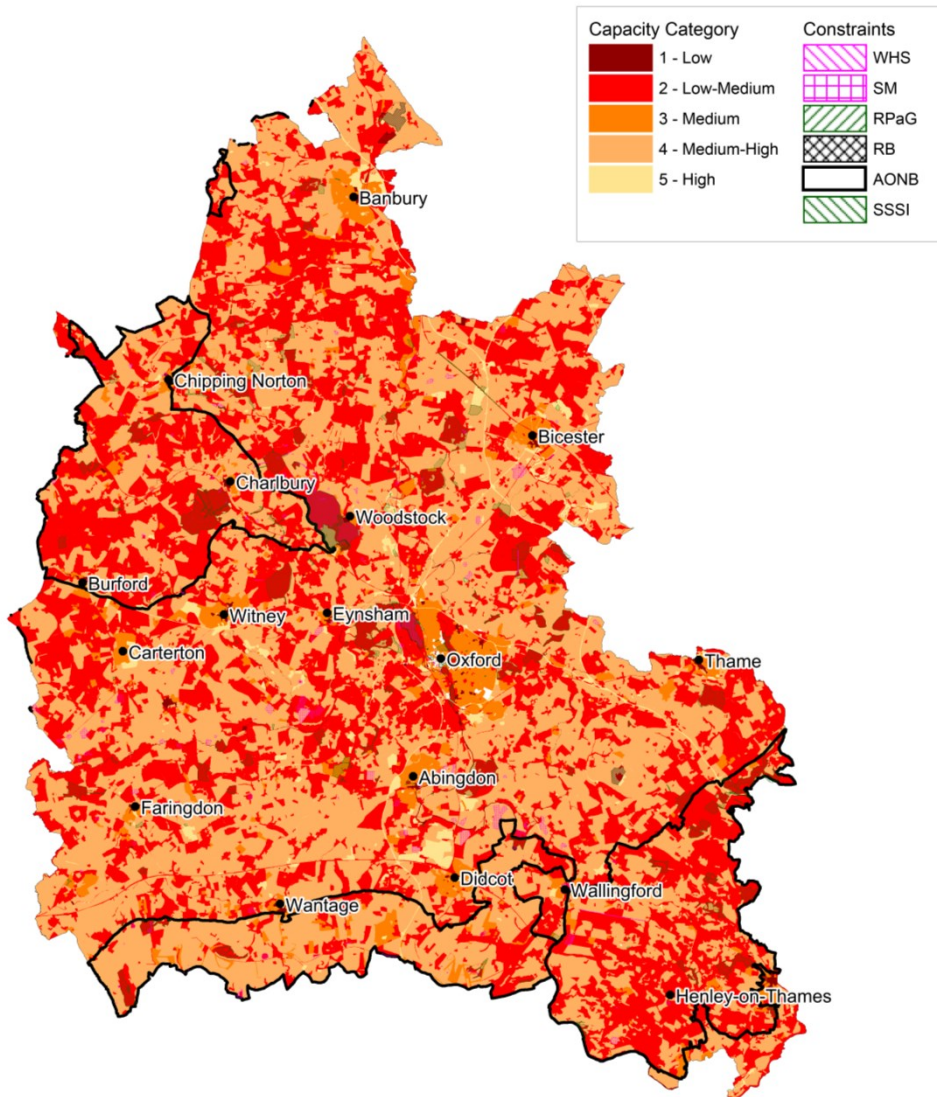

Figure 2 Adjusted Capacity for New Woodland in Oxfordshire

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[13] A larger version of this map is reproduced in the accompanying adjusted map tiff file.

4 Conclusion

This research has resulted in a dataset which can be used to promote sustainable development. The historic environment, whether that be ancient monuments, historic buildings, or whole landscapes is the inheritance of us all and it is our responsibility to manage its character for future generations. The National Planning Policy Framework (NPPF) recognises the significance and fragility of this resource and requires the consideration of the historic environment in applications for change of land use.[14]

As an evidence base, this dataset can be used to identify parts of the landscape where new woodland is likely to have the greatest and the lowest impact on the character of the historic landscape. It is, therefore, an excellent tool to aid in the identification of new woodland sites. In addition, it has suggested a series of ways in which simple adaptations to the design of new woodland can mitigate any impact, thus better managing and preserving historic character.

Finally and going one step further, this research can aid in the identification of areas and landscape types where new woodland might actually enhance historic landscape character.

4.1 Where might new woodland enhance historic landscape character?

In this research twelve possible adaptations were suggested which, if implemented, could reduce the impact of new woodland on the historic environment. These twelve suggestions are just examples and many others will exist. However, amongst the adaptations set out here there are three which could be used to not only reduce impact but also *enhance* the historic environment:

- Restoration of historic boundaries
- Restoration of (former) woodland
- Planting of large wooded tracts (akin to historic woodland)

Restoration of historic boundaries – the reinstatement of boundaries which previously divided the landscape, but which might have been removed through agricultural reorganisation or change of land use. These can be identified using historic maps or in consultation with the HERO or the local Records Office. Strategies to restore these boundaries might include: the position and shape of the new woodland to respect, mark, and delimit these; the locating of internal paths within the site along the route of former boundaries.

Restoration of (former) woodland – the planting of woodland on land which was historically wooded, but which has been cleared since the 17th century.[15] Former woodland can be identified using historic maps and the HLC dataset.

Planting of large wooded tracts (akin to historic woodland) – the creation of large, coherent areas of woodland whose layout is inspired by natural and historic woodland. Strategies might include:

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[14] See Chapter 12 of the National Planning Policy Framework for further information about the Historic Environment
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

[15] It is understood that in prehistory huge areas of the UK were wooded; however, the restoration of former woodland referred to here relates to woodland which has been cleared since the 17th century. The 17th century was chosen due to Natural England's classification of woodland in existence prior to 1650 as 'Ancient Woodland' and due to the huge amount of landscape change since the 17th century brought by widespread enclosure of land and an increased rate of settlement expansion.

species selection appropriate to local area; natural planting patterns; irregular perimeter boundaries; large woods in contrast to small copses.

Additional ways in which new woodland could enhance historic character might include:

- Investigation of any identified heritage assets on site and the placement of information panels in publically visible locations.
- Clearing of vegetation from overgrown heritage assets identified on site.
- Restoration of historic rights of way or common access – many parts of the landscape in the medieval and post-medieval period held rights for common access and use. By restoring access to land which may have been privatised, this historic use of the landscape can be returned. Areas of former common land can be identified by using historic maps and the HLC dataset.

Certain current and former HLC Types would particularly benefit from new woodland. Assarted Enclosures are fields which have been created through the clearance of woodland. The restoration of woodland on sites identified as assarts would, therefore, be particularly appropriate. Similarly, where Ancient and Secondary Woodlands have been recorded as a previous HLC Type, new woodland could return a historic landscape feature to an area. Where new woodland plans to permit public access, some aspects of the historic character of former commons could also be restored. In Oxfordshire, these commons are recorded as the HLC Type 'Rough Ground'.