Belsay Hall and Estate, Northumberland
Belsay Awakes: Historic England Contribution
Landscape Survey Report

Matthew Oakey

Belsay Hall and Estate
Northumberland

Belsay Awakes: Historic England Contribution
Landscape Survey Report

Matthew Oakey

SUMMARY

This report covers a landscape analysis of Belsay and its wider setting from aerial photographs and lidar. This work was part of 'Belsay Awakes', an English Heritage Trust project which aims to enhance the presentation and interpretation of Belsay Hall, Castle and Gardens in Northumberland. As part of this project Historic England carried out a multidisciplinary programme of research into the site and its broader context. The aerial mapping covered an area of 26sq km which encompassed the surrounding parkland and the historic township of Belsay.

The research uncovered a rich archaeological landscape with features ranging in date from the Bronze Age to the Second World War. Numerous prehistoric or Roman enclosures and settlements were mapped, some of which are new to the archaeological record. Extensive medieval open fields of ridge and furrow survive, relating to villages such as Belsay and Newham. The physical evidence for the transition from a village based settlement pattern to an enclosed landscape of dispersed farmsteads is seen as post medieval sod-cast boundary systems. Analysis of lidar data revealed traces of the medieval park pale which once enclosed Belsay deer park.

The Belsay landscape we see today has been heavily shaped by estate management. Field systems and farmstead character provide a rich source of information, showing the influence of the estate on the farming landscape. Physical evidence, alongside contemporary documents, records the impact of intense technological change in farming practice and industrial land use during the 18th and 19th centuries.

CONTRIBUTORS

Mapping was undertaken by Sally Evans and Matthew Oakey of Historic England's Aerial Investigation & Mapping team.

ACKNOWLEDGEMENTS

The author wishes to express his thanks to Tim Gates for granting permission to scan his aerial photographs. He would also like to thank Jeremy Lake for sharing his expertise on farmstead character. Photo loans were managed and delivered by Luke Griffin at the Historic England Archive and HER data were provided by Liz Williams at Northumberland HER.

ARCHIVE LOCATION

The Historic England Archive, Swindon.

DATE OF SURVEY

Mapping was undertaken between July 2016 and May 2017.

CONTACT DETAILS

Historic England
37 Tanner Row,
York
YO1 6WP

E: matthew.oakey@HistoricEngland.org.uk

CONTENTS

LIST OF FIGURES

Cover: A view of Belsay Park from the east. 28948_020 04-AUG-2017 ©Historic England

INTRODUCTION

Project background

In 2015 the English Heritage Trust (EHT) developed a proposal for the 'Belsay Awakes' project (Hann 2015) which aimed to enhance the presentation and interpretation of Belsay Hall, Castle and Gardens in Northumberland. As part of this project Historic England (HE) was approached by EHT to carry out a multidisciplinary programme of research under a Shared Services Agreement which exists between the two organisations. The aim of the work was to better understand key elements of the site's history through integrated architectural, aerial and geophysical survey alongside terrestrial laser scanning. This research sits alongside documentary and archival research being undertaken by EHT.

One element of the research programme was a landscape analysis of the Belsay estate and its wider setting. This involved mapping and recording from aerial photographs and airborne laser scanning (lidar) data. Work was carried out by specialists from HE's Aerial Investigation & Mapping team, part of Historic Places Investigation, North & East. This report focusses on the results of the landscape survey but refers to other results from the research programme where appropriate. The geophysical and architectural survey results are summarised in accompanying Research Report Series reports (Linford *et al* 2017; Taylor *et al* 2017).

Methods, scope and sources

The project covered an area totalling 26sq km, encompassing the Belsay estate and the presumed extents of the historic township of Belsay (Fig 1). All archaeological features visible on aerial photographs or lidar as cropmarks, soilmarks, earthworks or structures were mapped and recorded. These included features that were visible as extant earthworks on historic photographs but which have since been levelled. The chronological scope ranged in date from the Neolithic to the 20th century, although the earliest features identified from the aerial sources date to the Bronze Age.

Aerial photographs were consulted from the Historic England Archive and Northumberland HER alongside images supplied to HE through the Aerial Photography for Great Britain (APGB) agreement by Next Perspectives and imagery hosted on Google Earth. Bespoke vertical photography and lidar at 10cm resolution were commissioned from Bluesky International Ltd by EHT for an area of 16.8sq km. This was supplemented by lidar flown for the Environment Agency at 1m resolution which covered parts of the survey area.

Aerial photographs were rectified and georeferenced using Aerial 5.36 software. Lidar data were processed using the Relief Visualization Toolbox 1.1 to create 2D GeoTIFF images. Georeferenced imagery was loaded into AutoCAD Map 3D where

archaeological features were digitised. Accompanying textual records were made in the National Record of the Historic Environment (NRHE) database AMIE. These are accessible via the PastScape website (www.pastscape.org.uk).

Full details of the methods, scope and sources can be found in **APPENDIX 1**.

The Belsay landscape

The project falls entirely within Natural England's National Character Area 12: Mid Northumberland (Natural England 2015) which sits between the Northumberland sandstone hills to the west and the coastal plain to the east. It is a gently undulating landscape characterised by east-west running ridges and watercourses. Current land use in the Belsay area is a mix of arable and pasture with small areas of woodland. The settlement pattern is largely one of small, dispersed farmsteads with the small estate village of Belsay representing the only larger settlement. Although areas of older enclosure exist, the current field patterns largely reflect the regular rectilinear arrangement of planned 18th and 19th-century enclosure which was undertaken by large landowners. This is interspersed with other landscape features such as small plantations which are characteristic of Northumberland's estate-managed landscapes.

Bedrock geology comprises bands of mudstone, sandstone and limestone overlain in parts by Devensian tills and areas of alluvium. Some areas have no superficial deposits and these have historically been exploited for the extraction of sandstone and limestone. The area also contains smaller seams of coal which were mined into the early 20th century with the remains of this industry visible as shafts and shaft mounds. Soils are predominantly slowly permeable loamy and clayey soils with impeded drainage but modern land improvement means that around 50% of the project area is currently under arable cultivation.

Past and current land use mean that large areas of archaeological earthworks survive which can be surveyed from aerial photographs or lidar. These include prehistoric sites as well as large areas of medieval and post medieval ridge and furrow cultivation. In those areas under arable cultivation in the 20th and 21st centuries, buried archaeological features were identified as cropmarks and soilmarks. However, cropmark formation is affected by a wide range of variables such as soils, geology, crop type and weather so can rarely give a complete picture of subsurface remains over a wide area.

Post-Roman land use, particularly extensive ploughing from the medieval period onwards, means that the picture of prehistoric and Roman settlement is a very fragmentary one. Centuries of ploughing have undoubtedly levelled or destroyed traces of earlier activity, leaving only small islands of earthwork survival. Furthermore, modern agricultural regimes limit our ability to identify subsurface features through cropmarks in some areas. Archaeological sites are generally only revealed by cropmarks in areas under arable cultivation, although marks can occasionally be seen in pasture. The presence of grassland, particularly where there is also extant ridge and furrow, may have a masking effect.
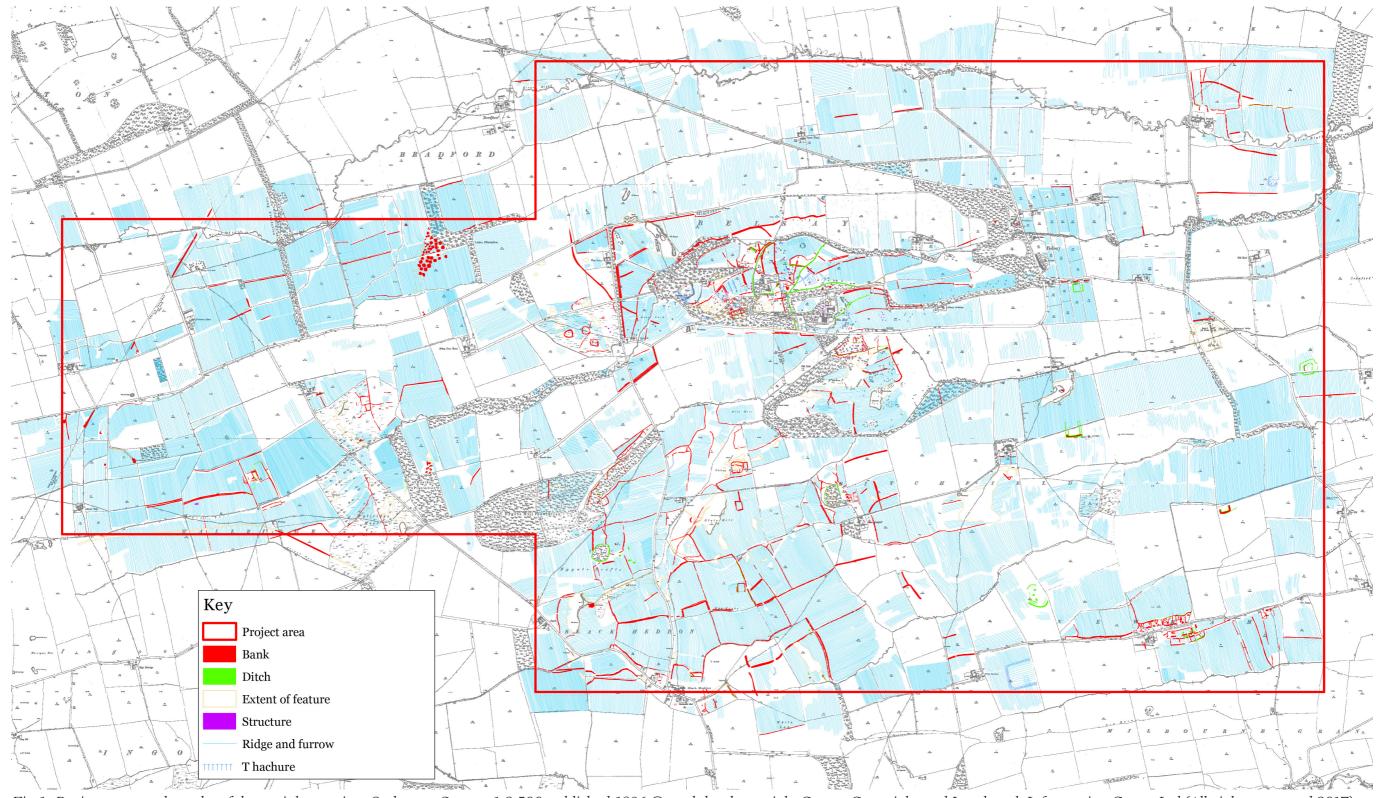
Fig 1: Project area and results of the aerial mapping. Ordnance Survey 1:2,500 published 1896 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.

Key

▭	Project area
▬	Bank
▬	Ditch
▭	Extent of feature
▬	Structure
—	Ridge and furrow
⊺⊺⊺⊺⊺	T hachure

48 - 2017

Previous survey

Much of the existing research into the Belsay landscape concentrated on the parkland and was mainly concerned with buildings. However, a Royal Commission on the Historical Monuments of England (RCHME) survey undertaken between December 1985 and April 1986 (Blood and Welfare 1986) revealed a complex landscape of earthwork remains relating to the medieval and post medieval village as well as later landscaping of the park. The survey comprised analytical field survey at a scale of 1:1,000 of the English Heritage land holdings and surrounding areas of the Belsay Estate, around 70ha in total.

Little archaeological work has been undertaken on the wider estate and surrounding landscape. A watching brief at Middle Newham village in 2002 (HER Event No 351) revealed no archaeological deposits while a 1995 evaluation of a possible moat at West Bitchfield (HER Event No 12821) uncovered two stone revetments. Aside from these excavations, the only other archaeological work has been a series of trenches dug across the Devil's Causeway in the late 1930s (Wright 1938) which exposed several well-preserved sections of the Roman road in the west of the project area.

THE PREHISTORIC AND ROMAN LANDSCAPE

Pre-medieval Belsay

Human activity on and around the Belsay estate from the Neolithic to Roman periods is attested through both small finds evidence and monuments. No evidence for pre-Neolithic activity has been identified by the current project or previous work. As noted above, this is a fragmentary picture due to past and present land use.

The Neolithic and Bronze Age

Small finds evidence is very limited and most discoveries have been made by chance rather than through excavation. Furthermore, the exact locations of these finds are rarely known, never having been properly recorded at the time. The earliest are two Late Neolithic/Bronze Age cup and ring marked stones that were discovered in 1860 in an old dyke near Black Heddon farm (HER No 10243). Their origin is ambiguous as it was suggested at the time of discovery that they had been moved from the site of a nearby Roman camp, the location of which has not been established. Later sources stated that they were found in association with similarly uncorroborated burials.

Somewhere in the location of Boghall farm a Bronze Age urn and jet beads, under stones which were possibly the remains of a cist, were uncovered during drain digging in 1840 (HER No 10190). Other finds of Bronze Age pottery include a collared urn from West Bitchfield (HER No 10254) and a bowl from Black Heddon (HER No 10255). A Bronze Age 'incense cup' (HER No 10240) was found in 1914 in a 'barrow' near Belsay Castle but the location of this monument has never been identified.

Only two Bronze Age monuments — a scheduled standing stone on Bygate Hill (National Heritage List for England (NLHE) 1015843) and a round cairn north-east of Bygate farm (NHLE 1015845) — have been recorded within the survey area. The cairn shows evidence of disturbance, presumably from antiquarian investigations, and a 19th-century find of a cist burial containing a human skull and Bronze Age pot is assumed to have come from this monument. Only the round cairn was identifiable on aerial sources and the analysis of lidar and aerial photographs has not identified any further monuments that can be confidently dated to the Bronze Age.

Iron Age and Roman settlement

Thirteen enclosures have been identified in the Belsay landscape as earthworks and cropmarks, six of which were not previously recorded on the NRHE or HER (Fig 2). Morphologically these all fit into classes of Northumberland settlements broadly presumed to date to the Iron Age and Roman periods.

The scheduled Iron Age hillfort on Bantam Hill (NHLE 1015517) underwent detailed investigation as part of the RCHME's 1986 survey of the Belsay estate (Blood and Welfare 1986) and no further detail was added from aerial photographs or lidar. The hillfort is sited on a promontory with naturally defensible steep slopes to the north, south and west which would have given commanding views over the surrounding landscape.
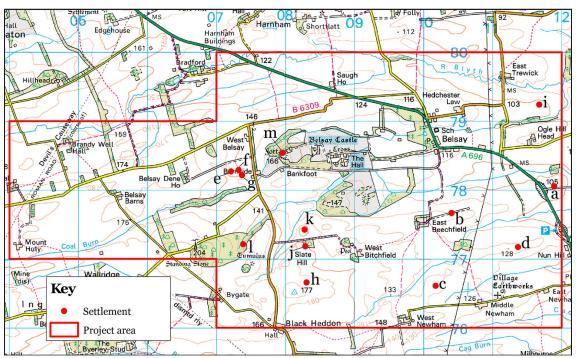
Fig 2: Distribution of Iron Age/Roman enclosures and settlements. Sites a-k are those illustrated in Fig 4 below. Site l is the probable promontory fort east of Bygate Hill Plantation and m is the scheduled hillfort on Bantam Hill © Crown Copyright and database right 2017. All rights reserved. Ordnance Survey Licence number 100024900.

Two other enclosures occupy similar topographic positions to Bantam Hill. Around 1.5km SSW, at NZ 0739 7721, there is another promontory with similar aspects to the north, south and west. An arc comprising two ditches with flanking banks and a possible external counterscarp bank was identified from lidar data partially enclosing the promontory (Fig 3, a). It is possible that the ditches represent a later trackway but there is no evidence of them continuing downslope. Furthermore, an incised trackway runs up to the top of the promontory further to the west (Fig 3, b), suggesting that this is the established route of access and has been for some time. A likely interpretation is that this is an Iron Age promontory fort, broadly contemporary with the hillfort at Bantam Hill. If correct, the defensive banks and ditches would have once continued to the south, completely enclosing the tip of the promontory (approximately 0.4ha). However, this area is covered by ridge and furrow and an embanked enclosure at this location (Fig 3, c) is interpreted as part of a post medieval field system.
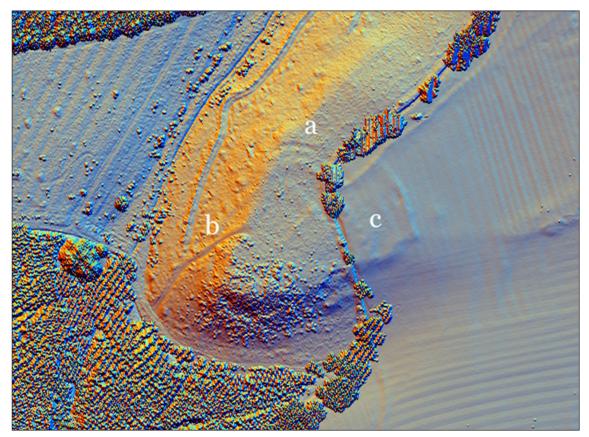
Fig 3: A possible promontory fort east of Bygate Hill Plantation. © Historic England; source English Heritage Trust.
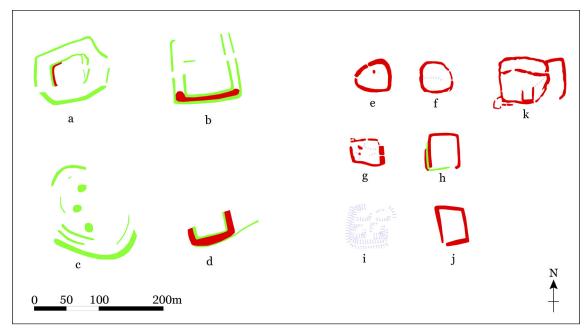
Fig 4: Iron Age/Roman enclosures and settlements. Sites a-d were identified as cropmarks and e-k survive as earthworks.

To the east, the promontory of Whitey Hill is less pronounced with steep sides only to the west and north. A large rectilinear enclosure has been identified from lidar data on the promontory at NZ 0828 7742 but its situation, slightly downslope of the highest point, suggests that it was less likely to have a defensive purpose (Fig 4, k). The enclosure is bank-defined with maximum internal dimensions of approximately 65m by 70m and it is sub-rectangular in plan, with a bowed eastern side. A sub-division separates the northern quarter of the interior from the rest of the enclosure. A rectilinear annexe abuts the enclosure on its eastern side and a small irregularly shaped enclosure is appended to its south-western corner. While their relationship with the enclosure bank indicates that they are later additions, it is not possible to ascertain how much later they were added.

The whole site is disturbed by later stone quarrying and traces of medieval ridge and furrow lie around the enclosure, including a few furrows within the annexe. Their relationship with the enclosure suggests that they were respecting it as an existing feature so, while this does not discount the possibility of a medieval date, it is probable that the enclosure is Iron Age or Roman in date. Parallels can be found elsewhere in Northumberland which are similar in both plan and scale (eg Gates 2012, fig 3.6).

Further earthwork enclosures are located in less prominent positions within the landscape. To the west of Bantam Hill at NZ 0730 7828 are three embanked enclosures, two curvilinear in plan and the other rectilinear (Fig 4, e, f and g). They are currently recorded as probable medieval or post medieval stock enclosures (NRHE 20690) but their size and form, including the presence of scooped areas within the embankments, is similar to numerous other enclosures and settlements in Northumberland of Iron Age/Roman date. Two rectilinear structures, either the remains of buildings or small stock enclosures, lie along the eastern side of one enclosure (Fig 4, g). The regularity of these suggests that they are a later imposition, perhaps reflecting reuse of the earlier enclosure in the medieval or post medieval periods.

Other rectilinear enclosures were identified from lidar data close to Slate Hill (NZ 0829 7718) (Fig 4, j) and Hay Banks (NZ 0830 7666) (Fig 4, h). Both are overlain by extant medieval ridge and furrow and are similar in size and form, enclosing around 0.15ha and 0.18ha respectively. At Hay Banks the enclosure is defined by a bank with traces of an outer ditch and potential counterscarp bank. Its situation, on a slope just north-east of a high point, is typical of Northumberland settlements of this date (T Gates pers comm).

North of Ogle Hill Head farm, at NZ 1167 7923, the remains of another probable settlement have been identified from lidar data (Fig 4, i). The earthworks are very denuded and overlain by traces of medieval ridge and furrow but appear to reveal a rectilinear settlement. It is sub-square in plan with the interior divided into four scooped areas, a form which would fit within Jobey's 'type A' classification of Roman settlements (Jobey 1960) which is still broadly accepted today.

Further enclosures were revealed by cropmarks in areas under arable cultivation. North-east of West Newham farm, at NZ 1017 7661, a multiple-ditched enclosure occupied a small knoll (Fig 4, c). The cropmarks are fragmentary but show that the enclosure was formed by at least three curvilinear circuits of ditch. Although it is small (enclosing somewhere around 1ha) the enclosure's multiple-ditch circuit means that it could comfortably fit into the category of lowland fort (Gates 2012, fig 3.5).

To the west of Well House farm, at NZ 1189 7805, is another enclosure identified from the air from cropmarks (Fig 4, a). It is defined by two circuits of ditch – a sub-rectangular interior enclosure with a north-east facing entrance surrounded by a broader-ditched outer enclosure with a matching out-turned entrance. An additional ditch on the north-eastern side of the interior enclosure also suggests some phasing. This could again have a defensive function and is very similar in size and form to the fort at Flodden Edge (Gates 2012, fig 3.5). Although it can be seen as a cropmark on several aerial photographs, lidar has revealed that the enclosure still survives as a shallow earthwork.

Two other rectilinear enclosures lie close by, both occupying ridges of higher ground (Fig 4, b and d). Cropmarks show each is defined a broad bank flanked by two narrower parallel ditches. The more complete enclosure, at NZ 1040 7767, is square in plan, measuring around 100m externally. A short section of ditch hints at a possible internal division. The second enclosure lies just under 1km to the south-east at NZ 1137 7716. Only the southern part of the enclosure has been identified but the similar form may indicate that it was comparable to the other. Similar enclosures have been identified elsewhere in Northumberland and classified as Iron Age/Roman defended settlements (Passmore and Waddington 2009, 360).

The Devil's Causeway (Margary Roman Road 87) runs through the western part of the project area on route from Berwick-upon-Tweed to Beukley and can be traced as an earthwork in several places. The longest continuous section is situated north-west of Brandy Well Hall farm where the agger survives as a denuded earthwork beneath medieval and post medieval ridge and furrow (Fig 5). This earthwork section had not been identified by Ordnance Survey (OS) surveyors but is visible on Environment Agency lidar data. Further earthwork sections survive to the east and south of Boghall farm. Excavation at these three locations in 1937 (Wright 1938) revealed the road to be constructed of small sandstone blocks topped with a narrower layer of large whin-boulders, up to around 25ft 6in (7.7m) wide. It also identified kerbstones and roadside ditches.
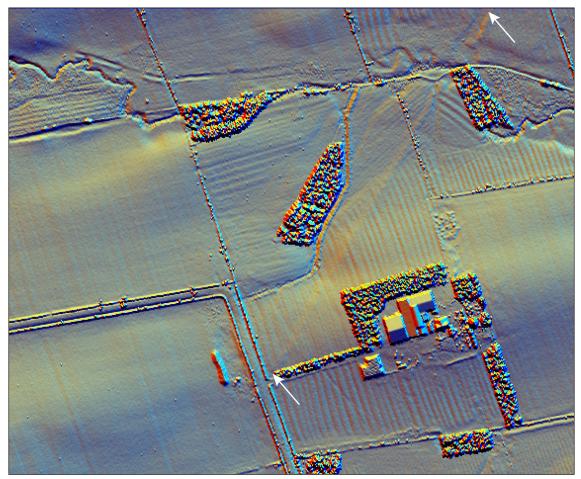
*Fig 5: The course of the Devil's Causeway Roman road north of Brandy Well Hall. ©
Historic England; source Environment Agency.*

THE MEDIEVAL LANDSCAPE

Settlement and farming

The Middleton family's possession of the Belsay estate can be traced back to 1270 when it was under the ownership of Sir Richard de Middleton (White 2005, 37), and in following centuries numerous additional landholdings such as Bitchfield came into their hands. Aerial photographs and lidar record extensive evidence for medieval settlement and farming both on the estate and in the wider Belsay landscape.

Villages

Previous work identified a complex set of earthworks within Belsay Park which relate to the medieval village of Belsay and its associated open fields (Blood and Welfare 1986). This was one of a number of medieval settlements within the immediate landscape (*see* Fig 12) and others are recorded at Black Heddon, Bitchfield, Middle Newham and Trewick (Beresford and Hurst 1971, 198–200). All but Trewick are listed in the Lay Subsidy of 1334, although Northumberland was not actually taxed until 1336 (Glasscock 1975, xxiii). Detailed documentary research for these villages was carried out by Stuart Wrathmell (1975) and is only summarised within the current report.

Fig 6: An extract from William Green's 1769 map of the estate showing Belsay village. Although the Castle is not depicted, the rectangular enclosure to the east of the village (P) is likely to represent the extents of castle enclosure. Published with permission of the Belsay Estate and Northumberland Archives.

Fig 7: An extract from the 1986 RCHME survey of the park. © Historic England

Belsay is recorded as a settlement from the 1200s and by the late 14th century probably comprised around 30 tenements (Wrathmell 1975, 302). Of the villages within the project area it returned the greatest tax revenue from the 1336 Lay Subsidy, totalling £1 1s 3d (Glasscock 1975, 221). Belsay village was still occupied until the early 19th century when it was cleared as part of changes to the landscape park by Sir Charles Monck (Blood and Welfare 1986, 4). It was located, broadly speaking, within the area used to quarry stone for new Hall and subsequently developed as the Quarry Garden (Fig 6). A series of boundaries underlie ridge and furrow to the north of the former village and these were interpreted by RCHME as the division of medieval closes that were taken into cultivation later in the medieval period (ibid, 5) (Fig 7). Some additional earthworks in this location were identified from lidar data (Fig 8, c) and these too may be part of the settlement.

Earthworks to the east of the castle are thought to represent further elements of the medieval village; these include enclosures and scarps identified by RCHME as possible outlying buildings and yards (ibid, 6). Further to the east lidar has revealed other subtle earthworks which could also be settlement remains (Fig 8, a). A series of scarps terminate on a broad boundary bank which encloses an area of ridge and furrow. Their character is similar to the potential closes to the north of the village so they may have had a similar function.
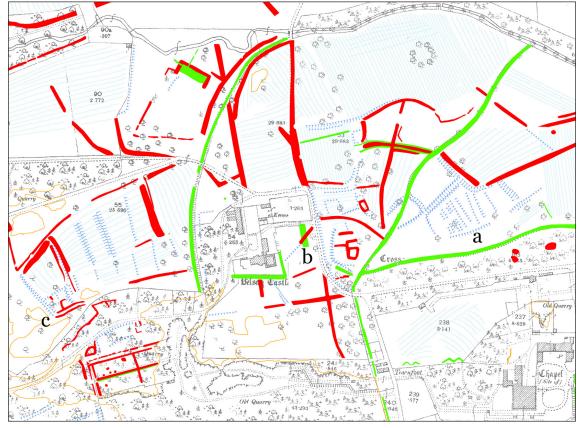
Fig 8: Earthworks within Belsay Park. Lidar has revealed additional features possibly relating to medieval settlement (a and c). The rectangular depression (b) has now been confirmed as an isolated feature, probably a pond. Ordnance Survey 1:2,500 published 1896 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.

To the south-east of Belsay, the scheduled remains of Middle Newham (NHLE 1006421) represent the most archaeologically complete medieval settlement within the project area (Fig 9). Documentary evidence records the village from the late 13th century when it was noted in the 1296 Lay Subsidy as having 10 taxpayers (Bradshaw 1916, 74; Wrathmell 1975, 454) and by 1336 it was raising 9s in tax (Glasscock 1975, 221).

Earthwork remains of the village straddle the current road to the north and west of Middle Newham farm. North of the road a hollow way runs east-west and is flanked by several embanked croft boundaries on its northern side. A number of rectilinear platforms front onto the hollow way, representing building remains or house platforms. To the south of the current road are traces of further settlement aligned on a back lane, again traceable as an east-west hollow way. Some of the best preserved building remains have been identified here with the house plans readable from the earthworks but some of these may relate to post medieval occupation (see below). Small areas of ridge and furrow ploughing lie within some of the crofts to the south of the modern road. This may be linked to village expansion or adaptation where areas of the open fields have been enclosed to create new plots of land, as observed at

other sites locally (Oakey 2009, fig 8; Smith and Tolan-Smith 1997, fig 5.4). However, some of the ridges are aligned east-west which differs from the predominant north-south alignment of the open fields to the south of the village. In this instance they may have had another function – possibly orchards.
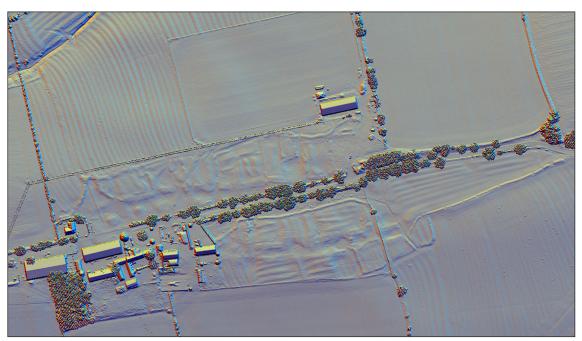
Fig 9: Earthwork remains of Newham village showing house platforms and croft boundaries aligned along a hollow way and back lane. © Historic England; source English Heritage Trust.

Black Heddon was recorded as having six taxpayers in 1296 (Bradshaw 1916, 29) and was taxed at 18s 6d in 1336 (Glasscock 1971, 220). By 1377 15 occupants were recorded (Wrathmell 1975, 310). The remains of earthworks can be seen on aerial photographs and lidar data around the current farm (Fig 10) but their fragmentary nature means that it is difficult to establish whether they are medieval or post medieval in date. For example, several boundary banks are likely to represent post medieval enclosure of the open fields although they follow the line of medieval ridges. Other earthworks include a probable building to the west of the farm and further potential building platforms to the south. A small circular structure is clearly visible on aerial photographs to the west of the farm but this appears to represent the remains of a post medieval wheelhouse associated with a range of farm buildings rather than an earlier structure such as a dovecote.

The Middletons acquired Bitchfield in the late 1300s, reuniting a township which had been split in two since the late 13th century (Wrathmell 1975, 308). The farmstead at West Bitchfield incorporates a 14th-century tower which is listed at Grade I (NHLE 1303894) and the Bitchfield Subsidy of 1296 notes a priest, indicating the presence of a chapel. A complex of earthworks has been identified to the north of the current farm (Fig 11) but, as noted below, these are likely to represent a later farmstead. To the east of the farm traces of platforms and a possible
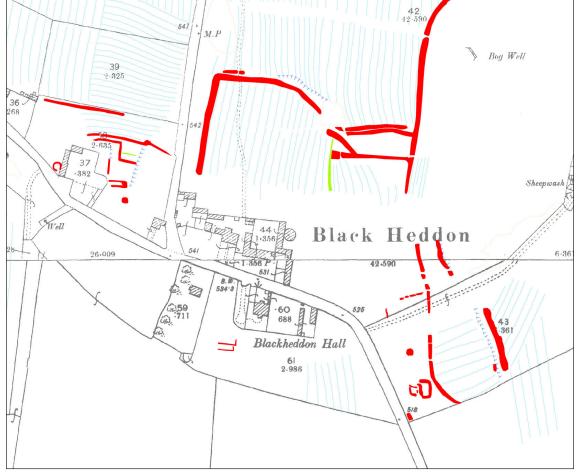
Fig 10: Earthworks around Black Heddon. The circular structure to the west of the farm appears to be the remains of a wheelhouse which had already been demolished by the OS first edition mapping. Ordnance Survey 1:2,500 published 1896 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.

building have been identified from lidar imagery. These may relate to elements of medieval settlement but their location and regular rectilinear form may suggest an association with the tower house, perhaps in the manner of formal garden remains or alternatively the remains of farm buildings.

Trewick is recorded in 1242 and had just four inhabitants in the early 1300s (Wrathmell 1975, 518). It is not listed in the 1336 Lay Subsidy but it is recorded in Poll Tax returns of 1377 (University of Hull 2017). No remains indicative of settlement were seen on aerial photographs or lidar but large areas of Trewick's open fields survive as extant ridge and furrow to the east of the present farm (*see* Fig 12).

Fig 11: Earthwork platforms to the east of West Bitchfield farm possibly associated with medieval settlement. Features to the north near Crag House are likely to be the remains of a post medieval farmstead. Ordnance Survey 1:2,500 published 1896 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.

Fields

The remains of Trewick's open fields form just part of a much wider ridge and furrow landscape which covers large parts of the Belsay estate (Fig 12). Post-war arable intensification has resulted in the levelling of several areas of ridge and furrow that were extant in the 1940s but significant areas survive to this day in permanent pasture. The ridges generally exhibit a distinctive reverse-S form which is characteristic of oxen-drawn ploughing in the medieval period and vary in width from around 6m to 11m. These forms were described by Bailey and Culley (1797, 61) in their 'General View of the Agriculture of the County of Northumberland', in which they noted that ridges 'that were used as arable some centuries since… are mostly very high, broad, and crooked'.

Some of Middle Newham's open fields survived as earthworks into the 1940s between Cadgers Burn and the current road. Most have now been levelled but one field survives well, albeit bisected by a modern pipeline. Other areas of broad ridge

and furrow survive to the north of the village but these were once again more widely upstanding in the 1940s. Some of the ridges are narrow – around 4m wide – which suggests that they have been split in later periods. This is a practice which can be seen elsewhere in the project area and appears to be supported by documentary evidence where an indenture of 1616 refers to the division of 45 ridges of open field land in Newham (Wrathmell 1975, 455).

Within Belsay's parkland several well-preserved furlongs of ridge and furrow relating to Belsay village survive as earthworks. Further traces lie outside the park, particularly to the south. Remnants of fields relating to the settlements of Bradford and Wallridge, both outside the project area, are also visible but by far the most extensive and best-preserved field systems can be found around Black Heddon and Bitchfield. Much of this area has been used for pasture and continues to be to this day, accounting for this survival. The name 'Hay Banks' on the OS first edition map seems likely to reference the extant ridges of medieval cultivation, and their subsequent use as meadow.
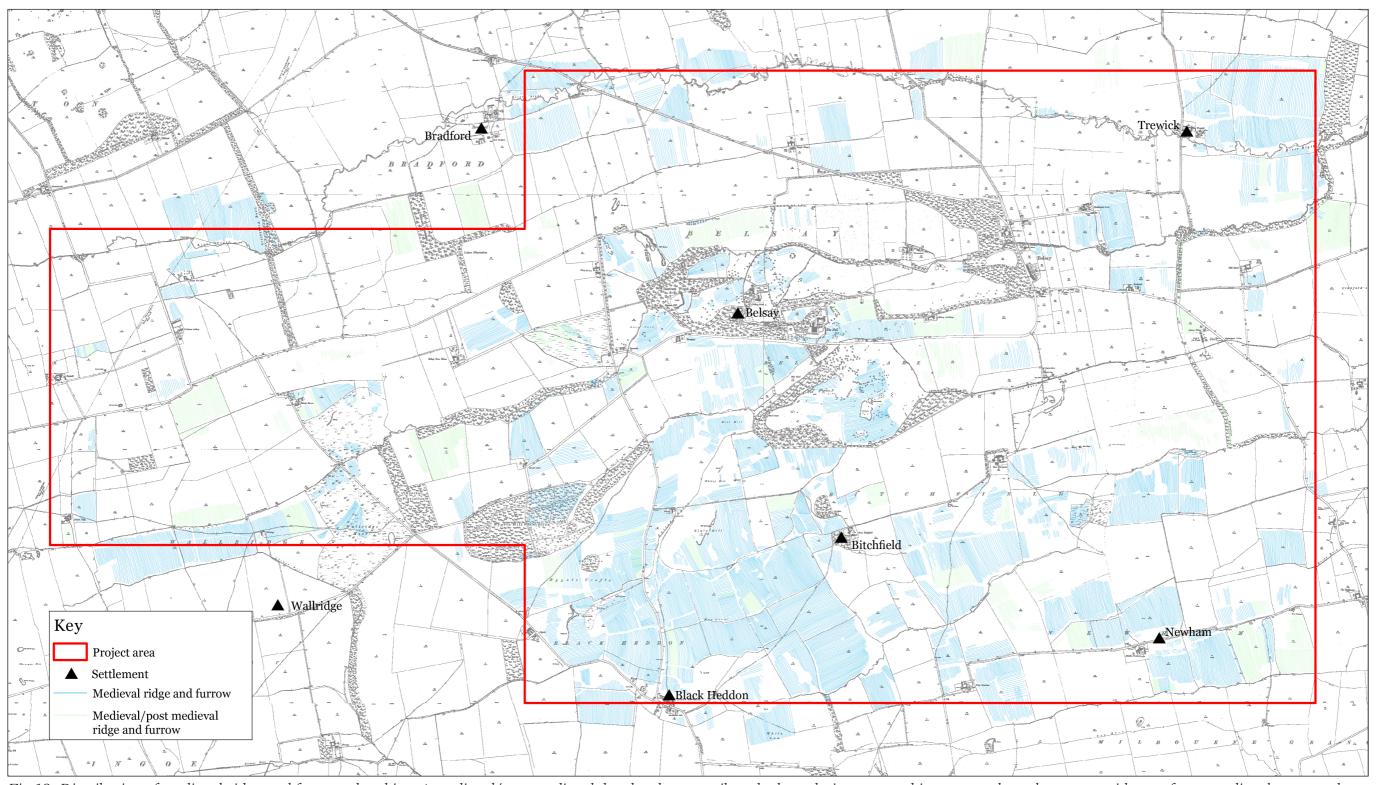
Fig 12: Distribution of medieval ridge and furrow ploughing. A medieval/post medieval date has been attributed where dating was ambiguous or where there was evidence of post medieval reuse and splitting of earlier ridges. Ordnance Survey 1:2,500 published 1896 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.

The deer park

Although no licence to impark has been identified, it seems entirely possible that a medieval deer park existed at Belsay. Armstrong's 1769 county map depicts a curvilinear impaled park surrounding Belsay Castle (Fig 13) but the scale and projection make it difficult to identify the location of the pale with any degree of certainty.

The south-western part of the estate is noted as 'Deer Park' on the OS first edition 25-inch mapping (1866), but this appears to be an indication of contemporary use rather than an historic reference. Green's 1769 map of the estate (NRO 8504/10) names the two fields at this location as 'The New Close' and 'The Wheat Field', suggesting that farming was the dominant activity there at that time. However, the earlier presence of a deer park is now supported by probable traces of a park pale revealed by lidar to the west of the estate (Fig 14), feasibly representing the park as depicted by Armstrong. The bank survives as a very denuded earthwork and can be traced from NZ 0721 7894 where it runs southwards before gradually turning to the east as far as NZ 0778 7833. To the east of the B6309, which defines the western edge of the estate, post medieval narrow ridge and furrow ploughing clearly overlies the bank. It is possible that the bank can also be traced east of Coal Burn as a barely discernible feature underlying medieval ridge and furrow. At NZ 0764 7839 the bank appears to terminate on another bank running north-south. However, this is interpreted as a later boundary so it is likely that different land use to the east and west of this has resulted in differential survival of the pale.
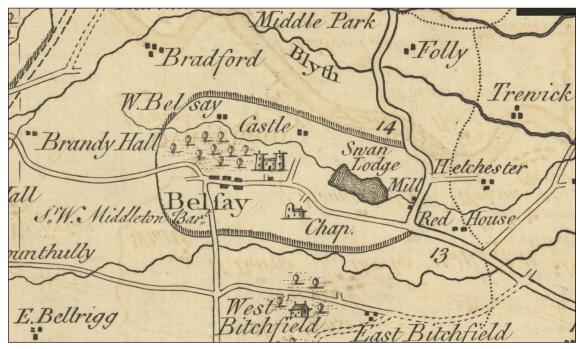
Fig 13: Extract from Armstrong's 1769 'A map of the County of Northumberland: [sheet 3]: with that part of the County of Durham that is north of the river Tyne also the Town of Berwick and its bounds'. Licenced under a Creative Commons Attribution-NonCommercial 2.5 License. McMaster University Library Digital Archive http://digitalarchive.mcmaster. ca/islandora/object/macrepo%3A79588
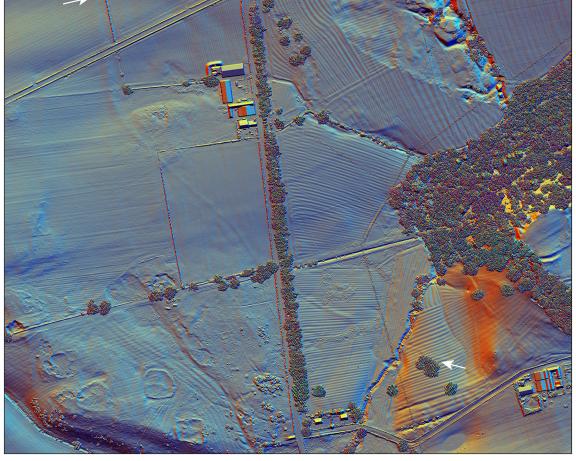
Fig 14: The probable medieval park pale. © Historic England; source English Heritage Trust.

Belsay Castle

Belsay Castle's immediate environs were surveyed as part of the 1986 RCHME survey and the results will not be repeated in detail within the current report. Within this area lidar has provided subtle additional detail but nothing that radically changes the findings of the original field survey.

No additional features that are considered to relate to the medieval castle have been identified but recent research has elucidated the function of a rectangular depression to the east (*see* Fig 8, b). With some caution, this had speculatively been interpreted as a surviving section of a moat associated with the castle (Blood and Welfare 1986, 3–4) but no further evidence was visible on aerial photographs or lidar data to support this interpretation. Ground penetrating radar (GPR) survey undertaken as part of this project has also confirmed that the depression is an isolated feature (Linford *et* al 2017, fig 19).

The most likely interpretation is a rectangular pond, possibly a medieval fishpond or alternatively an ornamental pond forming part of a formal garden to the east of the castle. At this stage dating can only be speculative but invasive techniques such

as coring may be able to provide clarification. The pond does, however, share an alignment with and sit in close proximity to a rectilinear arrangement of anomalies which have been interpreted as the probable remains of gardens depicted on a Buck engraving of 1728 (Fig 15) (Linford *et al* 2017, 9–10) which might indicate that it relates to a post medieval phase of landscaping (see below and Howard *et al* 2017).

THE POST MEDIEVAL LANDSCAPE

Belsay Park

Within the area surveyed in 1986 the results from aerial photographs and lidar broadly correspond to the results of the field survey. They have provided some additional detail in places, but their major contribution is to the understanding of landscape features outside the earlier survey area.

Few additional remnants of formal landscaping around the Old Castle complex were identified as surface remains. Conversely geophysical survey undertaken as part of the current project (Linford *et al* 2017) has considerably enhanced our knowledge of this area, revealing probable traces of the rectangular walled garden lying immediately to the south of the castle and axially aligned with the central porch of the later mansion, as depicted in the Buck engraving of 1728 (Fig 15). Lidar shows slightly more of the course of the old road from Ponteland to Capheaton running east-west to the south of the castle. It has also revealed a previously unidentified north-south embankment crossing it (Fig 16, a), also identified by geophysical survey. The northern part of this probably coincides with a road depicted on a 1784 plan of the estate (NRO 2719/03).
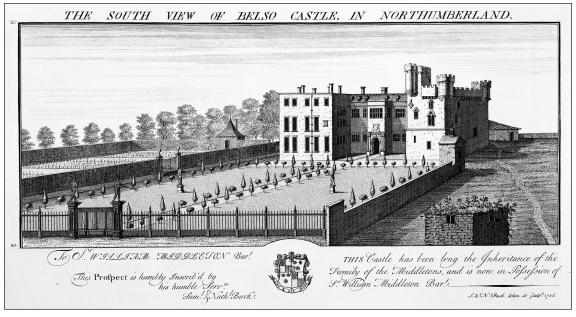
Fig 15: A 1728 view of Belsay Castle by Samuel and Nathaniel Buck showing the formal gardens to the south. MP/BEL0672 Reproduced by permission of Historic England Archive

To the west of the castle, lidar shows a rectilinear scarp within the wooded area (Fig 16, b) running northwards before taking a right angled turn towards the northern end of the stable block. This corner was also identified by GPR survey and has been interpreted as a continuation of the castle wall (Linford *et al* 2017, 11) and it is very likely to be the enclosure depicted on Green's 1769 plan as 'The Gardens' (*see* Fig 6).

An embankment runs northwards from the castle complex and aligns with a similar feature to the north the other side of the long, gently curving ha ha (Fig 16, c). Additional detail on the lidar leads to a subtly different interpretation of these features than that arrived at from field survey (Blood and Welfare 1986, 11). The southern embankment (ibid, plan, L) can now be traced for a further 40m as far as the ha ha. GPR survey also identified this and showed it to be flanked by two ditches (Linford *et al* 2017 fig 12). It therefore seems likely that this embankment and the one to the north in Lady Anne Middleton's Garden (ibid, plan, K) are part of the same feature rather than distinct from one another as originally suggested. If the embankment was once continuous, this would also explain the gap in the ha ha depicted on Green's 1769 map (*see* Fig 6).
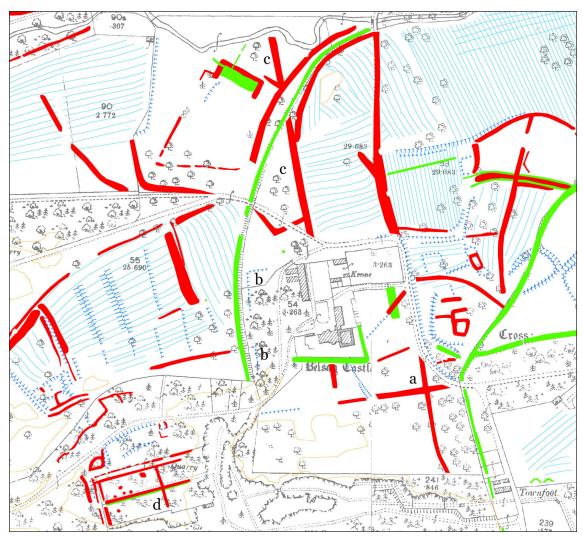
Fig 16: Belsay Castle's immediate landscape. Ordnance Survey 1:2,500 published 1896 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.

The walled garden to the west of the Quarry Gardens is depicted in an 1824 plan in the Belsay cropping book (ZMI B42/1) and appeared to still be in use in 1859 when surveyed by the OS. It is thought to have fallen out of use when the stone for

the steward's house was quarried at this location (Blood and Welfare 1986, 9) and by the time of the OS second edition mapping in the late 1800s it was planted with conifers. Lidar has revealed additional detail of the garden's remains (Fig 16, d) which were presumably obscured by dense vegetation when it was surveyed on the ground. Further traces of the western wall can be seen along with the cruciform path dividing the interior, only one scarp of which was identified on the ground. The 1824 plan also depicts a narrow building, presumably a glazed range or hot-house, along the length of the northern wall which is absent on the 1859 OS first edition. Its remains survive as two parallel banks or walls.

To the south of the parkland, east of the rhododendron garden, a rectilinear enclosure has been identified from lidar data (Fig 17). It is defined by a narrow bank and ditch and measures around 28m wide by at least 44m long. It is sub-divided into two or three compartments around 14m wide. Its function and date are unclear but this may represent traces of a garden associated with Park House farm.

Further possible garden remains were identified to the south of the Castle Inn coaching inn on the eastern edge of the estate (Fig 17). Lidar shows an embanked circle surrounded by four curving mounds. These sit within a square area defined by broad paths, some of which are only visible as scarps. The coaching inn and associated stable block to the south were built in 1836 for Sir Charles Monck but no gardens are depicted on OS maps. No trace of the earthworks is visible on aerial photographs which suggests that a post-Second World War date is highly unlikely but it is only possible to determine that the features must date from the period between 1836 and 1946. An alternative interpretation is that the features relate to a carriage circle.

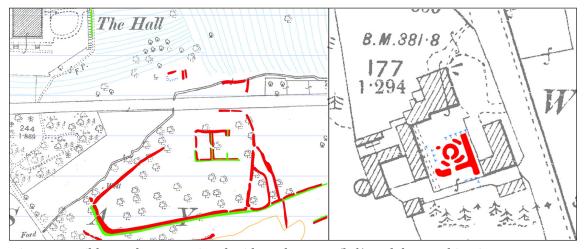*Fig 17: Possible gardens associated with Park House (left) and the coaching inn at Woodhouse (right). Ordnance Survey 1:2,500 published 1896 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.*

Settlement

Documentary evidence records continuity of occupation at all the medieval villages into the post medieval period. However, the two centuries from 1550 to 1750 represented a significant period of change in Northumberland where the focus of settlement shifted from the village with its associated open fields to a more enclosed landscape occupied by isolated farmsteads (Wrathmell 1975, 164). Reasons for this shift are varied but they reflect a move from customary tenure to leaseholds – a transition which forms the origins of the pattern of dispersed farmstead settlement that we see today in the Belsay landscape.

At the time of the Hearth Tax of 1666 Belsay village comprised 36 houses including the manor but 22 were exempt from the tax, possibly indicating that a high number of farm labourers still inhabited the village (Wrathmell 1975, 302–3). By 1691 rental records show that landholdings were held by just eight tenants. While this may indicate depopulation through farmstead dispersal during the second half of the 17th century, it is possible that the new pattern of tenure was already in place by 1666 (Wrathmell 1975, 303). Both Armstrong's county map of Northumberland and Green's 1769 survey of the park (*see* Fig 6) depict the village to the south-west of the castle. Few coherent earthworks that can be confidently associated with the village survive and those identified from lidar data broadly reflect the results of the RCHME survey.

Depopulation at Black Heddon was similarly gradual where, as at Belsay, the village continued to be inhabited by farm labourers in the mid- to late 1600s (Wrathmell 1975, 205). By the mid-1600s it was a sizeable settlement with 25 houses listed in the township (Wrathmell 1975, 310). The fragmentary nature of the earthworks at Black Heddon (described in the preceding chapter) mean that it is difficult to establish whether they relate to medieval settlement or post medieval farmsteads (*see* Fig 8).

At Newham the vill had been reduced to four leasehold units by 1608, three of which were held by Roger Fenwick, John Fenwick and Robert Robson (Wrathmell 1975, 454–5). It is probable that some of the earthworks at Middle Newham represent 17th-century reorganisation of the former village tenements (Fig 18), in particular some of the rectilinear elements to the south of the current road. Better-defined buildings at the eastern end of the village may well be those identified as barns, houses and byres in contemporary documents. Two large buildings at NY 1118 7641 and NY 1113 7648, for example, are likely candidates for later barns. It is also probable that the earthworks identified on lidar adjacent to East Newham farm (Fig 18, a) relate to a newly established farmstead of this period. Several medieval furrows are enclosed by the farmstead and its construction presumably levelled others. It also relates to a boundary bank enclosing an area of ridge and furrow which is likely to date to the 1616 enclosure of the village's open fields.
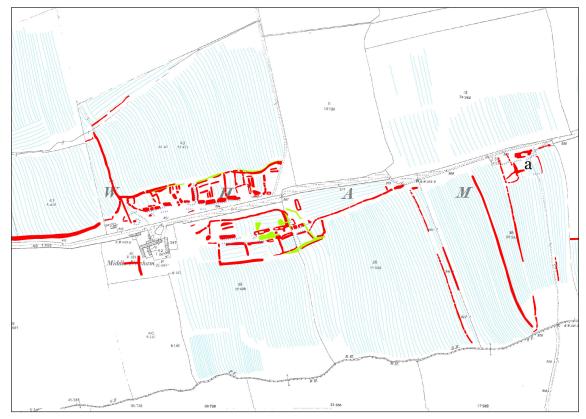
Fig 18: Earthworks at Newham village. An isolated farmstead to the east (a) probably dates from the 17th-century reorganisation of the former village tenements. Ordnance Survey 1:2,500 published 1896 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.

By the late 16th century Trewick comprised around nine tenements and by 1701 the township, which had been owned by the Middletons for around 50 years by this point, had been divided into two farms (Wrathmell 1975, 518). Bitchfield was similarly reduced in size by the late 17th century with the Hearth Tax of 1666 only recording five houses (Wrathmell 1975, 308). No traces of earthworks relating to the settlement at Trewick have been identified. These have presumably been levelled by the present farmstead which itself is likely to be located on much the same site as its earlier predecessors.

Earthwork remains are visible at Bitchfield to the north of West Bitchfield farm (*see* Fig 11). These include an arrangement of small enclosures or yards and a probable building around 3m wide and 20m long which may represent a barn. While it is possible that they date from the medieval period, the regularity and crispness of the earthworks suggest that they relate to one of the post medieval holdings.

While most post medieval settlement remains have been identified in the context of extant farmsteads, at NY 0522 7736 a possible isolated farmstead has been identified on aerial photographs north of the abandoned Wallridge farm (Fig 19). It is defined by a large rectangular enclosure with a group of rectilinear yards on its south-western side and at least two buildings are incorporated into this arrangement.

Further possible buildings abut a field boundary to the west and this boundary is part of a wider field system, some of which survives to this day. Two further isolated buildings lie around 390m SWW of the farmstead on top of medieval ridge and furrow.
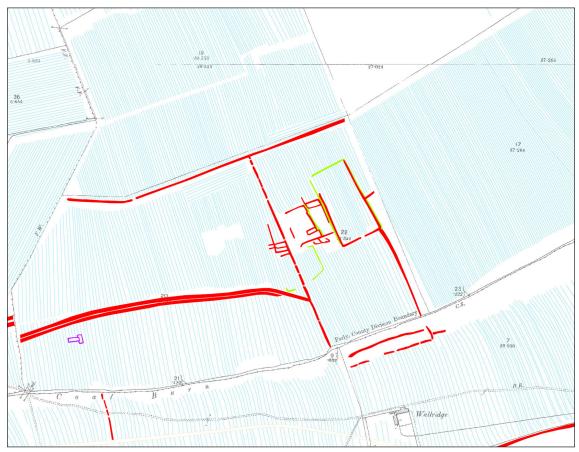
Fig 19: A probable post medieval farmstead north of Wallridge farm. Ordnance Survey 1:2,500 published 1896 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.

Dating of the farmstead is uncertain but its omission from the 1824 plans in the Belsay cropping book (see below) suggests that it had fallen out of use by at least the early 19th century. There is also nothing in the field name to suggest that the farmstead retained any significance at this point. Extensive narrow ridge and furrow ploughing surrounds the complex and this overlies the northern ditch of the enclosure. It is likely that this ploughing post-dates at least some elements of the farmstead.

Enclosure

The current field pattern largely reflects the Belsay landscape as it was in the mid-1800s when first surveyed by the OS. Its character is typical of those associated with large Northumberland estates with regular rectilinear fields, straight roads and small tree plantations. Northumberland's Historic Landscape Characterisation (HLC)

project has studied and categorised the fieldscapes within the project area and this forms a useful basis for understanding the transition from open fields to the enclosed landscape we see today. The 17th and 18th centuries represented the main period of change in Northumberland where open fields began to be enclosed and the pattern of dispersed farmsteads was established – a process that was largely complete in the lowlands by the mid-18th century (Williams 2015, 37).

Most of the fieldscapes within the project area were classified by the HLC as 'surveyed enclosure' of the mid-18th to 19th century. This is generally characterised by regular straight edged fields although in some instances at least part of the perimeter may have a more irregular boundary. Good examples of this form of enclosure can be seen in the west of the project area around Belsay Dene House and Belsay Barns and to the north of the park at Saugh House and Middlepart (*see* Figs 22 and 30). Farm plans in the Belsay cropping book show that the pattern of fields recorded in the 1860s by the OS was in place by at least the early 1820s although the exact dates of enclosure are unknown.

The character of land division around Bygate, Black Heddon and West Bitchfield is noticeably distinct from that over much of the project area (Fig 20). Here fields are generally more irregular, often with sinuous elements, and classified by HLC as 'piecemeal enclosure' and 'other irregular fields'. This pattern of enclosure often relates to the division of open fields in the 17th to mid-18th centuries and a correlation can be observed between this area and extensive survival of medieval ridge and furrow. In addition to those marked on OS first edition mapping, several other boundaries have been identified on aerial photographs and lidar data, indicating that they were already redundant by around 1860 and no longer maintained as hedges. Others continued to be removed in the following decades, as evidenced by the 2nd edition mapping from the late 19th century. At Newham a 1616 indenture notes recent enclosure by the freeholders (Wrathmell 1975, 455) so it is possible that enclosure around Black Heddon and West Bitchfield was taking place at a similar time.

Enclosure boundaries commonly take the form of narrow banks, often around 3m wide. Boundaries of this form, sometimes referred to as 'sod-cast', are common in Northumberland and have been recorded extensively along the Hadrian's Wall corridor (Oakey 2009, 19; Gates 2004, 34). This method of construction is also described by Bailey and Culley (1797, 56) where they note that 'The fences most generally used for new inclosures, are earth mounds; at the base of which, and on the edge of the ditch out of which they are raised, are planted the quicks, generally upon a turned sod six inches high... This in most cases doubles, and in thin soil trebles, the surface soil, and forms a thick bed of the best earth for the roots of the quicks to grow in'.

Boundaries generally follow the alignment of ridge and furrow or mark the end of a group of strips, enclosing them into smaller units. The length of the medieval strips was often maintained with boundaries rarely bisecting them. It is possible that some

of the boundaries at the end of the strips may have originated as medieval plough headlands but it is likely that most relate to post medieval enclosure.
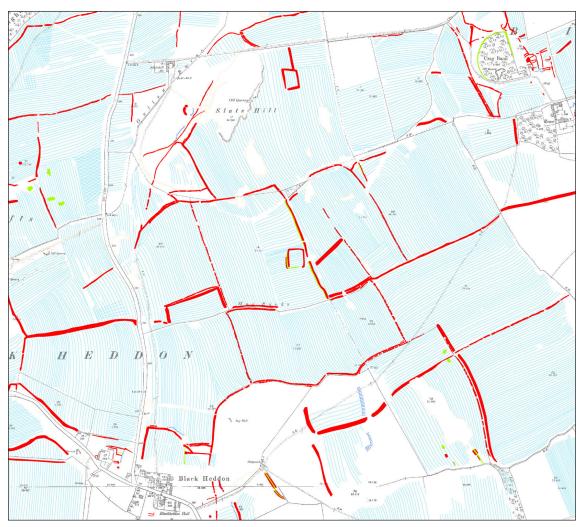
Fig 20: Early post medieval enclosure around Black Heddon farm. Ordnance Survey 1:2,500 published 1896 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.

There is some evidence that more marginal areas were being incorporated into managed farms in the post medieval period. Wallridge Moor contains medieval ridge and furrow ploughing but was also enclosed with sod-cast boundaries in later years. To the north marginal land was incorporated into the Belsay Barns farmstead. Field No 11 is named 'Intake' in the Belsay cropping book and narrow ridge and furrow relating to its improvement survives as earthworks. A series of bank defined enclosures (Fig 21) also survives and presumably related to stock management.

Fig 21: Stock enclosures on marginal land east of Belsay Barns farm. Ordnance Survey 1:2,500 published 1896 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.

Ridge and furrow cultivation

As noted above, there is evidence that some medieval ridges continued to be cultivated into the post medieval period but it is likely that many were reverted to pasture after, or even before, enclosure. Field names such as Hay Banks and Blackheddon South Pasture hint at this but there is also physical evidence in the form of a small number of stack stands to the east of Black Heddon. Used for storing winter fodder, the stands are defined by a narrow bank surrounded by a ditch for drainage and clearly cut into older ridge and furrow. It is presumably this historic use as enclosed grazing land which meant that later, more regimented surveyed enclosures were not required.

Post medieval ridge and furrow ploughing is distinguishable from earlier medieval cultivation by its straightness and narrowness – the ridges frequently no more than around 6m in width. Large areas of narrow ridge and furrow can be seen throughout the project area (Fig 22) but some of the most extensive coverage lies in the west. Although it is difficult to date accurately this type of ridge and furrow,

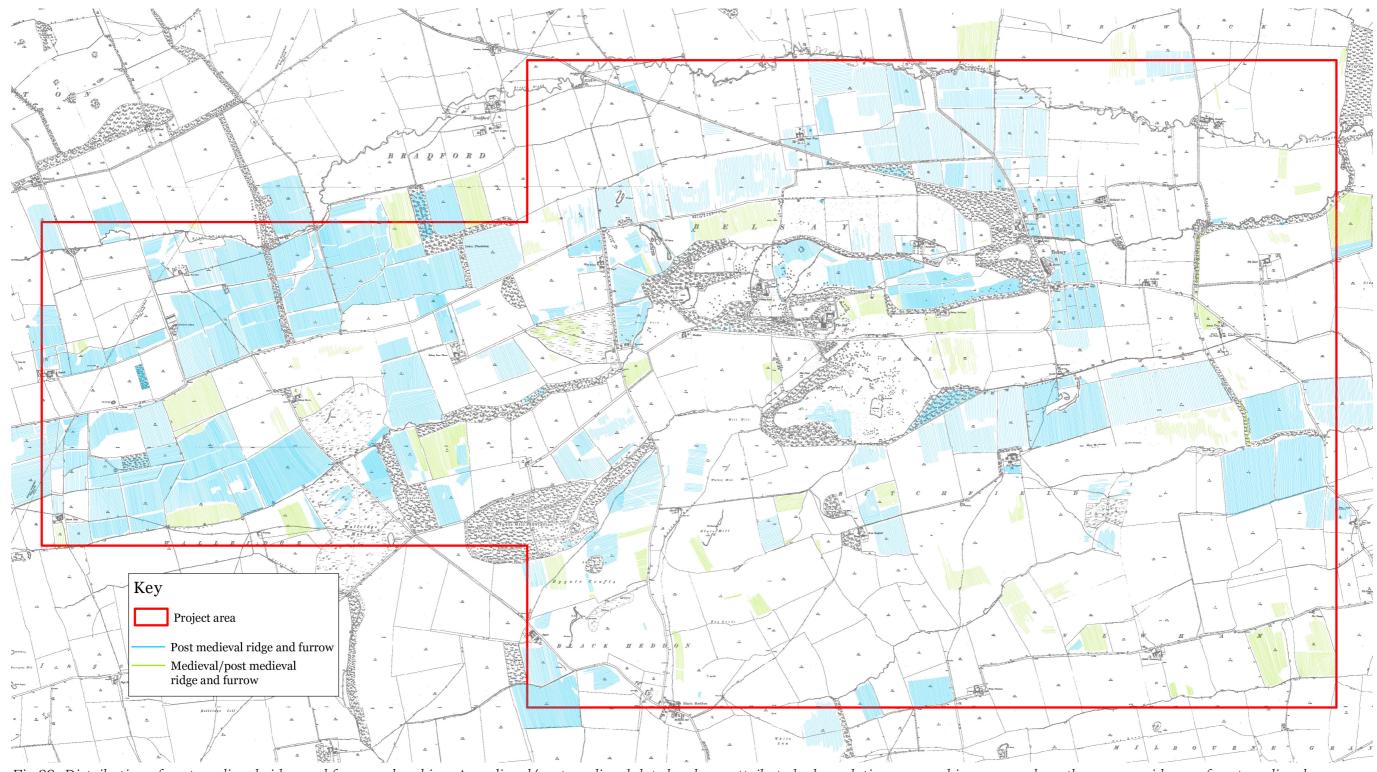Fig 22: Distribution of post medieval ridge and furrow ploughing. A medieval/post medieval date has been attributed where dating was ambiguous or where there was evidence of post medieval reuse and splitting of earlier ridges. Ordnance Survey 1:2,500 published 1896 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.

it is generally thought to develop in the late 18th and early 19th centuries (Taylor 1975, 143), during the hey-day of Georgian surveyed enclosure. The pattern of this later ridge and furrow shows a consistent relationship with those regular fields. Areas of ploughing are generally confined within them and their longer straight boundaries, clearly dictated the direction of the plough. Before the introduction and ready availability of ceramic field drains narrow ridge and furrow cultivation was the principal means of draining and improving Northumberland's uplands (Macdonald 1974, 358), so it is plausible that surviving narrow ridge and furrow in more marginal areas of the estate could have been created as late as the 1860s.

Fig 23: 1853 sub-division of fields on Hedchester Law and Belsay Redhouse farms with associated narrow ridge and furrow. Ordnance Survey 1:2,500 published 1896 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.

Where ridge and furrow relates to datable boundaries or other landscape components it is possible to arrive at a narrower date range. At Hedchester Law the Belsay cropping book notes the sub-division of two fields (12 and 13) into long plots in 1853. South of Belsay Burn, on Belsay Redhouse farm, a similar sub-division of fields 5 and 6 is also noted. Both amendments are in pencil and in the same hand so it is reasonable to assume that this also took place in 1853. Very regular narrow ridge and furrow (3.7m wide) sits within these plots and is distinct from other narrow ridge and furrow close by at Guidepost (Fig 23). This is characteristic of ploughing undertaken using steam power. While it is possible that the ridge and furrow was in place when the fields were sub-divided, it seems far more likely that it can be dated to some point after 1853.

There is some variance in the distance between furrows, the narrowest being around 2m apart and the broadest 10m, but much is no more than around 6m. The narrowness of the ridges probably reflects the relatively heavy soils across much of the estate. On soils with impeded drainage ridge and furrow cultivation played an important role in draining the land and narrow ridges were generally considered to be most effective (Smith 1979, 10). Bailey and Culley describe this late 18th-century cultivation in Northumberland, noting that 'upon lands that have been lately brought into cultivation, they are straight, nearly flat, and in general about twelve or fifteen feet broad' (Bailey and Culley 1797, 61).

In his 1832 Code of Agriculture, Sir John Sinclair discusses in detail the length, breadth, height and direction of ridging (Sinclair 1832, 309–16) and it is interesting to note that at least some of these ideas are reflected in the Belsay landscape. He recommends, for instance, that where possible ridges should be aligned north-south to give equal amounts of sunlight to both sides of the ridge, thus ensuring that crops will ripen at the same time (Sinclair 1832, 316). There is a clear trend for narrow ridge and furrow to be ploughed in this direction (*see* Fig 22) with east-west ridging largely confined to narrow fields where the long axis did not allow an alternative direction of plough.

Survival of post medieval ridge and furrow is likely for the large part to be due to the agricultural depression of the late 19th century which saw profits from arable decline and large areas given over to pasture. This decline has been observed elsewhere in Northumberland such as the coastal plain where arable reduced from 33% to 23% between 1866 and 1890 (Barnwell and Giles 1997, 69) and it was a trend that would continue until the Second World War.

Quarrying and lime burning

Several quarries are located around Belsay (Fig 24), largely coinciding with outcrops that are free from superficial deposits of glacial tills. They range in size from small-scale extraction – probably for localised use in walls and stock enclosures – to larger-scale quarries of up to 5ha. While some, such as the quarry on Slate Hill, were extracting sandstone, others exploited the bands of limestone that run north-south through the local area. More unusually, marble was also quarried at Park House farm and used for fireplaces in the new hall (Hodgson 1827, 364).

Sandstone is the principal building material locally (Natural England 2015, 24) so it is likely that it was being quarried for this purpose. Given the proximity of such large quarries to the estate, it would be reasonable to assume that they were the source of stone for buildings directly associated with it such as the 19th-century farmsteads and estate village. Sand was also used by Sir Charles Monck to lighten heavy soils on his land (Macdonald 1974, 96). Some of the smaller extractive pits might have been utilised for this purpose but alternatively sand may have been imported from elsewhere in the county.
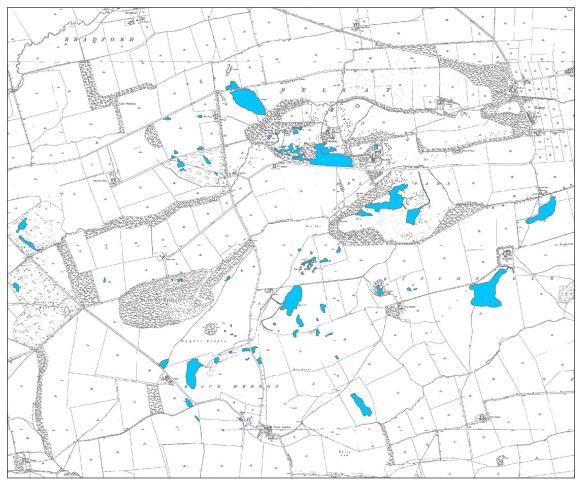

Fig 24: Quarries within the project area. Ordnance Survey 1:2,500 published 1896 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.

Numerous small limestone quarries have been identified and OS maps record limekilns within those at Bygate, East Bitchfield farm, Park House farm and north of Bantam Wood. Burning of limestone in draw kilns to produce quick lime (calcium oxide) for mortar or to improve agricultural land was common in the later 18th and 19th centuries (Williamson 2002, 122). In their observations on Northumberland agriculture at the end of the 18th century, Bailey and Culley discuss in some detail various methods for incorporating lime in the agricultural cycle (Bailey and Culley 1797, 114–7). It is probable that the kilns around the Belsay estate were predominantly burning lime for land improvement.

The quarries and lime kilns on East Bitchfield and Park House farms are both depicted on the plans in the Belsay cropping book of 1824–1854 (Fig 25). Not only does this demonstrate that they were active when the plans were drawn in the early 1820s, it also suggests a direct association with the estate. It is probable both kilns were producing lime to improve the pasture on estate farms but it is also possible that they supplied quick lime for the construction of Belsay Hall in the early 1800s. This is supported by John Hodgson's 1827 account of limestone quarrying and burning at Park House where he notes that it is 'now regularly worked for lime for building and agricultural purposes' (Hodgson 1927, 364). He also notes the presence of coal at the same location which would have presumably provided the fuel to fire the kilns. By the first edition OS mapping both were noted as 'Old Limekiln', indicating that they had fallen out of use by the late 1850s. At Bygate – the only kiln visible on aerial photographs and lidar data – no limekiln is depicted until the second edition. However, it is also noted as 'old' suggesting that it was either very short-lived or for some reason omitted from the first edition.
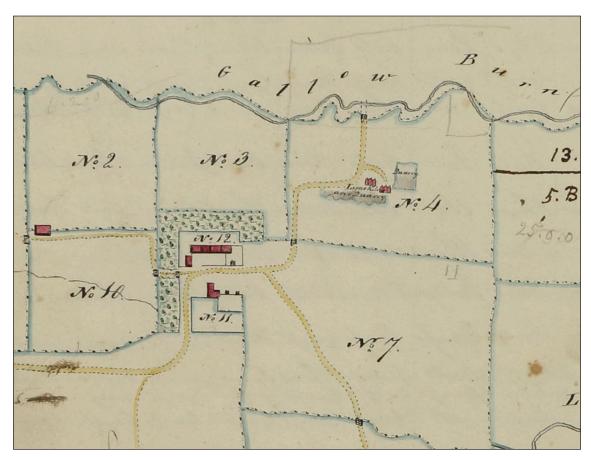

Fig 25: The quarry and limekilns at East Bitchfield depicted in the 1824 Belsay cropping book. Published with permission of the Belsay Estate and Northumberland Archives.

The limestone quarry to the north of Bantam Wood is particularly interesting as it has a clear chronological relationship with ridge and furrow ploughing (Fig 26). The west face of the quarry is very shallow and cuts into broad ridge and furrow of probable medieval date. This shallower area is, in turn, overlain by later narrow

ridge and furrow, demonstrating that it had fallen out of use and been reverted to farmland. Green's 1769 survey of the park notes this area as 'The Kiln Field', perhaps containing the same kiln which appears to be in use on first edition OS mapping, where it is linked to Bantam Wood by a trackway. Although not depicted on plans in the cropping book, its situation indicates that it must also have had a direct association with the estate.
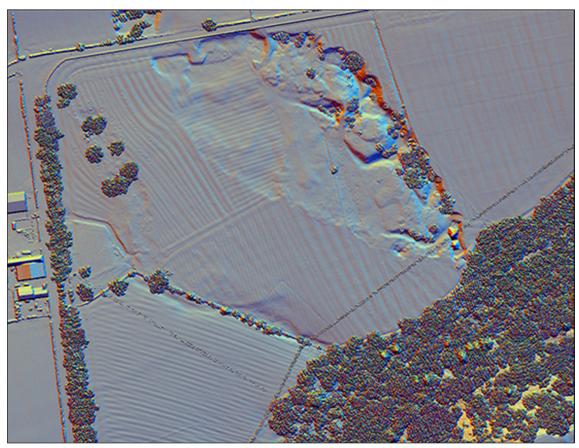

Fig 26: Limestone quarry north of Bantam Wood showing phasing with ridge and furrow. © Historic England; source English Heritage Trust.

Clay extraction

Clay pits are recorded on the OS early edition mapping on Wallridge Moor but it is possible that some of the other small extractive pits relate to clay digging. The clay pits relating to Belsay Tilery are also visible to the south-east of Redhouse farm along with the listed tile kilns (NHLE 1264126).

Coal mining

The earliest evidence for coal extraction has been identified in the vicinity of Hubert's plantation and Heather Plantation where a number of shafts and shaft mounds can be seen on aerial photographs and lidar (Fig 27). The density of their distribution indicates that the shafts are relatively shallow and given their irregular spacing it is possible that they represent bell pits, a form of mining dating as far back as the

medieval period. This distribution is distinct from other shafts in the vicinity which appear in isolation and relate to later deeper mining.
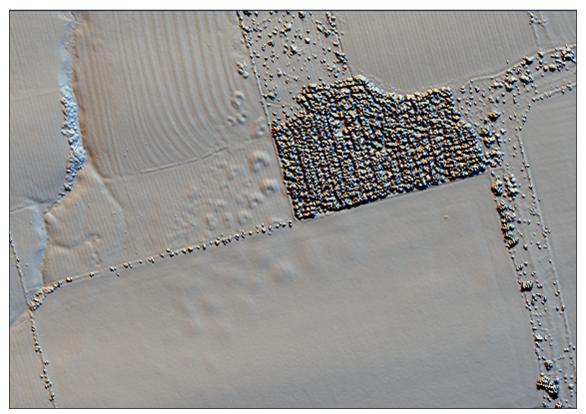

Fig 27: Coal shafts at Hubert's Plantation. Some are overlain by post medieval narrow ridge and furrow. © Historic England; source Environment Agency.

Although the date of the shafts is uncertain, their phasing with other features does provide a relative chronology. Neither site is marked on early edition OS maps, suggesting they had been redundant features for some time when the area was surveyed in 1859. At Hubert's Plantation the northernmost shaft mounds overlie medieval ridge and furrow but those to the south have been over-ploughed by post medieval narrow ridge and furrow. A 16th or 17th century origin could be tentatively suggested. At Heather Plantation the shaft mounds were avoided by post medieval ridge and furrow ploughing, presumably because their remains were too substantial to allow improvement.

To the southeast of the estate, at the crossing point of the track to East Bitchfield farm and Gallow Burn, a single '*Old Shaft*' is noted on early edition OS maps along with an engine house. This site is of particular interest as the engine house is depicted in the farm plan for Belsay Redhouse in the Belsay cropping book, accompanied by a detailed depiction of a Newcomen engine (Fig 28). The fact that the engine is illustrated in the cropping book with apparent pride and the shaft's location on a tenant farm indicate that this must have been a venture directly related to the estate. It's inclusion in the cropping book suggests that the engine was still operational in the mid-1820s but it is not known when it was first installed. Although

the shaft is listed by the Coal Authority as a mine entry (The Coal Authority 2017), it is located in Borewell Field. This field name might indicate that the engine was still in use for pumping water but was no longer associated with an operating mine.
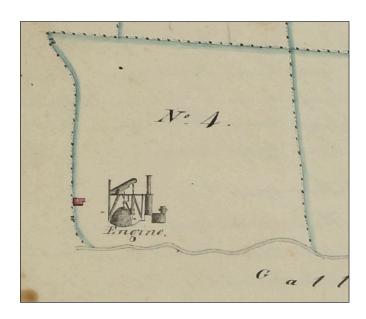

Fig 28: The engine house and Newcomen steam engine at Belsay Red House as depicted in the 1824 Belsay cropping book. Published with permission of the Belsay Estate and Northumberland Archives.

Later coal mining is evidenced by a number of individual shafts which relate to the underground workings of three collieries which were operating in the 19th and 20th centuries. Boghall Colliery was located north-east of Mount Huley and its remains are still visible as extant earthworks. Details of Boghall's operating dates are not known but it is recorded under the ownership of N Grace & Co in the 1860s (Durham Mining Museum 2017). OS first edition mapping records a shaft and building – presumably an engine house – at NZ 0445 7746. By the OS second edition mapping it no longer appears as a named colliery, indicating that it had ceased operating at some point during the second half of the 19th century. Other shafts can be seen in the vicinity which presumably relate to Boghall. This includes a shaft and engine house at NZ 0450 7817 which may have been a second entrance to Boghall's underground workings.

North-east of Boghall is Kirkheaton Colliery's Grace Pit. This first appears on the 1895 OS second edition map, but is noted as disused by time of the 1920 revision. A notice in *The London Gazette* from Christmas Eve 1915 records the dissolution by mutual consent of the partnership of 'The Owners of Kirkheaton Colliery' which highly likely coincides with the pit's closure. The partnership comprised Elizabeth Ogle Smith, Elizabeth Grace Smith, Arthur Innes, William Percy Grace and Herbert Wylam Grace and it is presumably the Grace family that the pit was named after. It is also probable that they were relations of N Grace, the owner of Boghall.

To the north of the entrance shaft and its associated buildings is a row of six workers' houses and three outbuildings (Fig 29). RAF photographs from 1947 show these still upstanding but by 1959 most of the row has been demolished with just part of the western end of the terrace surviving, none survives today.
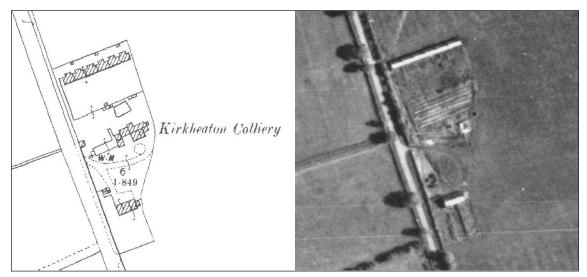
Fig 29: Kirkheaton Colliery – Grace Pit. Although the colliery closed in the early 1900s the row of workers housing survived into the 1940s. RAF/CPE/SCOT/UK/221 3383 27-JUN-1947. Historic England RAF Photography. Ordnance Survey 1:2,500 published 1896 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.

Belsay Colliery operated from 1923 to 1930 under the ownership of Kirkheaton Colliery Co Ltd. The colliery itself lies outside the project area but the course of an associated mineral railway partially lies within it. The course of the railway can be traced on 1940s aerial photographs cutting through medieval ridge and furrow. Much of this area is now under arable cultivation but a short section at NZ 0444 7699 survives.
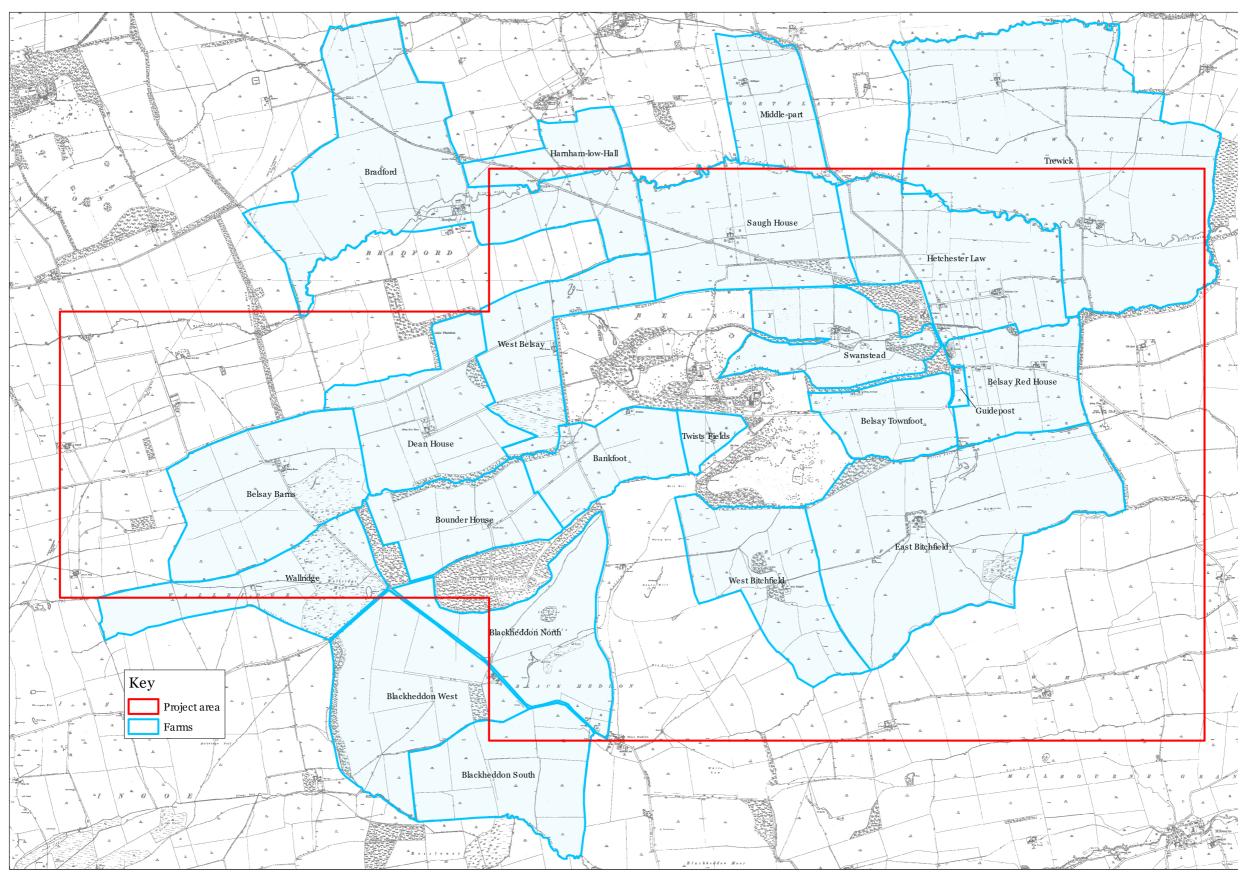
Fig 30: Belsay tenant farms in 1824. Additional farms and landholdings lie outside the area illustrated. Ordnance Survey 1:2,500 published 1896 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.

THE BELSAY CROPPING BOOK: TENANT FARMS 1824–1854

The cropping book

The Belsay cropping book of farms provides a fascinating insight into farming regimes on the estate during the first half of the 19th century. Compiled between 1824 and 1854, it lists the acreage and land use for every field rented out by the Belsay estate. It also includes plans of each farm which enables the landholdings to be reconstructed and illustrates the farmsteads' plans as they were in the early 1820s.

There is some variation in the spelling of farmstead names between the cropping book and later OS maps. The latter spelling is used throughout this report but the alternative spelling is noted in parentheses within the current chapter where appropriate. Dean House refers to Dean House farm at Whalton unless otherwise specified.

Land use

Apart from the hills in the west, much of Northumberland supported a mixed economy of arable and livestock rearing during the 19th century (Barnwell and Giles 1997, 66). Perhaps the most visible evidence for land use in this period is narrow ridge and furrow ploughing which can be seen across much of the survey area and is discussed in detail in the preceding chapter. Like many other areas of the county, the landscape around Belsay reflects the influence of the estate upon it. This influence could be through direct investment or the ability to lease farms large enough to provide the tenants with profits that would enable them to invest in improvements themselves (ibid, 67).

As of 1824 a total of just over 6,232 acres of land were rented out, with holdings varying in size from small plots of grassland to large farms (Fig 30). The estate was initially operating 24 farms but the two largest, Trewick and Edington, were sub-divided in 1847 and 1848 respectively. Castle Inn farm was also added in the late 1840s. Park House farm is illustrated in the cropping book but no records of land use accompanied it, possibly indicating that it was out of use by the early 19th century. Although the farmstead enclosure is depicted on the OS first edition map, most of the buildings had disappeared by this point. Eleven farms covered between 100 and 200 acres with a further eight of between 200 and 300 acres. The four largest farms – Bradford, East Bitchfield, Edington and Trewick – covered 465, 505, 631 and 745 acres respectively.

The great majority were operating a mixed economy with only Blackheddon North, Harnham Low Hall and Wallridge (*Wall Ridge*) farms under grass for the entirety of the cropping book. It is clear that the 'Durham four course' rotation of fallow-wheat-clover-oats was widely implemented across the tenant farms, as was common in Northumberland during the 19th century (Macdonald 1974, 327). Several instances of peas (often with the archaic spelling *Pease*) being substituted for clover can be seen in the cropping book. This was used as a way of preventing 'clover sickness'

where frequent sowing of clover limits the ability of the land to produce further clover crops. Sir Charles Monck had frequently recommended this practice to his tenant farmers in his rent day speeches (Macdonald 1974, 97).

The balance of arable and pasture was an important element of early 19th century farming in Northumberland (Barnwell and Giles 1997, 68) so it is interesting to observe that the ratio of grassland to crops on most of the farms fluctuated very little over the three decades covered by the cropping book. Investment seems to have been focussed on increasing yields from existing arable holdings rather than bringing new tracts of land under the plough. The only farm where a significant change in management can be observed is Blackheddon West. All 12 fields were in grass until 1829 with the common occurrence of 'Pasture' in the field names suggesting a historical use as grazing land. By the late 1830s around half the fields had been incorporated into a regime of crop rotation but this had reduced to only four by 1853, perhaps because the land at this location did not give economically viable yields.

Farmstead character

As well as illustrating the land holdings of tenant farms, the cropping book also provides invaluable plans of the farm building complexes as they were in the mid-1820s, before OS mapping. Comparison of these plans with early edition OS maps gives an interesting insight into changes in farmstead character during the early to mid-1800s, particularly the Victorian 'High Farming' years between the 1840s and 1870s. A comprehensive study of farmsteads, which would require detailed standing building survey, is outside the scope of the current project but maps and aerial photographs give a broad understanding of the change in farmstead character.

A farmstead's layout generally reflects its status, function and the size of the farm that it served (English Heritage 2014, 9). Developments in arable production, livestock rearing and increased mechanisation during the 1800s led to planned farmsteads that focussed on increasing the efficiency of agricultural production. Northumberland was at the forefront of agricultural improvement during the 19th century and the influence of the large estates is often readable in the character of farmstead complexes.

Adaptations to existing farmstead layouts can be identified on the first and second edition OS mapping. In some instances changes appear to be complete by the time the first edition was surveyed in the 1860s but at other farms further developments had taken place by the time of the second edition in the 1890s. At Swanstead, Redhouse (*Red House*), Hedchester Law (*Hetchester Law*) and East Bitchfield additional ranges were added to convert existing farm complexes to an 'E' plan layout while Belsay Dene House (*Dean House*) was converted to a 'U' plan.

At other farms change was more radical with complete rebuilding and/or relocation of the farmstead complex. These new developments commonly included a farmhouse, detached from the range of working buildings, which indicates a degree of planning and prosperity. The division of Edington and Trewick farms in the late 1840s included new farmsteads at East Edington and North Trewick. Both of these

started as 'U' plan but North Trewick had been converted to 'E' plan by the time of the second edition. Reorganisation of Hedchester Law also took place in 1848 with some land being transferred to Red House and Middlepart farms. Eight fields were also transferred to Castle Inn farm which is listed as a separate concern from 1850. This would date the construction of the farmstead complex (NHLE 1304154), located at the rear of the Castle Inn and its stable block, to the late 1840s.

New 'U' plan farms had also been established by the 1860s at Bankfoot, Edgehouse (*Edge House*) and South Bradford. Bankfoot was located in a small field in between the original farm buildings, by this point demolished, but Edgehouse was relocated around 500m to the north-east. Development of Bradford farm seems to have taken place at a later date as the new 'U' plan complex is not depicted until the second edition OS map, to the east of the original farmstead.

'U' plan complexes were also built at West Belsay, Dean House, Blackheddon West (by this point renamed Bygate) and Saugh House by around 1860. At Saugh House New Lands, the location of the new farmstead, was sub-divided by 1847 giving a date for its construction. This is contemporary with the building of North Trewick and East Edington, also 'U' plan farmsteads, so may also suggest that others date from around this period. All of these farms had been further developed by the OS second edition with the addition of a range to convert them to 'E' plan (Fig 31). At all but Dene House this third range was slightly detached from the 'U' plan buildings. None of the additional ranges are depicted on OS maps with open sides so it is possible that they once incorporated loose boxes – small outdoor compartments that could be used to temporarily house cattle (Barnwell & Giles 1997, 90). Changes in farm plan from 'U' to 'E' are likely, in this instance, to reflect greater output of corn alongside an increase in fatstock (J Lake pers comm).

Farmstead developments in the late 1840s and into the 1850s coincided with the repeal of the Corn Laws in 1847 which prompted a drop in the price of grain. It is very possible that at least some of the changes were in response to this – either an effort to intensify production through innovations and greater efficiencies or a change in emphasis to fatstock. These developments also coincided with the opening of the Newcastle and Berwick railway in 1848 which would have improved access to the Tyneside markets for farms in the coastal plain and beyond. Increased competition may therefore have provided additional impetus for investment in farmsteads on the Belsay estate which would previously have had the advantage of their proximity to Newcastle.

Wheelhouses

Wheelhouses were common on farms in Northumberland in the late 1700s and early 1800s (Atkinson 1960, 35; Hellen 1974, 140). Used to house a horse-driven wheel or *gin*, they are circular or polygonal buildings which were appended to the side of a threshing barn (Barnwell and Giles 1997, 80). Although horse power had largely been replaced by steam by the mid-1800s, the structures were often retained and adapted (Hellen 1974, 140).

Cartographic evidence indicates that 13 of the Belsay farms had wheelhouses by the time the OS first edition mapping was surveyed in the late 1850s (Fig 31). Some of these, such as the wheelhouses at Swanstead and Belsay Redhouse, appear to have been quite short lived as they are not depicted on the second edition. The removal of wheelhouses is associated in some instances with continued adaptation and improvement of farms. An example of this is Bygate (Fig 31) where an additional range – probably a mixing barn – had been added to the rear of the building during the development from 'U' to 'E' plan (see above), resulting in the loss of the wheelhouse. Earthwork remains of a further probable wheelhouse, already demolished by the OS first edition, have also been identified west of Black Heddon (*see* Fig 10).
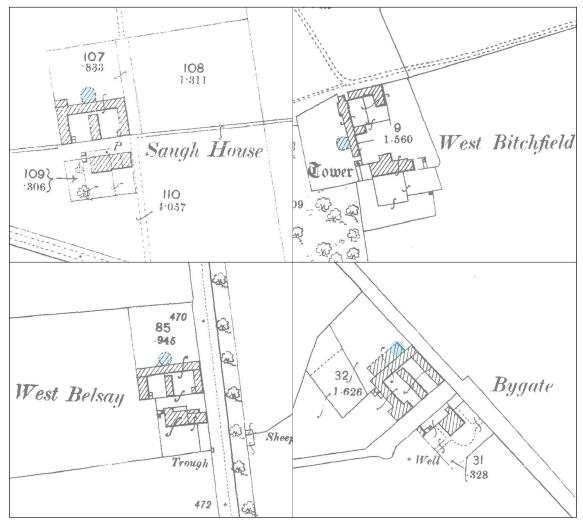

Fig 31: Examples of wheelhouses depicted on OS second edition maps. The wheelhouse at Bygate (location highlighted in blue) has already been demolished by this point. Building complexes at Bygate, Saugh House and West Belsay have all been converted from 'U' to 'E' plan with the addition of a third range. Ordnance Survey 1:2,500 published 1896 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.

WARTIME BELSAY

The Army comes to Belsay

At the outbreak of the Second World War Belsay was occupied by Arthur Charles Middleton, grandson of Charles Monck. He was succeeded in 1942 by his nephew Sir Stephen Middleton (White 2005, 46). Like many country estates, Belsay was requisitioned by the Army during the war years and large parts of the house were taken over by a succession of different units including the 4th East Lancashire Regiment, Royal Artillery and Royal Army Medical Corps.

Sir Stephen Middleton served with the Ministry of Food in London and Colwyn Bay during the war so only visited Belsay periodically. Nonetheless, his correspondence (NRO 3331/135) records a rather fractious relationship with the Army during their occupation of the house, leading him to observe in a letter to his land agent T W Atkinson in 1941 that they were 'Not a very reliable lot. I had a feeling they talked a lot better than they actually behaved'.
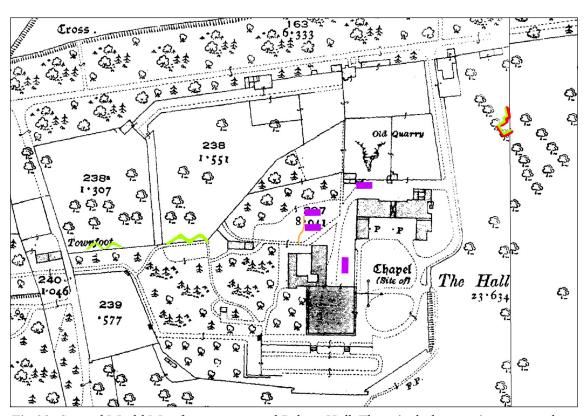

Fig 32: Second World War features around Belsay Hall. These include two zig zag trenches to the west of the house. Ordnance Survey 1:2,500 published 1922 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.

Use of the Hall and park during the Second World War left relatively little impact on the landscape which was captured on aerial photography. This contrasts with many other large estates where requisition involved substantial changes such as

the establishment of large military camps which often persisted for some years after 1945. A small trench was identified during the RCHME field survey (Blood and Welfare 1986, 14) and is also visible on aerial sources. In addition to this, lidar revealed two further trenches in woodland 130m to the west of the hall (Fig 32). The zig zag plan of these features suggests that they functioned as air raid shelters rather than defensive or practice works.

No aerial photographs of the estate during the war exist, but sorties taken by the RAF in 1946 and 1947 capture a snapshot of Belsay in the immediate post-war years. Four curved profile buildings, of the sort commonly termed Nissen huts, are visible located to the north of the hall in an area occupied by the current car park (Fig 33). It is possible that they were once more numerous as a letter relating to the establishment of a Divisional HQ in 1941 mentions the acquisition of land for huts on the south side of the hall. The siting of the remaining huts, however, appears to be very deliberately chosen so they were hidden from view behind the house and stable block. This may suggest that either Arthur or Sir Stephen Middleton, wanting to minimise the visual impact on the hall, requested that they were placed elsewhere.

Fig 33: Second World War huts to the north of the house. Also note the kitchen gardens in use. RAF/CPE/SCOT/UK/221 4390 27-JUN-1947. Historic England RAF Photography

Timber

Stephen Middleton's letters from 1939 and 1940 make several references to felling trees on the estate, specifically to supply the Ashington Coal Company Ltd with timber for pit props. In a letter to Atkinson on 28 November 1939 he notes that 'there is a market now for props of such poor quality that they would have been unsaleable [sic] 6 months ago! Do think about it - & don't let us 'miss the boat''.

Fig 34: Tree felling at Long Plantation (left) Fox Covert (top right) and Village Wood (bottom right). RAF/106G/UK/138 3030, 4044 & 4048 03-JUL-1946. Historic England RAF Photography.

Comparison of the immediate pre-war OS mapping and post-war RAF vertical photography suggests that felling did take place at some point during the war years, albeit on a limited scale (Fig 34). Long Plantation and Sharp Law had both been entirely cleared by 1946 while parts of Heather Plantation and Village Wood, northwest of Castle Inn farm had been partially cleared. Perhaps most interesting is the felling of Fox Covert at East Bitchfield as Middleton specifically notes this in his correspondence as one of the woods that he has been advised to consider selling.

Arable agriculture

The percentage of land under arable cultivation in the UK had fallen to its lowest recorded level in the years before the Second World War. During the course of the war this rose by 50% from 5.2 million to 7.8 million hectares (Zayed 2016, 4). By 1936 just 126ha of land within the project area were under arable, the great majority of managed farmland being meadowland and permanent grass (Land Utilisation Survey of Britain 1936).

Wartime correspondence between Stephen Middleton and Atkinson again gives an indication of the impact on the Belsay estate. It is clear that there was immediate pressure to cultivate land as in December 1939 Middleton was already noting that 'the increased area of plough land is becoming a serious undertaking'. By 1942 the pressure of ploughing out orders appears to have increased further, prompting him to observe that 'The 1942 programme is indeed 'drastic' & sounds almost beyond us! It will need much planning ahead if we are to tackle anything like as much as

is suggested… If labour difficulties etc incline you to think that size of crop can not wisely be made our first consideration then we must consider our own pockets first & plough such land as involves least disturbance of pasture & expense in laying down again finally'.

Photographs taken in the summer of 1946 show that arable had indeed intensified on the estate during the war years. Tracts of pasture around Saugh House and Swanstead, for example, had been taken under the plough. It is possible that some areas had already been reverted back to pasture by this point so wartime arable may have been more extensive that the photographs indicate. This point did, though, mark a change in agricultural regimes on the estate that would see more land come under the plough in the following decades.

1945–1980: THE DECLINE OF THE ESTATE

The Park

Like many country houses, the Second World War marked the beginning of an irreversible decline in the fortunes of Belsay. By 1980, four years before it passed into state guardianship, aerial photographs record several elements of the park in a state of disrepair. The eastern pavilion of Bantam Folly is roofless as is the stable block at the castle complex (Fig 35). Elements of the gardens are similarly derelict. The formal planting on the terraces to the south of the Hall is just discernible but overgrown while the walled garden to the north of the Hall, which was still in use in 1947, is abandoned.

Fig 35: Bantam Folly and Belsay Castle in 1980. OS/80075 V 0049 11-MAY-1980 © Crown copyright. Ordnance Survey

The Estate

The current field pattern has remained virtually unchanged since the late 1800s. In contrast to other areas in England where smaller fields have been amalgamated to accommodate modern farm machinery, few boundaries have been removed. Apart from the loss of a small number of hedges around Black Heddon, the only significant changes have been to the east and north of Belsay village where the sub-divisions instated in 1853 have been taken out. In terms of fieldscapes, the Belsay estate therefore remains largely intact.

Greater changes can be observed in land use since 1945 where aerial photography records a steady shift over the past seven decades from pasture to arable farming, reversing the earlier historical trend. Modern vertical photography shows that over 50% of the project area was under arable cultivation by 2015. This has resulted in the loss of large areas of ridge and furrow ploughing, much of which related to post medieval land improvement in the 18th and 19th centuries on estate farms.

Farmstead character

RAF photographs from 1946 and 1947 show that up to that point farmstead plans had often changed very little from the mid-1800s (Fig 36). In the following decades, agricultural advances and changes to farmstead character can be observed from the aerial photographs, although many have seen relatively minor adaptations to their layout. As noted above, the current study is limited broad observations on plan and layout – architectural survey on the ground would be needed to make a full assessment of changes or losses to the building fabric.
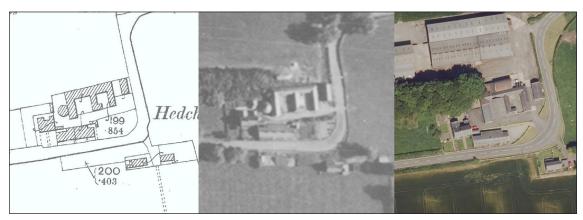
Fig 36: Hedchester Law Farm in 1897, 1947 and 2015. The farmstead remained largely unchanged after the war but recent adaptations have included roofing over the western courtyard of the 19th-century 'E' plan farm complex. The wheelhouse adjoining the western barn has also been lost. RAF/CPE/SCOT/UK/221 3392 27-JUN-1947. Historic England RAF Photography. NZ1079 10-JUN-2015 © Bluesky International/Getmapping PLC. Ordnance Survey 1:2,500 published 1896 © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2017) Licence numbers 000394 and TP0024.

Large modern sheds can be seen on most farms but in many instances these have been constructed abutting or adjacent to existing ranges rather than as a replacement for earlier buildings. At Middlepart, Bankfoot, Edgehouse, Bygate, Bradford, South Bradford, East Bitchfield, Trewick and North Trewick the 19th-century farmsteads remain largely intact. A common adaptation to courtyard farms nationally has been to enclose the cattle yards under a new roof. At West Belsay, Hedchester Law (Fig 36) and Saugh House one courtyard of the E plan has been enclosed while at Dean House both courtyards are now covered. A new range of barns has been inserted into the 'U' plan at Edington.

The largest changes can be observed at Swanstead where significant alterations can be seen on 1946 RAF photographs by which point many of the 19th-century agricultural buildings have been demolished. By the 1965 OS map the current pattern of buildings has been established, presumably associated with Stephen Hugh Middleton's move from the Belsay Hall to Swanstead in 1962.

All but one of the wheelhouses that were still extant in the OS second edition mapping were still upstanding on 1947 RAF photographs but these continued to be lost during the subsequent decades, a pattern reflected across Northumberland (Hellen 1972). Only those at Middlepart, West Bitchfield and Castle Inn still survive, the latter two being listed at Grade II (NHLE 1042825 and 1304154).

SUMMARY

Conclusions

The Belsay Awakes project has demonstrated the value of large-scale aerial photograph and lidar mapping for understanding the estate and its wider landscape. In particular, high resolution lidar commissioned for the project has proved invaluable for identifying and interpreting archaeological features. This dataset, alongside the vertical photography, will also be a useful tool for future estate management by EHT.

Analysis of the aerial imagery has identified six previously unrecorded enclosures or settlements dating to the Iron Age/Roman periods. This has further expanded the known distribution of these monuments in Northumberland and demonstrated that the Belsay landscape has been populated and farmed for several thousand years. This provides an important strand to the landscape narrative.

The previous picture of the park and estate has been enhanced, particularly by lidar data. The results of the aerial mapping, when considered alongside previous field survey and geophysical survey undertaken as part of this project, have indicated that the medieval enclosure was unlikely to have an exterior fortification. In particular, the rectangular depression to the east of the castle is now known to be an isolated feature rather than a surviving section of a once more extensive moat.

One of the most significant discoveries has been the identification of the conjectured medieval park pale surviving as earthworks. Although Belsay was assumed to have a deer park in the medieval period, this is the first firm evidence – either documentary or physical – that such a feature existed.

In the wider landscape, the aerial sources have recorded extensive remains relating to medieval settlement and farming. They have shown that large areas of medieval ridge and furrow ploughing survive as earthworks, helping to reconstruct a landscape that would have been broadly contemporary with the establishment and occupation of Belsay Castle, and integral to the life of the associated village. Changes in tenure and land management in the post medieval period can also be traced in the physical remains of field boundaries and farmsteads, charting a transition from a village-based open field landscape to one of scattered farmsteads and enclosed fields.

The aerial mapping, particularly when allied to documentary sources, has enhanced our understanding of post medieval land use around Belsay. It has provided evidence for stone and clay extraction, coal mining and lime burning – the latter intrinsically linked to 18th and 19th century land improvement. It has also illustrated the profound influence of the Belsay Estate on local farming practices and its role in shaping the agricultural landscape that we see today. Improvements in Northumberland agriculture, particularly during the Victorian 'High Farming' years, are reflected in the fieldscapes and farmsteads. Changes in farmstead character show how the latest developments in agricultural improvement were being implemented under the direct or indirect influence of the family.

RAF imagery has provided some evidence for the impact of the Army's use of the estate during the Second World War but it has also provided evidence of the wider effects of the conflict as woods were felled and pasture ploughed up. Photographs from the 1940s onwards chart the steady decline of the estate in the post-war years but they also show that the landscape we see today has changed relatively little in the past two or three centuries – the present landscape very much shaped by the influence of Belsay.

Recommendations for future work

- Continued aerial reconnaissance in appropriate conditions has the potential to reveal further evidence for pre-medieval settlement from crop- and soilmarks.

- Analytical field survey may be able to identify subtleties in chronology and phasing of earthworks identified on lidar and aerial photographs.

- Desk-based assessment has gone some way to understanding farmstead character but detailed survey of building fabric alongside documentary research is needed to more fully characterise the building complexes.

- Carefully targeted invasive survey such as small-scale excavation and coring would help to better understand features identified around the Old Castle complex.

- Documentary research into farming practices and tenant farms will help to further understand the physical remains of the 18th and 19th-century landscape, particularly the changes in land holdings and farming practices which took place after the agricultural depression.

REFERENCES

Atkinson, F 1960 'The Horse as a Source of Rotary Power'. *Trans of the Newcomen Soc* **33** 31–55

Bailey, J and Culley, G 1797 *General View of the Agriculture of the County of Northumberland: With Observations on the Means of its Improvement; Drawn up for the Consideration of the Board of Agriculture and Internal Improvement.* University of Oxford Text Archive http://ota.ox.ac.uk/text/4054.html accessed 6 June 2017

Barnwell, P and Giles, C 1997 *English Farmsteads, 1750-1914.* Swindon: RCHME

Beresford, M and Hurst, J G (eds) 1971 *Deserted Medieval Villages.* London: Lutterworth

Bettey, J H 1993 *Estates and the English Countryside.* London: Batsford

Bradshaw, F 1916 'The Lay Subsidy Roll of 1296: Northumberland at the End of the Thirteenth Century'. *Overprint from Archaeol Aeliana* **13** ser **3**

Blood, K and Welfare, H 1986 *The parkland around Belsay Hall.* Unpublished report with accompanying 1:1,000 scale plan. RCHME

Durham Mining Museum 2017 *List of Mines.* Available online at http://www.dmm.org.uk/lom/index.htm

English Heritage 2014 *National Farmsteads Character Statement.* Swindon: English Heritage

Gates, T 2004 *The Hadrian's Wall Landscape from Chesters to Greenhead: An Air Photographic Survey.* Northumberland National Park Authority

Gates, T 2012 'Monuments from the Air' *in* Passmore, D G and Waddington, C 2012 *Archaeology and Environment in Northumberland: Till-Tweed Studies Volume 2.* Oxford: Oxbow, 58–110

Glasscock R E (ed) 1975 *The Lay Subsidy of 1334.* London: Oxford University Press

Hann, A 2015 *Belsay Hall, Castle, Gardens and Estate: Research Plan.* Unpublished internal document

Hellen, J A 1972 'Agricultural Innovation and Detectable Landscape Margins: The Case of Wheelhouses in Northumberland'. *Agricultural History Review* **20** 140–54

Hodgson, J 1827 *A History of Northumberland.* Part **II** vol **I**. Newcastle-upon-Tyne

Hutton, K 1976 'The Distribution of Wheelhouses in the British Isles'. *Agricultural History Review* **24** 30–35

Jobey, G 1960 'Some Rectilinear Settlements of the Roman Period in Northumberland'. *Archaeol Aeliana* **38** ser **4**, 1–38

Linford, N, Linford, P and Payne, A 2017 *Belsay Hall and Castle, Northumberland. Report on Geophysical Surveys, July and October 2016*. Historic England Research Report Series no. 4-2017

Macdonald, S 1974 'The Development of Agriculture and the Diffusion of agricultural Innovation in Northumberland 1750-1850'. Unpublished PhD thesis, Univ Newcastle

Natural England 2015 *National Character Area profile: 12 Mid Northumberland. Available online at http://publications.naturalengland.org.uk/publication/4839052410880000?category=587130*

Oakey, M 2009 *Hadrian's Wall World Heritage Site National Mapping Programme Project: Summary Report.* English Heritage Research Department Report Series no. 73-2009

Passmore, D G and Waddington, C 2009 *Managing Archaeological Landscapes in Northumberland: Till-Tweed Studies Volume 1*. Oxford: Oxbow

Sinclair, J 1832 *The Code of Agriculture*. Hathi Trust Digital Library https://hdl.handle.net/2027/mdp.39015027623308 accessed 7 July 2017

Smith, D J 1979 *Discovering Horse-Drawn Farm Machinery*. Aylesbury: Shire

Smith, J E and Tolan-Smith, C 1997 'The Medieval Landscape 2: Welton Deserted Medieval Village' *in* Tolan-Smith, C 1997 *Landscape Archaeology in Tynedale*. Newcastle: University of Newcastle, 53–67

Taylor, C 1975 *Fields in the English Landscape*. London: J M Dent & Sons

Taylor, S, Jessop, L and Howard, C 2017 *An Investigation of the Tower, House and Castle Court*. Historic England Research Report Series no. 65-2017

The Coal Authority 2017 *Interactive Map Viewer*. Available online at http://mapapps2.bgs.ac.uk/coalauthority/home.html

University of Hull, 2017 *Beresford's Lost Villages*. Available online at https://dmv.hull.ac.uk/index.cfm accessed 8 May 2017

White, R 2005 *Belsay Hall, Castle and Gardens*. English Heritage guidebook reprint 2014

Williams, L 2015 *Northumberland Historic Landscape Characterisation (HLC)*. York: Archaeology Data Service

Williamson, T 2002 *The Transformation of Rural England: Farming and the Landscape 1700-1870*. Exeter University Press

Wrathmell, S 1975 *Deserted and Shrunken Villages in southern Northumberland from the Twelfth to the Twentieth Centuries*. Unpublished PhD thesis, University College, Cardiff

Wright, R P 1938 'The South-Western Section of the Devil's Causeway'. *Archaeol Aeliana* **15** ser **4**, 351–61

Zayed, Y 2016 *Agriculture: historical statistics*. House of Commons Library Briefing Paper number 03339

APPENDIX 1. METHODS AND SOURCES

Archaeological scope

Cropmarks, parchmarks, soilmarks

All sub-surface archaeological remains visible as cropmarks, parchmarks or soilmarks were mapped and recorded.

Earthworks

All archaeological earthworks visible on aerial photographs were mapped and recorded. This included features visible as earthworks on early photographs, which have since been levelled and archaeological features depicted on OS maps that are within the NMP sphere of interest.

Buildings and structures

The foundations of ruined buildings visible as cropmarks, soilmarks, parchmarks, earthworks or stonework were mapped and recorded. Standing roofed or unroofed buildings were not mapped.

Ridge and furrow

Medieval and post medieval ridge and furrow were mapped and recorded, regardless of preservation. Each furrow was depicted as a single polyline.

Post medieval field boundaries

Post medieval field boundaries (upstanding or levelled) that are depicted on OS first edition or later mapping were not generally mapped. The exception to this was where they formed part of an earlier field system that was not depicted by the OS.

Parkland, landscape parks, gardens and country houses

Vestigial man-made elements of the landscape park and gardens were mapped and recorded. Those elements of the park that are still in use such as formal gardens and tracks were not recorded.

Industrial features and extraction

All extraction, irrespective of size, was mapped and recorded.

20th-century military features

Second World War military features were mapped and recorded. Although within NMP scope, no First World War or Cold War military features were identified.

Natural features

Natural features which are geological or geomorphological in origin were not mapped. If there was risk of confusion in contexts with other archaeological features, then the natural features were mentioned in the text record.

Methods

Sources

The aerial photograph collections of the Historic England Archive and Northumberland HER were assessed. Digital orthophotographs supplied through APGB and Google Earth were also consulted. At the time of the project there was no access to the Cambridge University Collection of Aerial Photography (CUCAP) archive so these images could not be assessed.

The English Heritage Trust commissioned 10cm resolution lidar and aerial photography from Bluesky International Ltd for an area of 16.8sq km, focussed on the current Belsay estate and presumed extents of the medieval park. The lidar was captured on 03-MAR-2016 and 14-MAR-2016. The aerial photography was flown on 14-MAR-2016 between 4.00 pm and 4.15 pm to capture the imagery under good lighting conditions for showing archaeological earthworks.

Additional lidar at 1m resolution was acquired by the Environment Agency and was downloaded from the Government Open Data website in ASCII grid format. Where no lidar was available, 2m interval height data supplied by Next Perspectives through the APGB agreement was used to produce Digital Elevation Models (DEMs).

Height data processing

Raw lidar data were processed in house using QT Modeler to produce DEMs. Lidar data and 2m interval height data were processed using the Relief Visualization Toolbox v1.1 to produce 2D GeoTIFF images. In addition to these, the data were also processed in Quick Terrain Modeler to produce files in .qtt format.

Evaluation of imagery

All photographs were examined under magnification and in stereo where possible. Born digital images were viewed on screen. DEMs in .qtt format were examined in Quick Terrain Reader where the lighting and vertical exaggeration could be manipulated. The 2D GeoTIFFs produced in the Relief Visualization Toolbox were examined on screen in AutoCAD Map 3D.

Rectification

Rectification of aerial photographs was undertaken using Aerial 5.36. Control was derived from the commissioned 10cm orthophotography or APGB 25cm orthophotography. OS 1:2,500 scale MasterMap® vector data were used to

supplement control if required. Digital terrain models derived from 5m interval DTM data in ASCII grid format provided through APGB were used to improve the accuracy of rectifications.

The accuracy of rectified images is normally to within ±2m of the source used for control but this error may be larger in areas with large topographic variation. Consequently the accuracy of mapped features, relative to their true ground position, will depend on the source used for control. The accuracy of orthophotography is within 10–15cm. Features mapped directly from orthophotographs and lidar will be sub-metre accurate.

Mapping

Georeferenced imagery was imported into AutoCAD Map 3D where features were digitised. All features were mapped as closed polygons apart from scarps, where a schematic t-hachure was used, and ridge and furrow. Attribute data were attached to each feature as defined in Table 1.

Attribute	Description	Sample data
PERIOD	Date of feature (HE Thesaurus). Single or dual indexed terms	MEDIEVAL
NARROW_TYPE	Monument Type (HE Thesaurus). Specific monument type for individual features	RIDGE AND FURROW
BROAD_TYPE	Monument Type (HE Thesaurus). Broader monument type to enable grouping of individual features	RIDGE AND FURROW
EVIDENCE_1	Form of remains (HE Thesaurus) as seen on PHOTO_1	EARTHWORK
PHOTO_1	Source feature was mapped from (aerial photograph or lidar)	OS/67307 V 0065 20-AUG-1967
EVIDENCE_2	Form of remains (HE Thesaurus) as seen on PHOTO_2	LEVELLED EARTHWORK
PHOTO_2	Latest available source (aerial photograph or lidar) to give indication of current state of preservation. Not applicable for cropmark sites	LIDAR English Heritage Trust DSM 03 & 14-MAR-2016
NRHE No	NRHE Unique Identifier (UID)	23092
HER No	HER number for those features concorded with existing HER records	10928

Table 1. Aerial mapping attribute data.

APPENDIX 2 MAPPING LAYERS

Layer Name	Layer content	Layer colour	Linetype	
BANK	Closed polygons for features such as banks, platforms, mounds and spoil heaps	1 (red)	CONTINUOUS	
DITCH	Closed polygons for cut features such as ditches, ponds, pits or hollow ways	3 (green)	CONTINUOUS	
EXTENT_OF_FEATURE	Closed polygons outlining a feature or group of features such as an industrial complex	30 (orange)	CONTINUOUS	
MONUMENT_POLYGON	Closed polygons encompassing features recorded within a single NRHE record	7 (white)	CONTINUOUS	
RIG_AND_FURROW_ALIGNMENT	Polyline showing the direction and form of ploughing in areas of ridge and furrow	4 (cyan)	CONTINUOUS	
STRUCTURE	Closed polygon for built features including stone, concrete, metal and timber constructions	190 (purple)	CONTINUOUS	
THACHURE	Polyline t-hachure convention to schematise sloped features indicating the top of slope and direction of slope	5 (blue)	CONTINUOUS	

Table 2. Drawing layers.

Historic England Research and the Historic Environment

We are the public body that looks after England's historic environment. We champion historic places, helping people understand, value and care for them.

A good understanding of the historic environment is fundamental to ensuring people appreciate and enjoy their heritage and provides the essential first step towards its effective protection.

Historic England works to improve care, understanding and public enjoyment of the historic environment. We undertake and sponsor authoritative research. We develop new approaches to interpreting and protecting heritage and provide high quality expert advice and training.

We make the results of our work available through the Historic England Research Report Series, and through journal publications and monographs. Our online magazine Historic England Research which appears twice a year, aims to keep our partners within and outside Historic England up-to-date with our projects and activities.

A full list of Research Reports, with abstracts and information on how to obtain copies, may be found on www.HistoricEngland.org.uk/researchreports

Some of these reports are interim reports, making the results of specialist investigations available in advance of full publication. They are not usually subject to external refereeing, and their conclusions may sometimes have to be modified in the light of information not available at the time of the investigation.

Where no final project report is available, you should consult the author before citing these reports in any publication. Opinions expressed in these reports are those of the author(s) and are not necessarily those of Historic England.

The Research Report Series incorporates reports by the expert teams within the Research Group of Historic England, alongside contributions from other parts of the organisation. It replaces the former Centre for Archaeology Reports Series, the Archaeological Investigation Report Series, the Architectural Investigation Report Series, and the Research Department Report Series