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Crossing boundaries ancient and modern: Methodological considerations on approaching multi-scalar landscape and settlement research in Northern Britain

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ABSTRACT

A significant challenge facing archaeological research today is how to deal with the very large volume and diversity of existing data, together with the range of archives and other sources from which to access them. Another issue is how to best combine data collected for a range of purposes, with new custom-collated data, in order to answer current research questions. This article discusses these issues in the context of the Leverhulme-funded project 'Beyond Walls: Reassessing Iron Age and Roman Encounters in Northern Britain'. The project utilized a broad range of existing and newly created data, drawn from a variety of sources across modern regional and national boundaries, to examine wide-reaching changes in late prehistoric to late antique settlement landscapes in northern Britain. Using this extensive range of data within a multi-scalar approach, the project has been able to assess settlement patterns and associated environmental evidence at a range of spatial and temporal scales, some preliminary examples of which are presented here.

1. Introduction

The northern limits of the Roman Empire in Britain are a long-standing research area, although approaches have traditionally been marked by both administrative and academic divides. These divisions include the differing characteristics of the archaeological record across regional and national boundaries and between those taking a Romanist perspective and those whose starting point is the Iron Age (e.g. see Clack and Haselgrove 1982; Harding 2017; Richmond 1958). Over the last few years, some of these issues have been addressed within our Leverhulme-funded project 'Beyond Walls: Reassessing Iron Age and Roman Encounters in Northern Britain' (2021–25), which has involved researchers from the University of Edinburgh, the University of Glasgow, Historic Environment Scotland (HES) and the University of Oxford. The aim of this multi-disciplinary project has been to examine regional changes and continuities in landscape, settlement and environment

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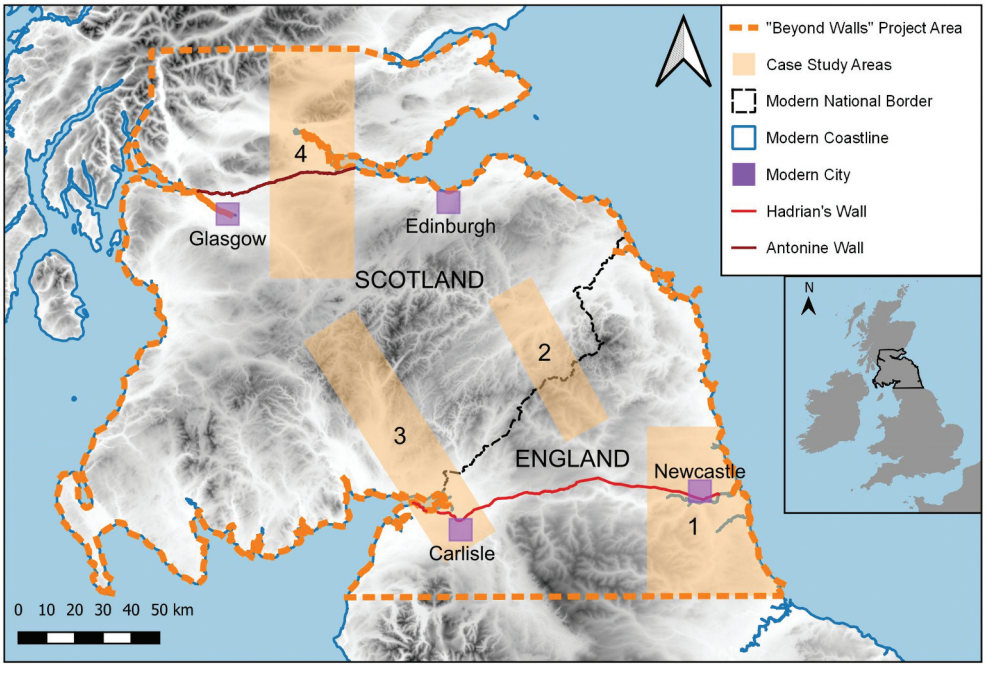

Figure 1. Map showing the 'Beyond Walls' project area and Case Study blocks (background topographic map contains public sector information licensed under the open government licence v3.0. © Crown copyright and database rights 2023 Ordnance survey [AC0000851941]), (authors).

from later prehistory (c. 500 BCE) through to the Early Medieval period (c. 500 CE), together with the specific impacts and influences of the Roman Empire upon these (Fernández-Götz et al. 2022; Fernández-Götz et al. 2024).

The project's study area extends from approximately 40 km south of Hadrian's Wall to 40 km north of the Antonine Wall, within which four case study blocks were selected for more detailed assessment and analysis (Figure 1). A pilot project entitled 'On the Edge of Empire: Exploring Iron Age Settlement Landscapes in Southwest Scotland', completed in 2021 with funding from the British Academy, helped to develop the settlement and landscape survey approach (Cowley et al. 2022).

The 'Beyond Walls' project had four main data-gathering and research foci, including reassessment of excavation data, palaeoenvironmental evidence, radiocarbon (^{14}C) dating, and settlement and landscape analysis. The present article is centred on the settlement data collection and survey, together with elements of the approach to the excavation record. A central focus is the factors shaping the archaeological record, a key issue underpinning the representativity of the patterns observable in the data and the variety of ways in which they may express the behaviours and lifeways of past populations.

2. Framing the problem

Understanding the character of the archaeological record for later prehistoric settlement across the region is key to down-the-line analyses. In most landscapes, past and present land use significantly shape the known distributions of evidence. Variable survival of

remains from this period across northern Britain is known to distort modern perceptions and thus interpretations (Cowley 2013, 2016b; Halliday 2011, 19–23; Stevenson 1975). In a landscape context, this is often framed within the concept of *palimpsest*: a parchment document repeatedly rewritten over and bearing traces of earlier writing. This was applied in an archaeological context by Crawford (1953) (see also Aston and Rowley 1974) and in landscape history by Hoskins (1977) to convey the partial and cumulative nature of the evidence that survives in the landscape.

In addition, beyond historical landscape change, a range of factors impact the ability of archaeologists to detect material remains of the past. In aerial reconnaissance, for example, weather patterns and drift geology have profound impacts on the visibility of archaeological remains (Cowley and Dickson 2007; Oakey 2005), with the prior understanding and perceptions of the archaeologists themselves also exerting an influence on the known evidence (Cowley 2016b). Here, we discuss the character of these sources of patterning in the study area, as key contextual information that supports robust interpretation of the evidence.

In addition to these variables, it is also difficult to define chronological periods and the features and sites belonging to them. In northern Britain, settlement and building forms, as well as associated material culture, are often chronologically insensitive and even extensively excavated sites may not produce reliable material for dating. This results in a picture generally characterized by broad, 'fuzzy' developments rather than well-defined sequences. Attempts to formally categorize site-types and features in chronological frameworks have proved problematic. For example, the 'Hownam sequence', which proposed that settlements of unenclosed houses were followed by palisaded and then earthwork enclosures of increasing complexity, before being replaced once again by unenclosed settlements (cf. C. M. Piggott 1948; S. Piggott 1966), has subsequently been shown to represent only isolated examples (Armit 1999; Halliday 2025, pers. comm.; Harding 2017, 74–79). Furthermore, while large-area comparative surveys, excavations and radiocarbon-dating have revealed broad chronological developments across the region (see Armit 1999, 2016, 54–56; Armit and McKenzie 2013, 11–13; Harding 2017, 74–79; RCAHMS 1997, 151), with some indications that the structural forms of buildings rather than site morphology may be useful for identifying occupation periods of settlement (RCAHMS 1997, 152), this too should be caveated by the small corpus of well-dated and understood sites that underpin the observations.

This definition of regional settlement sequences is complicated by the widespread evidence for variable patterns of settlement occupations, with a few potentially long-lived sites, some settlements that are intermittently occupied, and many settlements that appear to have short-lived (e.g. generational) durations (e.g. Halliday 1999, 53, 60–63; RCAHMS 1990, 1–13). The difficulty of comparing sequences identified in excavated sites to those known only from the survey record remains a challenge – one that is magnified by differential preservation, such as with plough-truncated remains. In this case, the interplay of current and historic land-use patterns, methods of archaeological detection, and the character of the known remains, have profound impacts on the nature of the evidence from which to understand the past (Figure 2).

Thus, establishing whether a settlement that survives as an earthwork is really a single 'phase' as the surface evidence might suggest, or not, is generally impossible. Nor is it

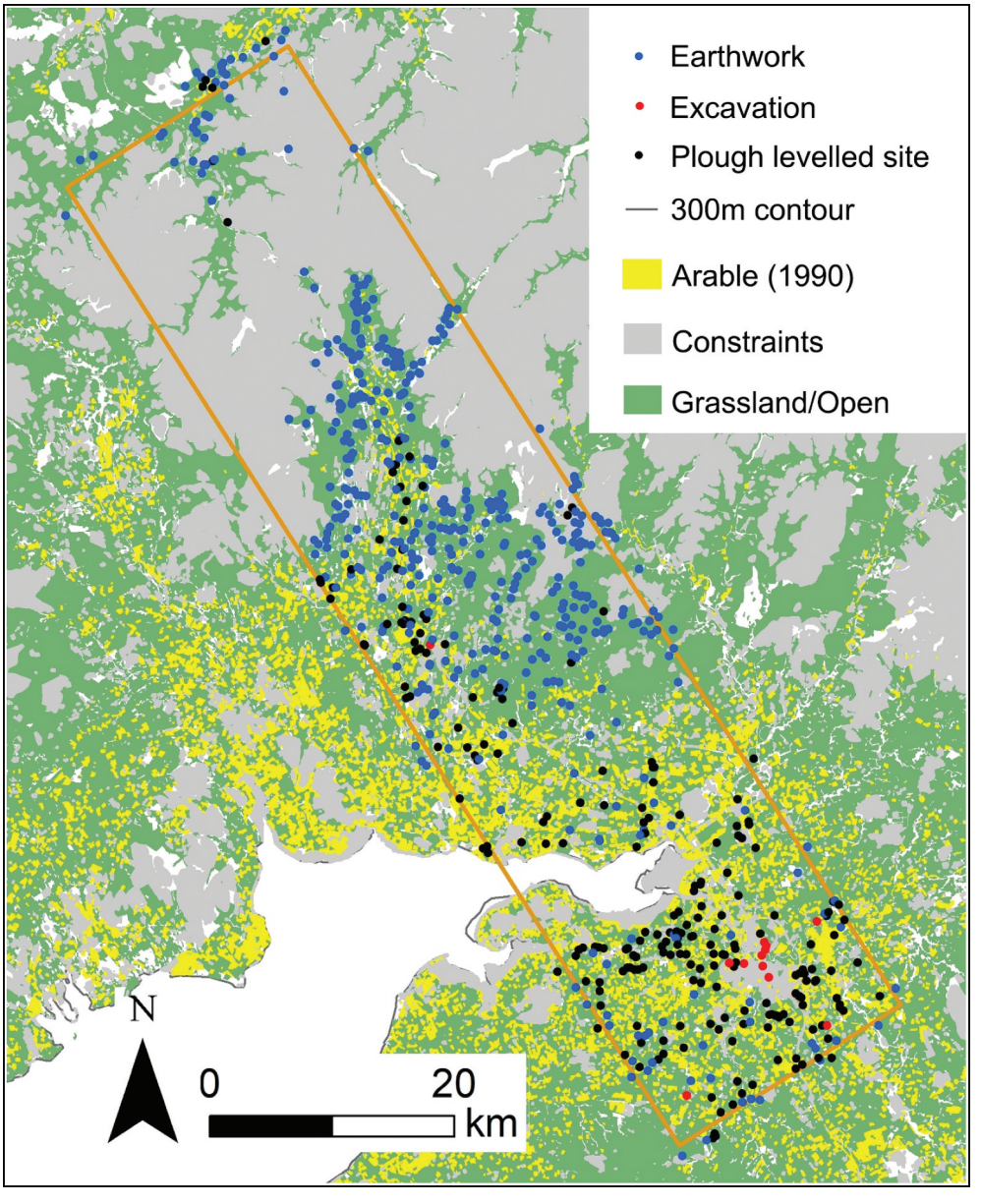

Figure 2. The known settlements in the topographically diverse Case Study 3 area, according to the primary forms in which they survive or were identified. This demonstrates the broad impact of current and past land use on the character of evidence. The constraints shown include land over 350 m ASL, which appears to be the upper altitudinal limit of settlement. Dense coniferous forestry, peatland, and, to a degree urban areas, represent zones of low potential for new evidence. The survival of earthworks is largely in areas of what is now less intensively farmed land, while the disposition of arable land use (and well-drained soils) conditions the effectiveness with which cropmarked evidence can be detected. The influence of development-led excavation in and around Carlisle is especially striking (background topographic map contains public sector information licensed under the open government licence v3.0. © Crown copyright and database rights 2023 Ordnance survey [AC0000851941]), (authors).

usually possible to ascertain at a site-by-site level the durations of occupation even when radiocarbon or other dating is available. Thus, while broad patterns of short durations and intermittent cycles of occupation are evidenced in some periods across the area as a whole (Barber and Crone 2001; Cowley 2021; Halliday 1999), establishing how an individual site fits into regional settlement sequences is challenging. Furthermore, contemporaneity of settlement occupations is largely impossible to establish with certainty.

From the discussion above it will be evident that establishing the reliability of the archaeological record in representing the past is difficult and that defining settlement sequences and potentially contemporary patterns of settlement is a challenge. While improved understanding of the character of the archaeological record is only part of the answer to these challenges, in following sections we approach that issue for the project study area.

3. Addressing the challenges of long-term data collection

The study region has a long history of antiquarian and archaeological research, documented within a complex range of past and present archiving strategies that have resulted in a wide variety of sources of information (Figure 3).

Antiquarian beginnings

Antiquarian interest in the study region has its origins in the sixteenth and seventeenth centuries, with a primary focus on the most substantial prehistoric sites and Roman remains. General Roy's surveys (Roy 1793) followed the lines of Roman military roads northwards, providing the earliest visual depiction of many archaeological monuments, including Iron Age farmsteads and hillforts, as well as Roman forts and other military installations. Throughout the nineteenth century, surveys and excavations across the region included the work of John Clayton on Hadrian's Wall (E. Birley 1961), the Society of Antiquaries of Scotland at major Roman forts and indigenous enclosed sites such as Burnswark (e.g. Christison 1894, 1896; Christison, Barbour, and Anderson 1899), and the Antonine Wall (Keppie 2016). These, together with other documentary sources (Figure 3(H)) remain a significant source of primary information, especially where systematic efforts have been made to explore them.

Earthwork surveys

Given the extent of surviving earthwork remains in the study area, it is unsurprising that they attracted attention through field survey (Figure 3(A)) since the late nineteenth century (e.g. Charlton and Day 1984; Halliday 2016). As well as those at the tail-end of an antiquarian tradition, this work included the mapping of antiquities by the Ordnance Survey (OS) Archaeology Division (Bowden and Mackay 1999; Linge 2004), and the area surveys of the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) and the Royal Commission on the Historical Monuments of England (RCHME). The OS work is the foundation for national and regional Historic Environment Records, while the county-based inventories of the RCAHMS and RCHME created benchmark surveys of many areas (Dunbar 1992; Sargent 2001). With the OS records of mappable antiquities, the inventories

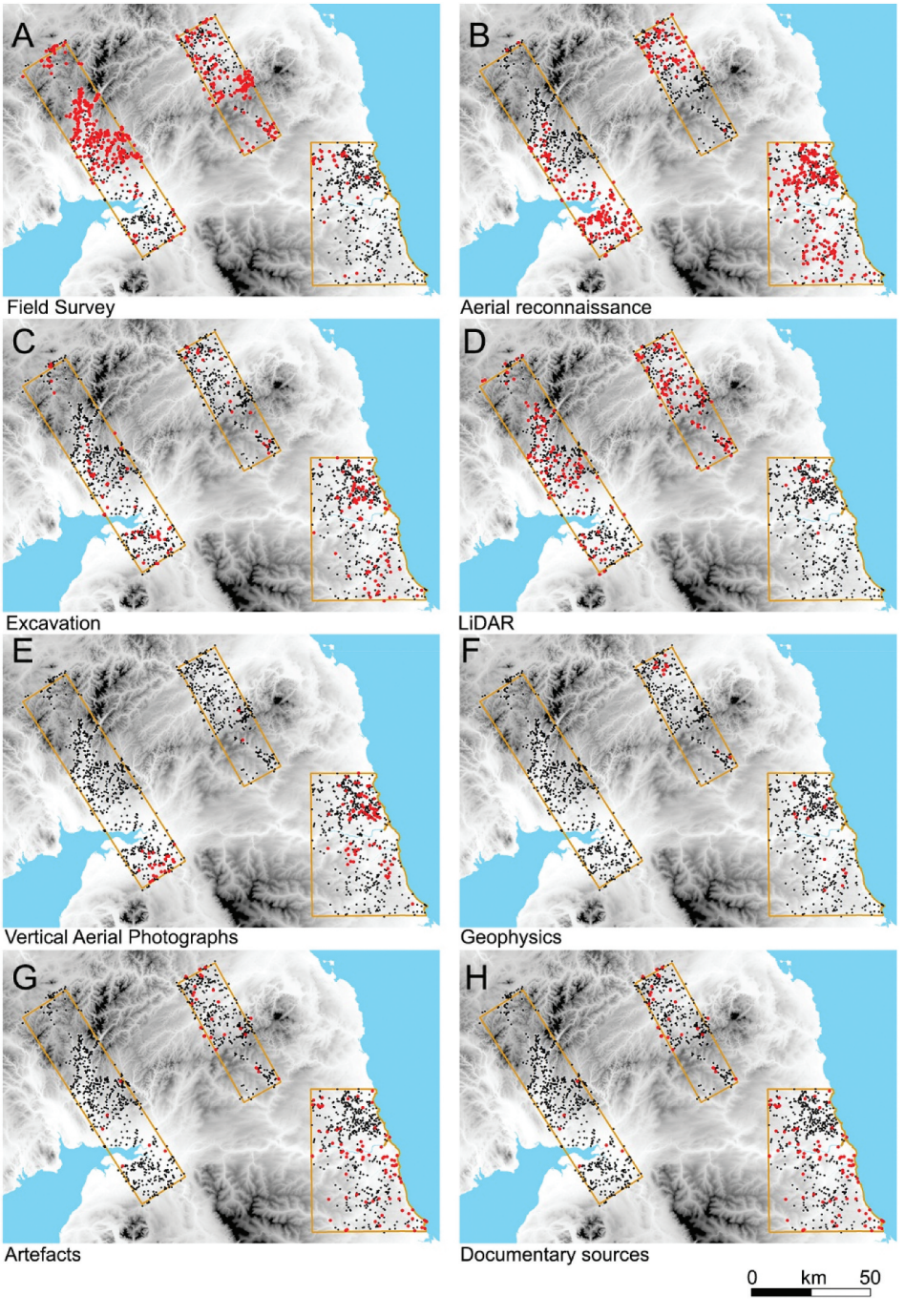

Figure 3. The distributions of records according to the primary source illustrates the spatial variation in the contributions of different techniques. In many cases multiple sources of information have contributed to the creation of any given record, but these maps attempt to convey the method or type of archaeological remains that first drew attention to the site. The red dots indicate the sites recorded by specific technique, with the black dots representing the rest of the corpus to demonstrate relative contributions to knowledge (authors).

are a core part of the monument databases now known as the National Records of the Historic Environment (NRHE), divided between modern England and Scotland. The study of earthworks and the framing of their morphological characteristics owes much to the work of George Jobey (1966). His extensive programme of excavation (below) helped to consolidate his survey work, in a pioneering approach that was extended from northeast England into eastern Dumfriesshire (Jobey 1971).

In general terms the distribution of earthwork remains is largely conditioned by the disposition of historic and modern land use (though see LiDAR section below). In areas of historic and contemporary arable cultivation earthwork survival is limited to niches such as stands of deciduous woodland or odd corners of the landscape that have escaped the plough. Thus, a fundamental characteristic of the archaeological evidence is the concentration of earthwork survival into 'unimproved' land, often in upland areas. This is generally the archaeological settlement evidence that has been the focus for the most sustained interest, and an aspect of the history of study that infuses understandings of the past (Halliday 2016, 55). Until recently, the study of earthwork remains has thus fundamentally informed the development of archaeological understandings, with plough-levelled sites recorded as cropmarking in lowland areas contributing much less until the 1980s (e.g. Cowley 2005, 2016a).

Aerial reconnaissance and photography

The application of aerial reconnaissance (Figure 3(B)) using light aircraft revolutionized knowledge of site distributions across northern England and southern Scotland during the second half of the twentieth century. While this included earthworks where aerial photographs provided fresh insights into the character of remains (e.g. prehistoric cord rig cultivation), the most significant impacts were the discovery of otherwise largely levelled archaeological sites revealed as cropmarking, mainly in cereal crops, as well as less commonly parching in grass and soilmarks in bare earth conditions. The application at scale of aerial reconnaissance in the study area took place after World War II, initially by J. K. St Joseph with a particular focus on Roman archaeology (Cowley 2016a; St Joseph 1976). Since then, the aerial perspective has contributed significant new knowledge (e.g. Bewley 2003; Cowley and Brophy 2001; Maxwell 1983) from both aerial reconnaissance and archives of vertical block coverage aerial photography taken by the Royal Air Force (RAF) in the 1940s and subsequently by the OS and various commercial companies (Figure 3(E)) (e.g. see Cowley, Standring, and Abicht 2010). Nevertheless, with climate change and developments in crop management, this approach may be witnessing a pattern of diminishing returns, especially of previously unknown monuments and landscape features (e.g. Cowley 2019, 10–11).

LiDAR

The increasing availability and resolution of LiDAR (i.e. Airborne Laser Scanning [ALS]) data is proving to be a very powerful survey tool (e.g. Banaszek, Cowley, and Middleton 2018; Bennett and Cowley 2025; Cowley 2013; Cowley et al. 2020; Opitz and Cowley 2013). This is routinely allowing identification or clarification of a range of upstanding remains and sites that had often remained undetected, either due to factors

such as tree cover or the subtlety of surface remains largely levelled by ploughing (Figure 3(D)). The increasing availability of LiDAR data is prompting another period of significant growth in site discovery and interpretation – which will match that generated by aerial photography in the second half of the twentieth century. For example, our desk-based mapping exercise covering 1500 km^2 of southwest Scotland, about half of which had been intensively surveyed in the past, produced an increase of 20% in the numbers of known certainly, probably or possibly later Iron Age settlements (Cowley et al. 2022, 16–19). The returns from LiDAR-based survey are within areas of woodland, in tucked away corners of the landscape that have escaped earlier attention, but also in areas of pasture where aerial photography and pedestrian survey have proved ineffective in detecting slight plough-levelled earthworks. These results come from an area previously surveyed to modern standards, but without the benefit of LiDAR. More generally, depending on the intensity of earlier investigation and the character of the landscape, systematic survey can increase the numbers of known archaeological site and landscape records by between 50% and 200% (Banaszek, Cowley, and Middleton 2018, 1; Cowley et al. 2020, 110–11).

Landscape approaches

Whilst the number of known archaeological sites in the region dating to the first millennia BCE/CE has increased apace since the nineteenth century, the wider landscape context was not explored extensively until the last quarter of the twentieth century. Although Crawford discussed the concept of broader landscape dynamics for the Roman period across the region during the 1943 Rhind Lectures (Crawford 1949), it was not until the 1970s and 1980s that the first approaches were undertaken in the field. These included the move towards more discursive studies of landscape by RCAHMS (e.g. RCAHMS 1997) and others, for example the University of Edinburgh's survey of the Upper Esk valley in southwest Scotland (Mercer 2018). A greater focus on investigating 'landscapes' alongside site-based studies has since led to regional works assessing an increasingly broad range of later prehistoric, Roman and Early Medieval archaeology (e.g. Cowley 2021; Hardwick 2021).

Excavation, geophysical surveys, artefact recovery and palaeoenvironmental studies

As indicated above, most of the distributions of known archaeological sites in northern England and southern Scotland are a product of survey of various sorts. Nonetheless, excavation (Figure 3(C)) since early antiquarian investigations has also made significant contributions to knowledge, with a particular focus on Roman military sites, notably along the lines of the Roman road now called Dere Street, Hadrian's Wall and the Antonine Wall (Breeze 2019; Breeze and Hanson 2020; Petts and Gerrard 2006, 43–45; ScARF 2023). The extensive programme of excavations undertaken between the late 1950s and the 1980s by George Jobey in northeast England (Jobey 1962, 1978) and southwest Scotland (Jobey 1975) are important. These provided a counterpoint to the emphasis on Roman monuments and were also fundamental in building a framework for the survey evidence (above). In the last quarter of the twentieth century especially,

urban expansion and development of transport infrastructure has led to increasing excavation, especially in Carlisle (e.g. McCarthy 2002; Zant 2009) and Newcastle (e.g. Hodgson, McKelvey, and Muncaster 2012), as well as the road upgrades from the A74 to M74 in Dumfries and Galloway (Banks 2000, 2004), and the A1 in Yorkshire (e.g. Fell 2020; Fell and Johnson 2021) and East Lothian (Armit and McKenzie 2013; Haselgrove and McCullagh 2000; Lelong and MacGregor 2024). In contrast, there have been relatively few research driven programmes of excavation (e.g. Haselgrove 2009; see Birley, Meyer, and Greene [2016] for a notable exception at Vindolanda), and it is noteworthy how much the distributions of excavated sites are driven by modern imperative, such as infrastructure and housing, which are not evenly distributed across the landscape and thus do not represent a systematic sample of known sites.

Alongside excavation, geophysical survey (Figure 3(F)) is producing further information (e.g. the 'Newstead Environs' project [Dent 2012]), though much of the emphasis of this work has been to compare aerial photographic evidence and geophysics in a very traditional site focus (e.g. Hale and Cowley 2009). With increasing spatial coverage possible through motorized survey, geophysical data is also contributing to a landscape perspective, albeit still relatively local in scale (Hanson, Jones, and Jones 2019). This includes surveys covering over 100 hectares in southwest Scotland, partly undertaken as part of our 'On the Edge of Empire' pilot project (Rummel et al. 2025).

While 'Beyond Walls' has focussed on settlement and landscape, the distributions of the corpus are informed also by artefact recovery, from ploughed field walking, casual finds and metal detecting (Figure 3(G)). Though no attempt has been made to harness the full evidence from artefacts, where this information was available in the NRHEs and HERs and it identified potential settlement sites it was included.

The remaining major data source for the study region are palaeoenvironmental analyses undertaken since the 1970s. These are primarily palynological studies on cores from wetland and peat areas (Dark 1999, 2000, 2015; Dumayne 1993; Dumayne-Peaty 1998, 1999; Tipping 1997a, 1997b, 2018; Tipping and Tisdall 2005; Turner 1979), with some studies of excavated botanical and faunal remains, e.g. in waterlogged deposits from Carlisle (Dumayne-Peaty and Barber 1997; Groves 1990; Huntley 1989; McCarthy 1991) and Vindolanda (Manning, Birley, and Tipping 1997).

Collating the evidence and bridging the gaps

The range of data described above suffers from significant disarticulation, which is a challenge to collating known records. While there are UK-wide thesauri of monument terms, the structure of records across the project region varies significantly, and every data source, whether the two national records (England and Scotland) and a range of local Historic Environment Records (HERs), have their own distinctive character. This is a greater research challenge in England than in Scotland, as national heritage practice in England has led to a multiplication of sources of information, and this variability in data collection and subsequent archiving and accessibility is a significant challenge (see also Lock and Ralston 2022).

The variability across sources of information is exacerbated by the sheer volume of archaeological data within the study area. For example, the 2011–2016 'English Landscapes and Identities' project (EngLaId) (Gosden et al. 2021; Green and Creswell

2021) drew together nearly a million records for England from the NRHE and various HERs, amongst other sources, for the period c. 1500 BCE to 1086 CE. While information from recent 'Big Data' projects has been assimilated in the corpus for 'Beyond Walls', adding significant value, they too are a source of variability in the character of data. In addition to the EngLaId data kindly made available by the project team, the 'Atlas of Hillforts of Britain and Ireland' (AHBI) was used for reference along with data from the 'Rural Settlement of Roman Britain' project (RSRB) (Allen et al. 2017; Smith et al. 2016, 2018).

4. Data-gathering: existing and newly created data

Collation of existing datasets

As a result of the wide range of datasets outlined above, there was a requirement for rationalization or 'cleaning' of data before, for example, distributions of settlements that may be in scope can be identified. The creation of the project database for 'Beyond Walls' was thus an inherently manual process of assessment to ensure that classifications, morphology and other settlement attributes, and dating were applied to some extent systematically. To a degree this manual approach was supported in the Scottish part of the study area by selective data mining of the NRHE and *Discovery and Excavation in Scotland* (DES – an annual list of archaeological investigations). Searching for terms (e.g. 'Iron Age', 'Roman', 'settlement', 'fort') or archaeological methods (e.g. 'excavation', 'evaluation', 'trench') went some way to overcoming the shortcomings of the necessarily limited classifications that are used, for example, in the NRHE (Figure 4; see also Blankshein et al. [2025] for an application of this approach).

Cleaning and assessing the data

Collating the settlement evidence into a consistent format to support further analysis and comparative study relied on preliminary sifts of the NRHE, HERs, AHBI and EngLaId data to manually consolidate the different source records into a single record per site (Figure 5). While this process could have been automated, the variability between records across sources meant that manual assessment was felt necessary. For example, variability between sources for what constitutes a 'site' record undermines systematic identification of all known settlements without manual assessment.

During the preliminary sifts for in-scope records, location accuracy was checked, especially for those with six-figure grid references (i.e. only accurate to within 100 m). Missing chronological information was added or rationalized where inconsistently applied. This was a time-consuming process, requiring knowledge of the region's archaeology and the history of data-gathering and archiving. For example, assessing those 'enclosure' records without period attributions required examination of the textual record (where one existed) and supporting information, informed by knowledge of comparanda, to identify those sites related to the project's chronological scope from others that could range from Neolithic monuments to recent sheepfolds. The cost-benefit of trying to compile as complete a picture as possible was informed by the recognition that a significant proportion of the available evidence, especially that

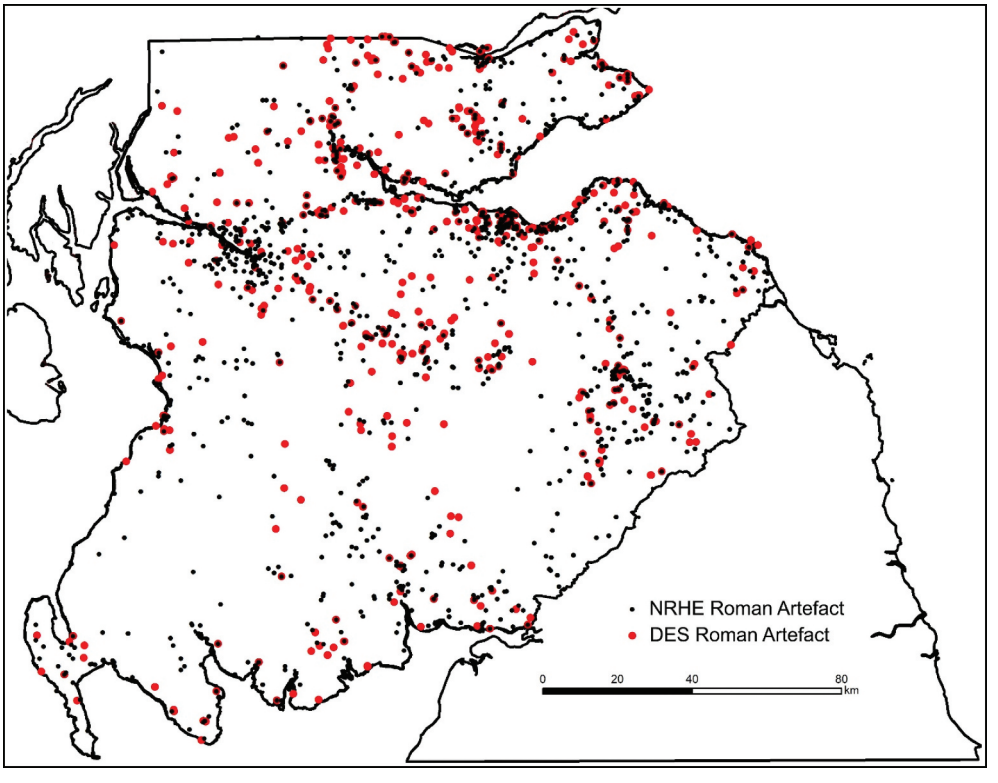

Figure 4. The distributions of site records for Roman objects according to those identifiable through data mining as such in the Scottish NRHE, compared to the results of the same search of *Discovery and Excavation in Scotland*. This illustrates the power of a data mining approach that can extend beyond the necessarily limited classifications that can be applied in a database like the NRHE, and the flexibility to ask questions that were not in the minds of the database designers (authors).

identified from cropmarking on aerial photographs, tended to attach general classifications (e.g. 'enclosure'), requiring systematic site-by-site assessment.

Database creation and synthesis

Following initial filtering to identify indigenous settlements and landscape activity for the period 500 BCE–500 CE, along with that for Roman military, urban, religious and funerary sites, in-scope records for the four case study areas were given more detailed treatment. For example, recent Historic England Aerial Investigation and Mapping (AIM) projects demonstrate the value of systematic survey to stated standards (Evans 2019), drawing on both aerial photography and LiDAR visualizations (Figure 6). These included projects overlapping with parts of our Case Studies 2 and 3 (Deegan 2013, 2019; Hardwick 2021), as well as Case Study 1 (Deegan 2022). Since these were undertaken to stated standards and drew on the currently available source information they could be treated as a reasonably comprehensive record of what is known. On the other hand, earlier projects in Case Studies 1 and 3 (e.g. Oakey 2009) that were based only on aerial imagery were assessed by the 'Beyond Walls' project using more recently acquired

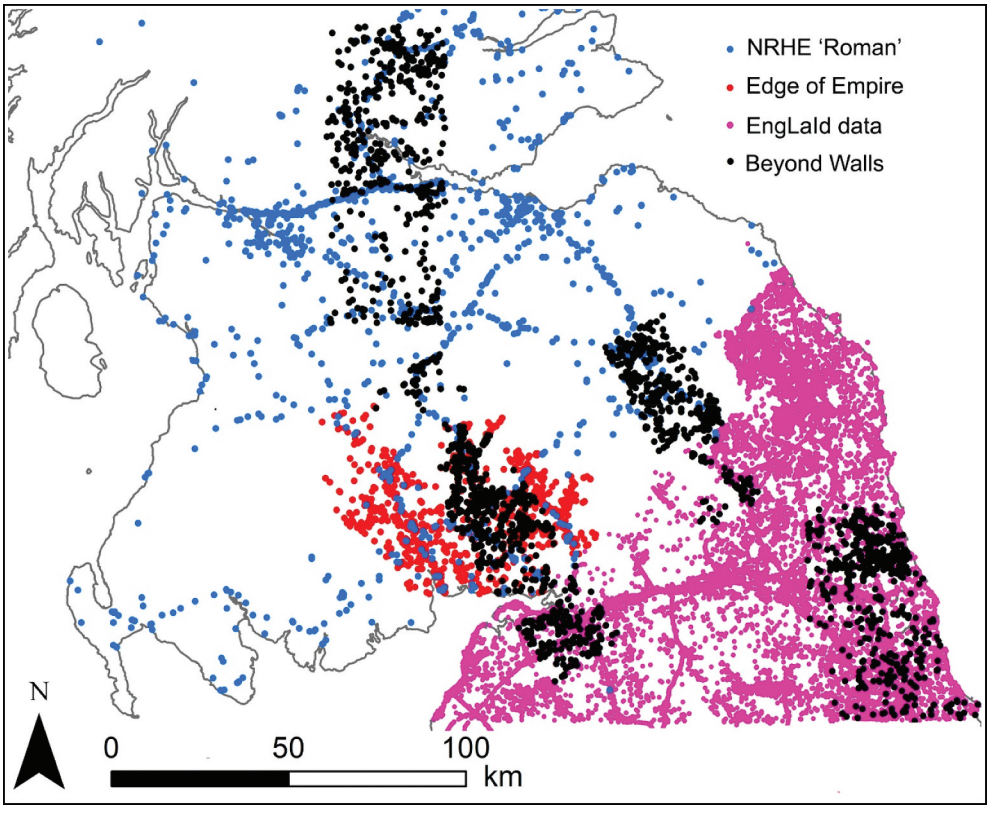

Figure 5. The broad distributions of selected monument data from different sources, including records tagged as 'Roman' in the Scottish NRHE, the 'Beyond Walls' case study areas, the Edge of Empire study area and the English Landscapes and Identities project. These and many other sources of data have their own characteristics which can make collation of information a complex and time-consuming process (authors).

LiDAR to rapidly prospect for previously unrecorded in-scope sites and features. Other sources of information included excavation records and environmental research (including unpublished archive entries, project reports and published monographs).

New data from airborne remote sensing

As part of our project, we also conducted desk-based archaeological survey using aerial photography and LiDAR data both to add additional details to known sites and to explore apparent gaps in the record in order to confirm whether these represented genuine absences of visible archaeological remains or merely lacunae in past archaeological research. In practice LiDAR data (https://remotesensingdata.gov.scot/; https://environment.data.gov.uk/survey) made the most significant contributions in areas where systematic earlier survey had not been undertaken, such as Case Study 2, and also proved invaluable by providing a relatively consistent means of viewing earthwork remains. By comparison, aerial photographs (both specialist oblique imagery and

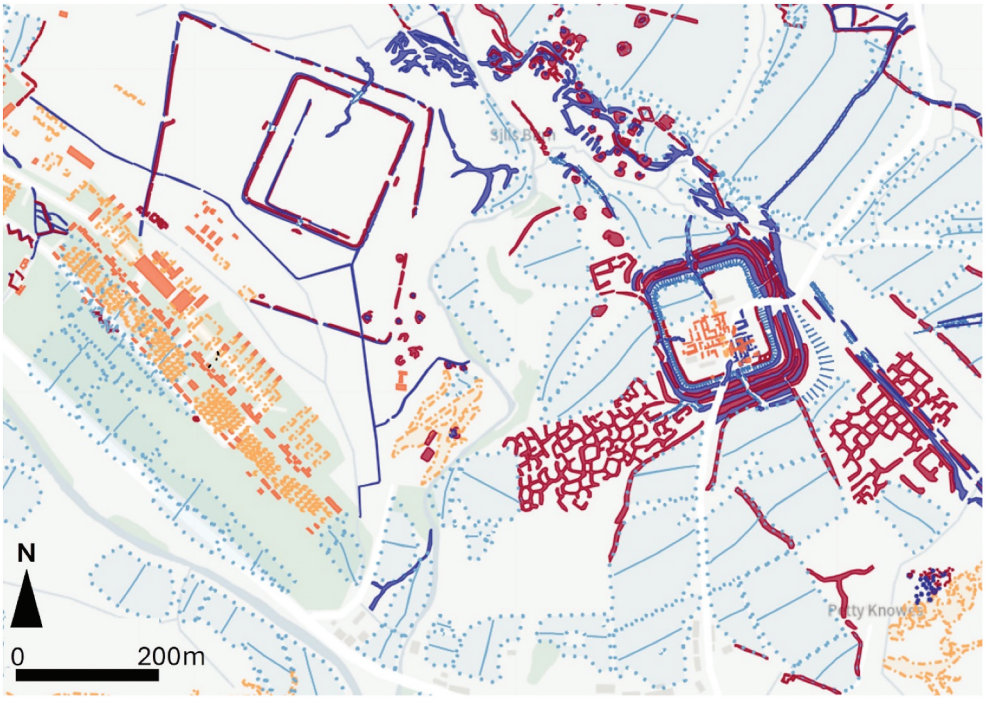

Figure 6. Extract of Historic England aerial survey mapping from Redesdale in Northumberland, showing the enhanced spatial evidence available from such data (source data copyright Historic England). *Bremenium* (High Rochester) Roman fort is shown centre right, with the cemetery at Petty Knowes bottom right.

vertical, large-area coverage orthophotographs, including Google Earth™) made a less significant contribution to new knowledge.

The examination of LiDAR data followed procedures developed in the 'On the Edge of Empire' project (Cowley et al. 2022, 16), whereby initial inspection was undertaken in horizontal strips at a viewing scale of 1:3000 with reference to aerial photographs, existing survey data and nineteenth century Ordnance Survey maps. In areas of exceptional earthwork preservation, closer examination at 1:1000 scale was used to see if smaller archaeological features (such as palisade trenches or timber roundhouse ring-grooves) could be identified. This pilot study covered the central 60% area of the 'Beyond Walls' project's Case Study 3 block, leading to the identification of 134 previously unknown sites of certain, probable or possible Late Iron Age date – an increase of c. 20% (Cowley et al. 2022).

Finally, the project also utilized topographic and elevation data and historic/modern mapping from the OS, geological mapping from the British Geological Survey, soils data from the James Hutton Institute, and land use coverage and hydrological mapping from the UK Centre for Ecology and Hydrology (available through Edina Digimap).

5. Data consolidation and synthesis

The data collection described above aimed to provide as comprehensive a record of the in-scope known archaeological evidence as possible, as a foundation to exploring regional patterning in lifeways and the disposition of settlement and landscape organization. Given the range of sources of information, creating information that could support further analysis required further consolidation in a systematic framework within the project database.

Structuring the 'Beyond Walls' database

The project database of settlement evidence from survey and excavation captures detailed information in a systematic manner for the case study areas (see Appendix 1 for data structure). Records based purely on survey data and those drawing on excavated evidence inevitably had different richness of information, and this is reflected in the content and structure of related database tables. Nevertheless, records across all data are linked by a unique project identifier (UID), together with name and location, and links to relevant monument and other external records and publications. Variability in the character of information is also evident between records of indigenous settlements and for Roman sites and monuments. While these had as many common fields as possible, differing fields were required to capture the heterogeneous character of information. In all cases, the database fields attempted to capture broad characteristics, such as overall typology, chronology and phasing, geographical setting, morphological characteristics, present-day survival level, associated landscape features and history of study. The fields captured information to support analysis of both the factors that might structure that data (e.g. cropmark/earthwork) and those that would allow inter-site and regional assessments of characteristics such as size and setting, phasing and complexity, to support the exploration of settlement structure and change over time.

More detailed information was compiled for excavated sites, capturing the nature of the investigations, site stratigraphy and phasing, construction and occupation histories, artefactual and ecofactual assemblages, and scientific or artefactual dating. The potential for further radiocarbon dating or associated palaeoenvironmental research was also flagged. Alongside providing information for analyses of the excavated record, the greater detail in the excavation database fed back into the wider settlement database, informing and improving interpretation of the unexcavated sites across the study area.

While the core fields of the database were populated for all four case study areas, aspects of the data structure varied slightly between the case study areas in order to account for the different available sources. For Case Studies 2 and 3 lying in the predominantly rural and upland landscapes of the Anglo-Scottish border, full records were completed for every site. For Case Study 1, which has a larger number of excavated sites due to greater recent urban growth, the *Site & Survey Data* and *Excavation Data* tables were completed in a more concise form, providing a nested approach with areas of different data resolution (Figure 7). Thus, the broad distribution of indigenous and Roman sites are recorded across the entirety of Case Study 1 using survey and excavation data derived primarily from the EngLaId, RSRB and AHBI projects. A core area containing a high density of excavated settlements was then examined in greater detail. Here, the initial dataset was supplemented by additional,

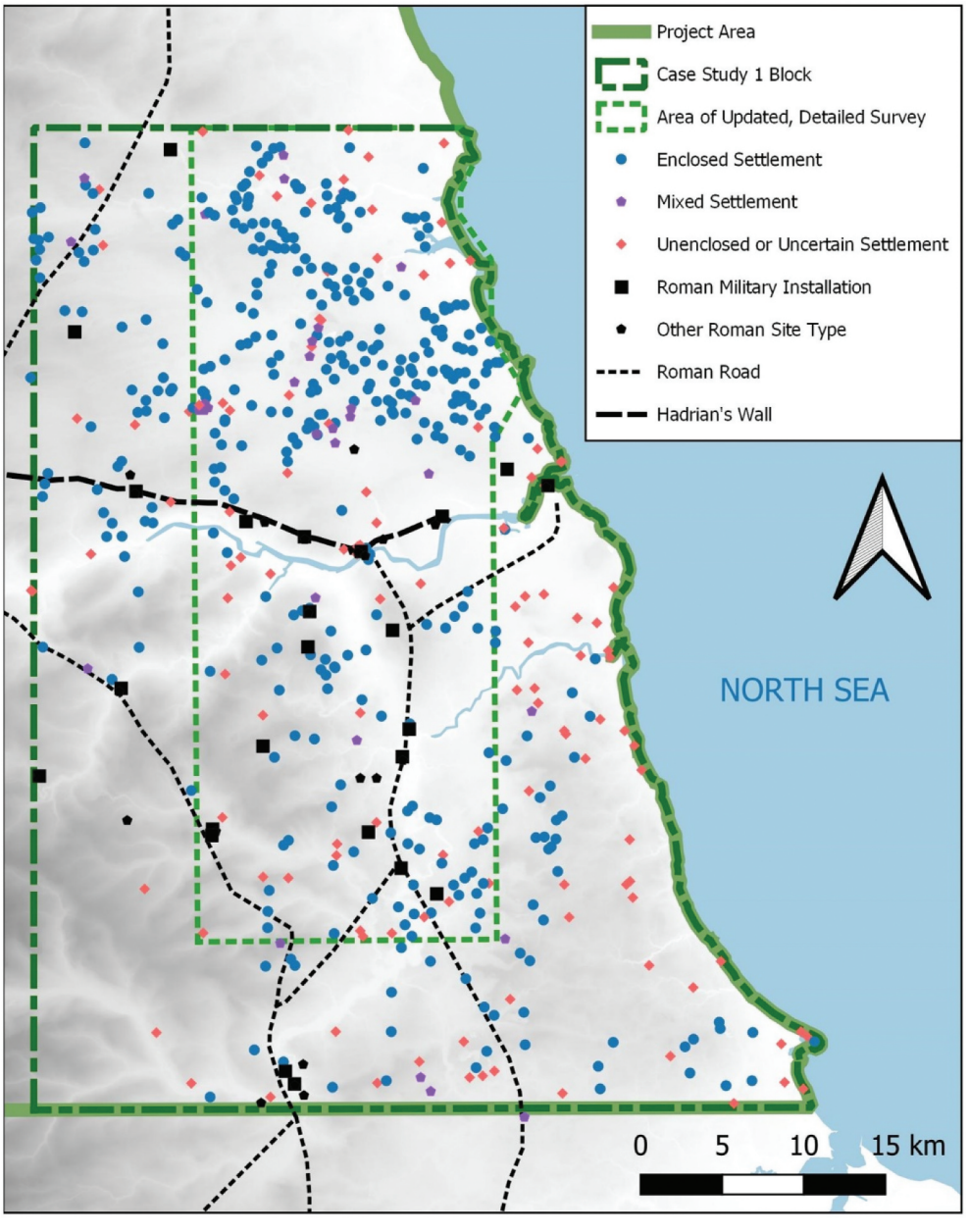

Figure 7. Map of Case Study 1, showing the overall distribution of identified archaeological sites against the different, 'nested' levels of detail in data-gathering undertaken by 'Beyond Walls', and including the spatial coverage of previous survey projects by Historic England (authors).

updated (2022) information supplied by the three relevant HERs and recent AIM-standard mapping published by HE. The latter used all available aerial photographs and LiDAR data, removing the need for further desk-based prospection.

In contrast, Case Study 4 was the largest survey block, comprising a geographically diverse transect that crosses the Antonine Wall. Initial analysis established that the overall archaeological record was much more fragmented than in the other study areas, and so the

database was completed in a more abbreviated format for all excavated indigenous and Roman sites based on a consolidation of the NRHE records rather than a full spreadsheet for non-excavated sites. Underpinning these decisions was a subjective assessment of the benefits of expending resources on time-consuming data collection when an initial assessment already demonstrated that the record was highly fragmented.

A note on chronology

An important aspect of the data consolidation was to apply as consistent a chronological scheme as possible. This is challenging for a number of reasons, including variations in definition of terms between modern scholars, national and regional heritage bodies, and other data sources. This compounds an underlying issue that many sites are dated only in the very broadest terms on the basis of morphology, with very few scientifically well-dated sites, which is a challenge to examining processes that require 'tight' chronologies of a century or less. Nevertheless, the broad scheme used in the project incorporates regional and period variation within a framework of broad and narrow periods that recognizes the variable granularity of the dating evidence (Table 1).

Table 1. The chronological scheme of the 'Beyond Walls' project (authors).

<table>
<tr><th>Calendar Dates</th><th>UK Broad Periods</th><th>Atlantic 'Long Iron Age'</th><th>Scottish Lowland Terms</th><th>English Periods</th><th>Project Broad Periods</th><th>Project Narrow Periods</th></tr>
<tr><td>1000 BCE</td><td rowspan="15">Later Prehistoric (< c. 400 CE)</td><td rowspan="3">Bronze Age (< c.800 BCE)</td><td rowspan="3">Bronze Age (< c.800 BCE)</td><td rowspan="3">Bronze Age (< c.800 BCE)</td><td rowspan="3">Bronze Age (< c.800 BCE)</td><td rowspan="3">Bronze Age (< c.800 BCE)</td></tr>
<tr><td>900 BCE</td></tr>
<tr><td>800 BCE</td></tr>
<tr><td>700 BCE</td><td rowspan="5">Early Iron Age (c.800 - 200 BCE)</td><td rowspan="12">Iron Age (c.800 BCE - 400 CE)</td><td rowspan="8">Iron Age (c.800 BCE - 43 CE)</td><td rowspan="8">Pre-Roman Iron Age (c.800 - 1 BCE)</td><td rowspan="4">Earlier Pre-Roman Iron Age (c.800 - 400 BCE)</td></tr>
<tr><td>600 BCE</td></tr>
<tr><td>500 BCE</td></tr>
<tr><td>400 BCE</td></tr>
<tr><td>300 BCE</td><td rowspan="2">Mid Pre-Roman Iron Age (c.400 - 200 BCE)</td></tr>
<tr><td>200 BCE</td></tr>
<tr><td>100 BCE</td><td rowspan="7">Middle Iron Age (c.200 BCE - 400 CE)</td><td rowspan="2">Later Pre-Roman Iron Age (c.200 - 1 BCE)</td></tr>
<tr><td>1 BCE / 1 CE</td></tr>
<tr><td>100 CE</td><td rowspan="4">Roman (43 - 410 CE)</td><td rowspan="4">Roman Iron Age (c. 1 - 400 CE)</td><td rowspan="2">Earlier Roman Iron Age (c.1 - 200 CE)</td></tr>
<tr><td>200 CE</td></tr>
<tr><td>300 CE</td><td rowspan="2">Later Roman Iron Age (c.200 - 400 CE)</td></tr>
<tr><td>400 CE</td></tr>
<tr><td>500 CE</td><td rowspan="6">Medieval (c.400 - 1500 CE)</td><td rowspan="5">Late Iron Age (c.400 - 900 CE)</td><td rowspan="6">Early Medieval (c.400 - 1100 CE)</td><td rowspan="6">Early Medieval (410 - 1066 CE)</td><td rowspan="6">Early Medieval (> c.400 CE)</td><td rowspan="6">Early Medieval (> c.400 CE)</td></tr>
<tr><td>600 CE</td></tr>
<tr><td>700 CE</td></tr>
<tr><td>800 CE</td></tr>
<tr><td>900 CE</td></tr>
<tr><td>1000 CE</td><td>Early Historic (> c. 900 CE)</td></tr>
</table>

The challenges of chronology are especially evident for the Iron Age. While there is broad agreement on *c*. 800 BCE as a start date, there are a range of end dates dependent on where in Britain one is. Our project has used an end date of around 400 CE, as commonly used in southern Scotland and northern England. While this pertains to the approximate end of both later prehistoric and Roman-influenced occupation forms and socio-political dynamics, the project also splits the Iron Age into *Pre-Roman* and *Roman* broad periods to acknowledge the changing influences of the Roman Empire upon the wider region. That this divide is placed at the turn of the first millennia BCE/CE, the median point between the invasions of south-eastern England by Julius Caesar and Claudius, and of the initial period of Roman socio-economic and cultural influences upon Britain from continental Europe, recognizes the inherent difficulties of assigning tight chronologies to material and sites that are poorly dated.

Splitting the *Pre-Roman Iron Age* into *Earlier, Mid* and *Later* is applied only to the small percentage of sites where occupation histories are based on scientific and artefactual dates. The divide between *Earlier* and *Mid Pre-Roman Iron Age* also accounts for the Hallstatt Plateau (c. 800–400 BCE) in the radiocarbon calibration curve, hindering more specific dating.

For the *Roman Iron Age*, a division between *Earlier* and *Later* is based on some roughly synchronous developments, including a widely recognized drop-off in identified material culture at indigenous settlement sites regionally, the end of long-term direct Roman occupation north of Hadrian's Wall, and changes to the material culture from Roman military communities on the frontier. For excavated Roman military, urban and religious sites in the study region, even more-detailed chronology was recorded, where available, given the greater available dateable material culture and past investigation (including scientific dating). A key point to arise out of the consideration of chronology is the very limited proportion of the total corpus of sites that have detailed dating evidence.

6. Preliminary analysis and discussion

As described above, the character of the archaeological data for Case Study 4 is slightly anomalous, so the following discussion will largely focus on Case Studies 1 to 3 (Table 2). Nearly 2000 sites have been recorded for these three case studies, representing the most comprehensive database for the study period in northern Britain. Methodologically, the first point to stress for this large corpus of evidence is that it is consolidated within a common, reasonably systematic framework. This work has been completed with an awareness of the history of archaeological research and a broad familiarity with the material that developed further during the project.

Table 2. The results from Case Study areas 1–3, broken down into Roman and non-Roman sites, together with the respective areas covered by each study block (authors).

	Case Study 1	Case Study 2	Case Study 3	Totals
Total number of sites recorded	602	465	885	1952
Indigenous sites and features	555	413	720	1688
Roman military, urban, religious, funerary or infrastructure sites	47	52	165	264
Area covered (square km)	2128	1013	2002	5143

It is also worth noting that for Case Studies 2 and 3 about 13% of the total number of indigenous sites are new discoveries made by the 'Beyond Walls' project, while within Case Study 1 the recent AIM 'South-East Northumberland' project added about 9% to the indigenous settlement corpus. The significant amount of development-led excavation in Case Study 1 has had a major impact on knowledge, whereas in Case Studies 2 and 3 the pattern is much more of infilling known distributions of sites.

Assessing representativity

As introduced above, the assessment of whether the distributions of known archaeological sites are representative of past patterns of settlement and landscape activity is a key primary objective. This involved comparing the site distributions against factors such as elevation (i.e. the known or suspected topographic limit of occupation throughout all periods in the past) and modern land use (with its effects on site surface survival and/or other visibility), in order to determine whether these had influenced the nature of the results and any subsequent interpretation (Figure 8).

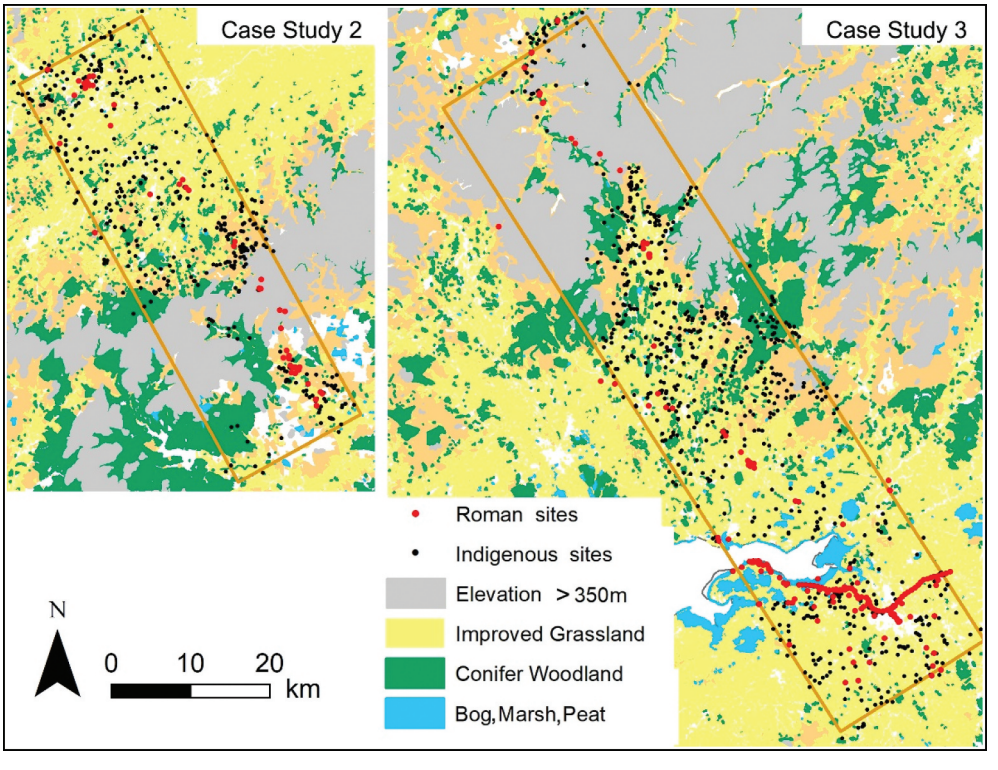

Figure 8. The distributions of indigenous settlements and Roman sites against a background of dominant modern land use and drainage or topographic constraints (elevation data contain public sector information licensed under the open government licence v3.0. © Crown copyright and database rights 2023 Ordnance survey [AC0000851941]; land use mapping downloaded from the UK Centre for Ecology and Hydrology through Edina Digimap) (authors).

As can be seen in Case Studies 2 and 3, other than a few isolated sites, the vast majority of both indigenous settlements and Roman sites occupy elevations below 350 m (above sea-level) and also appear to avoid areas of long-standing peat or bog (particularly visible in the low-lying marshland and peat bogs around the coastal plain surrounding the inlet of the Solway Firth in Case Study 3 – see also Figure 2). The former pattern is likely due to actual site distribution, given the ongoing lack of later human activity on higher ground to obscure or level potential features. The latter pattern, for its part, may be a genuine avoidance of wetter terrain for settlement construction during the study period (for a similar pattern in East Lothian see Cowley 2021, 75), or alternatively represent subsequent peat growth or changing climatic conditions concealing any settlement remains. Meanwhile, the notable gaps in the archaeological distribution beneath present-day woodland areas likely represents a mixture of modern taphonomic or survival bias (particularly in the larger areas of twentieth century coniferous plantation, with associated ground preparation removing all but the most substantial of earthwork remains) and some genuine patterning (given such plantations often being sited on otherwise difficult terrain).

In the large areas of lower-lying open and solid ground, clear patterns in the distribution can be discerned. This is regardless of whether the landscape has been ploughed (resulting in site identification primarily from cropmarks, excavations or large-area geophysical survey) or left as rough, unimproved ground permitting survival of earthwork or structural remains. Some elements, such as the greatest densities of sites being in the unimproved land on upland margins and higher-elevation valleys (with closely spaced settlements surviving as upstanding earthworks), likely represent a survival bias in the modern landscape. Others, such as the notable gaps in north-eastern parts of Case Study 2 and the lowland plain northeast of the Solway Firth estuary in Case Study 3, could represent a genuine absence of later prehistoric through to Early Medieval settlement activity and require further investigation. Finally, some distinct clusters of sites, such as that in the very north of Case Study 2 (around Melrose in the Tweed Valley) and the dense distribution of identified sites along the linear zone in the southernmost quarter of Case Study 3 (following the line of Hadrian's Wall) represent a combination of known, substantial Roman sites (mostly well-known military installations) with long histories of study, and the impact of this archaeological interest subsequently resulting in greater numbers of discoveries of smaller and less substantially surviving indigenous and Roman settlements in their immediate vicinities (the so-called 'honey-pot site' effect, see Cowley 2003, 257–258). Understanding of these varied factors is therefore crucial for effective regional analysis of any broader archaeological distributions across the study area.

7. Conclusion

This article has summarized the methodology for survey and excavation research conducted within the 'Beyond Walls' project, highlighting that answering archaeological research questions addressing long periods and large regions with a long history of study requires the crossing of a substantial number of existing academic, geographical, and administrative divides. The project therefore demonstrates the importance of balancing qualitative data to allow discussion of detailed archaeological remains (from site-specific, local contexts) with quantitative evidence for wider regional patterns and distributions.

While applied here in the United Kingdom's context of multi-regional and binational archaeological and heritage body divisions, this flexible, multi-strand approach combining both existing archived legacy data and newly created supplementary evidence (tailored to the requirements and restrictions of the region's archaeology) offers an example which could be applied to other settings with similar boundaries.

One major outcome of the project is that it shows the need for such multi-disciplinary, synthesis projects to be developed in the context of a deep understanding of the history of archaeological study and data-gathering in the study region, together with knowledge of the existing purposes (and thus nature) of archival data. For 'Beyond Walls' the sheer variety of data utilized (from antiquarian field survey records to modern computer-driven 'Big Data' synthesis projects) required a number of different, complementary approaches, including computerized data-mining of sources, manual collation of existing records within a consistent data-collection framework and chronological scheme, and creation of new site-based data from aerial survey sources to fill gaps in the record and provide updated material.

Consequently, an additional requisite to such approaches is to deal with the inherent difficulties in re-using existing datasets. Referring to the use of general-purpose data (as in the case of national and regional inventories such as the NRHE and HER data utilized by 'Beyond Walls'), Verhagen et al. (2016) suggest that not enough attention is usually paid to the intrinsic uncertainties within that data, nor the impact this can have on any subsequent interpretations using them. Of paramount importance is recognizing that such generalized datasets were collected from a wide range of sources, over long periods of time, and based on very different methodologies (Banaszek, Cowley, and Middleton 2018, 1–5), alongside issues of archaeological survival and other taphonomic biases. The EngLaId project (Cooper and Green 2015; Green et al. 2017) hoped to achieve this by examining the structure built into such records by the nature of their collection, something that the approach in 'Beyond Walls' has sought to examine as part of its methodology; for instance, by discussing the representativity and reliability of the data prior to any further analysis on settlement dynamics and patterning in the study period, and testing known 'gaps' in the previous archaeological record.

In summary, this article shows the challenges, but also the potential, of using a large range of existing archaeological evidence for purposes other than what it was originally intended for, and in association with newly gathered evidence. By creating projects which do this, archaeologists can attempt to bridge both ancient divisions (such as Hadrian's Wall) and also modern national and regional divides, which have segmented knowledge of the past, forming the potential for future connections and collaborations.

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Data availability statement

The newly created and synthesized data generated by the 'Beyond Walls' project will be disseminated to both the NRHE in Scotland (which will hold the original database alongside integrating the evidence into the relevant monument records) and the appropriate HER records in northern England.

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Appendix

Appendix 1: The 'Beyond Walls' database structure, arranged over three tables linked by a project UID (authors)

Site ID Spreadsheet = completed for all sites	*Site & Survey Data (Indigenous)* Spreadsheet = completed for all native / non-Roman sites	*Site & Survey Data (Roman)* Spreadsheet = completed for all military, urban and religious sites constructed by the Roman Empire	*Excavation Data* Spreadsheet = completed for any excavated sites (in addition to either of the *Site & Survey Data* spreadsheets)
Project UID – unique number allotted by 'Beyond Walls'	**Project UID**	**Project UID**	**Project UID**
Site Name – name(s) linked to the site's geographical location	**Site Type** – e.g. Unenclosed, Enclosed, Rare Site-Type	**Site Type** – e.g. Roman Fort, Military Settlement	**Excavation Date(s)** – e.g. 1975–1976, 2001
X Coordinate – latitude in six-figure British National Grid	**Source Classification(s) –** original terminology used	**Source Classification(s) –** original terminology used	**Excavation Extent** – area of trenches (square metres)
Y Coordinate – longitude in six-figure British National Grid	**Broad Period(s) –** e.g. Pre-Roman (PR) Iron Age	**Narrow Period(s) – e.g.** Earlier Roman Iron Age	**Phases Number** – number of identified occupation phases
NRHE UID (Scotland)	**Narrow Period(s) –** e.g. Later PR Iron Age, Early Medieval	**Roman Phase(s)** – e.g. Flavian, Hadrianic, Antonine	**Construction Material(s)** – e.g. Timber, Earthwork, Stone
NRHE UID (England)	**Artefactual / Scientific Date(s)** – e.g. 50–100 CE	**Phases Number** – number of identified occupation phases	**Evidence Of Vitrification** – Yes / No (fusing of stone-built structures due to heat)
HER UID – regionally specific record number	**Dating Method(s)** – e.g. Radiocarbon, Stratified Artefactual	**Elevation** – metres above sea level (Ordnance Datum – OD)	**Occupation History** – e.g. Single Phase, Multi-Phased Intermittent
Scheduling / List Entry Number	**Topographic Position** – e.g. Hilltop, Slope, Lowland	**Perimeter Number** – Single, Multiple (2–3), Multiple (4+)	**Artefactual Assemblage** – e.g. Coarse Pottery, Glass
RSRB Project Number	**Elevation** – metres above sea level (Ordnance Datum – OD)	**Primary Source(s)** – e.g. Artefacts, Field Survey, LiDAR	**Ecofactual Assemblage** – e.g. Faunal, Botanical, Human
AHBI Project Number	**Internal Area** – area within enclosure (square kilometres)	**Past Project Type(s)** – e.g. Antiquarian, Commercial	**Indigenous Material** – Yes / No
EngLaId Project Number	**Total Area** – total site area (square kilometres)	**Current Form** – e.g. Levelled (cropmarks, excavated, etc.)	**Hybrid Material** – Yes / No (native-Roman 'fusion')

(*Continued*)

(Continued).

Site ID Spreadsheet = completed for all sites	*Site & Survey Data (Indigenous)* Spreadsheet = completed for all native / non-Roman sites	*Site & Survey Data (Roman)* Spreadsheet = completed for all military, urban and religious sites constructed by the Roman Empire	*Excavation Data* Spreadsheet = completed for any excavated sites (in addition to either of the *Site & Survey Data* spreadsheets)
Newly Identified Site – Yes / No	**Phases Number** – number of identified occupation phases	**Notes** – free text describing any relevant extra interpretation	**Roman Material** – Yes / No
Published Reference(s) – citations for previous works	**Enclosure Type** – e.g. Unenclosed, Curvilinear		**Scientific Dating** – Yes / No / Potential
	Perimeter Type(s) – e.g. Palisade, Bank, Ditch		**Radiocarbon Dates** – e.g. 54 BCE-131 CE, 60 BCE-40 CE
	Perimeter Completeness – e.g. Full, Truncated (Erosion)		**Other Scientific Dates** – e.g. 620 BCE (+/-395) (OSL)
	Perimeter Number – Single, Multiple (2–3), Multiple (4+)		**Artefactual Dates** – e.g. 70–120 CE (Samian ware pottery)
	Interior Type – e.g. Scooped, Terraced, Platforms		**Features Excavated** – e.g. Ring-ditch Roundhouse, Broch
	Structure Type(s) – e.g. Circular, Rectangular		**Excavated Sequences** – e.g. Ring-ditch Roundhouse [C14 Date] >Surface (Cobbled)
	Structure Number – number of identified structures		**Other Chronological Information** – free text to record relevant chronology
	Juxtaposed Feature(s) – e.g. Annexe, Field System, Pit		**DES Volume / Grid Ref** – for sites initially identified through data-mining
	Primary Source(s) – e.g. Artefacts, Field Survey, LiDAR		**Excavator(s)** – name(s) of the original excavator(s)
	Past Project Type(s) – e.g. Antiquarian, Commercial		**Excavation Project Type(s)** – e.g. Academic, Commercial
	Current Form – e.g. Levelled (cropmarks, excavated, etc.)		**Physical Archive Location(s)** – e.g. HES, HER, Museum
	Notes – free text describing any relevant extra interpretation		**Paper Archive Location(s)** – e.g. HES, HER, University
			Notes – free text describing any relevant interpretation details