Biocultural heritage:

mapping heritage opportunities for nature and climate

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McCord Centre Report 2023.1

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Biocultural Heritage: Mapping Heritage Opportunities for Nature and Climate

Introduction

In November 2022, the McCord Centre for Landscape was commissioned by the National Trust to undertake a pilot project designed to develop and test a methodology for mapping heritage opportunities for nature and climate. The McCord Centre submitted a brief in response to the National Trust's Brief for Consultants entitled 'Biocultural heritage: mapping heritage opportunities for nature and climate' (Appendix Two). At present there is no defined methodology for identifying, collating and presenting data, to enable landscape managers to identify opportunities afforded by the historic environment at a landscape scale to support The National Trust's nature and climate decision-making, The pilot project was designed to explore the potential to develop a methodology that could be extended nationally.

The rationale for the project is a result of the National Trust's (NT) commitment to landscape-scale land-use change in support of its ambitions for nature and carbon sequestration. As part of this commitment, NT intends to restore and establish carbon-rich habitats, including 20 million trees by 2030. The Trust intends to deliver this change in a way that supports its other objectives, including landscape and heritage. For example, resilient landscapes will reflect the history and natural processes that have shaped them, providing distinctive local character; and heritage and landscape assets will be sensitively managed, providing a means to deliver positive land management and engagement opportunities for the public.

Large-scale biodiversity renewal projects (through programmes such as Accelerator Places, Riverlands, Landscape Recovery Schemes, Peatlands, Community Forests) provide huge opportunities for restoration and creation of priority habitats. The historic environment affords enormous opportunity to support decision-making that can deliver for nature and climate, support restoration and creation of priority habitats, and strengthen, re-create or create resilient landscapes which provide distinctive local character and enable heritage assets to be managed sensitively.

Two National Trust estates were chosen for the pilot study: Killerton in Devon and Coleshill and Buscot, which mostly lies in Oxfordshire with a small part in Wiltshire (Figure 1). These two areas were chosen as they were within the study areas for a previous project carried out by Peter Herring and the McCord Centre for Landscape for Historic England and the Environment Agency. That project developed an approach utilising Historic Landscape Characterisation as a systematic representation of the whole of the country's historic environment in assessing how heritage can be 'part of the solution' to the climate change challenge (Herring *et al* 2022). This project for the National Trust is intended to build upon the previous work for the Environment Agency.
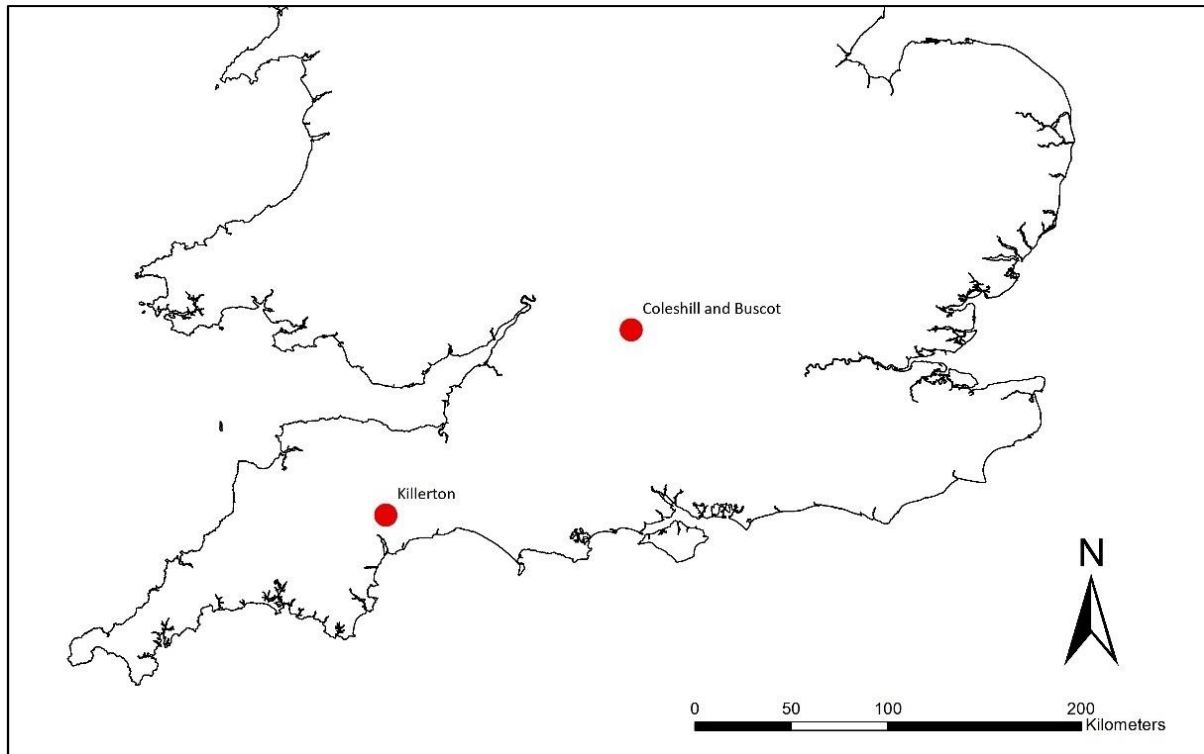
Figure 1: Location of the Killerton, and Coleshill and Buscot National Trust estates

Research Aims and Objectives

Research Aims

- To develop an outline methodology using historical spatial data to identify opportunities for historic environment-led habitat creation at a national and regional scale, and to assess its limitations and applications.
- To create an 'unconstrained map of possibilities' that can provide a starting point, grounded in the historical character of places, for discussions and options at different levels from local properties upwards. It should be noted that the details of any habitat creation will always need to be worked out at a local level where consideration of impacts, significance and constraints will need to be addressed.
- To gain an understanding of the suitability of different historic environment data, especially historic landscape and historic landscape character data, for identifying opportunities. In particular, which heritage asset types may 'afford' particular opportunities for nature and climate.

Objectives

- To use a GIS-based methodology based on that initiated for the Environment Agency and Historic England by Herring *et al* (2022).
- To use HLC data, additional historic environment spatial data sets, historic Ordnance Survey maps, tithe maps, place names and other relevant data identified during the project, in order to identify opportunities for habitat creation.

- To determine a set of change scenarios, in discussion with the National Trust, which can be scored as opportunities against the HLC and historic environment data.
- To develop a simple scoring system that can be applied across National Trust properties in order to create an 'unconstrained map of possibilities'.
- To produce a clearly structured, interactive, prototype GIS tool. The tool will provide a means of presenting the spatial data and indicate the opportunities for habitat creation for the selected areas of study with appropriate pre-processing, to enable users to interrogate/visualise the opportunities derived from different sources or in relations to different priority habitat types.

Methodology

Data Sources: Vector.

The project was entirely desk-based, using datasets provided by the National Trust, Historic England and other sources including print and available online. The National Trust provided digital datasets of the relevant estate boundaries and their Historic Buildings, Sites & Monuments Record (NT HBSMR). NT HBSMR data was in the form of vector points, polylines and polygons. Historic England listing data, with vector polygons on scheduled monuments and registered parks and gardens, were downloaded from the Historic England portal (Historic England 2023b). Historic England also provided GIS data polygons from the aerial mapping programme for the Killerton estate (see Appendix Three for licence agreement). Although the Coleshill and Buscot estate had also been covered by the mapping programme, the data was not available digitally and the Historic England Aerial Archaeology Mapping Explorer portal (2023a) shows that sites have already been transferred to the Oxfordshire Historic Environment Records and, where relevant, are also recorded on the NT HBSMR.

The Historic Landscape Characterisation data was downloaded from the Archaeology Data Service Historic Landscape Characterisation page (Historic England 2018). The Killerton estate was covered by the Devon HLC dataset (Turner 2015) was available as a whole dataset, but it was also possible to download disaggregated HLC data for the modern landscape, the post medieval landscape, orchards and field boundary loss. The Coleshill and Buscot estate was mostly covered by the Oxfordshire HLC (Tompkins and Malone 2018). The south western part of the estate lies within Wiltshire, and was covered by that HLC (Sunley 2017). Both HLCs for Oxfordshire and Wiltshire had to be downloaded as a whole.

The development of HLC as a tool that enables the historic environment in its entirety to be considered alongside other aspects of place (natural environment, landscape, land use, etc.) when considering management and change has been discussed in detail elsewhere (Herring *et al* 2022). Study areas are divided into polygons based on shared historical attributes and ascribes each polygon to one of a series of HLC Types according to its predominant character. Each HLC is particular to its own county or area (some cover AONBs or National Parks), but all have a common set of principles and follow the same basic method, mapping Broad Types and more specific Types. A thesaurus for Historic Characterisation gathers together the various HLC types employed in England (Fish 2015).

Data Sources: Raster.

Modern and historic Ordnance Survey maps were download from the EDINA Digimap Service (2023). Modern maps at a scale of 1:25,000 were used as background images for the

project mapping. The map tiles were clipped to the search areas and comprised tiles ss80, ss90, sp10, sp20, st00, su18, su19, su28, su29, sp30, su38, su39, sx89, sx99 and sy09. Historic mapping comprised first and first revision editions of the six inch to one mile (1:10,560) maps of each area. The Coleshill and Buscot estate now lies mostly in Oxfordshire close to the modern boundary, with a small section south west of Coleshill in Wiltshire. The northern boundary of the estate lies on the border between Oxfordshire and Gloucestershire but, historically most of the estate lay within Berkshire. The following table lays out the historic map tiles downloaded from Digimap for each area.

Table 1: Ordnance Survey 1:10,5060 map tiles for Killerton, and Coleshill and Buscot

Killerton	1st edition 1891	1st revision 1906
	ss90ne, ss90nw, ss90se, ss90sw, st00nw, st00sw, sx99ne, sx99nw, sx99se, sx99sw, sy09nw, sy09sw	
Coleshill and Buscot	1st edition 1883	1st revision 1900
Berkshire	sp20se, sp30se, sp30sw, su18ne, su19ne, su19se, su28ne, su28nw, su28se, su28sw, su29ne, su29nw, su29se, su29sw, su38ne, su38nw, su38se, su38sw, su39ne, su39nw, su39se, su39sw	
Gloucestershire	sp00ne, sp00se, sp10ne, sp10nw, sp10se, sp10sw, sp20ne, sp20nw, sp20se, sp20sw, su09ne, su09se, su19ne, su19nw, su19se, su19sw, su29ne, su29nw	
Oxfordshire	sp10ne, sp10se, sp20ne, sp20nw, sp20se, sp20sw, sp30ne, sp30nw, sp30se, sp30sw, su19ne, su29ne, su29nw, su39ne, su39nw	
Wiltshire	sp10se, sp10sw, sp20sw, su08ne, su08se, su09ne, su09se, su18ne, su18nw, su18se, su18sw, su19ne, su19nw, su19se, su19sw, su28ne, su28nw, su28se, su28sw, su29nw, su29se, su29sw, su38sw	

As the dates of the first edition Ordnance Survey maps were late nineteenth century, it was initially intended that the project would also use tithe maps, where available. There was no available online and downloadable tithe map for that small part of Coleshill and Buscot that lies in Wiltshire. The Berkshire tithe maps for Buscot (BRO D/P30/27B) and Coleshill (BRO D/D1/40/1) can be browsed online, but the maps are not georeferenced and the accompanying awards are not available. The Devon tithe maps and apportionments are available online. Though the maps can only be browsed, it is possible to download the apportionments as CSV or PDF files. The Broadclyst tithe map and apportionment of 1842, which covers most of the Killerton estate, is available online (Devon County Council 2023). The apportionment can be downloaded, but the map must be browsed online. It was thus possible to look up tithe map information for individual polygons, but other than for occasional queries, it proved too time-consuming to use it systematically.

The land-cover map 2007 (Morton *et al* 2011) was download from the EDINA Environment Digimap Service (2023). The map recorded land cover based on parcels greater than 0.5ha

and the classifications are based on UK Biodiversity Action Plan (BAP) Broad Habitats (Morton *et al* 2011, 3-4). Although the map was recorded originally as vector data, the downloadable version available through Digimap was a raster image; thus it was of only limited value to this project. The map did not add any new information compared to that provided by the HLC.

Other Data Sources

There is a range of secondary sources that could be used to inform on past land use, such as the Victoria County History (VCH)series. The Buscot and Coleshill estate, now in Oxfordshire, is mostly covered by the Victoria County History of Berkshire (Page and Ditchfield 1924); however, there is no VCH that covers the Killerton estate. The late eighteenth-century general view of agriculture county surveys were assessed for both Devon (Fraser 1794) and Berkshire (Pearce 1794), but they were too general in scope to be of use in this project. Where required, place-name evidence was used to inform on possible past land use and on the potential for archaeological evidence, but it was not used consistently. Place-name evidence was used mostly where the HLC had already recorded them. As there was no access to local place-name studies, three general works were used. Two (Gelling and Cole 2000; Mills 1991) focussed on place-names and place-name elements in general, and one (Field 1972) was on field names. The online resource Key to English Place-Names (University of Nottingham 2023) was not used as it covers towns and villages, rather than field and landscape names, which were more relevant to this project. Secondary sources such as the VCH volumes and place-name studies can provide valuable background information, but the detailed research required would have gone beyond the scope of the project.

Online sources were used mainly to clarify questions arising from the archaeological data from Historic England and from the NT HBSMR. The sources comprised lidar, and aerial and satellite imagery. Lidar data was browsed through the National Library of Scotland's Side by Side viewer (National Library of Scotland 2023). Satellite Imagery was browsed using Google Earth Pro's Historical Imagery tool.

Data Preparation

The first step was to create polygons defining the study areas for each estate. The National Trust GIS data for its estate boundaries is divided into components, according to the land holder, and excludes public highways. In order to simplify each study area, a polygon was drawn around the limits of the estates. Killerton could be encompassed by a single polygon (Figure 2), but Coleshill and Buscot (Figure 3) included some detached areas around Kelmscott plus one parcel north of Faringdon.

Once the areas of interest had been defined, HLC data was added and clipped to the study areas. Where there were polygon slivers on the edge of the study areas, these were removed. For Killerton, this only comprised the Devon HLC, where it was decided to use the modern landscape polygons that had been disaggregated from the main HLC table. The modern landscape polygons contained enough data to inform on past and present-day character. HLC data for the Coleshill and Buscot area involved adding layers from the Oxfordshire and Wiltshire HLC, both of which were only available in their original complete forms and thus had to be simplified.
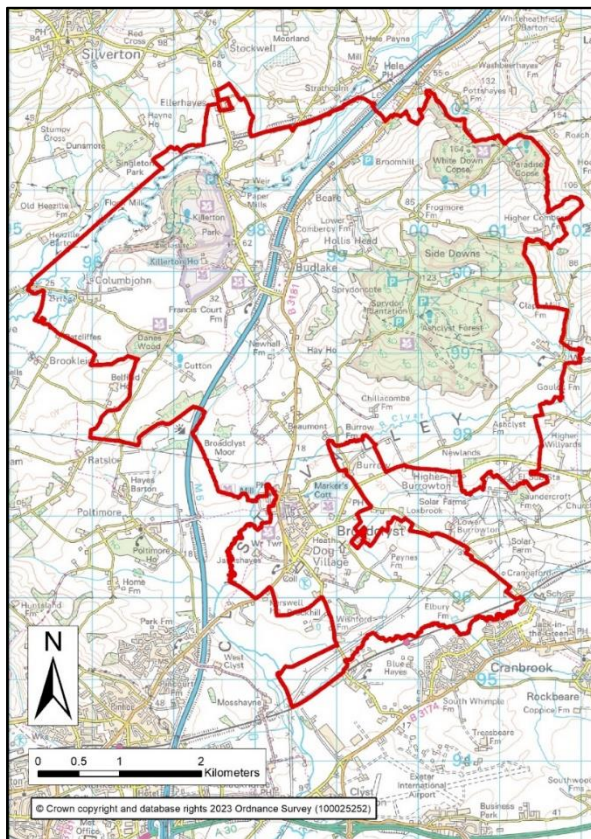
Figure 2: The extent of the Killerton estate
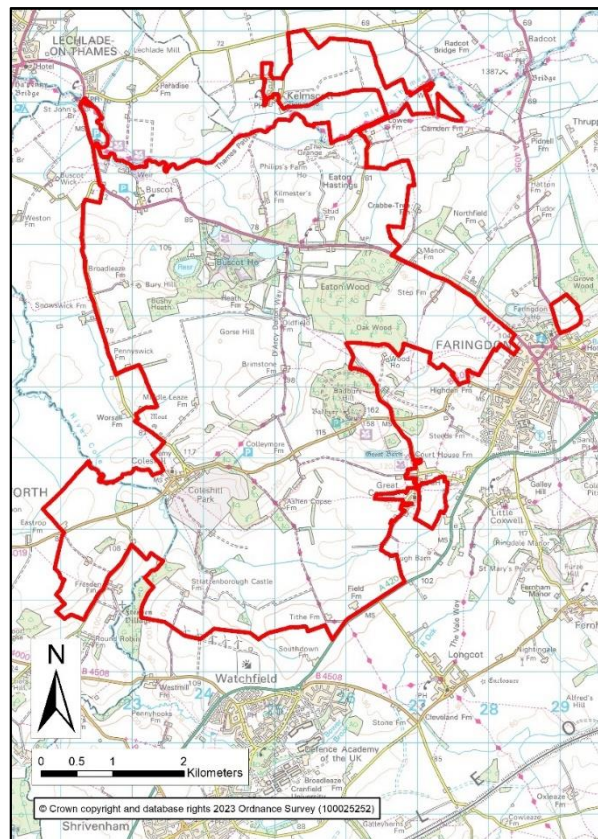
Figure 3: The extent of the Coleshill and Buscot estate

Once the HLC data had been clipped to the study areas, attribute fields were removed that were considered unnecessary to the project. Fields that were removed included data on boundary and field shape, interpretation of earlier character and confidence ratings, as well as administrative fields. The disaggregated data from Devon and the Oxfordshire and Wiltshire HLCs all had Description attribute fields that provided information on previous character and interpretation, and were considered to be sufficient for the purposes of this project. Where this was not already within the Description field, the information was added from other fields. Once the attribute tables of the Oxfordshire and Wiltshire HLCs had been simplified and checked to ensure they were compatible, the two datasets were merged into one. The simplified datasets were saved as new shapefiles, one for Killerton and one for Coleshill and Buscot.

The three HLCs were designed to be specific to each county. Devon was the earliest to be completed, and both Wiltshire and Oxfordshire were carried out over a similar period using the same GIS and database software (Tompkins and Malone 2018; Sunley 2017). The HLC data for the Coleshill and Buscot estate were therefore compatible across the county boundary and could be easily combined. The Devon HLC was completed in 2005 (Turner 2015) and differed in some of the HLC Types used. In order to ensure that the two areas are comparable, a simplified system of HLC types (recorded under a 'Simple HLC' field) was used for both areas. The simplified HLC Types were taken from the previous project undertaken by Herring *et al* (2022). The following table sets out the HLC types for each county and the new simplified form.

Table 2: Concordance of HLC type attributes into simplified types

Simplified HLC Type	Devon	Oxfordshire	Wiltshire
Ancient enclosures	Strip fields Medieval strip-enclosures Medieval enclosures (from strip fields) Medieval enclosures Barton fields Post medieval enclosures (strips) Post medieval enclosures (with medieval elements)	Open field system Ancient enclosure Piecemeal enclosure	
Small enclosures	Former orchards	Closes Crofts Squatter enclosure Assarted enclosure Paddocks and stables Reclaimed land	Paddocks
Regular enclosures	Post medieval enclosures Post medieval enclosures from rough ground	Ladder field system Planned enclosure	Planned enclosure Meadows*
Modern enclosures	Modern enclosures Former airfields	Prairie/amalgamated enclosure Reorganised enclosure	Prairie fields
Watermeadow	Watermeadow Post medieval watermeadow Old watermeadow	Watermeadow	
Orchards and Vineyards	Orchards	Orchards Vineyards	
Parkland	Park/garden	Parkland/designed landscape and deer park Public park	
Ancient woodland	Ancient woodland	Ancient woodland	Coppice
Secondary woodland	Other woodland Woodland with old field boundaries Conifers	Secondary woodland Plantation	
Unenclosed and unimproved	Rough ground Rough ground with former enclosure Rough ground with mining remains Rough ground with prehistoric remains	Rough ground Green	

* There was one instance of a meadow recorded on the Wiltshire HLC, as a sub-type of fields and enclosed land, a category not included in Devon or Oxfordshire. There are clearly areas in

Oxfordshire, for example along the River Thames, of enclosures that would have been used as meadow, including one area that has been characterised as rough ground. In Devon, these areas have usually been characterised as former watermeadow or as specific types of enclosure.

The HLC types set out above are not comprehensive, but only represent those found within the study areas. If the project were to be widened out to cover other parts of the country, then the character types would have to be expanded, to include all the types presented in the previous project (Herring 2022) as well as others not found in Devon and Oxfordshire.

Opportunities for Biocultural Heritage

The previous project, undertaken for Historic England and the Environment Agency, examined eleven change scenarios related to flood alleviation. The NT wanted this project to examine wider opportunities for the historic environment, looking at how it could help achieve the Trust's ambitions for landscape-scale land use in support of its ambitions for nature and carbon sequestration. As part of this commitment, NT intends to restore and establish carbon-rich habitats, including 20 million trees by 2030. In discussion with the NT, a range of change scenarios was agreed. Whilst acknowledging that these scenarios were not comprehensive, they were intended to test the development of a GIS-based tool to help decision-making. In discussion with the NT, the following change scenarios were agreed:

- *Woodland restoration/creation*. To include new areas of planting, replanting former areas of woodland, or replacing coniferous species with native tree species in existing woodland. It could also include wood pasture, wood pasture and small areas of planting in field corners or edges. This change scenario is not intended to cover individual tree planting but could include the restoration of ornamental planting within parkland, in conjunction with other conservation advice.
- *Orchard restoration/creation*. Devon, in particular, has lost numerous orchards but in both areas, many have been lost which were very small and often around farmsteads. Larger areas of orchards have also been lost. Oxfordshire also had plant and tree nurseries, marked on the 1st edition OS map, and these could be restored as orchards.
- *Field boundary restoration/creation*. The HLC projects usually recorded instances of boundary loss, particularly since the 1st edition OS maps. In Devon, boundary loss is significant as it was an area of small fields. In Oxfordshire and Wiltshire, boundary change is often associated with field reorganisation and, where fields were usually larger than those in Devon, boundaries were often added or moved. Field boundary creation and restoration could include putting back lost boundaries, but could also mean restoring existing boundaries, where hedgerows have been replaced by fencing, for example.
- *Wetland creation*. Former wetlands, such as meadow, were not really recorded within the two study areas, apart from one example of meadow from the Wiltshire HLC. In Devon, many of the low-lying riverside areas were recorded as watermeadow (see below). There is an opportunity to create wetlands or washlands in fields alongside rivers, to restore more meandering river course, plant reed beds and wet woodland, or even to create water storage areas.
- *Watermeadow restoration* (Devon only in this project). Although watermeadows were recorded in the Oxfordshire HLC, none were contained within the study area for Coleshill and Buscot. Many examples were recorded within the Killerton estate study

area, and they could be restored or, in the case of low-lying catch-meadows, be
adapted as wetlands.

Recording Biocultural Opportunities

As there was no defined methodology for mapping heritage opportunities for nature and
climate, three approaches were used, which are compared and contrasted in this report.
Method one took a more detailed approach, assessing each HLC polygon individually against
the agreed sources in order to score the potential of opportunities for biocultural heritage
against each of the change scenarios set out in the previous section. Method two took a
more light-touch approach, with the aim of assessing the potential for biocultural heritage
more rapidly. The range of sources assessed were more limited and scores were assigned to
batches of polygons sharing the same characteristics, and using Herring *et al* (2022) as
guidance on the level of scoring. Following the completion of methods one and two, a third
option was developed, using a combination of elements from the first two and tweaking the
scoring of some HLC Types to better reflect the opportunities for change they presented.

Method One: Detailed Recording of Historic Environment Opportunities

The revised HLC Shapefiles formed the basis of the new Shapefile layer for recording historic
environment potential to inform environmental change. The new Shapefile was named
Historic Environment Opportunities. Each Shapefile retained most of the original polygons
recorded by each HLC project, although it was decided to remove settlement polygons
covering built-up areas (e.g. villages). In the case of the Oxfordshire HLC, there were some
multi-part polygons (particularly for woodland) which were exploded into discrete polygons.

New attribute fields were added to the revised HLC data Shapefiles (see Data Preparation,
above), one for each possible change scenario. A 'Score' field was also added, recording the
total score across all change scenarios, to give an overall indication of the historic
environment potential for biocultural heritage. The existing description field was used to
briefly record what the historic environment data was for each HLC polygon. A 'Source' field
was also added to record data sources that informed further on the historic environment
(see Data Sources: Raster, and Other Data Sources, above). The Shapefiles thus contained
the following attribute fields.

Table 3: Attribute table structure for Method One

Field Name	Description
FID	Unique identifier
Shape	Records vector shape, in all cases polygons
HLC Type	HLC character name, e.g. woodland, ancient enclosure. In Devon this was recorded as Title, but has been given the alias of HLC type to match Oxfordshire/Wiltshire
Simple HLC	The simplified HLC character names as defined in Herring *et al* (2022)
Woodland	Scored according to the polygon's capacity for maintaining woodland or for woodland planting. In general, the definition refers to blocks of tree planting though these could be very small. As well as extension to existing woodland, this can cover new plantations, replanting in existing woodland, wood pasture,

	planting up field corners, or shelter belts. The exception relates to restoring designed parkland landscapes where more scattered trees and copses are appropriate, but planting schemes in these situations would be led by conservation management plans
Wetland	Scored according to the polygon's capacity for wetland creation. Wetland creation may encompass different scenarios including pond creation, restoration of floodplain meadow, planting reedbeds and wet woodland, or reinstating 'natural' river courses.
Watermeadow	Scored according to the polygon's capacity for the restoration of watermeadows. Used for Devon only, as there were none recorded in the Coleshill and Buscot estate
Field boundaries	Scored according to the polygon's capacity for the restoration of old field boundaries. This has been restricted to boundaries lost since the publication of OS 1st edition maps. Although there are archaeological remains, in the form of crop/soilmarks and earthworks, these have not been scored as it was not possible to date them and in many instances they relate to earlier field systems. There would have to be assessed in more detail on a case-by-case basis.
Orchards	Scored according to the polygon's capacity for the restoration and recreation of orchards. There are many recorded in Devon, though fewer in Oxfordshire and Wiltshire. Not all former orchards were recorded by the HLCs as their size often fell below the minimum threshold for recording in the HLC projects. For the purposes of this project, however, they were scored if observable on OS 1st edition maps, even if not recorded on the original HLCs.
Score	The total score for all change scenarios.
Description	Usually including original HLC brief descriptions of past use, plus brief information on known historic environment features.
Sources	Information taken from aerial or satellite images, historic OS maps, or historic environment record data (NT HBSMR or Historic England data).

Although scoring on the earlier project for the Environment Agency (Herring *et al* 2022) was done on a five-point scale it was agreed, in discussion with the National Trust, to use a three-point scale (0-2), which could be mapped thematically as a 'traffic light' system using green, amber and red. The change scenario for each polygon was scored as follows:

- 0: (Red). Limited opportunities for change scenarios in relation to historic environment considerations. Historic environment data and historic landscape character may indicate other priorities, for example watermeadow restoration rather than wetland creation, or orchard restoration rather than woodland planting. Red does not specifically exclude particular change scenarios, but these should be considered carefully in light of historic environment evidence which may suggest other potential changes.

- 1: (Amber) Some opportunities for change scenarios in relation to historic environment considerations. Historic environment data and historic landscape character may indicate particular change scenarios and should be used to guide the design of such changes. Examples may include field boundary restoration where there is archaeological evidence for earlier field patterns as well as late nineteenth and twentieth century boundary loss, so advice should be taken on the most appropriate boundaries to restore.
- 2: (Green) Good opportunities for change scenarios in relation to historic environment considerations. Areas in green are able to absorb change in a way that will not affect the historic landscape character or will enhance it, for example orchard restoration and creation, new woodland within existing the field pattern, and watermeadow restoration. In the case of watermeadow restoration, there are often surviving features, such as channels and sluices, which can be reused and restored.

In almost every instance, historic environment considerations are not intended to obstruct or prevent biocultural change, but to inform on ways in which they could be carried out.

The scoring for this method was undertaken on a polygon-by-polygon basis. For Killerton, this involved scoring 237 polygons, whilst there were 98 polygons for Coleshill and Buscot. Each polygon was assessed against the presence or absence of National Trust historic environment data, aerial survey data (available for Killerton only), scheduled monuments and parks and gardens. The OS 1st ed maps were used to assess the presence or absence of landscape features such as field boundaries, woodland, orchards, and the site of agricultural buildings and farmsteads, where these were not recorded elsewhere. Where appropriate, satellite imagery (Google Earth Pro 2022), Lidar imagery (National Library of Scotland 2023), aerial photographs (Historic England 2023a) and tithe maps (Devon County Council 2023; BRO D/D1/40/1; BRO D/P30/27B) were consulted to provide information on field boundaries, place names or on archaeological data. These supplementary sources were particularly useful for Coleshill and Buscot, where the Historic England aerial survey data was not available.

Method Two: Rapid Recording of Historic Environment Opportunities

Once the detailed polygon-by-polygon method had been completed for each area, a more rapid method of scoring was developed to record historic environment biocultural opportunities. Copies of the Method One Shapefiles were made, named 'Rapid Historic Environment Opportunities', and the scoring system set back to zero for each category. Additional fields were then added to record known historic environment data. The additional fields were as follows:

Table 4: Attribute table structure for Method Two

Field Name	Description
Scheduled Monuments	Sites recorded as scheduled monuments on Historic England's List
Parks and Gardens	Sites recorded as registered parks and gardens on Historic England's List
HBSMR	Sites recorded on the National Trust's Historic Sites and Monuments Record
HE aerial survey	Sites recorded on Historic England's aerial survey mapping programme

The change scenario fields were then scored according to the simplified HLC types using the three-point scale as for Method One. In Method Two, however, the scores were assigned in batches according to simplified HLC type, rather than polygon by polygon. The scoring used was as follows:

Table 5: Attribute table structure for Method Two

Simple HLC Type	Woodland	Orchards	Field boundaries	Wetland	Watermeadow
Ancient Enclosures	0	0	1	0	0
Regular Enclosures	1	2	1	0	0
Modern Enclosures	2	2	2	0	0
Small Enclosures	2	2	0	0	0
Ancient Woodland	2	0	0	0	0
Secondary Woodland	2	0	0	0	0
Orchards	0	2	2	0	0
Parkland	2	0	0	0	0
Unenclosed and Unimproved	2	0	1	2	0
Watermeadow	0	0	1	1	2

As for Method One, the change scenario scoring for each polygon was as follows:

- 0: (Red). Limited opportunities for change scenarios in relation to historic environment considerations.
- 1: (Amber) Some opportunities for change scenarios in relation to historic environment considerations.
- 2: (Green) Good opportunities for change scenarios in relation to historic environment considerations.

For Method Two, historic environment considerations were determined automatically according to HLC Type. GIS tools were used to select each simple HLC type and a score given against each change scenario as set out in Table 5, above. The detailed rationale for each score is set out in Appendix One, below. The scoring differed from that in Method One in that it assumed that each simple HLC types would be able to absorb certain change scenarios and was based on the scoring system developed by Herring *et al* (2022). For example, modern enclosure types were scored as 2 for woodland creation and field

boundary restoration, as they were considered less sensitive to change than ancient enclosures which were scored as 0. The method was adapted slightly to accommodate local landscape conditions within the relatively small areas of the two estates. For example, small enclosures were found only on the Coleshill and Buscot estate and were features of modern reorganisation of older fields into paddocks. In the earlier study, small enclosures also included components of ancient field systems and so attracted a negative score. In this project, the modern small enclosures were considered less sensitive to change. This simple scoring system did not take into account known historic environment data, however, so the scores were weighted according to recorded National Trust and Historic England data.

As the presence of historic environment sites would have to be taken into account on change scenarios, a negative score was assigned where known historic environment features intersected polygons. Sites considered to be of national importance, that is scheduled monuments and registered parks and gardens, were assigned a score of -2, whilst sites recorded on the NT HBSMR and of Historic England's aerial survey, were given a score of -1. The scores across each of the change scenarios and historic environment attributes were added to give a total score, giving a scoring range of -6 to 4. Each polygon was then assigned to a revised three-point scale as for Methods One and Two as follows:

- Negative score or 0: (Red). Limited opportunities for change scenarios in relation to historic environment considerations.
- 1: (Amber) Some opportunities for change scenarios in relation to historic environment considerations.
- 2 and above: (Green) Good opportunities for change scenarios in relation to historic environment considerations.

Method Three: Combined Recording of Historic Environment Opportunities

Following a comparison of the first two scoring methods, a third method was devised. Method One showed more opportunities for environmental change, but did not automatically score some HLC Types against specific change scenarios. Method Two, whilst automatically scoring for different change scenarios against each HLC Type, involved a more cautious approach regarding historic environment assets, and thus tended to under-estimate the capacity for change. Method Three took the best aspects of each method and combined them.

Each polygon was assigned a score (0, 1 or 2) against each change scenario, depending on HLC type (see Table 6), as for Method Two. The scores were then adjusted according to the additional historic environment information. If historic environment data supported the automatic scoring, the score would remain the same, but if it suggested other change scenarios, the score could be downgraded to indicate that historic environment guidance may be needed to design appropriate change. Two changes were made from the automatic scoring employed in Method Two. Ancient enclosure had been scored 0 for the woodland and orchards change scenarios, based on the original Herring *et al* (2022) project, because of the potential impact on field pattern. For Method Three, this was changed to a score of 1, as it was clear that this HLC Type could absorb woodland planting and new orchards, but with guidance to ensure ancient field patterns were maintained. The modern enclosure HLC type was automatically given a score of 1 for the wetland change scenario, regardless of topography, as it was less sensitive to changes in field pattern. In some cases, however,

topographical restrictions may limit wetland scenarios and proposals would have to be assessed on a case-by-case basis.

Table 6: Attribute table structure for Method Three. The values show the automatic scores, which were then adjusted for historic environment data

Simple HLC Type	Woodland	Orchards	Field boundaries	Wetland	Watermeadow
Ancient Enclosures	1	1	1	0	0
Regular Enclosures	1	2	1	0	0
Modern Enclosures	2	2	2	1	0
Small Enclosures	2	2	0	0	0
Ancient Woodland	2	0	0	0	0
Secondary Woodland	2	0	0	0	0
Orchards	0	2	2	0	0
Parkland	2	0	0	0	0
Unenclosed and Unimproved	2	0	1	2	0
Watermeadow	0	0	1	1	2

Results

The following section discusses the results for each estate in turn by comparing the three methodologies. The mapped data for each method have been produced side-by-side to allow a direct comparison. A 'traffic light' system has been used to present the data, with red areas representing limited opportunities, amber some opportunities, and green good opportunities for the historic environment to drive biocultural change. The results are discussed for each estate by the scores against all change scenarios and by individual change scenarios. Comparison of the scoring system is given in Table 7, below. The widest range of scores was recorded against Method 2, where the score adjustment for historic environment features could result in negative scores. Methods 1 and 2 for individual change scenarios scored between 0 and 2, and it was only when looking at the scores across the combined change scenarios that scores over 2 were recorded.

The aim of the scoring method was to be consistent across all three methods and across the range of change scenarios. It was determined that a score of zero (or a negative score for Method 2) indicated limited opportunities for change, though with proper consideration for historic environment features, change management is possible. A score of 1 across all methods and scenarios indicates some opportunities for change, though these may be limited in range (all methods) or indicate that certain change scenarios are limited (Method 3).

Table 7: Comparison of scoring between Methods One, Two and Three

Opportunities for Change	Opportunities	Method One	Method Two	Method Three
Red	Limited	0	Negative score or 0	0
Amber	Some	1	1	1
Green	Good	2 and above	2 and above	2 and above

Coleshill and Buscot Estate

Overall Change Scenario Scores

The maps of the overall scores show more opportunities for change scenarios in Methods One and Three, and more limited opportunities in Method Two (Figure 4). The limited opportunities of Method Two reflects the automatic scoring of historic environment assets as negative. In many cases, the historic environment features indicate opportunities for biocultural change (for example field boundary restoration), but this could only be pulled out and recorded using the more detailed methods. Method 3 presents the widest range of good opportunities, across most of the study area. There are limited opportunities in two areas, both of which contain scheduled monuments. The presence of scheduled monuments would require consent to carry out the change scenarios considered here (e.g tree planting, boundary restoration), but may present other opportunities for change scenarios not covered by this project, such as arable reversion, or grassland restoration. The areas with some opportunities mostly contain archaeological features recorded on the NT HBSMR, which would have to be taken into consideration before appropriate change scenarios were decided upon and carried out. Overall, however, Method 3 indicates a high level of good opportunities across the mapping of all change scenarios.

Woodland Change Scenario Scores

The mapping of opportunities for the woodland change scenario shows more opportunities using Methods One and Three, with the latter having the smallest area of limited opportunities (Figure 5). The limited opportunities reflect the most archaeologically sensitive areas, such as the scheduled monument near Kelmscott, and any woodland planting would have to use the historic environment and historic landscape character as the guiding principles in woodland design. The more limited opportunities in Method Two reflects the presence of Buscot Park, a II* registered park, and Badbury Camp, a scheduled monument. Although there are opportunities for woodland creation and improvement in these areas, the positive associated scores were more than cancelled by the negative scores for the park and scheduled monument. Overall, Method Three presents the widest range of opportunities for woodland planting, with either good (green) or some (amber) opportunities indicated across most HLC types. Historic environment considerationa and historic landscape character would enhance woodland planting design. Well-designed woodland in these areas could also enhance knowledge and understanding of historic landscape character.

Orchard Change Scenario Scores

The three methods show a stark contrast in the opportunities presented for the orchard change scenario (Figure 6). The largely limited opportunities shown in Method One reflects the lack of known orchard sites in this study area, whilst the wider opportunities indicated by Method Two, reflect the automatic positive scores for orchard creation in certain HLC enclosure types. Method Three, however, indicates the widest range of green and amber areas, with the limited opportunities, shown in red, mainly in areas of existing woodland. The wide range of opportunities produced in Method Three reflects the small size of most individual orchards and that they can be planted within existing historic field patterns enhancing and helping to maintain historic landscape character.

Field Boundary Change Scenario Scores

The Field boundary change scenarios is shown as having very limited opportunities using Method One, whilst Method Two shows widespread areas of some opportunities (Figure 7). The relatively low level of opportunities in both these methods reflects the already historically large field sizes in this study area. Indeed, in many of the HLC enclosure types, there is boundary change, with some loss, but also new boundaries added since the nineteenth century. Method Three, in contrast, shows a much wider range of some or good opportunities to create or restore field boundaries. The difference is a result of scoring modern field patterns as being capable of absorbing change, regardless of the historic environment evidence for past boundary loss. The areas shown in amber indicate that the historic environment should be a key consideration in designing new boundaries, as there is often evidence for earlier field systems and careful choices would need to be made to maintain a cohesive field pattern. Creating new field boundaries would be a conscious decision to change the present-day field pattern, but this is a process that HLC shows is ongoing. None of the methods, however, can add information on restoring existing boundaries, for example replanting hedgerows where they have been replaced with fences.

Wetland Change Scenario Scores

Opportunities for wetland change scenarios is limited for all methods (Figure 8). Creating various wetland scenarios would be reliant on suitable topography, and those areas shown as having good opportunities generally lie along river valleys, such as the Rivers Cole and Thames. Methods One and Three show more good opportunities along the Rivers Thames and Cole, as they assessed the historic environment issues individually, rather than assuming they would have a negative impact, as for Method Two. Method Three indicates a wider range of limited opportunities, shown in amber, which is the result of automatically scoring the modern fields HLC types as being able to absorb the new wetlands change scenario in conjunction with assessing historic environment issues individually. The ability to implement such change, however, is more likely to be driven by topographical considerations.

Killerton Estate

Overall Change Scenario Scores

As with Coleshill and Buscot, there are some marked differences between the mapping results for the three methods at Killerton (Figure 9). Method One has the largest area of limited opportunities (red), Method Two is dominated by areas of some and limited opportunities (amber), whilst Method Three presents the best opportunities (green and amber) overall, with no areas of limited opportunities. For all methods, Killerton Park, a grade II* registered Park, and Dolbury Hillfort, a scheduled monument there appear to be fewer good opportunities for change scenarios. In these areas, the historic environment and historic landscape character would need to be the guiding principles for leading change. There are also large areas of ancient and post medieval enclosure HLC types, and these did not score highly for some change scenarios in Method Two, whereas HLC polygons were individually assessed for Method One and suggest greater opportunities for change. The combination of scoring used in Method Three, alongside the additional scoring for change in a wider range of HLC types such as ancient fields, indicates the ability of the historic landscape to inform change scenarios.

Woodland Change Scenario Scores

When the Methods are compared for the woodland change scenario (Figure 10), Method One shows more limited opportunities, reflecting the widespread presence of ancient and post medieval field systems. Some or good opportunities for change tend to reflect the areas that are already wooded, many of which are now mixed woodland and could be restored to native species. Although Method Two automatic scores positively for woodland planting in post medieval field systems, the negative scores attributed known historic environment sites, as well as to parks and ancient fields limits opportunities for woodland planting. Where there are some or good opportunities shown by Method Two, they are in areas already wooded. Whilst Method Three shows more good opportunities than Method One, overall, there are also fewer limited opportunities than either Methods One or Two. The dominance of amber (some opportunities) reflects the positive scoring against a wider range of HLC types, but indicates the importance of using HLC as a guide to designing woodland planting schemes to complement and enhance historic landscape character.

Orchard Change Scenario Scores

The Orchard restoration and creation change scenario using Method One (Figure 11) is dominated by limited opportunities, probably reflecting the small scale of orchards in comparison to HLC polygons. Where Method One shows good opportunities for orchard creation and restoration, these are in polygons of modern or post medieval fields, where small orchards were present on historic maps but were too small to record on the HLC. Method Two is dominated by limited or some opportunities, and reflects the automatic positive scoring for orchards against post medieval and modern HLC enclosure types as well as the negative scoring for historic environment features. Method Three suggests the widest range of opportunities for restoring former orchards or creating new ones. The scoring for orchard creation against more HLC types in Method Three reflects the small size of most individual orchards and that they can be planted within existing historic field patterns enhancing and helping to maintain historic landscape character.

Field Boundary Change Scenario Scores

The field boundary change scenario differs markedly between the mapping methodologies (Figure 12). Method Two indicates mostly limited opportunities, as the negative scoring of known historic environment evidence, including complex changes to field patterns, negates the automatic scoring of certain HLC Types, such as modern fields, which are able to absorb field boundary creation and restoration. Methods One and Three, show larger areas of some or good opportunities. The largest area of good opportunities are presented by Method Three, where the automatic scoring of certain HLC types are enhanced by historic environment and historic landscape character data on former field boundaries that could be restored.

Wetland Change Scenario Scores

The wetland chance scenario shows largely limited opportunities for all methods (Figure 13). The limited opportunities reflect the topography of the study area. Where there are good opportunities, along river valleys, this was reflected more using Methods One and Three, rather than Method Two. The automatic positive scoring for wetland against the modern field pattern HLC Type, indicates a wider potential for change using Method Three, though this would have to be led by topographical considerations.

Watermeadow Change Scenario Scores

Watermeadow restoration was not assessed for Coleshill and Buscot, as none were recorded within the estate boundaries, but there are several known and recorded areas within the Killerton estate (Figure 14). The watermeadows in Devon were either catchmeadows constructed along valley sides, or bedworks, built along river floodplains. Method Two shows only good opportunities, marking areas of known watermeadows. Though the overall area of some or good opportunities is smaller in Method Two, which is probably an artefact of the scoring system rather than showing genuine opportunities. As Methods One and Three assessed individual polygons and did not automatically score historic environment data negatively, it probably reflects the areas of watermeadow restoration potential with more accuracy.

Discussion and Recommendations

There are strengths and weaknesses to each mapping methodology. Method One more accurately reflects opportunities provided by the historic environment, as it assesses each polygon individually. Using this method makes it easier to identify where the historic environment can enhance or limit opportunities as it can use both raster and vector sources overlaid onto the HLC data layer, such as the historic OS maps. It was also useful to be able to assess external sources such as aerial survey data and Lidar, even where they could not be directly imported into the GIS. It is limited, however, in that it does not assume certain change scenarios are possible according to HLC types, for example woodland planting in areas of post medieval and modern enclosures. The method is also more resource intensive, though the relatively small size of the National Trust estates, in comparison to HLC areas, means that relatively few polygons have to be characterised.

Method Two, by partly automating the scoring process, is a faster process, taking approximately two thirds of the time for Method One, but tends to reduce the opportunities provided by the historic environment. Because the method involved the automatic selection and scoring through selection tools, it meant that raster sources could not be used. By assigning an automatic score, however, it does indicate areas of opportunity by HLC type which were not recognised by Method One.

Method Three, by combining elements of Methods One and Two, presents the widest range of opportunities across each change scenario. It allows automatic scoring of HLC types against different change scenarios, and to be assessed against both raster and vector data such as historic environment potential, as well as other sources such as aerial photography, Lidar and historic maps. A combined approach would less resource intensive than Method One, although more so than Method Two, and would have the advantage of assessing historic environment potential in more detail.

With all three methods, the longest part of the process would be preparing the data. If the National Trust were to roll this project out across its entire estate in England and Wales, it would need to consider how to create a consistent base layer. This project used Shapefiles from the HLC projects for Devon, Oxfordshire and Wiltshire, downloadable from the Archaeology Data Service (Historic England 2018). Not all HLC projects are available to download, however, and would have to be sourced separately though each local authority or Historic England. In Wales, HLC is not available, instead Cadw compiled a register of landscapes of historic interest (Cadw 2007). Cadw identified 58 landscapes of outstanding or

special historic interest the work did not cover the whole of the Welsh landscape. Where landscapes have been registered, they are recorded as landscape character areas and do not have the individual character polygons used in the English HLC projects. To cover the National Trust's Welsh estate, therefore, would need a separate solution from that in England.

Having assessed a range of sources for this project, it is clear that only a limited range would be practical to use on a wider-scale. The following table sets out the resources considered and how useful they would be on a national scale.

Table 8: Resources used or considered for mapping biocultural heritage opportunities

| Resource	Assessment
OS modern maps	Essential. A scale of 1:25,00 contains sufficient detail.
OS historic maps	Essential. The first edition map at 1:10560 has sufficient detail to check on historic landscape character.
Historic Landscape Character GIS data	Essential. These will form the base layer for mapping biocultural opportunities.
National Trust property boundaries	Essential. These form the extent of the biocultural heritage mapping.
NT HBSMR	Essential. Provides a background on historic environment features in addition to HLC. Data available as a GIS layer but, to date, are not consistent. Some sites have been mapped as polygon extents or polylines, others are still point data.
Local authority HERs	Limited. A useful source, though acquiring data would probably take too long for the purposes of the project. An alternative, not used for this project, would be to acquire the SHINE (Selected Heritage Inventory for Natural England) dataset from Natural England.
Historic England's List	Essential. Provides a background on designated historic environment features in addition to HLC.
Historic England's aerial archaeology mapping data (Historic England 2023b)	Desirable. There is no national coverage and at present is only browsable online
Historic England's aerial photo explorer (Historic England 2023b)	Desirable. There is no national coverage and at present is only browsable online
Tithe maps	Limited. It was intended that tithe maps were used to provide greater information on past landscapes, but they were only available to browse online and apportionment data was stored separately, making it labour intensive to use. Tithe maps could not be used consistently at a national level as not all land was subject to tithes.
Land cover maps	Limited. Although they provide comprehensive cover, they are only available as raster images and have no attribute data attached.
Lidar	Desirable. Can be downloaded, but requires processing. Pre-processed imagery can be browed online (National Library of Scotland 2023) and provides extra information where other sources, such as Historic England's mapping is not available.
Place-name studies	Limited. Can be used to enhance HBSMR and HLC data, but not a consistent source. The Key to English Place-Names website (University of Nottingham 2023) is too general for the purposes of a

	mapping project such a this, and county-based studies are of varying detail and not always easily available. More general place-name and field-name books can provide useful information, but would require too much time to use consistently across a project.
Secondary historical sources, such as Victoria County History	Limited. Could be used to check individual details where necessary, but it is not available nationally, and is too labour-intensive to use consistently.
Late 18th and early 19th century county views on agriculture	Very limited. A useful source for background but too general for the purposes of this project.

In summary, the most useful sources for mapping biocultural heritage opportunities are the modern and historic OS maps, HLC data, and the National Trust's HBSMR. These can be supplemented by Historic England listing data, aerial survey data and aerial photo explorer, plus Lidar from the National Library of Scotland. Where possible, Historic England's survey data should be acquired as a GIS layer where possible. It is only practical to use other sources to answer specific questions. In order to make a national-scale mapping programme viable, it is recommended that mapping resources are restricted to those available digitally, wherever possible, and available nationally. Any other resources should be used sparingly and only to provide information that cannot otherwise be found.

There are several stages involved in preparing data and mapping biocultural heritage opportunities, and Table 9 (below) sets out a proposed work flow. The actual mapping of the biocultural heritage opportunities is a fairly rapid process. Once the methodology had been decided, it took only a day to map the Killerton estate and less for the Coleshill and Buscot estate. Once familiar with the mapping process, the process should become even more efficient. One of the most time-consuming aspects of the project was data acquisition, the cleaning of data and data preparation, particularly the HLC. Where datasets are available to download from websites, data acquisition is rapid, but this process can slow down considerably when relying on information being provided by organisations external to the National Trust. As each HLC dataset is different, even when employing more recent, standardised mapping and recording methodologies, character interpretation differs from project to project. The HLC attribute data contains more information than is required and needs to be simplified by pulling out the relevant data and standardising terminology, which can be time-consuming. The simple HLC terms devised for the Herring *et al* (2022) project would need to be reviewed to ensure that they can be applied across all HLCs. A standard method of scoring for specific HLC types would also need to be agreed, along with an agreed method of revising scores for additional historic environment data. Finally, there would have to be an agreed set of change scenarios that could be applied nationally, with an explanation of what these might entail.

Table *9: Proposed workflow for future mapping of biocultural heritage opportunities mapping*
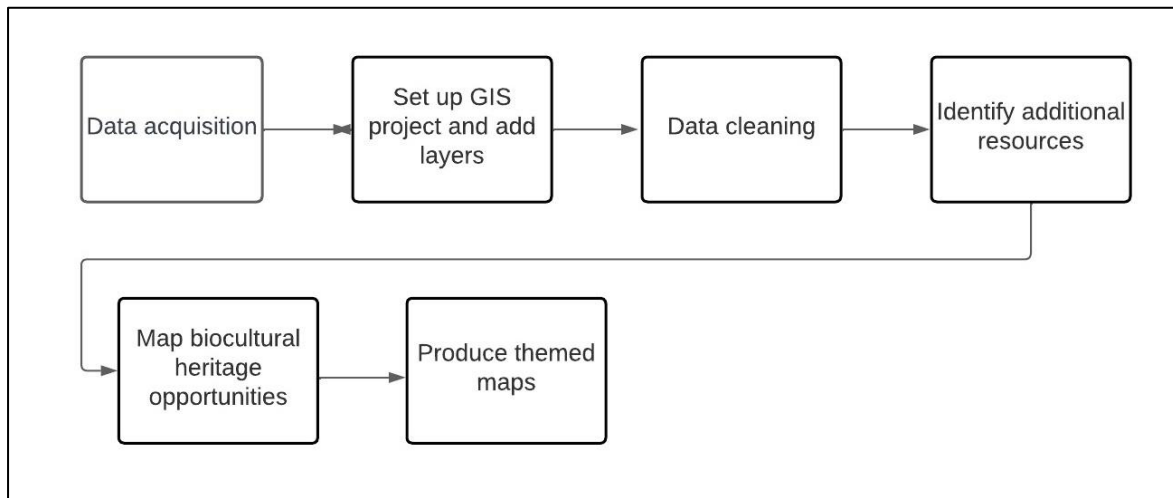
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Appendix One: Scoring Rationale for Recording Biocultural Opportunities Method Two

Woodland

Simple HLC Type	Score	Rationale
Ancient enclosure	0	Planting woodland may obscure historic field patterns. Any woodland planting should be sympathetic to field patterns. Small areas of woodland, planting field corners, small shelter belts, in-field trees, etc, may be appropriate
Regular enclosures	1	Field patterns should be observed in order to retain legibility, but there is scope for woodland planting within the existing field patterns.
Modern enclosures	2	Often large fields, resulting from the removal of field boundaries in the second half of the twentieth century, particularly on the Killerton estate where modern infrastructure developments (e.g. motorway) have disrupted field patterns. In the Coleshill and Buscot estate, there is significant boundary change within already large fields, and in some cases boundaries have been added or moved. These are often fields under intensive arable.
Small enclosures	2	Not present at Killerton, there are two examples at Coleshill and Buscot, where they take the form of modern paddocks. There are no significant historic environment considerations for woodland planting,
Ancient Woodland	2	Restoring, replanting and maintaining woodland.
Secondary woodland	2	Restoring, replanting and maintaining woodland.
Orchards	0	Existing woodland would take precedence over orchards trees.
Parkland	2	Woodland planting here is appropriate but needs to consider the designed landscape. Planting could restore existing or former woodland, extend existing woodland, or restore former stands of trees and avenues.
Unenclosed and Unimproved	2	Only recorded as a landscape character type at Coleshill and Buscot, these are in riverside locations and are probably old meadows. Wet woodland would be a possibility here.
Watermeadow	0	Only recorded on the Killerton estate, and recognised as have extant features such as channels, banks and sluices. Not appropriate for woodland

Orchards

Simple HLC Type	Score	Rationale
Ancient enclosure	0	Large-scale orchards may obscure field patterns, though there is scope for small-scale planting, particularly in areas of former orchards too small to have been recorded on the HLC.
Regular enclosures	2	Orchards could be created within the existing field pattern
Modern enclosures	2	Orchards could be created within the existing field pattern
Small enclosures	2	Orchards could be created within the existing field pattern
Ancient Woodland	0	Maintain and restore woodland rather than orchards
Secondary woodland	0	Maintain and restore woodland rather than orchards
Orchards	2	Restore existing and recreate former orchards
Parkland	0	Orchards not usually a significant feature of parkland
Unenclosed and Unimproved	0	Within the Colshill and Buscot estate this character type referred to wetland, and so not suitable for orchards
Watermeadow	0	Not appropriate for orchards

Field Boundaries

Simple HLC Type	Score	Rationale
Ancient enclosure	1	Restoring old field boundaries lost since the 1st ed OS map. Need to respect the legibility of the existing field pattern.
Regular enclosures	1	Restoring old field boundaries lost since the 1st ed OS map. Need to respect the legibility of the existing field pattern.
Modern enclosures	2	Restoring and recreating field boundaries lost in the 20th century.
Small enclosures	0	Planting or restoring hedgerows.
Ancient Woodland	0	Restoring and maintaining woodland is the priority.
Secondary woodland	0	Restoring and maintaining woodland is the priority.
Orchards	2	Restore or create boundaries around existing and new orchards
Parkland	0	Maintaining the designed landscape is the priority.
Unenclosed and Unimproved	1	Some scope around wetland areas covered by this type.
Watermeadow	1	Some scope around periphery of watermeadows.

Wetland

Simple HLC Type	Score	Rationale
Ancient enclosure	0	Wetland change scenarios not appropriate.
Regular enclosures	0	Many wetland scenarios not appropriate. Need to consider on a case-by-case basis.
Modern enclosures	0	Many wetland scenarios not appropriate. Need to consider on a case-by-case basis.
Small enclosures	0	Wetland change scenarios not appropriate.
Ancient Woodland	0	Restoring and maintaining woodland is the priority.
Secondary woodland	0	Restoring and maintaining woodland is the priority.
Orchards	0	Restoring and maintaining orchards is the priority.
Parkland	0	Maintaining the designed landscape is the priority.
Unenclosed and Unimproved	2	In Coleshill and Buscot this character type covers riverside land.
Watermeadow	1	Some potential, but need to conserve historic watermeadow features

Watermeadow

Simple HLC Type	Score	Rationale
Ancient enclosure	0	Watermeadow change scenario not appropriate.
Regular enclosures	0	Watermeadow change scenario not appropriate.
Modern enclosures	0	Watermeadow change scenario not appropriate.
Small enclosures	0	Watermeadow change scenario not appropriate.
Ancient Woodland	0	Restoring and maintaining woodland is the priority.
Secondary woodland	0	Restoring and maintaining woodland is the priority.
Orchards	0	Restoring and maintaining orchards is the priority.
Parkland	0	Maintaining the designed landscape is the priority.
Unenclosed and Unimproved	0	In Coleshill and Buscot this character type covers riverside land but there is no watermeadows are recorded
Watermeadow	2	Watermeadows are recorded only at Killerton, and there is scope to restore some of them.

Appendix Two: National Trust Brief

Biocultural heritage: mapping heritage opportunities for nature and climate

Brief for consultant (int/ext)

Hannah Fluck, Senior National Archaeologist
Tom Dommett, Head of Historic Environment

Context

1. **Biocultural Heritage**
   Mapping heritage opportunities for nature and climate

1.1   The National Trust has committed to transformational landscape-scale land use change in support of its ambitions for nature and carbon sequestration, to **Restore and establish carbon-rich habitats, including 20 million trees (by 2030)**.

1.2   The Trust has committed to delivering this change in a manner that also provides:

    1.2.1   Resilient landscapes reflect the history and natural processes that have shaped them, providing distinctive local character

    1.2.2   Heritage & landscape assets: sensitively managed and a means to deliver positive land management and engagement

1.3   Delivering this commitment requires the right input at visioning/concept stages of biodiversity renewal projects (particularly through programmes such as Accelerator Places, Riverlands, Landscape Recovery Schemes, Peatlands, Community Forests) which actively embraces the opportunities presented by the historic environment for the restoration and creation of priority habitats.

1.4   There is currently no defined process for doing this, nor a defined method of identifying, collating and presenting data which identifies the opportunities afforded by the historic environment to support decision making to deliver for nature and climate.

1.5   Previous work by Turner and Herring (2022), commissioned by Historic England and the Environment Agency, began to explore how Historic Landscape characterisation might be used in this way. This project builds on that foundation, bringing in additional data to seek to develop a methodology that could be applied at a national or regional scale to identify key opportunities for delivering habitat creation options for the National Trust.

2 Objective

2.1   To develop a methodology for using historical spatial data to identify opportunities for habitat creation at a national and regional scale.

The objective is not so much to create a 'definitive opportunity map' but to create an 'unconstrained map of possibilities' which can provide a starting point, grounded in the historical character of places, for discussions and options at a local, property level. It should be noted that the details of any habitat creation will always need to be worked out at a local level where consideration of impacts, significance and constraints will need to be addressed.

2.2   We will gain an understanding of:

- The suitability of different historic environment data for identifying opportunities
- A methodology for using historic environment data for identifying opportunities at a regional and national scale
- The limitations and applications of the methodology

2.3   In order to deliver these objectives we propose developing further the approach initiated for Environment Agency and Historic England by Turner and Herring. As analysis has already been

undertaken as part of that study for Devon and Oxfordshire it is proposed that these areas would be the focus of A with analysis focussing on one NT property in each region, tentatively identified as Coleshill (Oxon) and Killerton (Devon). As well as the HLC the work will draw on additional spatial data sets - historic environment records/national trust HBSMR, tithe maps, place names and other relevant data identified in the course of the project.

3 Outputs

3.1   The outputs from this work will be determined according to the associated cost.

3.2   Key outputs include:

3.2.1   **A clearly structured, interactive, prototype GIS tool**: This is a means of presenting the spatial data and indicating the opportunities for habitat creation for the selected areas of study that brings together relevant data with appropriate coding /pre-processing, to enable users to interrogate/visualise the opportunities derived from different sources or in relations to different priority habitat types. This could use some sort of 'traffic light' approach but the most suitable way of presenting opportunities/affordances as spatial data is to be determined during the project.

3.2.2   A report summarising:

- **Identification of key HLC types for delivering opportunities for climate and nature**
The earlier work indicated which HLC types offered the greatest 'affordances' for different Environment Agency options. This project will develop this further for different NT options beyond flood resilience to consider the restoration/creation of priority habitats and seek to identify the most pertinent HLC types which could then be identified at a national scale.

- **Identification of key asset types for delivering opportunities for restoration/creation of priority habitats**
As well as HLC types there are certain heritage asset types that 'afford' particular opportunities for nature and climate. This project will identify those with the relevant FISH thesaurus terms to facilitate search via National Trust HBSMR database.

- **Identification of the suitability/applicability of other data sets and key indicators from heritage data for delivering opportunities for habitat creation**
It is anticipated that there will be other information, or features identified from heritage data that will be relevant to delivering options for habitat creation. The suitability/applicability of other data sets should be identified, including e.g. NT GIS data from AI automated extraction of woodland and orchards from early C20 mapping, or Devon CC data on areas of greatest field boundary loss since theearly C20.

- **Methodology that can be applied across NT**
The methodology developed should be set out in such a way that it can be replicated across the National Trust, whilst acknowledging that there may need ot be adjustment for appropriate data availability in Northern Ireland and Wales.

4 Specific Tasks

4.1   The appointed consultant will be required to utilise all the data necessary to produce the outputs

above. E.g. county HLC, NT HBSMR, NT Lost Woodland Mapping, NT Lost Orchards Mapping, Digitised Tithe Mapping + Apportion (Devon only), HLC-Derived Boundary Loss Mapping (Devon only), Historic Place Names Gazeteer, historic biodiversity records (where available). There will also need to be reference to current land use in defining opportunities, NT will provide UKCEH Land Cover data.

4.2   Historic mapping will be available for use including the National Trust's historic Ordnance Survey mapping (provided by Landmark Solutions) and the National Library of Scotland (NLS) georeferenced OS 25 Inch 1892-1914 map series and OS 1:10,560 1949-1970 map series. The format in which historic mapping is provided will be determined in discussion with the appointed contractor. NLS data is available as a Web Mapping Tile Service.

4.3   Full direct access to NT HBSMR (and support from the NT HBSMR Lead) will be made available to the appointed contractor.

4.4   Additional information for Devon has been gathered by NT GIS and will be shared with the appointed contractor.

4.5   Data from the Turner and Herring research will be made available.

5 Programme

5.1   The National Trust invites fully costed and itemised tenders against this brief to be submitted to Hannah Fluck (hannah.fluck@nationaltrust.org.uk) by 11/11/2022. Where VAT is payable this should be included in the bid.

5.2   The National Trust will seek to commission the work on 1/12/2022.

5.3   The National Trust will require delivery of the outputs (see 3 above) by 21/02/2023.

5.4   We anticipate a phase II for the project during 2023 for the refinement of the tool, data acquisition and rollout at key NT places for landscape change. This roll out will include training for NT staff.

6 Role and Responsibilities

6.1   The contractor will work closely with NT GIS consultants: NT will provide support and advice as required, including relevant data; outputs will need to be compatible with NT systems.
6.2   The contractor is required to keep in close touch with National Trust over the progress of the project, and is not to deviate from the agreed brief without previous discussion and agreement.

7 Copyright

7.1   The National Trust will retain full copyright over all information, reports and data produced as a result of the work stipulated in this brief, and shall have absolute control over the use and/or dissemination of that information.

7.2   The contractor will be fully accredited wherever the material is used or reproduced.

8 INSURANCE AND HEALTH AND SAFETY

8.1   The consultant will be fully responsible for developing and operating a safe system of working. A full site-specific Risk Assessment must be in place if a site visit is undertaken and approved by the National Trust's Head of Historic Environment prior to commencement of any work, this must include provision to provide a covid-safe working environment for any externals visiting site.

TENDER FORMAT

The consultant should provide a project proposal to explain: how the consultants will respond to the brief, a method statement which explains; the range of professional skills people involved in the project will need, including the names and CVs of proposed team members and their specific responsibilities and any arrangements for subcontracting parts of the work; a resource plan showing the breakdown of chargeable hours according to the different options presented in the brief; final cost and payment fee stages based on itemised and costed elements of the plan.

The tender should be emailed as a PDF file – maximum size able to be received is 20MB – and should be submitted to Hannah.fluck@nationaltrust.org.uk

Telephone: 07890401840

Tenders should be submitted by: 4pm on 11th November 2022**.**

For any queries relating to this brief or an informal discussion on the Tender please contact Hannah Fluck.

Appendix Three: Licence Agreement With Historic England

THIS AGREEMENT is made on the 19/12/2022

BETWEEN

(1)   The Historic Buildings and Monuments Commission for England of 4th Floor, Cannon Bridge House, 25 Dowgate Hill, London, EC4R 2YA **('Historic England')**; and

(2)   Caron Newman, Visiting Fellow, Newcastle University

BACKGROUND

(A)   The Licensee wishes to use the Data (as defined below) for the Purpose only (as defined below).

(B)   Historic England has agreed to provide the Licensee with a licence to use the Data subject to the terms set out below.

OPERATIVE PROVISIONS

1   Definitions

1.1   In this Agreement the words below have the meanings next to them unless the context otherwise requires:

Data	means the data or information, in whatever form it may be stored, to be accessed by Caron Newman and more particularly to include: • Aerial Survey Data
Derived Data	any Data (wholly or in part) Manipulated to such a degree that it: *(a) cannot be identified as originating or deriving directly from the Data and cannot be reverse-engineered such that it can be so identified; and* *(b) is not capable of use substantially as a substitute for the Data;*
Effective Date	means 19th December 2022;
Intellectual Property Rights	rights in patents (including utility models), designs, chip topographies, copyright, , database rights, trade marks, trade and business names, rights to sue for passing off, rights in the nature of unfair competition rights, trade secrets, confidentiality and other proprietary rights including right to know-how and other technical information and any other intellectual property rights which subsist in computer software and computer programs (in each case whether registered or unregistered and including applications to register any of the foregoing) and all rights in the nature of any of the foregoing anywhere in the world;
Manipulate	to combine or aggregate the Data (wholly or in part) with other data or information or to adapt the Data (wholly or in part);

Manipulated Data	any Data which has been Manipulated. Manipulated Data includes any Derived Data;
Personnel	all students, employees, agents, consultants and contractors of the relevant party;
Publication	means any publication, article or presentation other than the Thesis;
Purpose	means the use of the data by the Student or Licensee's Personnel for research and academic purposes only in support of the submission of a Thesis and any other associated Publication.
Thesis	means any thesis or theses to be submitted by the Student in completion of a post graduate programme of study at [e.g. university].
Student	[Research Recipient name]

1.2   Any reference to any statute or statutory instrument or any section or part thereof includes any enactment replacing or amending it or any instrument, order or regulation made under it and also includes any past statutory provisions (as from time to time modified or re-enacted) which such provision has directly or indirectly replaced;

1.3   References to a Clause or Schedule are to a clause of, or schedule to this Agreement, references to this Agreement include its schedules, and references in a Schedule to a paragraph are to a paragraph of that Schedule;

1.4   Words denoting the singular include the plural and vice versa;

1.5   References to a **person** include any corporate or unincorporated body;

1.6   References to **consent** or **authorisation** shall be deemed to mean the consent or authorisation of a duly authorised and senior representative of the relevant party (which, in the case of Historic England, shall be the Head of Imaging and Visualisation).

1.7   The headings in this Agreement do not affect its interpretation;

1.8   The terms **including**, **include**, **in particular** or any similar expression shall be construed as illustrative and shall not limit the sense of the words preceding those terms;

1.9   References to the parties include their respective successors in title, permitted assignees, estates and legal personal representatives;

1.10   The definitions contained in the Interpretation Act 1978 apply (unless a specific definition has been included or the context otherwise requires) in interpreting words and phrases used in this Agreement.

2   Consideration

In consideration of the Licensee paying to Historic England the sum of £1 (receipt of which is hereby acknowledged by Historic England) Historic England agrees to grant a licence to the Licensee to use the Data on the terms and conditions set out in this Agreement.

3   Licence and Intellectual Property Rights

3.1   Historic England grants to the Licensee a non-exclusive, non-transferable, revocable licence for the Purpose, in the United Kingdom, commencing on the Effective Date and terminating on the later of:

3.1.1   the conclusion of a period of 30 Months from the Effective Date; OR

3.1.2   three months after the submission of the Thesis by the Student

(the **Licence Term**).

3.2   , to access, view and Manipulate Data and create Derived Data in accordance with the terms of this Agreement solely for the Purpose**.** Except as expressly provided for in this Agreement,

the Licensee shall not use the Data or Manipulated Data for any commercial or exploitation purposes.

3.3   The Licensee warrants that it shall not transfer the Data or Derived Data to any third party or otherwise permit any third party to access or use the Data or Derived Data.

3.4   All Intellectual Property Rights in the Data shall remain vested in Historic England. The Licensee shall not acquire any right, title or interest in or to the Data.

3.5   The Licensee assigns to Historic England, and shall assign to it, with full title guarantee all Intellectual Property Rights in any Manipulated Data it may create (excluding, for the avoidance of doubt, the copyright in any Publication or Thesis), by way of future assignment.

3.6   Historic England grants the Licensee an irrevocable, royalty-free, non-exclusive licence to use the Manipulated Data for internal research and teaching purposes only.

3.7   In the event of termination of this Agreement and on expiry of the Licence Term, the Licensee shall cease to use store and/or retain the Data and Manipulated Data.

4   Obligations of the Licensee

4.1   The Licensee shall and shall (where appropriate) ensure that any third party acting for or on behalf of the Licensee shall:

    4.1.1   implement appropriate technical and organisational measures to protect the Data against unauthorised or unlawful use and against unauthorised use or access;

    4.1.2   obtain prior written consent from the Historic England Head of Imaging in order to transfer the Data to any third party;

    4.1.3   ensure that all Personnel of the Licensee required to access the Data are aware of and comply with the obligations set out in this Agreement;

    4.1.4   ensure that no Personnel of the Licensee publish, disclose or divulge any of the Data to any third party unless directed in writing to do so by Historic England;

    4.1.5   not describe itself or allow itself to be described as English Heritage's or Historic England's agent or representative; and

    4.1.6   immediately notify the Head of Imaging at Historic England in writing of any use of the Data which is not in accordance with this Agreement or if any Data is accessed or disclosed in breach of this Agreement.

5   Confidentiality and privacy

5.1   This Agreement and any information or material of a confidential nature supplied by (or on behalf of) one party (the **Disclosing Party**) to the other (the **Receiving Party**) or otherwise obtained by the Receiving Party (including any information relating to the business or financial or other affairs of Historic England) (collectively **Confidential Information**) are strictly confidential and will not be disclosed (in whole or in part) by the Receiving Party to any other person without the Disclosing Party's prior written consent (except where the Receiving Party is required to disclose them by any government authority or pursuant to an order of a court of competent jurisdiction). The Receiving Party shall take all reasonable security precautions in the safekeeping of the Confidential Information and in preventing its unauthorised disclosure to third parties, applying no lesser security measures to it than to its own confidential information. The Receiving Party shall use the Confidential Information solely for the purposes authorised by this Agreement. The Receiving Party shall not use any Confidential Information for its own benefit, or that of any third party, nor shall it use any Confidential Information to the Disclosing Party's detriment. The Receiving Party shall limit access to Confidential Information to those of its employees, agents and contractors who reasonably and necessarily require access to the same for the performance of the Receiving Party's obligations under this Agreement and shall ensure that each such employee, agent and contractor is aware of the confidential nature of the Confidential Information and complies with the obligations set out in this Agreement as if named as a party hereto. The Receiving Party shall promptly notify the Disclosing Party in writing of any unauthorised use or disclosure of any Confidential Information.

5.2   The Licensee will not make any announcement or publicity statement relating to Historic England, this Agreement or its subject matter without the prior written approval of Historic England (except as required by law or by any legal or regulatory authority).

6   Liability

6.1   Historic England warrants that it has the right to license the receipt and use of the Data as specified in this Agreement.

6.2   Historic England gives no warranty with regard to the quality of the Data and excludes, to the fullest extent permissible by law, all warranties, conditions, representations or terms, whether express or implied by common law, statute or otherwise, including, but not limited to, any regarding the accuracy, compatibility, fitness for purpose, performance, satisfactory quality or use of the Data.

6.3   Except as stated at clause 6.1 above, the Licensee acknowledges and agrees that Historic England shall have no liability whatsoever to the Licensee or any third party in relation to the Data or the Manipulated Data, save where such liability has arisen as a direct result of an act or acts of fraudulent misrepresentation by Historic England or relates to personal injury caused by Historic England's negligence. In the event of any apparent defect in the Data, Historic England's sole liability shall be to use reasonable endeavours to supply substitute Data.

6.4   The liability of any Party for any breach of this Agreement, or arising in any other way out of the subject matter of this Agreement, will not extend to loss of business or profit, or to any indirect or consequential damages or losses.

6.5   The maximum liability of the parties under or otherwise in connection with this Agreement shall not exceed £100,000. For the avoidance of doubt, nothing in this clause 6 shall be deemed to exclude or limit in any way either parties liability for intentional wrongdoing or statutory liability in respect of death or personal injury caused to any person as a result of the University's negligence.

7   Term and Termination

7.1   This Agreement shall commence on the Effective Date and shall continue unless and until terminated in accordance with its terms until the expiry of the Licence Term.

7.2   This Agreement may be terminated immediately by notice in writing:

7.2.1   by the non-defaulting party if the other party is in material breach of any of its obligations under this Agreement and fails to remedy the breach (if capable of remedy) within seven days after written notice by the other party specifying the breach and requiring the same to be remedied;

7.2.2   by either party with immediate effect from the date of service on the other party of written notice if a resolution is passed or an order is made for the winding up of the other (otherwise than for the purpose of solvent amalgamation or reconstruction where the resulting entity assumes all of the obligations under this Agreement of the relevant party) or the other becomes subject to an administration order or an administrator, receiver or administrative receiver is appointed of all or part of the other's undertaking and assets;

7.2.3   by either party with immediate effect from the date of service on the other party of a written notice if that other party ceases or threatens to cease to carry on its business or is unable to pay its debts or becomes insolvent (within the meaning of the Insolvency Act 1986) or makes or proposes to make any arrangement or composition with its creditors;

7.2.4   by either party with immediate effect from the date of service on the other party of a written notice if the other party suffers any analogous event to those set out in Clauses 7.2.2 and 7.2.3 in any other jurisdiction; or

7.2.5   by Historic England with immediate effect from the date of service on the Licensee of written notice if the Licensee has, in the reasonable opinion of Historic England, harmed the name or business of Historic England;

7.3   The expiry of this Agreement or the termination of this Agreement for any reason will not affect the coming into force or the continuation in force of any of its provisions which expressly or by implication are intended to come into force or continue in force on or after the termination. Without prejudice to the foregoing the following clauses shall survive termination: Clauses 1, 7 and 8.2, 7.4.

7.4   Any termination of this Agreement will be without prejudice to any other rights or remedies of either party under this Agreement or at law and will not affect any accrued rights or liabilities of either party at the date of termination.

8   General

8.1   The Licensee shall not assign, transfer, charge, subcontract or otherwise deal with this Agreement in any way without the prior written consent of Historic England. Historic England may assign, transfer, charge, subcontract or otherwise deal in any or all of its rights and obligations under this Agreement and the Licensee consent to all of these dealings.

8.2   A person who is not a party to this Agreement shall not have the right under the Contract (Rights of Third Parties) Act 1999 to enforce any of its terms.

8.3   Any notice given under this Agreement shall be in writing and served by delivering it personally or sending it by pre-paid recorded delivery or registered post to the other party at its registered office or principal place of business as set out at the beginning of this Agreement, or any alternative address notified by either party to the other for the purpose of receiving notices. In the case of notices to Historic England these must be addressed to Paul Backhouse, Historic England Head of Imaging and Visualisation.

8.4   No variation of this Agreement shall be valid unless it is in writing and signed by or on behalf of each of the parties.

8.5   This Agreement sets out the entire agreement and understanding between the parties and supersedes any previous agreements between the parties relating to the subject matter of this Agreement. Nothing in this Clause 9.5 will operate to limit or exclude any liability for fraud or fraudulent misrepresentation.

8.6   This Agreement is subject to English Law and the parties submit to the exclusive jurisdiction of the English Courts.

For and on behalf of The Historic Buildings and Monuments Commission for England

Signed by

Print Name… Matthew Oakey

Job Title… Aerial Survey Principal

Date… 19/12/22

For and on behalf of McCord Centre for Landscape, Newcastle Univeristy

Signed by

Print Name… Dr Caron Newman

Job Title … Visiting Fellow

Date… 19/12/2022
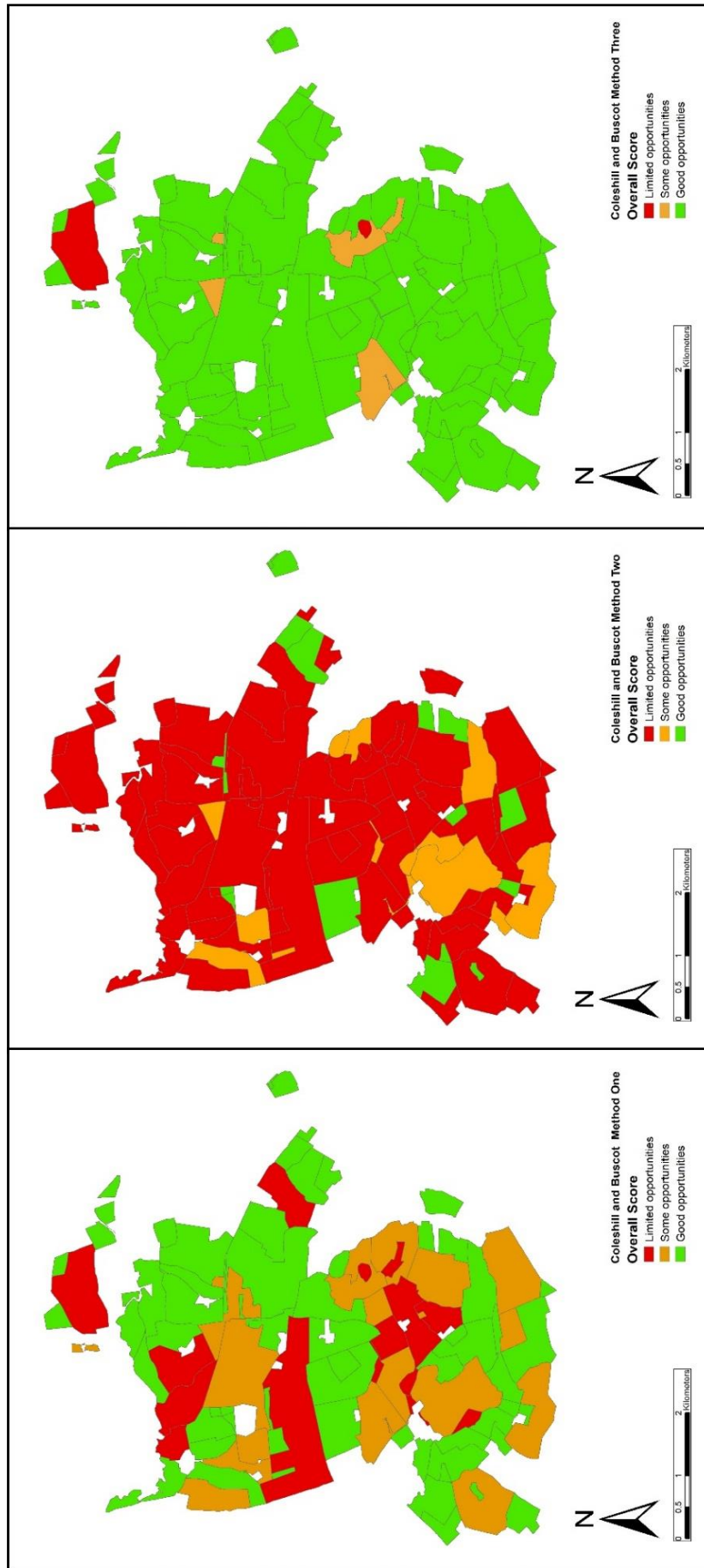
Appendix Four: Figures

Figure 4: Comparison of the three mapping methods for the Coleshill and Buscot estate. Method one (left) shows the likely range of historic environment opportunities across all change scenarios when each HLC polygon is assessed individually. Method Two, a more automated method of assessing historic environment opportunities, is shown on the right. Method Three is a combination of the first two methods
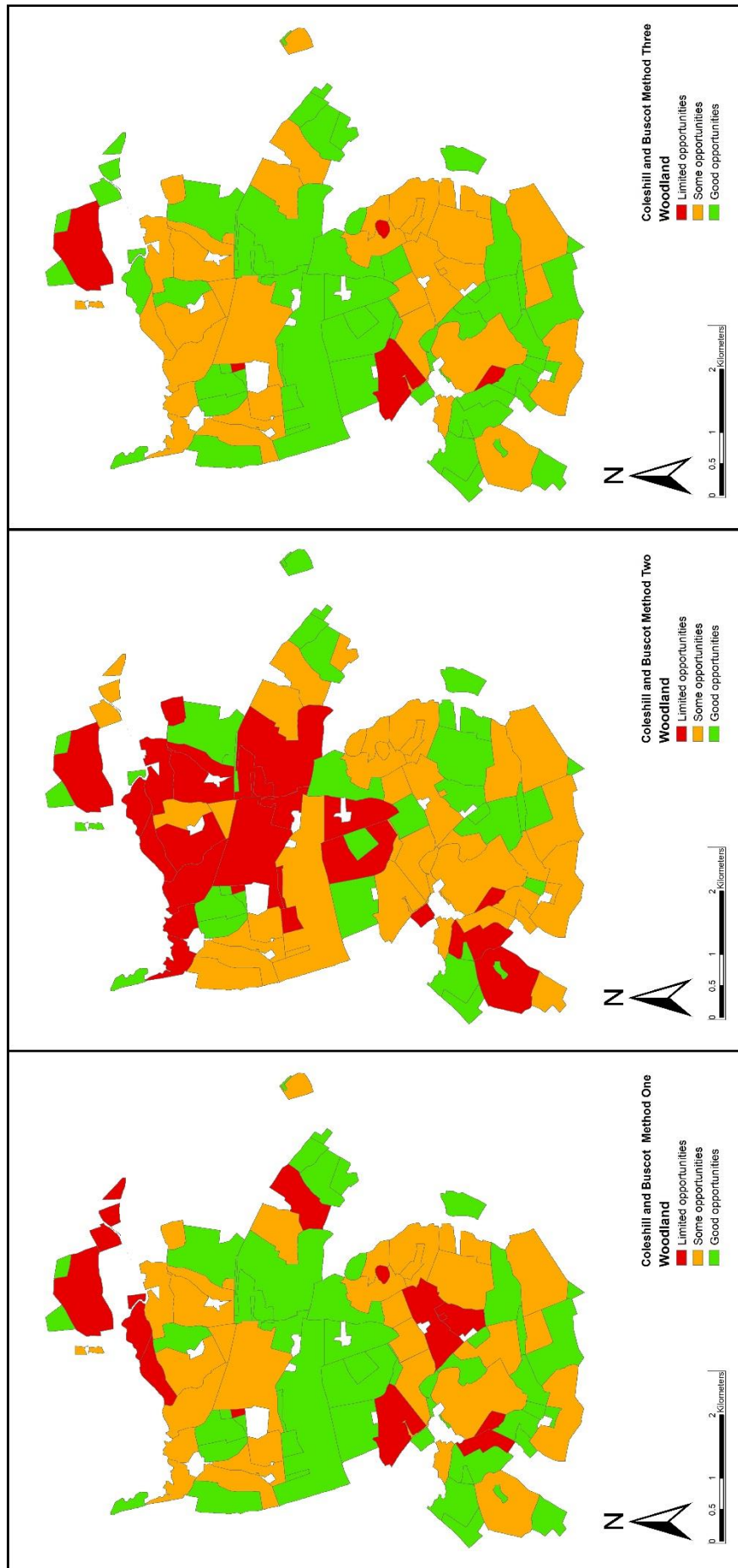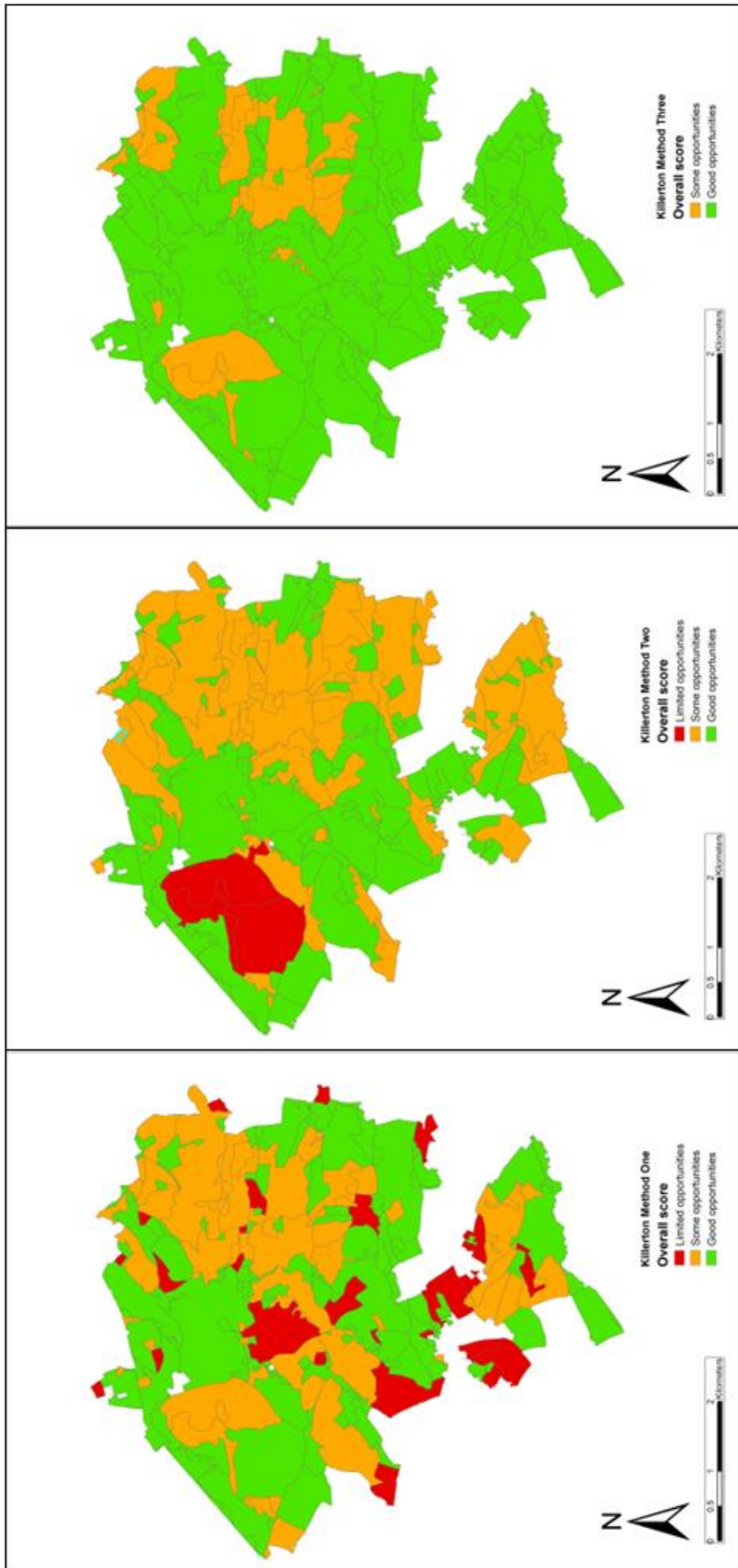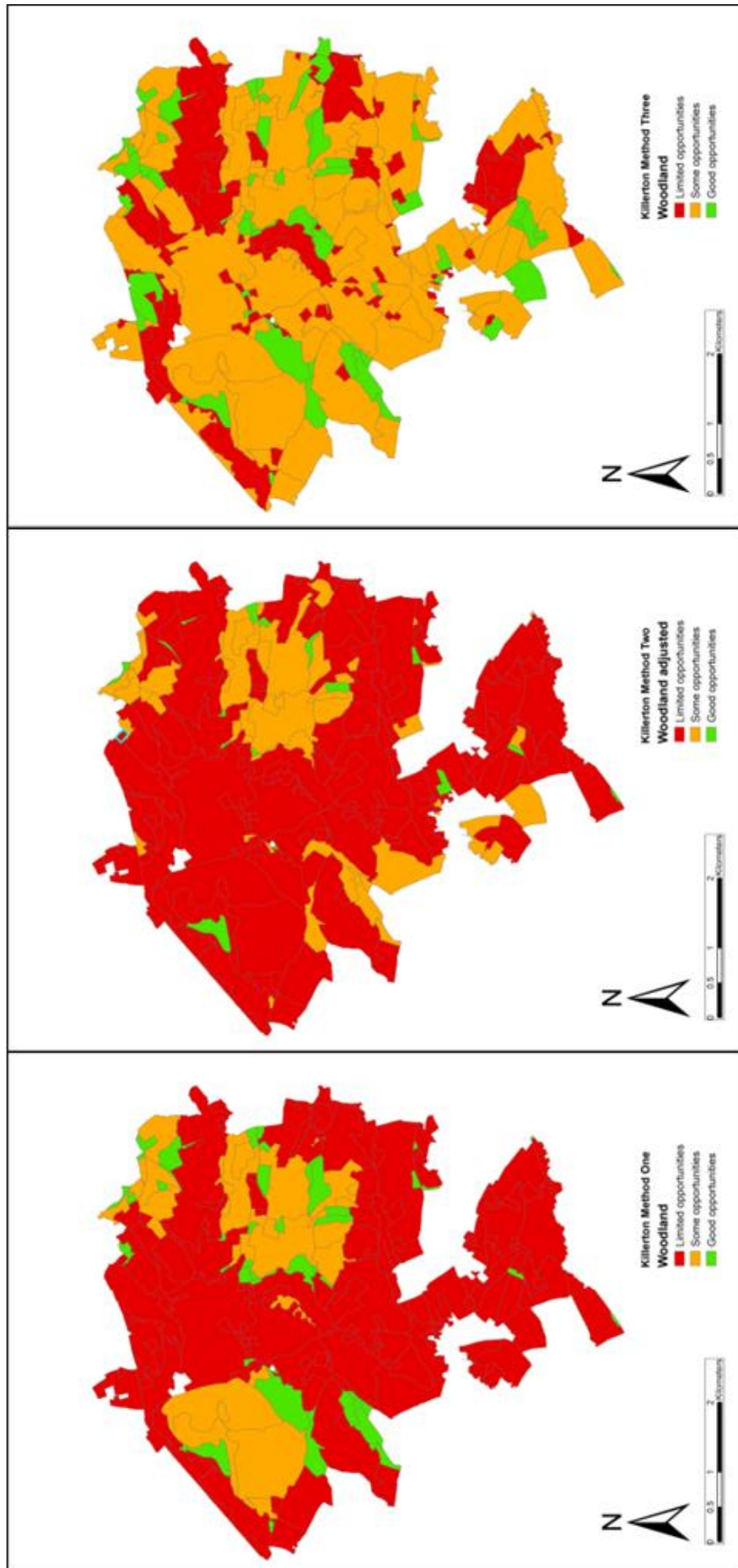
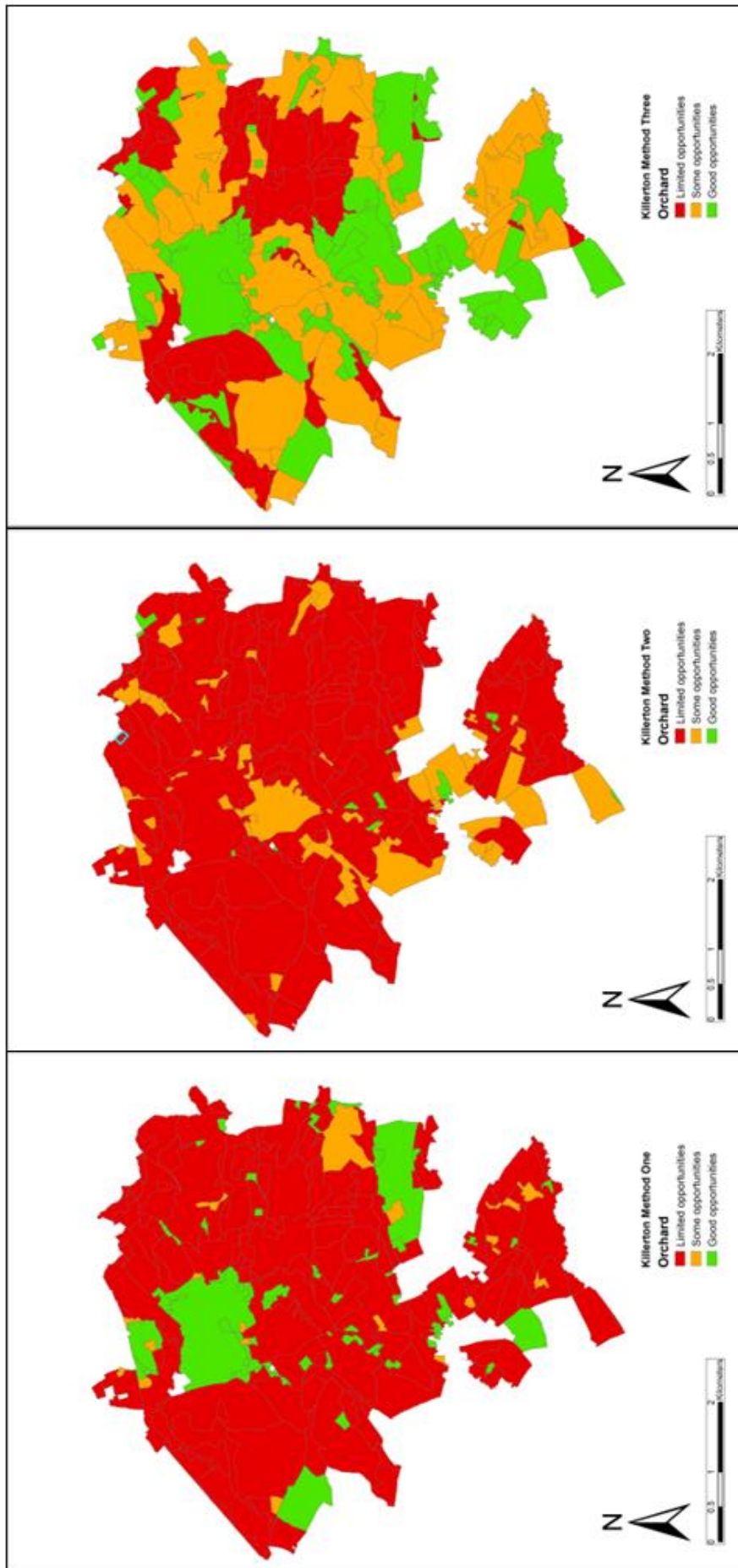*Figure 5: Comparison of the three woodland change scenarios for the Coleshill and Buscot estate.*

Figure 6: Comparison of the three orchard change scenarios for the Coleshill and Buscot estate.
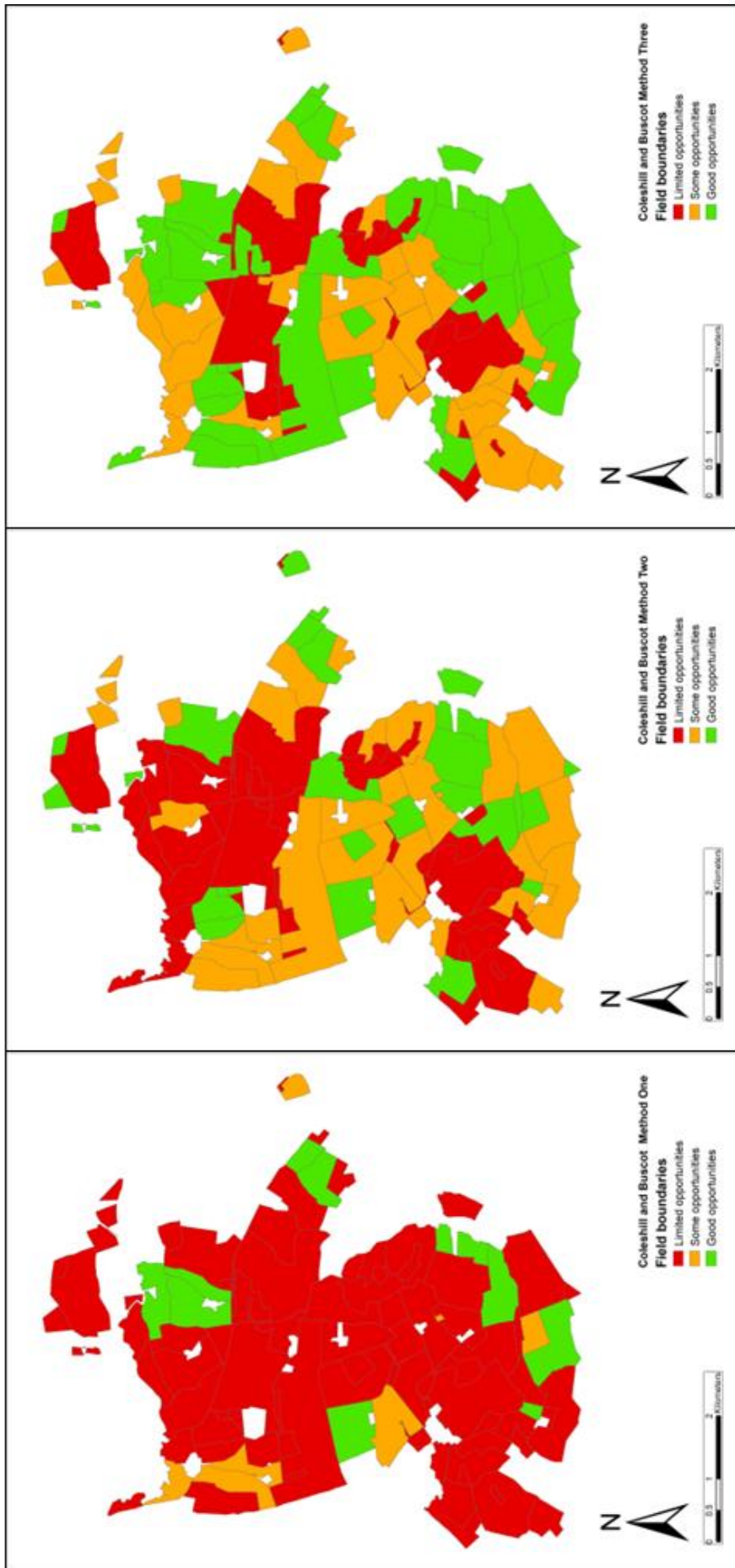
Figure 7: Comparison of the three field boundary change scenarios for the Coleshill and Buscot estate.
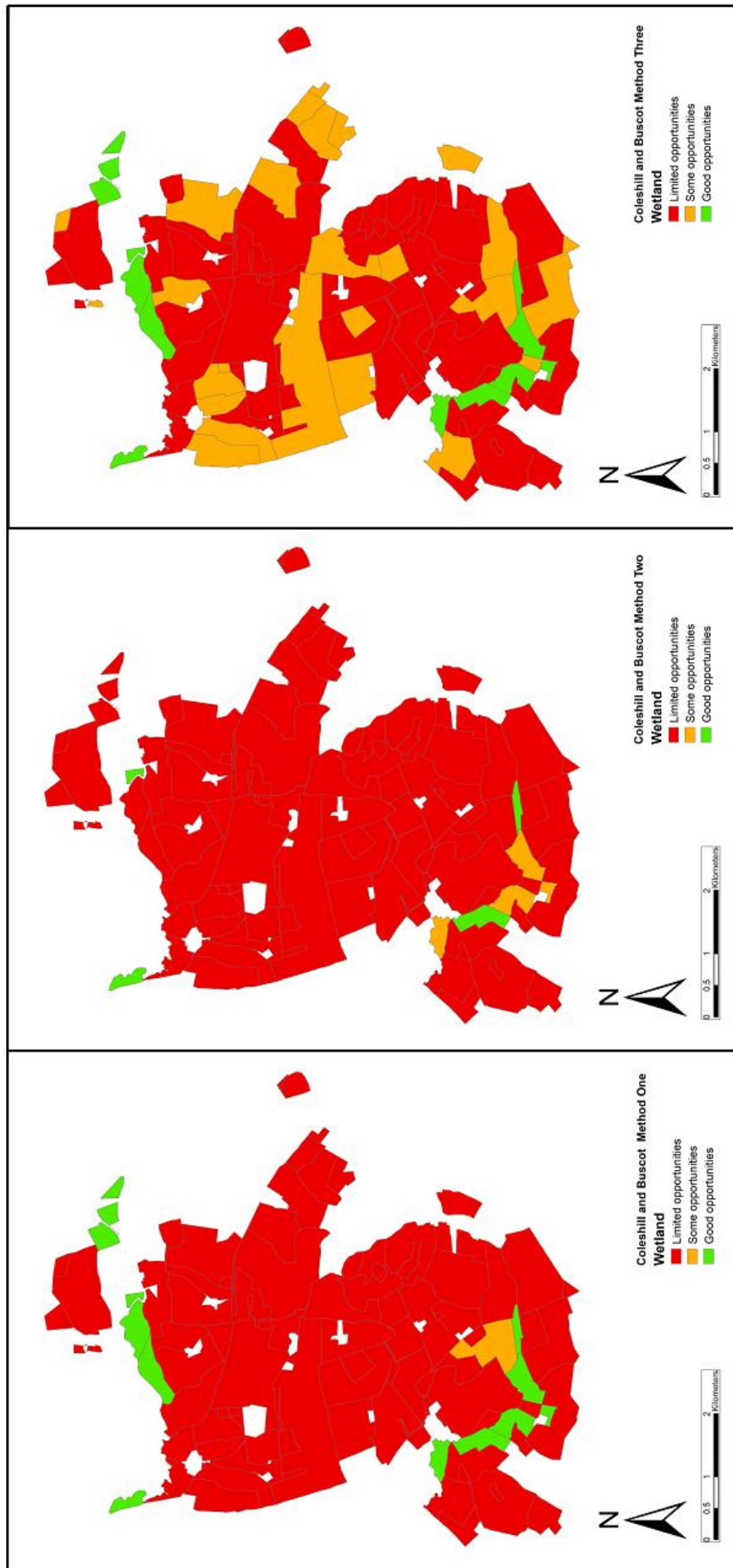
Figure 8: Comparison of the three wetland change scenarios for the Coleshill and Buscot estate.

Figure 9: Comparison of the three mapping methods for the Killerton estate. Method one (left) shows the likely range of historic environment opportunities across all change scenarios when each HLC polygon is assessed individually. Method Two, a more automated method of assessing historic environment opportunities, is shown on the right. Method Three is a combination of the first two methods

Figure 10: Comparison of the three woodland change scenarios for the Killerton estate.

Figure 11: Comparison of the three orchard change scenarios for the Killerton estate.
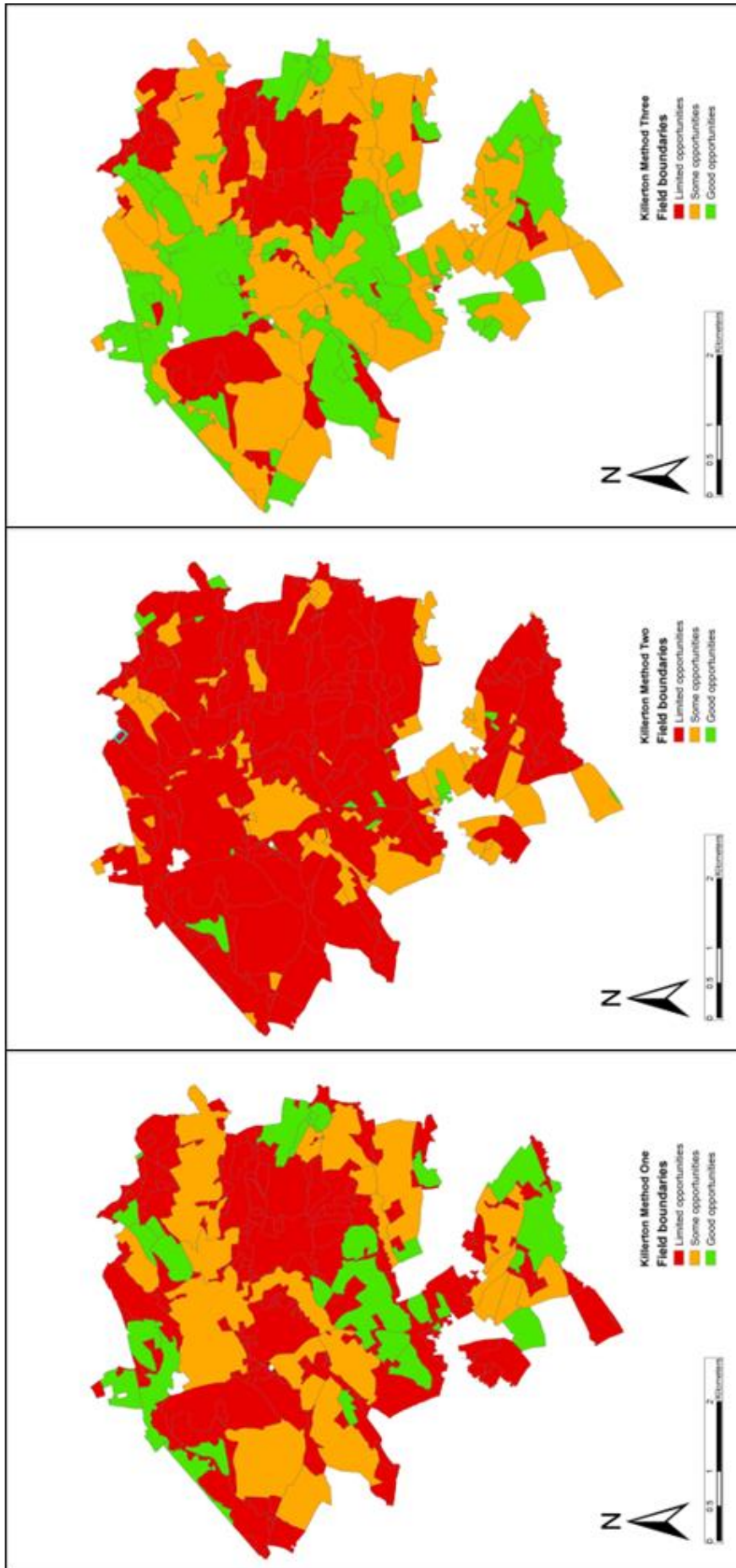
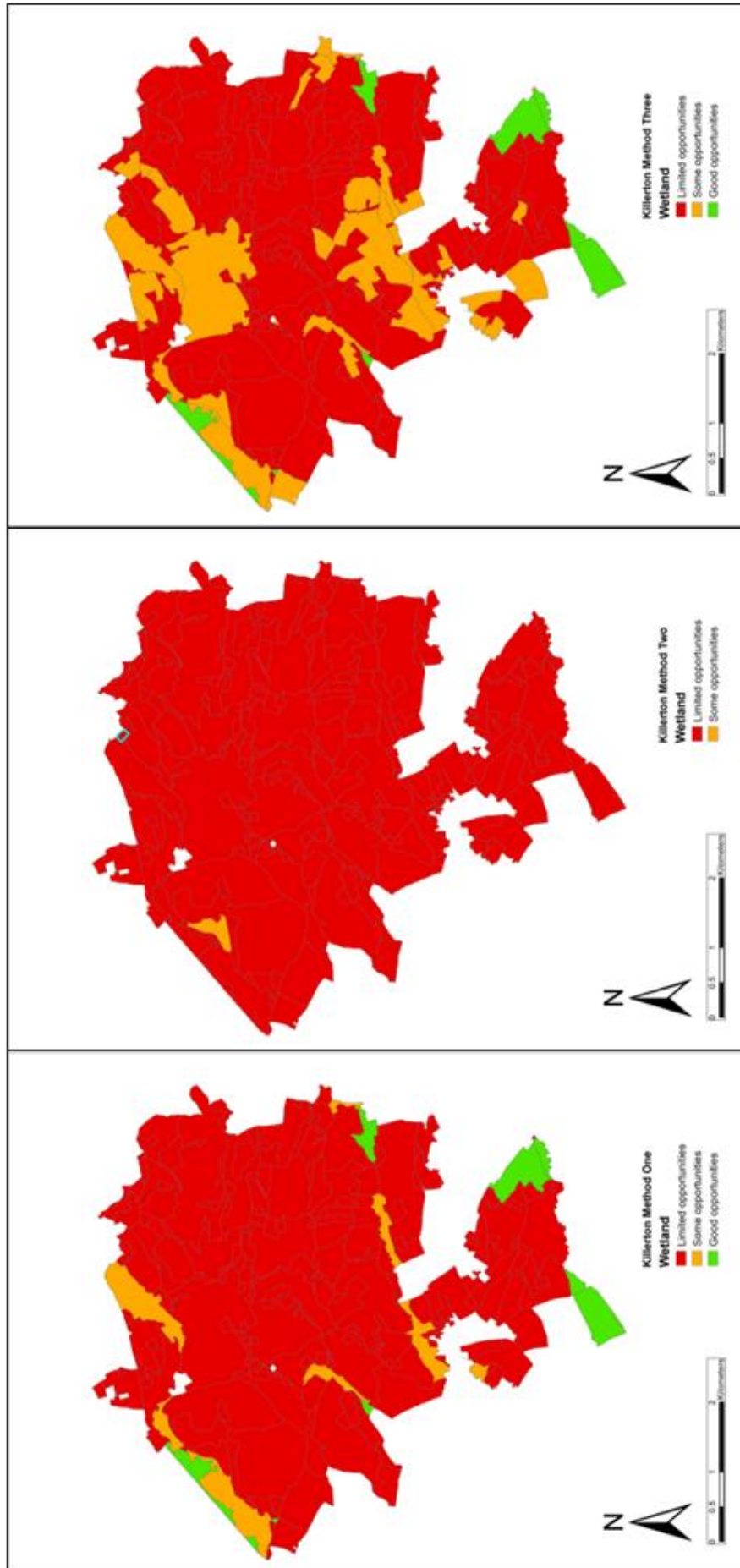*Figure 42: Comparison of the three field boundary change scenarios for the Killerton estate.*

Figure 13: Comparison of the three wetland change scenarios for the Killerton estate.
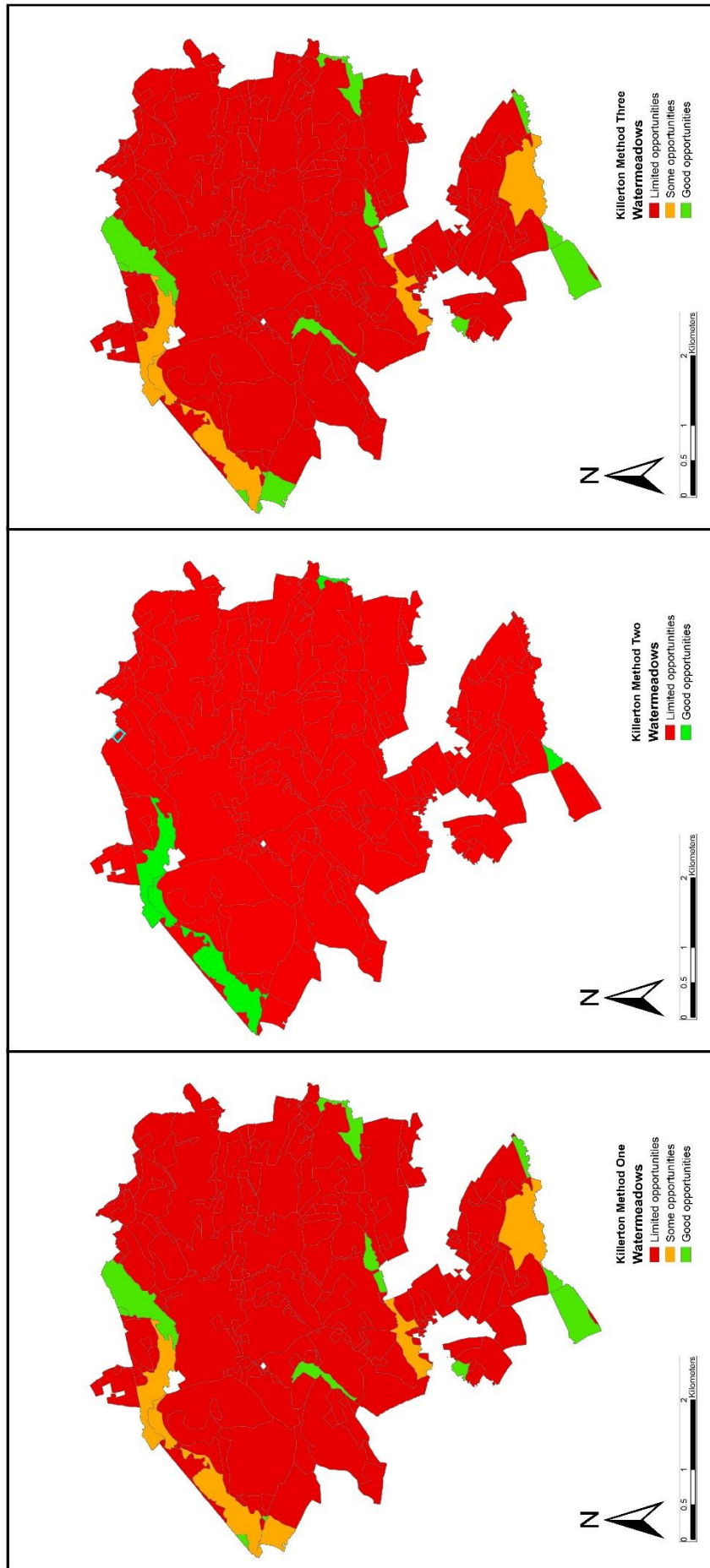
Figure 14: Comparison of the three watermeadow change scenarios for the Killerton estate.