Ryevitalise Landscape Partnership

HERITAGE FUND

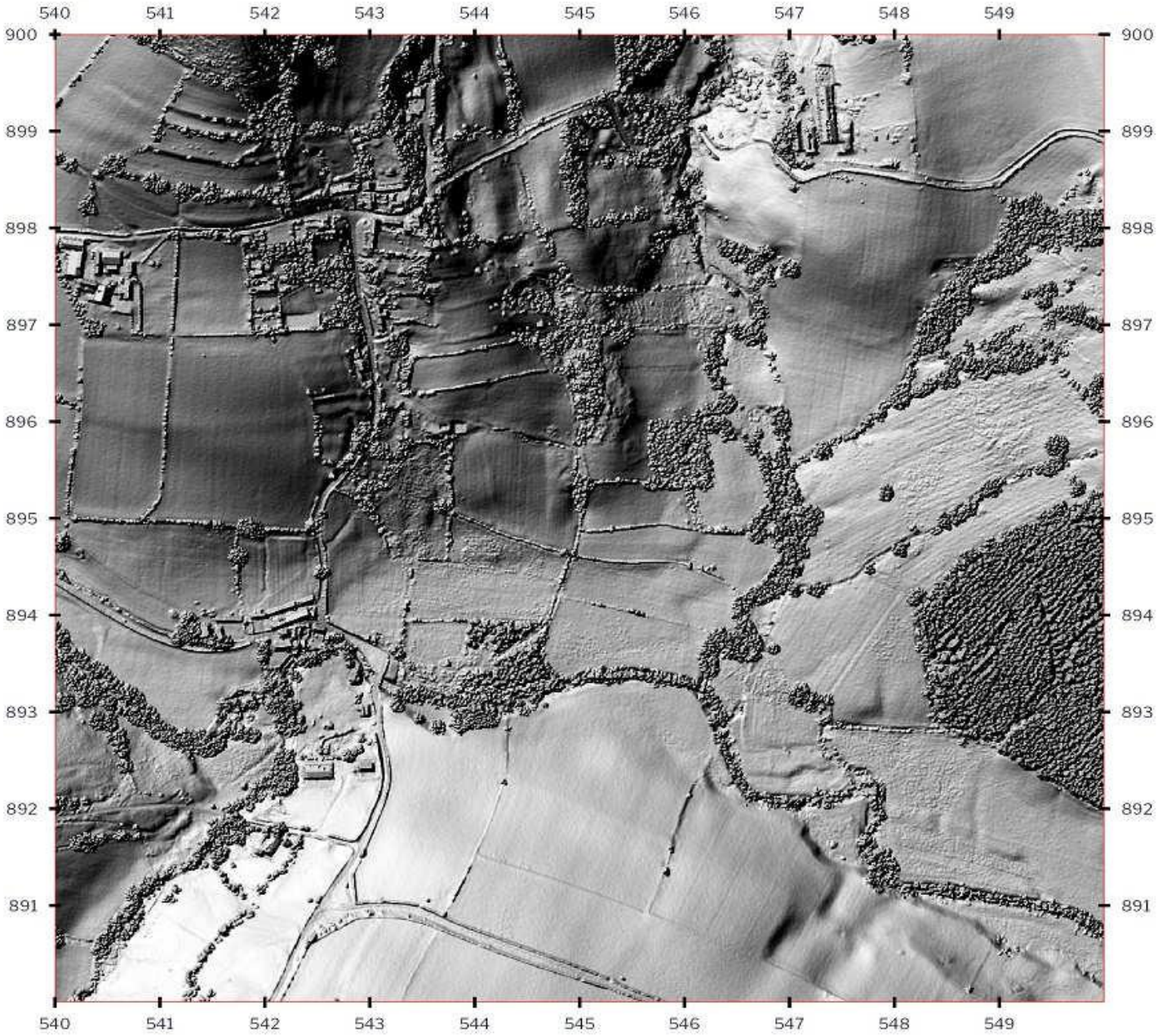
North York Moors National Park

ORACLE Heritage Services

RYEVITALISE

LIDAR LANDSCAPES

Project Report



This document summarises the **Ryevitalise Lidar Landscapes** project, an initiative that enabled local volunteers to complete the archaeological survey of nearly 200 sq kms around the town of Helmsley, extending northwards into the North York Moors National Park and southwards into the Howardian Hills AONB, using specially processed Environment Agency lidar data. The project was managed by Amy Carrick-Knowles, Ryevitalise Education and Engagement Officer . The Project Consultant was Paul Frodsham (ORACLE Heritage Services).

This document was written by Paul Frodsham (ORACLE Heritage Services).
References to it should be structured as follows:

Frodsham, P. 2021. *Ryevitalise Lidar Landscapes. Project Report*. Unpublished report for the Ryevitalise Landscape Partnership and North York Moors National Park Authority.

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Cover illustration

Digital Surface Model (DSM) lidar image of OS km sq SE5489, showing the village of Hawnby within its landscape setting, with the River Rye flowing across the S half of the image. Elements of the Hawnby's ancient field system, including a well-preserved system of terraces towards the NW corner of the image, can be seen quite clearly between the trees. These become much clearer on a DTM image, with the woodland stripped away, as shown in Fig. 26, which shows part of this area. This image also shows the effect of recent ploughing towards the S of the km sq, where the fields are featureless; any earthworks that may once have existed here have now been ploughed flat.

This is an example of the lidar imagery used by volunteers during this project; discussion of this imagery is included in this report, along with an overview of the results.

Contents

Foreword

Amy Carrick-Knowles, Ryevitalise Education and Engagement Officer.

At the start of this project we were focusing on the landscapes around Rievaulx, investigating whether anymore could be discovered about this fascinating monastic landscape. Then the pandemic hit, confining us to our homes, and limiting our travel. Desk bound at home, it was decided Lidar Landscapes would be the perfect way to not only utilise volunteers' time and knowledge at home, but to also further understand the whole Ryevitalise area. All available Lidar in the Ryevitalise area was processed and analysed; leading to the discovery of new finds but also the enhancement of previously known ones.

First and foremost a huge thank you to all volunteers, I've said it many times before but to persevere without a proper in-person workshop is fantastic. Without this effort and dedication we would not have been able to do this, so thank you for being a lovely bunch to work with!

Secondly thank you to project consultant Paul Frodsham of Oracle Heritage Services. It was great to work with Paul and use his profound knowledge of LiDAR and archaeology in general. He also went the extra mile to produce enhanced guidance notes and extensively research an area he wasn't familiar with.

I also need to thank the North York Moors National Park GIS Officer Sandra Kennish for producing all the processed LiDAR squares for us to use. Along with the Historic Environment Teams from the NYMNP and North Yorkshire County Council. I also want to thank Freya Horsfield for suggesting such a project in the first place! Lastly we have to thank the National Lottery Heritage Fund for without them none of this would be possible!

It has been a fantastic project to work on and I have certainly learnt a lot from researching the HER to discovering archaeological features to enhancing my IT skills! I hope all participants now have the confidence to use their new skills to go out there and discover more about the heritage of the Ryevitalise area, and that others will enjoy finding out about the results of the project.

1. Introduction

1.1 General introduction

This ambitious Lidar Landscapes survey, designed to enable a team of volunteers to study all available lidar coverage within the Ryevitalise project area, was undertaken during 2020 and 2021 as part of the NLHF-funded Ryevitalise Landscape Partnership (Map 1).

The project was managed throughout by Amy Carrick-Knowles (Ryevitalise Education and Engagement Officer, North York Moors National Park Authority). Environment Agency lidar data was specially processed for the project by Sandra Kennish (GIS Officer, North York Moors National Park Authority). The Project Consultant and author of this report was Paul Frodsham (ORACLE Heritage Services). HER data for the area within the National Park, to supplement information available via the online HER, was kindly supplied by Nick Mason (North York Moors National Park Authority Archaeology Team). Freya Horsfield provided useful background information linked to her PhD research. The Project Consultant is most grateful for all these contributions.

The project had two basic aims:

1. Teaching project volunteers about lidar and giving them the opportunity to use lidar imagery in a practical programme to survey the Ryevitalise area.
2. Enhancing the Historic Environment Records (HERs) for the North York Moors National Park and North Yorkshire, through the recording of previously unrecorded sites and new information about known sites.

The survey work was undertaken by a dedicated and enthusiastic team, none of whom had previously worked with lidar. Some members of this team completed much more work than others, but all played important roles by surveying individual areas and by contributing to the overall success of the project. The survey team consisted of the following individuals, to all of whom the Project Consultant is most grateful:

Malcolm Bowes, Peter Bradbury, Peter Clough, Andrew Cromack, Neil Edwards, Antony Fleming, Denise Grantham, Paul Grantham, Grant Grieve, Jim Hall, David Hollingworth, Michelle James, Jessica Nutt, Richard Owenson, Harry Pearson, Jane Pearson, Yvonne Ramage, Richard Randle, John Rees, Elizabeth Sanderson, Gill Smith, David Stephens, Martin Sutton, Clare Usher, Esme Walton, Peter Wood, Duncan Wright.

The project coincided with the Covid 19 crisis. It thus provided interesting work for the volunteers, working at home on their own, while restrictions were in place. These restrictions, however, did necessitate changes in the project methodology as originally proposed. In particular it was not possible to hold a start-up meeting, and only a single progress workshop (repeated 8 times due to restrictions on participants!) was possible. Fortunately it was eventually possible to hold a results workshop, attended by most of

the project volunteers, in September 2021. The methodology is discussed below in Section 2.

In general terms the results, as discussed below in Section 3, were much as expected, with hundreds of newly recorded sites but only a few which could be of any great archaeological significance. This contrasts with previous surveys of other areas of northern England where numerous important discoveries were made during comparable volunteer projects. The explanation for this lies in a combination of the nature of recent agricultural practice (in particular the amount of heavy ploughing, which has flattened earthworks in many places) and the amount of previous archaeological work (which has seen much of the project area quite intensively studied). However, these issues were known at the commencement of the project, and as a programme of HER enhancement, in addition to the positive experience gained by the volunteers, the project was certainly well worth doing.

1.2 Brief introduction to Lidar Landscapes surveys

The recent development of lidar technology enables the archaeological survey of extensive areas by local volunteers, after only a brief training session, from the comfort of their own homes. This project provided participating volunteers with training and guidance in the use of lidar in archaeological survey, which some will hopefully continue to use in later projects now this one is complete. The Environment Agency is currently undertaking a new high-resolution lidar survey of the whole of north-east England, so volunteers who have taken part in this project will be well-placed to begin studying this new data just as soon as it becomes publicly available.

This project is based on a methodology developed during recent Lidar Landscapes surveys of comparable upland areas in the North Pennines (including the Allen Valleys, Weardale and Upper Teesdale) and Redesdale. These involved more than 200 volunteers and resulted in numerous significant discoveries. The methodology was initially developed by Paul Frodsham (Project Consultant for this project) and Stewart Ainsworth (Visiting Professor of Landscape Archaeology at the University of Chester, and an expert in the use of lidar in archaeological survey). Reports on these recent projects (Ainsworth 2016; Frodsham 2017, Frodsham 2020) are available online as pdfs. The structure of this report closely resembles that of the Redesdale project, as the methodology for each was essentially identical.

ALSM (or 'airborne laser swath mapping') data, more commonly referred to as 'lidar' (originally a portmanteau of 'light' and 'radar') is a relatively new information source being used by archaeologists to discover, interpret and record archaeological sites (Crutchley & Crow 2018). The data for this project, now freely available from the Environment Agency, was gathered using sensors mounted on an aircraft. It was not originally commissioned for archaeological survey, but for work relating to flood management; hence the areas recorded are based on river valleys and, somewhat frustratingly for the archaeologist, there are substantial areas, some of much potential archaeological interest, for which no coverage is available. Nevertheless, coverage for the Ryevitalise project area, while far from complete, is extensive, offering much potential for significant discoveries, even in places where conventional archaeological survey has taken place previously. There are limitations to what can be achieved, not just to do with the lack of coverage in some areas but also due to the resolution of the

lidar coverage which, at 1 metre resolution (with 0.5m in some places), will not pick up relatively ephemeral features such as slight earthworks or small cairns. Neither, of course, given its very nature, can lidar see below the ground surface; it can only record above ground 'humps and bumps', and there will always be other sites, perhaps ploughed flat or buried beneath later sites, of which lidar cannot hope to record any trace. Thus it must always be born in mind that lidar only shows us part of the picture. However, despite these limitations, the project has proved to be very worthwhile for participating volunteers, and the results will be important for future students of local archaeology and for heritage management.

Appropriately processed lidar imagery can reveal aspects of the historic landscape in staggering detail, often being far more informative than aerial photography, but human eyes are required to spot and interpret this detail. This was the role of the project volunteers, who have developed new archaeological and recording skills as well as learning much about the development of the historic landscape within the project area.

The project methodology (discussed in Section 2) was designed to enable volunteers with little or no archaeological background to make meaningful contributions to the recording and understanding of the historic landscape, while providing the tantalising prospect of significant, even spectacular, new discoveries. The recording method uses software that is either commonly available on most home computers or is freely available on the internet, enabling contributors to work at home at a pace that suits their own circumstances. The project was designed to be essentially paperless as all file exchanges were by email. After validation by the Project Consultant the results were collated within a spreadsheet that will enable them to be readily incorporated into the North York Moors and North Yorkshire Historic Environment Records (HERs). They will thus be available for anyone planning new research projects, while also making a key contribution to future landscape management.

Advice on the kind of sites to look for and how to record them was provided to volunteers within a comprehensive Project Manual and a set of Guidance Notes. The Project manual also includes details of a range of online resources, such as aerial imagery and historic mapping, that volunteers were encouraged to consult in addition to the lidar images provided. Volunteers were encouraged to try and identify all sites by reference to a nationally agreed 'site type' thesaurus; in some cases such identifications might be certain, while in others they may be little more than informed guesses. In all cases, sites were recorded in outline, enabling closer analysis later where appropriate. The Project Consultant was constantly available online to help with any queries, though opportunities for interaction between volunteers was sadly restricted by the Covid crisis which meant that volunteers were unable to meet as a group until the final results workshop. This was unfortunate as a big part of other Lidar Landscapes projects has been the opportunity for volunteers to meet and discuss results at workshop while the projects were ongoing; events which were always popular and without fail overran due to a combination of interesting discussion and fun!

The results of the project have been collated into a digital archive which has been passed to the relevant HERs where it should be available by arrangement for consultation. This report contains a review of the project methodology (Section 2), an overview of the results (Section 3), and a brief list of some suggestions for future work that could potentially be undertaken by volunteers under professional supervision (Section 4). A selection of images (Section 5) has been chosen to illustrate the results.

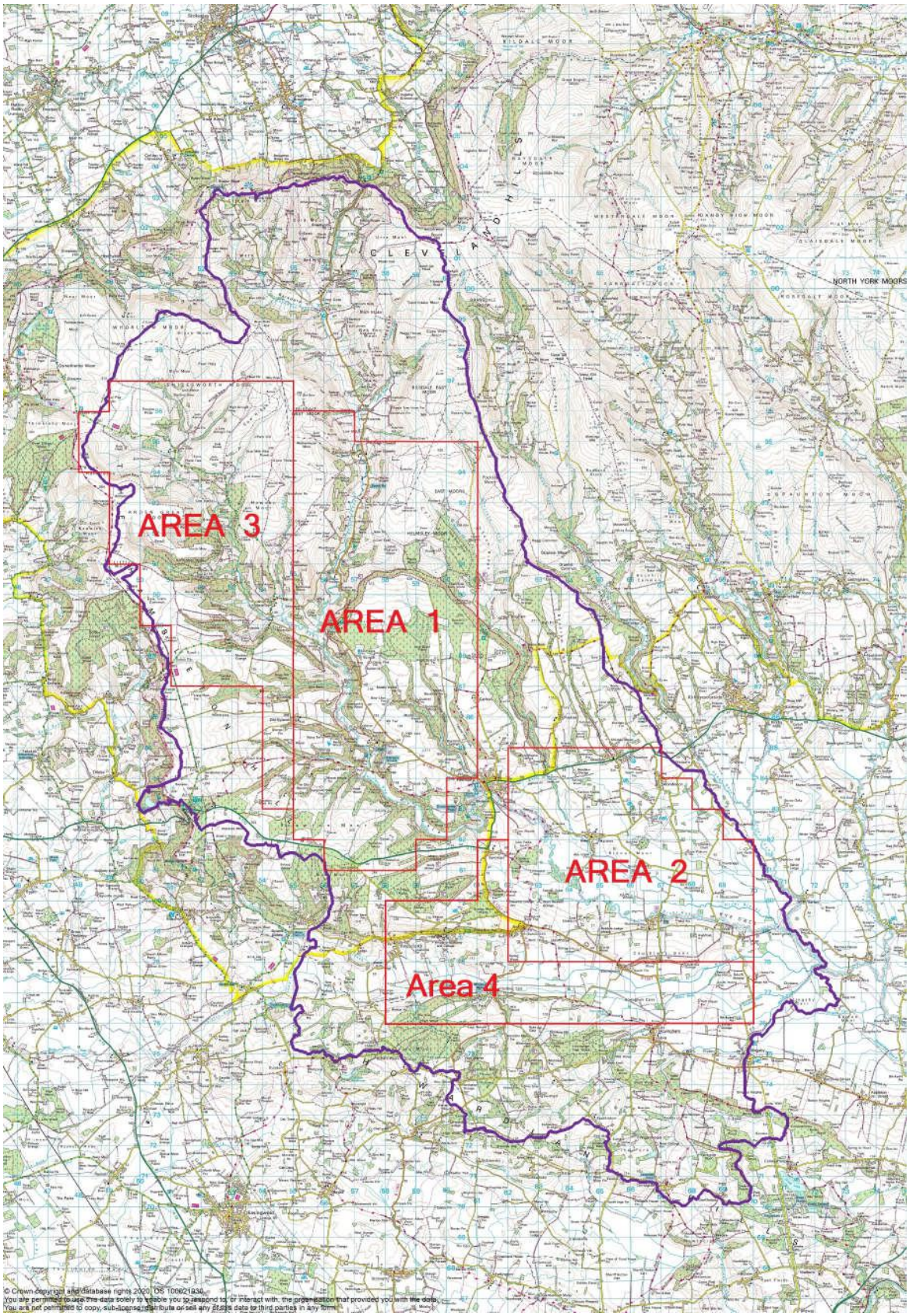
1.3 The Ryevitalise Lidar Landscapes survey area

The original survey area expanded during the life of the project to cover all kilometre squares (km sqs) within the Ryevitalise project area for which lidar coverage was available; a total of 225 km sqs (Map 1).

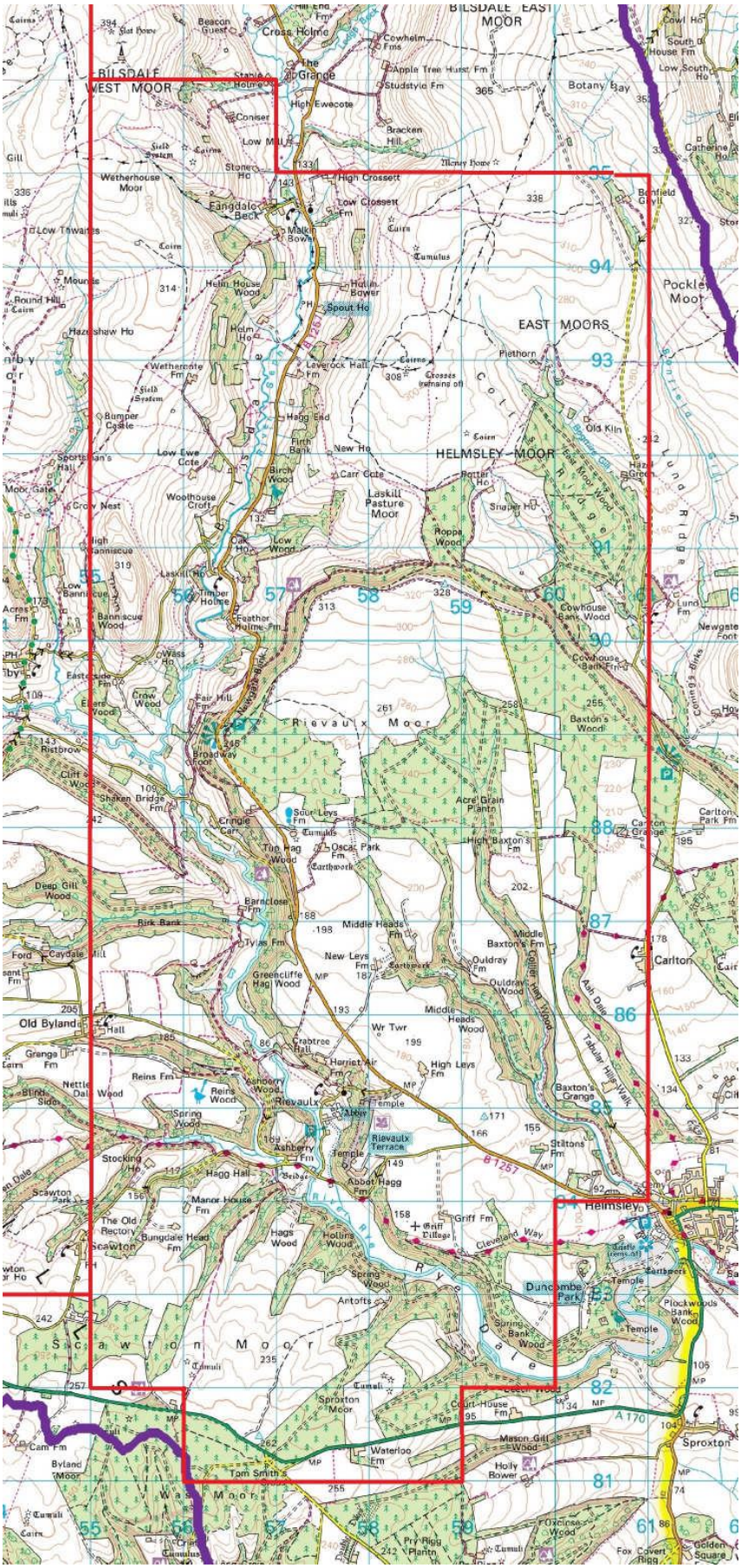
Work began with Area 1, an upland block of north-west of Helmsley including Rievaulx, all within the National Park (Map 2). It then moved to focus on Area 2, a contrasting lowland landscape south-east of Helmsley, within the Howardian Hills AONB.

Due to demand from the volunteers for more, Area 3 was then added. This is effectively a westward extension of Area 1. For all practical purposes, other than the delivery of this project, the distinction between Areas 1 and 3 is meaningless.

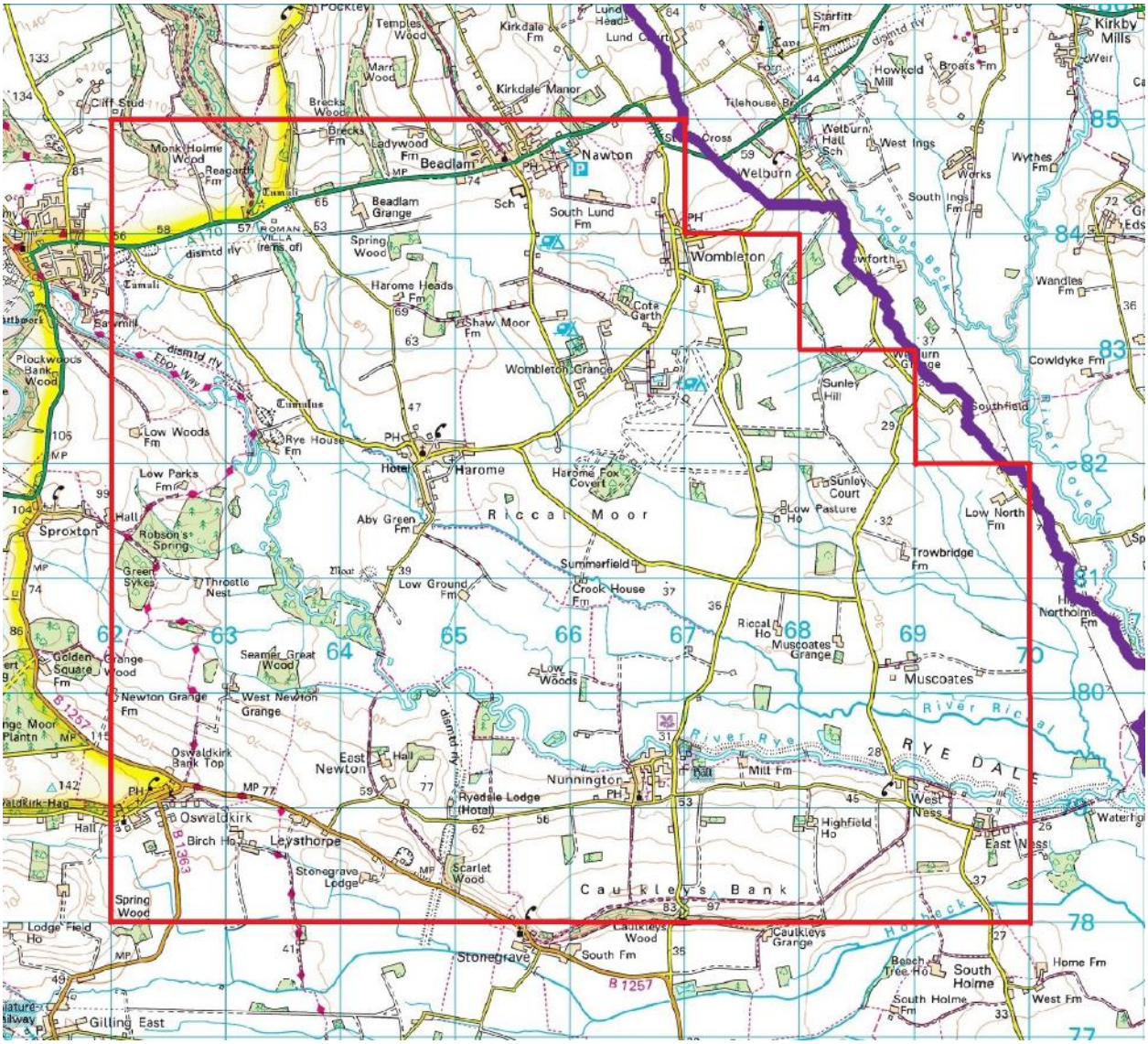
An 'Area 4' was also defined, extending Area 2 westwards and southwards to include all available lidar coverage within the southern sector of the Ryevitalise project area. The landscape here is essentially similar to that of Area 2, with quite low potential for significant new discoveries due to recent and current agricultural practice. This low potential is due to a combination of heavily ploughed fields, some quite dense woodland plantations, and dense crop growth in many fields (masking the ground surface) at the time the lidar data was captured. For these reasons, Area 4 was not surveyed by volunteers. Instead, it was rapidly checked by the project Consultant and results were added to the database for Area 2.



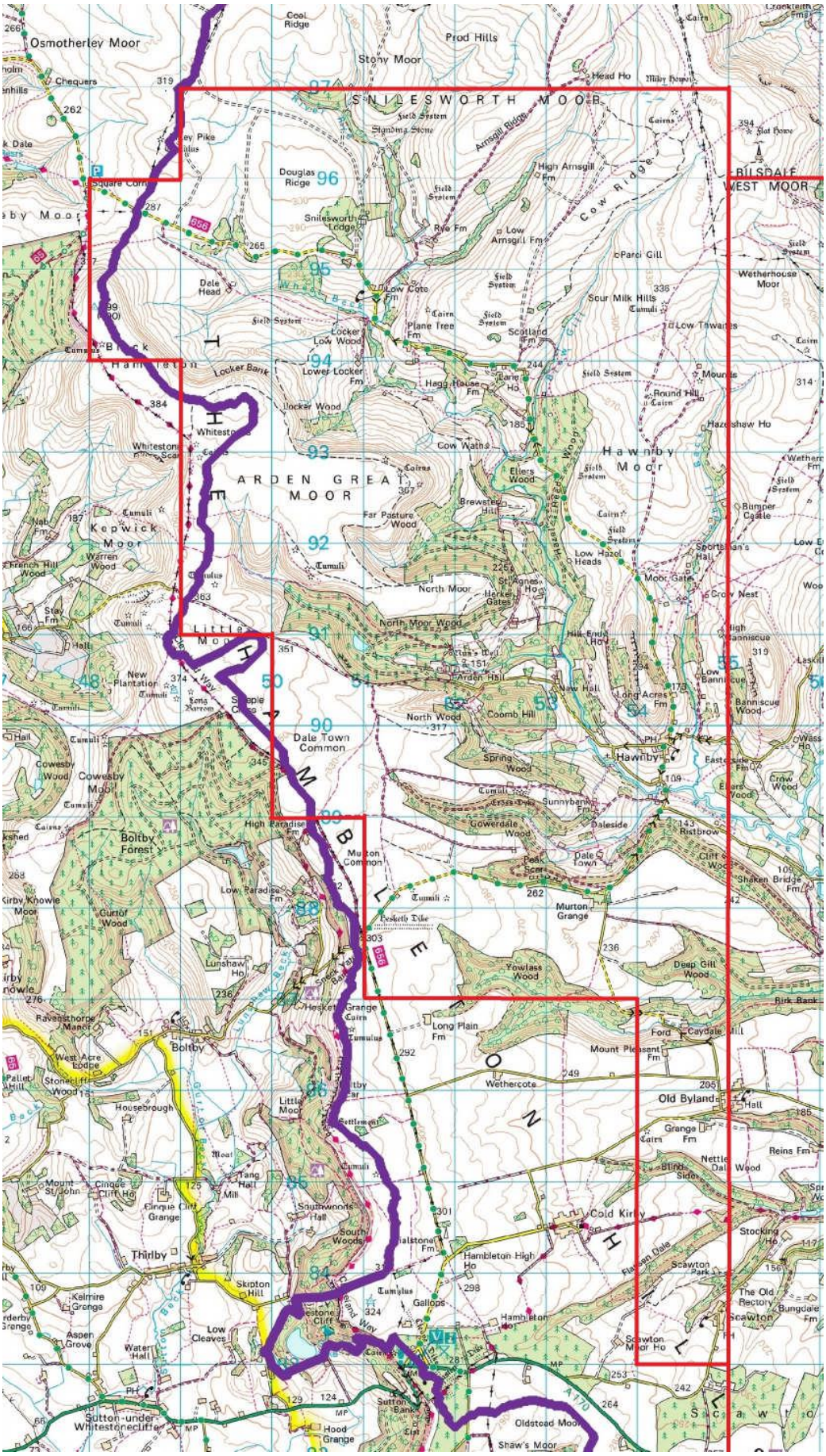
Map 1. OS map showing the three survey areas (in red) within the Ryevitalise project area (outlined in purple). The North York Moors National Park boundary is shown in yellow. Note that the area shown here as Area 4 was surveyed by the Project Consultant and not by volunteers; the reasons for this are explained in the text. See Fig 2 for more detailed maps of the survey areas. (Map provided by North York Moors National Park Authority.)



Map 2a. Map showing the extent of Survey Area 1 (81 km sqs). (Map provided by North York Moors National Park Authority.)



Map 2b. Map showing the extent of Survey Area 2 (50 km sqs).
(Map provided by North York Moors National Park Authority.)



Map 2c. Map showing the extent of Survey Area 3 (60km sqs).
(Map provided by North York Moors National Park Authority.)

2. Discussion of project methodology

2.1 Introduction

This section of the report summarises the methodology and offers some observations on how it worked in practice. It should be of interest to participants and also potentially of value to anyone planning comparable work elsewhere. The full methodology will not be described in detail here as it is set out in the Project Manual (Frodsham 2020b) provided to all participating volunteers at the start of the project.

The methodology was intended to enable the rapid assessment of a vast area by a group of volunteers with very little if any previous experience of working with lidar. A degree of inconsistency in the results was therefore inevitable, and despite the comprehensive validation process some inconsistencies between different areas remain, perhaps most notably in the level of detailed recording of the post-medieval landscape. While in retrospect it would be easy to criticise some aspects of the project, on balance, as a methodology to enable inexperienced volunteers to survey a very large area, it seems to have worked quite well.

It was noted at the outset that, in comparison to other recently completed Lidar Landscapes projects, the Project Consultant, though generally familiar with the upland landscapes of northern England, had no in-depth knowledge of this project area. However, this was not considered to be a problem, as others with more detailed knowledge would in due course be able to inspect and interpret the results.

Lidar data from the Environment Agency was processed to make computerised 3D models of the ground and all the features on it at the time of capture, precisely referenced to the OS National Grid, producing what were referred to during this project as 'lidarmaps'. For this project the raw lidar data was processed by Sandra Kennish (GIS Officer, North York Moors National Park Authority) to produce 2D 'hillshaded' images which replicate the original 3D data; this technique emphasises features on the ground, including surviving earthworks of archaeological sites and allows the data to be used as image files viewable using basic software on home computers. It is important to stress that although the images look like aerial photographs they are not – they are computer models of everything on the ground that the laser pulses hit. For the lidarmaps used in this project the 3D coordinates of approximately 5 million points were collected in each km square. Following experience gained in earlier projects, it was decided to use lidar imagery with a vertical exaggeration of X4, making earthworks stand out more clearly but without introducing unacceptable distortion to the general appearance of the landscape. Rather than combining lighting from different directions on a single 'lidar map', as had been done for similar projects elsewhere, it was decided to provide volunteers on this project with three separate 'lidar maps', with lighting from the north-west, north-east, and south, for each km sq. It was felt that this made interpretation easier for volunteers. It was also apparent during project planning that combining the light from more than one angle on a single image tended to render some earthworks less clear than when lit from a single angle, thus hindering their identification and interpretation.

This project used primarily Digital Surface Models (DSMs) which record everything on the ground including trees and buildings. Volunteers were also supplied with Digital Terrain Models (DTMs) for which the lidar data has been processed in a special way to effectively strip away areas of woodland and buildings to produce a model of the ground surface beneath. This works better in some places than others, depending on, for example, the density of tree cover. As explained at the start, there was no need for participants to understand the intricacies of this, though a basic understanding of the difference between DSMs and DTMs was considered essential.

Due to the impossibility of holding a start-up workshop, due to Covid restrictions, a detailed Guidance Notes document (entitled *Recognising archaeological sites on lidar imagery. Guidance Notes.* Frodsham 2020c) was specifically produced for volunteers along with the Project Manual. This included lidar imagery, taken from previous Lidar Landscapes surveys, of lots of different types of site. Although the images were not specific to this project area, the volunteers found the Guidance Notes very useful in helping them to recognise different types of site during their own survey work.

The project completed surveys of 225 km sqs, the majority of which were done by volunteers, subsequently validated by the Project Consultant. Within this area, the volunteers recorded a total of well over a thousand individual archaeological sites. While all of these are retained within the Project Archive, for a number of reasons many were deemed inappropriate for inclusion in the final Project Database, while many others were added during validation. Following validation the final number of records included in the database and passed on to the HERs, as explained in Section 3, was 1,251.

It would be possible to undertake a lot of detailed statistical evaluation of these results, looking, for example, at variations in the nature of recording between areas, or by individual volunteers, and the variations between the 'raw data' recorded by volunteers and the eventual validated results as set out in the project database and submitted to the HERs. Analysis of the extent to which the project has added to our understanding of known sites, in addition to discovering new ones, might also be interesting. However, such work would have to be separately resourced as there was little scope for it within the project budget; instead, work has concentrated on the recording of sites and their archaeological significance as discussed in Section 3.

2.2 Project structure

After production of the processed lidarmaps and collation of the volunteer team, the project had six basic phases, as set out below.

Phase 1: Project start-up and ongoing survey
Unfortunately, due to restrictions linked to the Covid crisis, it was not possible to hold a start-up meeting as originally planned. Consequently, the project got underway with the circulation to all volunteers by the Project Manager of the Project Manual, Guidance Notes, blank recording forms, and the lidarmaps and other material (see below) for their first km sqs. When complete the results for each km sq were returned to the Project Manager by email, and were saved in a Dropbox for later validation by the Project Consultant. From this point, the survey project was ongoing, with volunteers submitting results and then requesting their next km sq.

Phase 2: Trial period
In the absence of a start-up workshop (which would have included trial exercises), an initial trial period, during which volunteers were invited to submit provisional results on which the Project Consultant provided detailed feedback, was implemented. Several volunteers took advantage of this, though others felt sufficiently confident to press on in accordance with guidance without the need to submit provisional results.

Phase 3: Data Validation
The Project Consultant checked all results, and, after validation, entered them onto a master database (in the form of an Excel spreadsheet). The validation process, including analysis of all individual records produced by the volunteers and the careful checking of every lidarmap (which resulted in the recognition of several sites missed or misidentified by the volunteers), was extremely time consuming. However, it was essential in order to transform the results produced by the volunteers into a structured database of validated results. During this phase, all km sqs not surveyed by volunteers were checked by the Project Consultant and relevant information added to the results database.

Following validation, the workmaps and recording forms were not edited in any way. They therefore illustrate each volunteer's findings rather than the validated results. For this reason, the workmaps should never be consulted other than by reference also to the Project Database.

Phase 4: Progress workshop
Progress workshops (each attended by a maximum of 4 volunteers due to Covid restrictions!) were eventually held about halfway through the project. These included an introduction to working with lidar imagery that would have been given at the start-up workshop, and enabled volunteers to discuss results submitted and work in progress. These events proved to be very popular, despite the restrictions on numbers that meant they couldn't possibly be as effective as if everyone had been in the same room together, interacting with each other.

Phase 5: Results workshop
A final workshop was held once all results had been submitted and the validation completed. Due to relaxation of the Covid restrictions, this was attended by most of the volunteers and was an enjoyable occasion. One volunteer even went as far as to state that her life had been greatly enhanced by participation in the project! Others explained their gratitude at having had 'useful stuff to do' during lockdown. This event demonstrated how the project was meant to work form the start, with lots of positive interaction between participants. But we did the best we could under the circumstances!

Phase 6: Report and Archive
The final phase was the production of this report and the Project Archive. The report will be circulated to all participants, and will also be made universally available via the Ryevitalise project website.

A digital archive has been prepared and submitted to the Project Manager along with this report. The archive consists of the following:

- This Project Report (pdf).
- The final Results Database (Microsoft Excel spreadsheet).

- All the data produced for each km sq (DSM and DTM lidar, satellite photos, OS map).
- All the volunteer results, filed by km sq. (Workmaps, Summary Forms and Recording Forms).

It is important to note that for the few km sqs surveyed directly by the Project Consultant, and for sites noted by the Project Consultant during the validation stage, Workmaps, Recording Forms and Summary Forms were not created, as there was simply not enough time to do so. Instead, details of such sites were entered directly into the project database, with an appropriate degree of information provided therein.

2.3 Notes on the recording methodology

The methodology was created to help volunteers think constructively about what they were doing and to structure their work in a way that would provide consistency throughout the entire project area. As noted above, the detailed methodology is set out within the Project Manual; the following summary may be of interest to anyone wondering how the project worked but without the inclination to study it in great detail. The methodology may initially appear complicated but was designed to be as simple as possible while also generating meaningful results. Throughout the project volunteers were encouraged to ask if there was ever anything they were not sure about. It was stressed to volunteers from the start that they were being asked to record what they thought they could see, so they couldn't actually be wrong! In general terms, if they were unsure about something then they were asked to record it, provide a description and a possible interpretation on the recording form, and leave it to the Project Consultant to make a final decision as to what it might be during the validation process. Despite this, a large number of 'unclassified' sites are included amongst the final results, where earthworks were noted but their origin could not be ascertained with any degree of certainty.

Workmaps and recording forms

The project area consists of 225 kilometre-squares (km sqs) as defined by the National Grid and shown on Ordnance Survey maps. Each km sq was surveyed separately, with lidar maps provided for each. Participants were provided with the following by email for each km sq that they surveyed:

1. DSM and DTM lidar maps, OS map and aerial photo of each km sq to be surveyed.
2. Blank Site Recording Form
3. Blank Summary Form

Each batch included three DSM (Digital Surface Model) lidarmaps and three DTM (Digital Terrain Model) lidarmaps (with certain features such as trees, buildings and walls removed) of the relevant km sq, accurately rectified to match the OS National Grid. Of each set, one had simulated sunshine from the NW, one from the NE, the other from the S, with shadows on each cast at different angles from the others. Experimentation demonstrated that in many cases particular archaeological earthworks showed up clearly on one of the three lidarmaps while being far less (if at all) visible on the others.

Before starting work, volunteers made a copy of the DSM map lit from the NW and saved this as their workmap for this particular km sq. In some cases, if things were visible on lidar maps other than the DSM NW map, further workmaps were made to

record these. In practice, only the DSM NW workmap was needed for the vast majority of km sqs.

All sites noted on the lidarmaps were annotated on the workmaps in accordance with the guidelines provided in the Project Manual; a worked example of a workmap was included within the Project Manual. Thus, although some inconsistency in the identification of features was inevitable, the actual way in which they were recorded on the workmaps was consistent across the project area. Sites were recorded using a simple colour scheme (most volunteers used Microsoft Paint, though a few opted for more complex software packages – the only thing that mattered is that the resulting workmap was presented as a jpeg, with all sites clearly marked and annotated. Sites were allocated individual record numbers based on the relevant km sq (eg NY9988-1, NY9988-2 etc). Once allocated, to avoid any confusion, these numbers were maintained throughout the project and are retained within the final database; this is why there are gaps in the numbering system, where sites were not retained at the validation stage, perhaps because they were deemed to be natural features or were merged with other sites. For every site marked on the workmaps, volunteers completed a record form. They also completed a summary form for each km sq, this is in effect an index to the individual record forms, allowing quick identification of everything marked on the workmap.

The Recording Forms and Summary Forms were completed and submitted as Microsoft Word documents. A Recording Form was filled in for each feature recorded, cross-referenced to the Workmap by the unique number allocated to each feature. The Recording Form includes details such as NGR, site type, archaeological period, site form (the vast majority were 'earthworks'), existing HER number (where appropriate – for sites within the National Park only), and source (eg DSM NE lidarmap, satellite imagery, historic OS map). The form also included an open text box for a written description of the site, in which volunteers were encouraged to provide a clear description and also, if appropriate, to speculate about the nature and significance of the particular site. A worked example was provided within the Project Manual. Volunteers had little difficulty with the forms, which were completed and submitted in accordance with the guidelines and which collectively represent a huge amount of work.

For the purposes of the project, bearing in mind the limited archaeological knowledge of many volunteers, allocation of sites to archaeological periods was kept very simple; sites were recorded simply as 'prehistoric' (including Roman), medieval, post-medieval or unknown, with clarification of more detailed information supplied, where appropriate, within the discussion section of the form. In some cases, more detailed chronological information was added by the Project Consultant during the validation phase, and included within the project database.

2.4 Studying individual km sqs and decisions about what to record

Volunteers were invited to spend as long as they liked exploring the lidar maps, and advised that sometimes it is a good idea to have an initial look at one and make some notes, then return to it later, as quite often something will be noted during a second inspection that was missed the first time. They were also encouraged to consult a number of readily available online sources, in addition to the lidarmaps and satellite images provided by the project. For each individual km sq, the chances are that no-one

else will have studied it so carefully before, using so many different sources, so project volunteers were encouraged to become the world experts on their particular km sqs!

Within the guidelines, volunteers were advised to use their own initiative when deciding what to record and in how much detail to describe things. In general terms, the advice was to record anything that looks as though it is, or might be, archaeological, including any mounds, pits or linear features that don't appear to be natural, unless they are obviously of recent date. Where available, historic OS maps were also consulted, and notes made of the extent to which sites visible on lidar imagery were recorded on the maps. This can be useful in identifying historic sites such as old quarries, and establishing their chronology.

Specific and straightforward advice was provided with regard to ridge-and-furrow, which covers large parts of the project area. Ridge-and-furrow field systems with ridges that appear to be curved were recorded as they are quite likely to be medieval, but straight plough ridges are more recent and the advice was not to record these, though in practice they often were recorded. Extensive field systems were recorded in outline only, with a note provided on the Recording Form regarding nature their nature (eg state of preservation, relationship to other things) and extent (eg whether they extended onto adjacent km sqs). Old quarries, pits and other industrial features were recorded, along with any information about them provided on old maps, but the advice was to '*avoid recording present-day field boundaries, tracks, buildings, areas of woodland, or other 'modern' features, as doing so can take ages and they will only be deleted at validation stage; you will have wasted your time and that of the Project Consultant doing the validation!*'

In summary, despite the unfortunate restrictions imposed by the Covid crisis, the volunteers generally adhered closely to the guidance and completed an enormous amount of high quality work, as discussed in Section 3 and illustrated in Section 5.

3. Archaeological implications of the results

3.1 INTRODUCTION

There is always a temptation in projects like this to start examining and discussing particular sites or areas of landscape in great detail, but sadly this must be avoided; it can come later in any number of follow-up projects (see Section 4). Here, we can only offer a very general summary of the results as recorded in the project database.

This section consists of an overview of the project's results, presented chronologically. As noted above, for practical reasons the survey was divided into three areas. Areas 1 and 3 are adjacent to each other, effectively forming parts of the same landscape and with very similar results. Areas 2 and 4, to the south, are very different and the results reflect this. Also, Areas 1 and 3 fall within the North York Moors National Park and it was possible to use the online HER during the project (to clarify which sites were already recorded and which were 'new'), whereas no similar resource is available for Areas 2 and 4, so the survey was completed here without reference to the HER. (Note: a narrow band in the N of Area 4 does extend into the National Park, but for consistency with the rest of Areas 2 and 4, the HER was not consulted for this).

Area 4 was originally intended as a southwards and westwards extension of Area 3, effectively extending Area 3 to cover all areas of the southern part of the Ryevitalise project area for which lidar coverage was available. The lidar imagery for 'Area 4' was found to be of little archaeological potential due to a combination of heavy ploughing and the presence of dense crops in many fields that effectively mask the ground surface. Given this situation (and a lack of time), undertaking a structured survey of 'Area 4' by project volunteers was not deemed worthwhile. Instead, the area was rapidly inspected by the Project Consultant. A few areas did have features of interest that showed up well on the lidar imagery, some of which are illustrated at the end of this report.

As noted in the introduction, much of the project area has seen detailed archaeological survey in the past, meaning that the potential for new discoveries was less than it was in comparable projects elsewhere. In parts of the area, notably within Areas 2 and 4, ploughing over recent centuries has removed all trace of any earthworks that may once have been present, meaning that remnants of any such sites, though they may survive below ground, will not be detectable on lidar imagery. It must be remembered when considering the project results that a lack of sites on lidar imagery certainly does not mean an area is devoid of archaeological remains, as demonstrated by the cropmarks recorded in many places.

It was not possible as part of this project to undertake detailed analysis of previous work, or to study the HERs in any detail. Ideally, the results of the Lidar Landscapes survey should be considered alongside other relevant sources, but doing this in detail for the entire Ryevitalise project area would be a huge task, way beyond the remit of this project.

Before beginning the chronological summaries, a brief overview of the results will be presented. Although the figures presented here are impressive, it could be argued that they don't really mean much on their own (other than demonstrating the huge amount of work done by project volunteers!). There is certainly some duplication in cases of extensive sites extending over more than one km sq (eg upland prehistoric cairnfields, and ridge-and-furrow field systems around historic villages), but this can be rectified as appropriate when the information is incorporated into the HERs. The project has been primarily about identifying individual sites from lidar imagery, which is important, but the real value of the lidar imagery is the way in which it can be used to help understand how different sites relate to each other, both spatially and through time. A suggestion as to how volunteers may like to move onto a 'next stage' of lidar analysis, progressing from the identification of sites to the interpretation of archaeological landscapes, can be found in Section 4.

Throughout the project, where sites were recorded in the online NYMNP HER their existing HER numbers were recorded and a note made of their nature as seen on lidar imagery; in many cases this represents a considerable enhancement of the existing record, though in others the record merely notes that the site is visible on lidar imagery. Sites not noted on the online HER are considered to have been newly discovered. For Area 2 and 4, outside the national park, no such analysis was possible.

Period	**No of sites**	**No of 'new' sites** (%)	**No of enhanced records** (%)
Prehistoric (inc Roman)	105	17 (16%)	88 (84%)
Medieval (inc med/post-med)	103	25 (24%)	78 (76%)
Post-medieval	566	253 (45%)	313 (55%)
Unknown	202	164 (81%)	38 919%)
TOTALS	**976**	**459** (47%)	**517** (53%)

Table 1.1. Areas 1 and 3. Summary of results by chronological period, after validation.

Period	**No of sites**
Prehistoric (inc Roman)	12
Medieval (inc med/post-med)	78
Post-medieval	126
Unknown	59
TOTAL	**275**

Table 1.2. Areas 2 and 4. Summary of results by chronological period, after validation.

Period	**No of sites**
Prehistoric (inc Roman)	117
Medieval (inc med/post-med)	181
Post-medieval	692
Unknown	261
TOTAL	**1,251**

Table 1.3. All areas. Summary of results by chronological period, after validation.

In general terms it is probably fair to say that these results are pretty much in line with what was expected at the start. They equate fairly closely with those for other comparable upland areas of northern England for which similar surveys have been undertaken over recent years, with the single major exception of the lack of Iron Age sites, discussed below.

Within the survey area, the archaeological landscape is in many places quite complex, with demonstrable time-depth extending back through medieval times into prehistory, and much important research completed over recent decades. Much useful information is contained within *A History of Helmsley Rievaulx and District b*y J McDonnell *et al* (1963), a splendid volume for its time which, although now more than half a century old and dated in many ways, still represents essential reading for anyone interested in the area. Much more recently Freya Horsfield (2020) completed a PhD at Durham University about the medieval landscape around Rievaulx, extending throughout and beyond the area covered by this project. She used lidar imagery, alongside numerous other sources, and her fascinating thesis will be of interest to anyone wishing to know more about this area.

There are many places that would replay more detailed investigation, not into individual sites (though this would certainly be justified in many cases) but into the development of the landscape through time. This account must, however, restrict itself to brief overviews by period; there is no scope to consider past work in any detail. Such chronological accounts are never really satisfactory because these archaeological periods were invented by archaeologists and there were many aspects of continuity between them; they thus represent artificial divisions of a continuous whole, but they are now pretty much set in concrete and this certainly is not the place to try and demolish (or amend) them. During the project, sites were generally only recorded as prehistoric, medieval or post-medieval, and this is how they are recorded in the project archive. The following account uses the same periods, but also subdivides the prehistoric into Neolithic, Bronze Age and Iron Age (including Roman).

3.2 PREHISTORIC (and ROMAN)

Neolithic (New Stone Age), c4000 – 2400BC
Bronze Age (c2400 - 800BC)
Iron Age /Roman (c800BC – AD410)

3.2.1 Neolithic

Finds of lithics (including microliths, arrowheads and stone axes) from numerous places in and around the project area demonstrate the presence here of people during the Mesolithic (c10,000-4,000BC) and Neolithic (c4,000-2,400BC), though settlement was probably largely mobile throughout these times and any domestic structures that may have existed were probably timber-built, leaving no above-ground trace to feature on lidar imagery.

The earliest visible monuments in and around the project area are Neolithic long barrows (or long cairns), burial monuments dating from the fourth millennium BC. At the

onset of the project it was thought possible that more such monuments would be revealed by the lidar imagery, but no definite examples were noted. However, there is one potentially very interesting such site that should be inspected in the field. This is the mound, apparently overlain at its east end by (and therefore older than) the Silver Hill round barrow, itself partially excavated in 1864 and found to contain a single skeleton but no grave goods other than a single bone ring; it is assumed to be of early Bronze Age date (Fig. 1). Both mounds are now incorporated within Hesketh Dyke, itself not securely dated but usually assumed to be Iron Age. If originally a long barrow, the mound would have had flanking ditches to north and south; that to the north may have been incorporated into the ditch of the Dyke, while that to the south, now within an improved field, could have been flattened by ploughing. In other circumstances, the mound itself, and the Silver hill barrow, might have been ploughed flat, but their incorporation within the Hesketh Dyke, subsequently used a as a field boundary, means they have avoided this fate. Alternative interpretations of this site are possible, and it may not be possible to reach a firm conclusion without fieldwork, but if it is a Neolithic barrow then it is one of the earliest monuments to survive in the project area and a very significant discovery.

No further sites of presumed Neolithic date were discovered during the project. Elsewhere in northern England, probable late Neolithic 'henges', large circular banked-and-ditched ceremonial sites, have been recorded using lidar, but none were found during this project. If any ever existed here then they may well have been flattened by medieval or later ploughing.

3.2.2 Bronze Age

The Chalcolithic (Copper Age; c2400– 2100BC), also sometimes referred to as the 'Beaker period' on account of the distinctive beaker pots which were popular at the time and often found in burials, saw the introduction of the first metalworking, initially copper and gold, leading eventually to the Bronze Age. The pair of gold hair-tress ornaments (sometimes mistakenly called earrings) from Boltby Scar are amongst the earliest known metal objects from Britain; they must have been placed in a grave though sadly this has been destroyed and no evidence of the context is ever likely to be found. Evidence of activity during this time is known from the natural fissures known as the Windypits, which appear to have been used for settlement.

Numerous round burial mounds (sometimes called tumuli, cairns or barrows) of early Bronze Age (c2100 – 1600BC) date survive as earthworks within and around the project area, sometimes in isolation and sometimes in groups (Smith 1994). Many others have been ploughed flat, some of which are recorded on the HER as cropmarks but will of course not be detectable on lidar imagery. Many of these mounds were excavated in the 19th century; excavations in those days consisted largely of digging out the centre of the mounds looking for 'treasure'. Numerous pots, flints and other objects form such excavations can be seen today in museums. On lidar imagery, many burial mounds clearly have hollows at their centre (making them look a bit like bellpits which are thousands of years later and result from coal mining); these are the result of antiquarian excavations; people didn't bother backfilling their excavations in those days!

Most of the burial mounds visible on lidar imagery are already recorded on the HER; many are shown on historic OS maps, while some have been recorded from aerial

photographs. Many have been recorded as cropmarks, having been ploughed flat; all such sites were carefully examined on the lidar imagery to see whether any survived as earthworks but other than in a couple of traces no sign of them could be seen, confirming that they have been ploughed completely flat. In general, where mounds were recorded on the HER they could be seen on the lidar imagery, though in many cases only faintly as they have been spread and reduced in height by ploughing.

A mound that appears to be previously unrecorded round barrow was noted during this project in a ploughed field at Mount Pleasant farm, just NW of Old Byland (Fig. 26). Two mounds can be seen close to Beadlam Roman villa (Fig. 12); there is no record of these ever having been dug. They are assumed to be Bronze Age but could conceivably be Roman.

A cemetery of round mounds can be clearly seen on lidar imagery at Sunny Bank, west of Hawnby (Fig. 9). Several mounds here have clearly visible central hollows, resulting from antiquarian excavations. Evidence was found here for burials of Bronze Age and Anglo-Saxon date, suggesting that the cemetery was brought back into use in early medieval times perhaps 2,500 years after the first Bronze Age barrow was constructed here. Comparable complexity may well occur at other sites, but without excavation it can be impossible to recognise. A similar group of round mounds can be seen at Green Side on the NE slopes of Arden Great Moor (Fig. 2). Another survives within woodland at Dropping Gill Plantation, near Ampleforth (Fig. 10).

Several mounds noted during the project are recorded as unclassified and undated mounds; it is possible that some of these could be of Bronze Age date, while some could be natural features or the result of later activity.

Despite all this evidence of burials, early Bronze Age settlements remain elusive. The answer may lie in early phases of the often extensive ‘cairnfields’ that survive on high ground in many places, often largely undisturbed by later activity (McDonnell 1963, Appendix A-xii). These consist of numerous small mounds and other features, the result of field clearance. Many of them probably contained timber roundhouses, but these can leave no surface trace and can be hard to find without excavation. Several cairnfields, of various sizes, were recorded from the lidar imagery. Good examples can be seen on Hawnby Moor (Fig. 4), Iron Hill (Fig. 5), Bumper Moor (fig. 6) and Wetherhouse Moor (Fig. 7), amongst other places. What appears to be a newly discovered cairnfield on Douglas Ridge, close to the source of the Rye, can be seen on Fig. 3. Some of these extensive landscapes have been surveyed in the past; in such cases, existing surveys should be examined in the light of the newly available lidar imagery, as this seems in many cases to illustrate extra detail not shown on the surveys. Some cairnfields were clearly more extensive than they are today, having been encroached upon and flattened by more recent field systems.

Some of the mounds in these cairnfields could contain burials, but most are simply piles of stones cleared from fields. They are usually assumed to be middle to late Bronze Age, but some could include earlier and/or later elements. These landscapes potentially include evidence of settlement, agriculture and burial over many centuries, and offer much potential for archaeological investigation.

3.2.3 Iron Age, including the Roman Iron Age (c800BC – 410AD)

Recent Lidar Landscapes surveys of comparable upland regions of northern England have recorded numerous roundhouse settlements (ranging in size from large hillforts down to much smaller farmsteads) and field systems that appear to date from various times extending from the middle Iron Age through into Roman times. At the start of this project, it was thought that some such sites could well be found here, but only few possible examples were noted. Several are known as cropmarks, having been ploughed flat, from in around the area, while others may be overlain by more recent settlements. It should also be noted that some of the cairnfields noted above could have remained in use through into Iron Age times.

Of the few possible Iron Age settlement sites noted on lidar imagery, the enclosure on a low hilltop 1km east of Helmsley (Fig. 11), is perhaps the best candidate. Although partly plough-flattened, the banks of a polygonal enclosure are clearly visible on the lidar imagery, with possible internal features. It is probably an enclosed Iron Age farmstead that originally contained one or more round houses and yards for stock. It may have a had a surrounding field system, but if so then all surface evidence of this seems to have been flattened by later ploughing. Of all the sites newly discovered by this project, this site is high on the list of those demanding detailed examination on the ground.

About 1km north-east of the above site, low earthworks just north of Beadnall Roman villa may represent another Iron Age settlement (Fig. 12). These earthworks have been spread by ploughing and their interpretation is not straightforward; they could be evidence of an unrecorded old quarry. They lie within a very interesting area where sites ranging in date from the Bronze Age to Roman times have been recorded, and certainly justify detailed investigation to establish their true nature. Perhaps some fieldwalking could be done here when the field is next ploughed, to see whether evidence of activity of any period can be recovered.

Elsewhere, a possible enclosure at Barnclose Farm (Fig. 13) could have Iron Age origins, though it could be later and its apparent form on lidar imagery could be a result, at least in part, of later tracks and field boundaries. Again, this should be checked on the ground. A further apparent enclosure, at Easterside Farm, is shown in Fig.14; this is undated and could potentially have Iron Age origins, perhaps also with evidence of later occupation.

The Cleave Dyke system extends for some 10km roughly N-S along the western edge of the Hambleton Hills, for the most part just outside the project area. However, parts of it, including Hesketh Dyke (Fig. 1) as noted above and, further north, Steeple Cross Dyke and Kepwith Dyke, are clearly visible as earthworks on the lidar imagery. Other linear dykes, not necessarily part of the Cleave Dyke system but of similar form, are also recorded within the project archive in a few places; for example at Sunny Bank (Fig. 9). A detailed study of the Cleave Dyke system, published in the 1980s (Spratt 1982, Spratt & White 1986), concludes that it is most probably of late Bronze Age or early Iron Age date. Exactly how the dykes functioned within the landscape is not known, but they must have been some form of boundaries of some kind. It is not known for how long they were maintained; some lengths of dyke survive well, having been incorporated into field boundaries, while others have been ploughed flat. Earthworks as recorded on lidar imagery generally correspond with dykes as already recorded on the HER, but the lidar option enables then to be studied in a new ways, for example in terms of their form and

their relations with the wider landscape. It is important to note that not all linear earthworks are prehistoric; some are medieval, as noted below.

The Roman villa at Beadnell (Fig. 12) shows up clearly on lidar imagery, but what can be seen here is the result of the excavations and subsequent consolidation rather than undisturbed ancient features. The site was only recognised as Roman as recently as the 1960s, following the discovery of Roman pottery, and it is not known whether any earthworks would have shown up on lidar imagery prior to the excavations. Several seasons of excavations took place here in the late 1960s and 1970s. An assemblage of nearly 900 finds dates occupation to between the later second century and the late fourth century. This important site is discussed in a comprehensive report (Neal 1996) that notes that it seems to have existed in splendid isolation. It is possible that similar sites await discovery nearby, though none were recognised during this project.

Unsurprisingly, given the lack of known Roman roads through the project area, no Roman military sites were recorded. The apparent playing-card shaped enclosure just east of Wombleton village (Fig. 15) looks for all the world like a Roman camp, with its southern rampart overlain by post-medieval ridge-and-furrow, its northern and eastern sides followed by present-day roads, and its western side followed by a field boundary. However, it is probably a combination of field boundaries and roads that combine to create this effect. That said, Roman camps are recorded elsewhere in North Yorkshire, not always adjacent to known roads, so the site should be closely inspected if only to discount the possibility of this interpretation. The apparent large enclosure partially underlying the southern edge of Wombleton village (Fig. 15) is also potentially interesting and worthy of close inspection.

3.3 MEDIEVAL (c410 -1600AD)

In common with much of upland northern England, little is known of settlement here from the end of Roman times through until the Norman Conquest, and, just as with other lidar surveys elsewhere, no clear light has been shed on these ‘missing centuries’ during this project. Clearly the area could not have been completely abandoned, as evidenced by place-name evidence and occasional archaeological finds such as the burials at Sunny Bank noted above. Some of the linear dykes may also be of early medieval date. It is likely that settlements were built in timber, so little if any sign would survive for detection by lidar, and it is quite likely that many such settlement sites are still occupied, so overlain by more recent buildings. Finding out more about activity during these ‘missing centuries’ should be a priority for future research, but it may not be easy given the apparent lack of sites available for investigation.

After the Norman Conquest, evidence for activity becomes clearer in many places. The most celebrated medieval site within the project area is Rievaulx Abbey (Fig. 16). Various features (for example, water courses, fishponds and agricultural terraces) are visible here on lidar imagery, but the resolution is not sufficient to enable these to be studied in any detail. As the Rievaulx complex has been previously surveyed in great detail, no time was spent on it during this project. Substantial earthworks were noted on lidar imagery at various other monastic sites, such as Laskill Grange (Fig. 17), Newlass Grange (Fig. 18), and Griff (Fig. 19). All of these complexes were already recorded on the HER prior to this project, but the lidar imagery allows their earthworks to be seen

more clearly than previously. (See also the Historic England surveys listed in the References at the end of this document).

As noted above, Freya Horsfield (2020) has recently completed a PhD thesis on the landscape around Rievaulx. Her stated aim was to explore relationships between humans, belief and the physical environment within the context of Cistercian identity. She has kindly provided the following brief observations relating to her work and this project:

The medieval archaeology of the project area is largely dominated by the monasteries. It is popularly assumed that Cistercian monasteries such as Rievaulx 'transformed' their land. Bilsdale and Upper Ryedale are vital to understanding whether this was, in fact, the case. Much of this area was managed between the 12th and 16th centuries by two major Cistercian monasteries, Rievaulx and Byland. Yet Cistercian monasteries were only some of the monastic occupants of this land, and other medieval occupation here was an intricate patchwork which the map (below) greatly simplifies. Cistercian Rievaulx and Byland existed alongside monastic neighbours such as Arden nunnery (Benedictine) and land which supported Kirkham Priory (Augustinian). This land would have been worked under a variety of arrangements. Cistercian monasteries had lay brothers (and, in some places lay sisters), who took different vows to those of monks, but also monastic servants, and other types of support which we do not fully understand. Also, much of the land here remained in non-monastic hands, such as the lord of Helmsley manor.

The Ryevitalise Lidar Landscapes survey included Bilsdale, rights over much of which were given to Rievaulx by the abbey's founder, Walter Espec. Rievaulx inherited a landscape which had been shaped by previous occupants. The early medieval occupants who preceded the monasteries here are enigmatic. We have evidence that Anglo-Scandinavians (i.e. descendants of Vikings and other groups) were present in Bilsdale when the Norman Conquest (1066) led to both change and continuity: the so-called 'Harrying of the North,' a rapid establishment of stone churches and new monasteries, alongside longer term trends such as an emphasis on sheep husbandry, cereal production and fortification of centres like Helmsley.

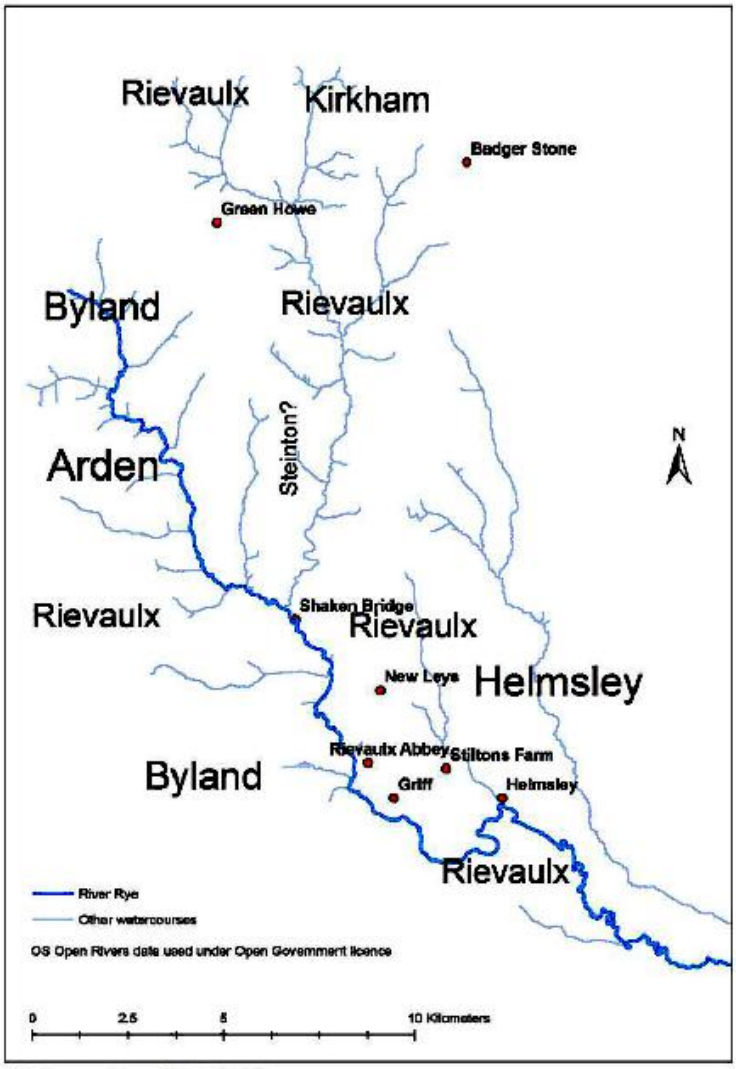
Metal working in Bilsdale pre-dated the Cistercians, as suggested by some tantalising evidence from place names and Domesday Book. A pre-Cistercian settlement at Steinton is now lost. This may have lain within Bilsdale West in Hawnby parish, and documentary references suggest this may have been a base for iron processing, possibly using the water from Fangdale Beck near the Seph. When Bilsdale became a grange (monastic farm) of Rievaulx the area supplied some of the stone for the construction of the abbey and Rievaulx also continued the iron extraction and working here. Geophysical survey by researchers based initially at Bradford University identified sites in Bilsdale where iron extraction and processing took place. Later, Rievaulx developed a proto-blast furnace at Laskill.

Lidar analysis (which was not possible during this project as it really requires high-resolution imagery, possibly processed in a different way) *may help understand the monastic precinct at Rievaulx, which lies downstream of Bilsdale in a mid-catchment valley of the Rye. A long-established theory, first suggested in 1889, suggested that the abbey made several major diversions / canalisations of the Rye which extended the area of the early precinct. Lidar evidence may help us reconstruct where the river course has been altered, activities which we now suspect may have been much more extensive and complex than the Victorian theory suggests. The monastery developed metalworking and other practical activities within the precinct, with the metal processing continued after Dissolution by the abbey's new owner. A recent drone survey by Historic England (Pearson 2019) found a complex picture of water management here which requires much further attention. Geophysical survey may be appropriate at some stage.*

Elsewhere on the limestone plateau north of Helmsley, Rievaulx established granges in new locations such as New Leys. Historic England carried out a drone survey here in 2015, which volunteers could help link to the wider picture of this part of the Moors. The Rye also flows past other Cistercian grange land such as at Sproxton, entering its floodplain and confluence with the River Derwent in the Vale of Pickering.

The physical landscape of the western Moors may have meant more to people here than just the means of subsistence. Physical characteristics, including geology and water, were intricately linked to how cultures related to the natural world. The Rye runs along various complex geologies, which influence water's behaviour in ways which would have appeared mysterious. The relatively impermeable geology and soils in the upper catchment can still lead to unpredictable flash floods, whereas across the limestone in the mid-catchment, water disappears down sinkholes and bubbles up unexpectedly at springs. The Rye also flows past a series of 'windy pits' in the limestone, several of which contain burials and other depositions which hint at complex pre-Christian beliefs. Might there have been a local assembly place or religious centre near Rievaulx before the Cistercian monastery?

Horsfield's excellent thesis leaves many fascinating questions to be answered by future work, sadly beyond the remit of this project.



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Medieval monasteries of Rievaulx, Byland, Kirkham priory and Arden had various interests in the western Moors, which intersected also with parts of Helmsley manor.

Lidar imagery reveals a fascinating archaeological landscape in the vicinity of Carr Cote (Fig. 20), including an unusual field system incorporating a substantial curved boundary. Documentary evidence suggests a monastic grange here and it is tempting to see this curved boundary as having originally been associated with this. The coal mining evidenced by numerous shafts surviving as earthworks is classed as post-medieval, but it is possible that a grange here could have exploited the coal reserves in earlier times. This is a very interesting area that justifies closer analysis. Other linear boundaries visible on lidar imagery are classified within the HER as medieval, for example the substantial dyke at Oscar Park Farm (Fig. 21), which shows up very clearly on lidar imagery, including on DTM imagery where it lies within woodland.

Other medieval features recorded as earthworks on lidar imagery, most of which were already on the HER prior to this project, include watercourses, quarries, industrial sites (bloomery, slag heap, ironstone workings, tile works), drove roads and hollow ways. It can sometimes be difficult to know the extent to which such features are actually medieval; hollow ways, for example, could have originated in earlier times and continued in use through into post-medieval times. The number of medieval sites other than field systems recorded during this project may appear initially smaller than expected, but this is probably largely due to the fact that most medieval settlements are still settlements today, with little or nothing of medieval date surviving within them as earthworks susceptible to discovery using lidar imagery. Many such historic settlements will retain evidence of medieval activity buried in the ground, or incorporated within buildings, but with out any earthworks detectable by lidar.

While it is interesting to see all the above features revealed on lidar imagery, by far the most extensive and obvious medieval features visible on lidar imagery are ridge-and-furrow field systems. For the purposes of this project it was decided simply to classify wide, curved fields as medieval, and narrow, straight ridges as post-medieval (with several complexes, containing combinations of apparently medieval and post-medieval fields, noted as 'medieval/post-medieval'), but the full story will certainly turn out to be rather more complex than this. These field systems have clearly been flattened in many places by recent ploughing as earthworks can be seen to have been truncated at field boundaries; sometimes they survive as visible earthworks but not as well preserved as in adjacent fields that have not been so heavily ploughed in recent times.

These field systems survive around many present-day historic villages, notably within Areas 2 and 4 where few older earthworks are recorded, for example at Harome (Fig. 22), West Ness (Fig. 25), Wombleton (Fig. 15), and Sproxton (Fig. 34). Remnants of similar field systems, in association with other potentially contemporary earthworks, can be clearly seen around shrunken medieval settlements at Surley Court (Fig. 22) and East Newton (Fig. 23). Elsewhere, patches of ridge-and-furrow have been recorded in numerous places (eg Figs. 30, 31, 32).

Further north, field systems incorporating terraces can be clearly seen around Hawnby (Figs. 27, 28). Similar terraces have been recorded on sloping ground elsewhere within the survey area. Unusual field systems can be seen near Old Byland (Fig. 26), elements of which are almost certainly medieval. Closer to the village, a small area of typical medieval ridge-and-furrow has survived (Fig. 29), surrounded by heavily-ploughed and featureless modern fields. Occasionally, it can be impossible to be sure of the chronology or field systems visible on lidar imagery, or even whether apparent boundaries could be at least partly natural in origin (for example, on North Moor, Fig. 30).

Lidar imagery offers much potential to study all these field systems; for example, to measure, classify and attempt to date various different forms of ridge-and-furrow and relate them to other elements of the medieval and post-medieval landscape.

3.4 POST-MEDIEVAL and MODERN (1600 – present day)

Signs of human activity through post-medieval times, including farms and field systems, quarries, villages, roads and railways have all left their often considerable marks on the landscape, leaving earthwork complexes that can appear quite bewildering on lidar imagery, though most can usually be interpreted through careful analysis. It is of course important to be able to recognise signs of post-medieval activity not only because they can be of interest in their own right, but also because only by accounting for these can we be sure of the extent to which earlier features might also be visible, perhaps peeping through isolated 'windows' in what are essentially post-medieval landscapes.

Volunteers were advised not to try and record post-medieval agricultural landscapes in any detail, simply because of the huge amount of data that would have been generated had they all done so. However, interesting post-medieval agricultural landscapes were recorded in some places, some of which on close analysis seem to owe their form in part to earlier activity. This is why, as noted above, some field systems are recorded as 'medieval/post-medieval'. In lots of places, ploughed-out field boundaries can be seen as low earthworks on lidar imagery, corresponding to boundaries shown on first or second edition OS maps. Elsewhere, older, but still post-medieval, boundaries were noted. There is some inconsistency in the recording of these old field boundaries; by no means all are included in the database, but in general terms where an old field system was noted underlying the present-day fields, this was noted. Unusual features, such as the huge enclosure on Pepper Hill (Fig. 36) were recorded. In total, about 200 field systems were recorded as either post-medieval or medieval/post-medieval.

Occasional abandoned farmsteads are visible on lidar imagery as earthworks, but throughout the project area most post-medieval settlement sites, including villages, hamlets and isolated farmsteads, seem still to be still occupied today.

Other than field systems, by far the most common class of site recorded is quarries, of which more than 170 were recorded, almost all of them definitely or probably post-medieval. Most of these, along with several sand/gravel pits, are small in scale and often exist in clusters (for example Figs. 9, 35). They often correspond to features shown on the first or second edition OS maps, on which they are often recorded as already 'old' or 'disused'. Should anyone ever wish to undertake a study of historic quarrying throughout the project area then the lidar imagery should be an essential source.

The database also includes more than a dozen sites relating to post-medieval coal extraction, including several extensive complexes of shafts or bellpits (Figs. 6, 8, 20).

Several post-medieval artificial watercourses are recorded in the HER, extending over several kilometres in some cases. Examples include the Rievaulx water race, Foord's Rievaulx water race, Foord's Carlton water race, and Nawton water race. These have all been recorded as earthworks on lidar imagery, though they survive better in some

places than others. They were large-scale projects, needed due to lack of natural streams and the difficulty of digging wells in the vicinity of some settlements, which involved complex planning and engineering (Grayson 1963). Smaller in scale, but clearly visible on lidar imagery, is the mill-race at Hawnby Mill.

Hollow ways have been recorded in more than 50 places, often in complexes with many channels. These are generally thought to be post-medieval, though some could have earlier origins. They relate to transport in times before particular routes were formalised through the construction of tracks or roads. Some, in remote areas, seem to be still in use today by farm traffic. Old railway embankments can be traced on lidar imagery, though they have been ploughed completely flat in some places. These were not recorded during this project as they would be better dealt with in a separate project looking at the wider railway network, rather than in a project structured around individual km sqs.

There is not space here to discuss any of these post-medieval sites in detail, but it is important to note that lidar imagery now offers a new way of studying the post-medieval landscape, enabling a range of industrial, agricultural and other features to be seen in relation to each other and to remains of earlier periods.

It is worth noting finally that the twentieth century has also left its mark on the landscape, occasionally creating sites visible on lidar imagery that would be completely baffling to the archaeologist were their actual origin not known from other sources, such as historic mapping. The remnants of Wombleton Airfield (Fig. 38) provide a good example. These serve to remind us that the lidar imagery should never be used in isolation, but must be used in combination with historic maps, aerial photography and other available sources.

3.5 UNDATED SITES

In addition to all the sites recorded during the project for which prehistoric, medieval or post-medieval dates could be reasonably assumed, a further 261 sites were recorded as ‘undated’. These include linear banks and boundaries, enclosures (eg Fig. 37), hollow ways, quarries, mounds and hollows, and several classified as ‘unclassified’. Some of these features could be natural, but all were recorded because it is thought that they were probably artificial but there was no clear evidence on which to assume their chronology. Most of the quarries are probably post-medieval, but where they aren’t shown on historic OS maps there is a possibility that they could be older. Some of the other sites, such as linear banks, could be of pretty much any age. There could well be some important sites hiding amongst this group, but further analysis will be necessary before anything more can be said for sure about any of them.

3.6 SUMMARY

These results represent a very important contribution to the study of the Ryevitalise project area, and all participating volunteers are congratulated for their efforts. Alongside the discovery of some potentially very important ‘new’ sites, and the clarification of details relating to many others, the results demonstrate how lidar, probably better than any other medium, demonstrates the seamless nature of the

archaeological landscape. Dividing the landscape up into specific types of site and allocating everything a number, and seeking to place everything in its correct chronological 'box', are essential to this kind of survey, but the lidar imagery clearly demonstrates the spatial and chronological seamlessness of the landscape, enabling us to see how individual 'sites' relate to each other, and how the landscape has developed through time, with many things clearly related to things that happened earlier, sometimes much earlier. So, while the results of this project may appear impressive in terms of the number of sites recorded, and the results will be important to future landscape management, these figures are relatively meaningless in themselves. The real value of the results lies in the opportunity they now offer for the integrated study of the landscape through time, something that participants in this project are well placed to undertake should they so wish.

4. Some suggestions for further work

This project has achieved its twin key aims of enabling local volunteers to undertake an ambitious lidar survey of most of the Ryevitalise project area, and producing results that represent a substantial enhancement of the Historic Environment Records for the North York Moors National Park and North Yorkshire. In spite of several significant discoveries, it would be fair to say that the results largely reinforce what we already knew of the area's archaeology, rather than necessitating the complete rethinking of any periods. This is largely due to the quantity and quality of previous survey work in the area, as outlined in the Project Manual. That said, the results, as discussed in the previous section of his report, certainly offer a completely new way of seeing the archaeological heritage of the area and in due course will probably come to be regarded as a significant episode in the story of archaeological research in the area. The splendid work of the project volunteers, now all collated within the project archive, also provides a sound basis for the planning of future work, much of which could potentially be done by local people with appropriate levels of professional support.

What follows is a list of ideas that have arisen during the Lidar Landscapes survey. It could potentially be used as the basis for a more comprehensive research framework, itself potentially a key to unlocking funds for more community work. Also, project volunteers may wish to undertake fieldwork relating to or more of the following suggestions during the remaining years of the project. The list is not intended to be in any way restrictive; should anyone wish to undertake detailed research into any area of interest identified by the Lidar Landscapes survey then they certainly should not be discouraged from doing so just because it isn't specifically mentioned here. Indeed, any detailed survey of any area would add to the results and should be encouraged. It is always best, though, if research is structured, and the following suggestions will hopefully help to provide a framework within which such programmes of research can be developed.

With regard to possibilities set out below, it should be stressed that anyone undertaking fieldwork in this area should not accept the results of this project without checking the lidar data, either in the form of the lidarmaps produced for this project or reprocessed data, for themselves. While most interpretations reached by this project are probably correct, there is always room for error, and indeed for simply missing things, when surveying such a large area. Also, within the next few years, new higher-resolution lidar data should become available for the whole of Yorkshire; this should be seamless, without the annoying gaps we have had to contend with when planning this project! It will be interesting in due course to examine this new data and see what further new insights it offers into the archaeology of the Ryevitalise area, both in terms of potential 'new' sites and reinterpretations of things recorded during this project. Given the training received during this project, participating volunteers will be well placed to attempt such work when the new data does become available.

1. Dissemination of results, including incorporation of results into the North York Moors and North Yorkshire HERs.

The first thing that should happen following completion of the Lidar landscapes project is that the results should be incorporated into the North York Moors and North Yorkshire HERs, which should be the first port of call for anyone planning further work in this area.

The project archive, which is entirely digital, will be passed to the HERs; copies should also be made available to any participating volunteers who may wish to consult it.

To date, the only people aware of the results of the project are the participating volunteers. It would be good if a public meeting could be arranged to present the results of the project to anyone who might be interested. To the same end, the project report should be made publicly available on the project website.

2. Complex multi-period archaeological landscapes.

There are some areas within the Revitalising Redesdale project area within which lidar imagery demonstrates complex multi-period archaeological landscapes. There is a tendency to try and compartmentalise each of these into a series of 'conventional' site types, each of which is then classified and dated according to the results of fieldwork undertaken elsewhere in Yorkshire or further afield. Thinking of archaeology in terms of such individual sites is far from ideal; ideally, such sites should be considered alongside other sites and finds, and palaeoenvironmental evidence, on a landscape scale. It would be an interesting exercise to choose a small number of these complex landscapes, each perhaps up to 10 sq kms in size, and invite volunteers to study them in great detail, using primarily the lidar data (including the results of this project) but also other relevant sources. The work could also include field visits. This basic idea has proved popular in Redesdale following completion of the recent Lidar Landscapes survey there, though it has to be said that the archaeological landscapes there tend to be busier in terms of what is visible on lidar imagery than much of the Ryevitalise project area. The basic idea is to concentrate not on the identification of individual 'sites' but on aspects of continuity and change through time; in effect, building narratives of 'people and place' for each area. For example, how were things that happened at any one time influenced by people's perceptions of things that had happened previously in the area, and how much did they influence subsequent developments? The different areas could then be compared at one or more results workshops, at which volunteers would present the results of their work and discuss these with others.

3. Detailed surveys of prehistoric sites

Detailed survey on the ground of some sites illustrated in Section 4 would be very useful, and could perhaps be done as training exercises, in partnership with local archaeological contractors, to teach aspects of archaeological fieldwork to volunteers. A programme of site surveys, perhaps including geophysics, could be drawn up for the remainder of the Ryevitalise project. Some of the surveys might result in recommendations for small-scale excavation that could perhaps also be done as part of the project. Sites that would potentially benefit from such work are the possible Neolithic long barrow on the line of the Hesketh Dyke, and the two possible Iron Age settlements close to Beadlam Roman Villa.

4. Bronze Age cairnfields

A potentially excellent small-scale follow-up project would be to visit and survey a selection of recorded Bronze Age cairnfields, comparing existing surveys (where available) with the lidar imagery and undertaking new fieldwork. Geophysics might prove especially rewarding, investigating the potential survival of 'invisible' features amongst the cairns. This could perhaps lead to small-scale excavation in some places. If designed initially as an evaluation of a sample of carefully chosen areas within perhaps 3 or 4 different cairnfields, this might well lead to better understanding of the nature and chronology of these sites. The cairnfields represent the earliest visible evidence for farming and settlement within the area, and their investigation by a team of volunteers, with professional supervision, would a very worthwhile exercise.

5. Settlement during Iron Age, Roman and early medieval times.

The absence of settlement evidence, in the form of earthworks, for this vast period of time is odd. A volunteer project could potentially be set up to look at the lidar imagery in association with cropmark evidence to assess the extent to which settlement evidence could still survive below ground. If access to cropmark sites can be secured, programmes of fieldwalking to recover artefacts form the surface of ploughed fields could be instituted. This could also throw light on earlier and later periods. It could perhaps be combined with the idea of studying particular areas in detail, suggested in 2, above. Field walking is a perfect volunteer exercise, as long as it is done properly and sufficient expertise is available to examine and catalogue all finds, and produce good quality reports.

6. Medieval and post-medieval field systems

Lidar offers a new and effective way of recording the often very extensive ridge-and-furrow field systems which once surrounded historic settlements, and still survive as earthworks in many places. There are clearly different types of ridge-and-furrow, with later systems overlying earlier ones in many places. In this project it was not possible to attempt any kind of classification of these different systems, which were simply classed as medieval, post-medieval, or medieval/post-medieval on the basis of brief analysis of the earthworks, with wide curved riggs being classed as medieval. It might be a very useful exercise to survey a small number of field systems using a combination of lidar imagery and field observation, then sample parts of these systems using test-pitting to see whether different types of pottery are found in different places; if so then this might enable the production of a chronological framework that would also be of relevance to associated settlements. This would potentially be an excellent project for volunteers, with a degree of professional supervision. Initial survey work could be done remotely using the lidar imagery produced for this project.

7. Medieval monastic sites

A volunteer project could be arranged to use lidar imagery and other sources to study the several monastic sites within the project area within their local landscapes, linked to

Rievaulx. How did all these sites work together to exploit the landscape? How do features visible on lidar imagery correspond to documentary sources? Are there monastic sites (perhaps like Carr Cote noted above) for which as yet unrecognised evidence survives within the landscape? Do particular types of field systems exist with these sites? Such a project would require careful planning and expert supervision, but may well prove very worthwhile.

8. Sites of unknown date.

A project could be designed to address the large number of earthworks (254) for which the date is recorded in the project database as 'unknown'. Within the constraints of the project it was not possible to consider such sites in any detail, and while it may be that the dates or functions of many cannot be ascertained without excavation, it is possible that careful analysis could suggest likely origins for many, enabling them to be classified, albeit perhaps with varying degrees of certainty, in terms of their function and date.

Finally, while the information presented in this report is undeniably fascinating, it is appropriate to end the document with a reminder that archaeology is not primarily about sites, but people. This project relates to the people today who completed it, all the people from the recent and distant past who created the sites and landscapes we study, and people in the future who will use the results of this project to plan and execute further campaigns of archaeological research. The project results are important in their own right, but also because of the legacy they represent in terms of opportunities for people, now and in the future, to use them to enhance understanding of the unique archaeological landscapes and past generations of the Ryevitalise area.

5. Illustrations

The following illustrations have been chosen to represent a range of sites and landscapes from throughout the project area. They include several sites that were newly discovered during the project, and others which were previously recorded but for which the lidar imagery shows interesting detail. Many of these were discussed in interim reports and during project workshops. All the illustrated sites are included in the project database, to be incorporated in due course into the relevant HER.

Some of the images illustrate particular sites, while others cover often-complex multi-period landscapes. There are also many other interesting places within the project area that could have been included; anyone studying the area in future should consult the full project archive and certainly should not assume that the sites illustrated here are necessarily the best examples.

All images are aligned with north to the top. Most are DSMs, but some are DTMs with woodland and other features stripped away. All but three (included to show wide areas around villages) are taken from the original lidar imagery used by volunteers during the project. Part of the margin is retained in each image, in order to provide a scale; the gap between each grid number is 100m in all cases.

The images tend to lose definition when printed and are best viewed on screen, where they can be enlarged as desired – though they inevitably become pixelated if enlarged too much. A few may appear quite dark in places, when lighting from another angle would show the general lie of the land more clearly, but these have been chosen because they illustrate the particular sites under discussion more clearly than if the lighting was changed.

Anyone wishing to discover more about any of the featured places should consult the project archive, which includes the individual kilometre squares of processed lidar data, the preliminary results produced by project volunteers, and the validated results following validation by the Project Consultant.

As noted in this report, the interpretations presented here should certainly not be regarded as definitive. Much fieldwork must be done before many of these images can be interpreted with any certainty. What can be said with certainty is that this project has cast intriguing new light on many aspects of the Ryevitalise project area's archaeology, while also demonstrating the clear need for more fieldwork.

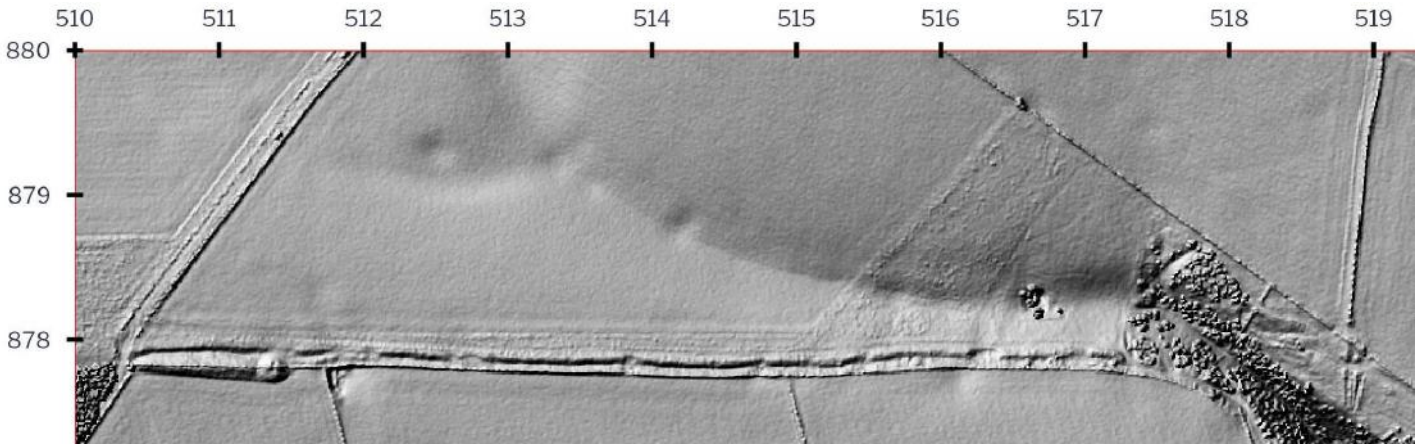

Fig. 1. Hesketh Dike shows clearly as a linear earthwork aligned E-W across this image. At its W end, the southern bank is more substantial than elsewhere and looks very much like a Neolithic long barrow, though one is not recorded here; perhaps such a barrow was incorporated into the later dike. Overlying the E end of this possible long barrow is a round mound; this is Silver Hill round barrow, already recorded on the HER.

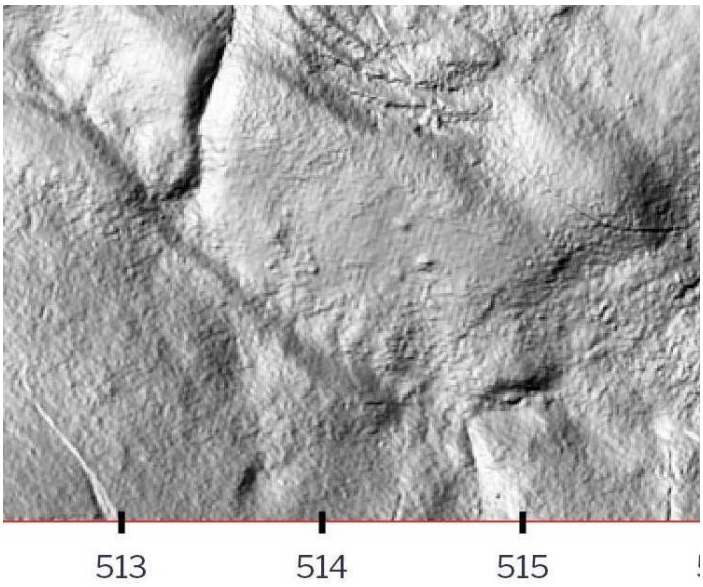

Fig. 2. Several roughly circular mounds can be seen at the centre of this image, at Green Side on the NE slopes of Arden Great Moor. The HER records four Bronze Age cairns in this area; the lidar imagery suggests there could be more.

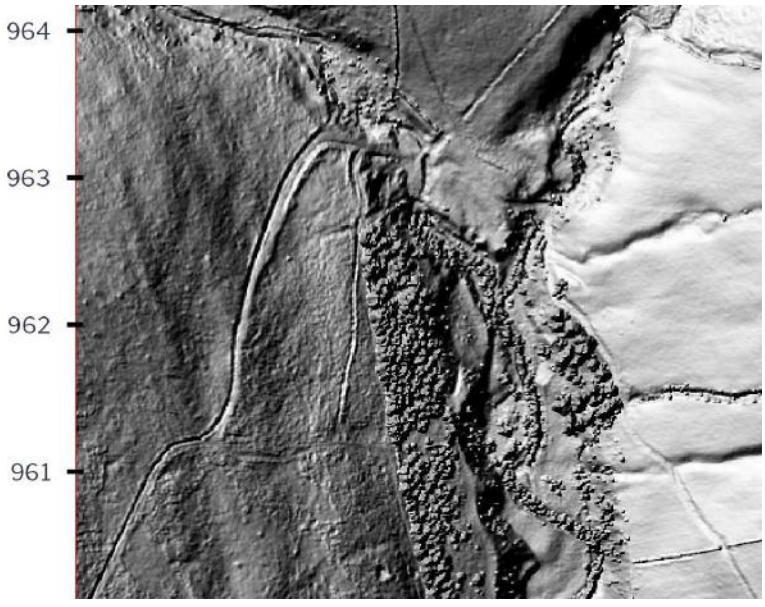

Fig. 3. Several roughly circular mounds can be seen towards the W margin of this image and also towards the SW corner, on the E slopes of Douglas Ridge overlooking the Rye just a couple of kms from its source. They seem to be part of a previously unrecorded Bronze Age cairnfield, and are certainly worthy of inspection on the ground.

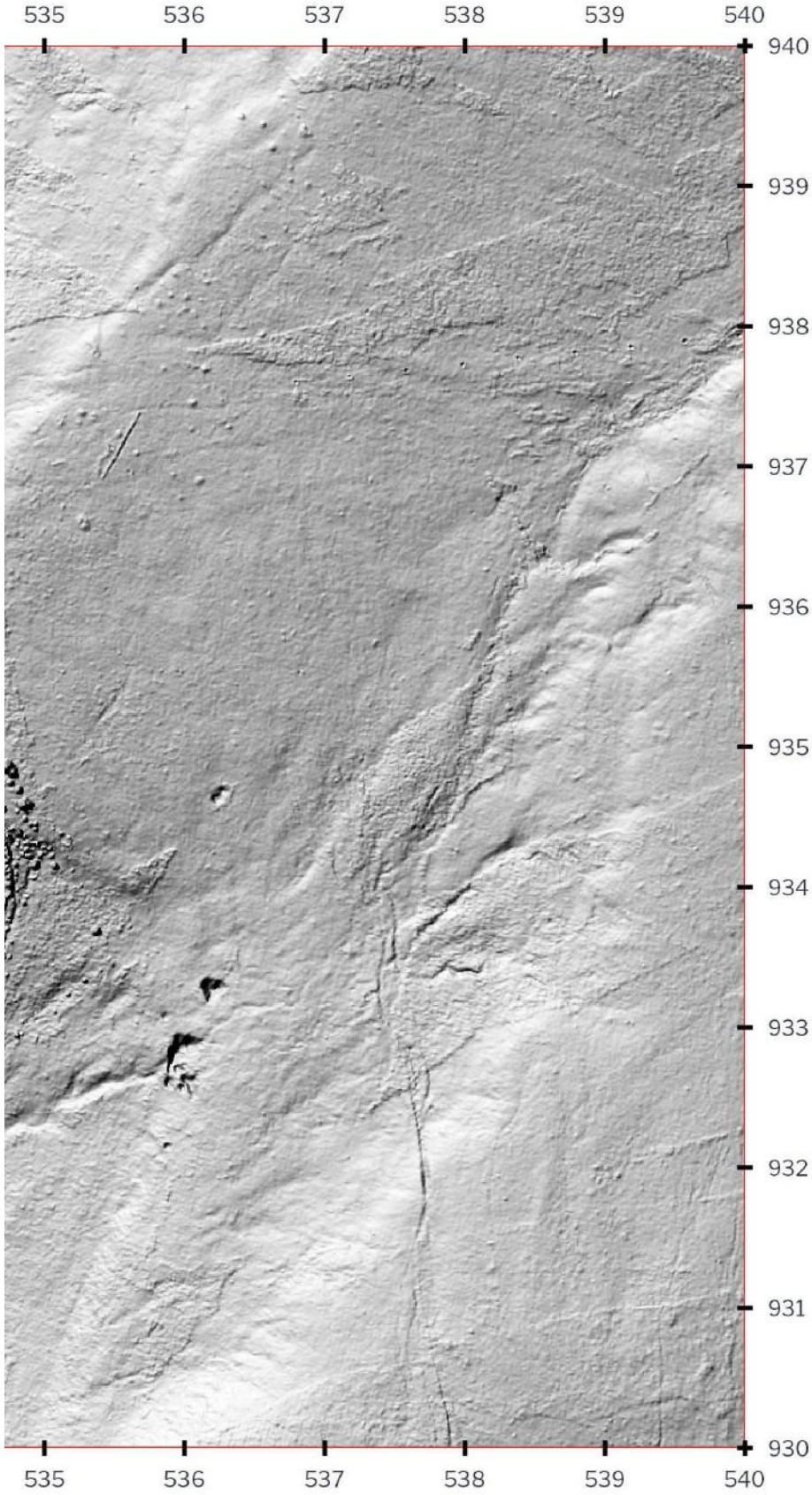

Fig. 4. Numerous mounds visible in the northern third of this image are part of the extensive Bronze Age field system on Hawnby Moor. Further mounds can be seen towards the SE corner of the image; these appear to be a previously unrecorded Bronze Age landscape. The large hollows visible at c536933 are labelled 'Hell Holes' on the OS 2nd edition map, but are labelled as 'disused workings' on more recent OS maps; perhaps they are a combination of natural features and post-medieval quarrying.

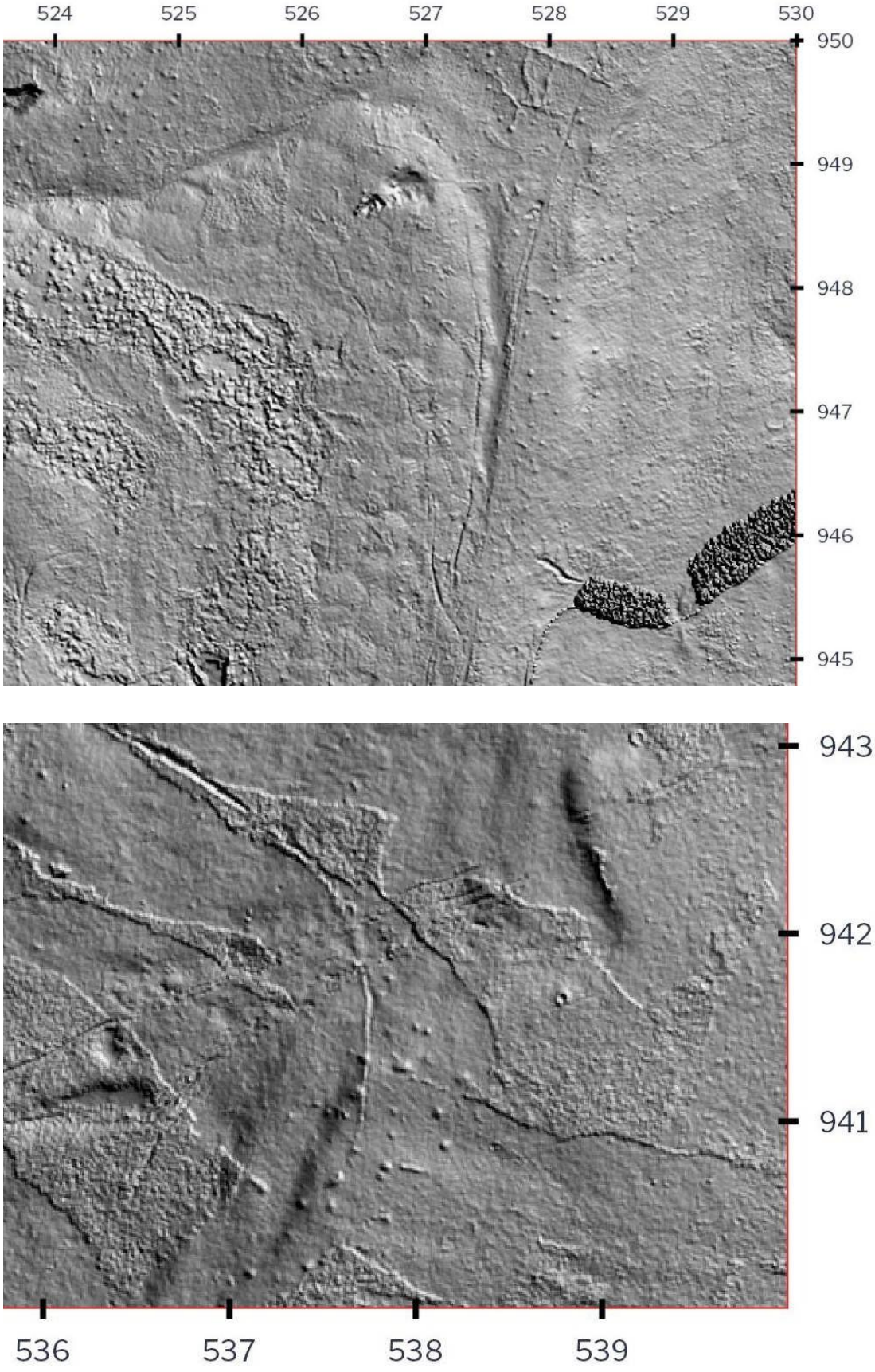

Fig. 5. These images show parts of the extensive Bronze Age landscape on Iron Hill; numerous small cairns and other features such as short lengths of field wall can be clearly seen. Many Bronze Age field systems like this are already recorded on the HER, but it might prove useful to compare survey plans with the lidar imagery which in some cases seems to show previously unrecorded detail.

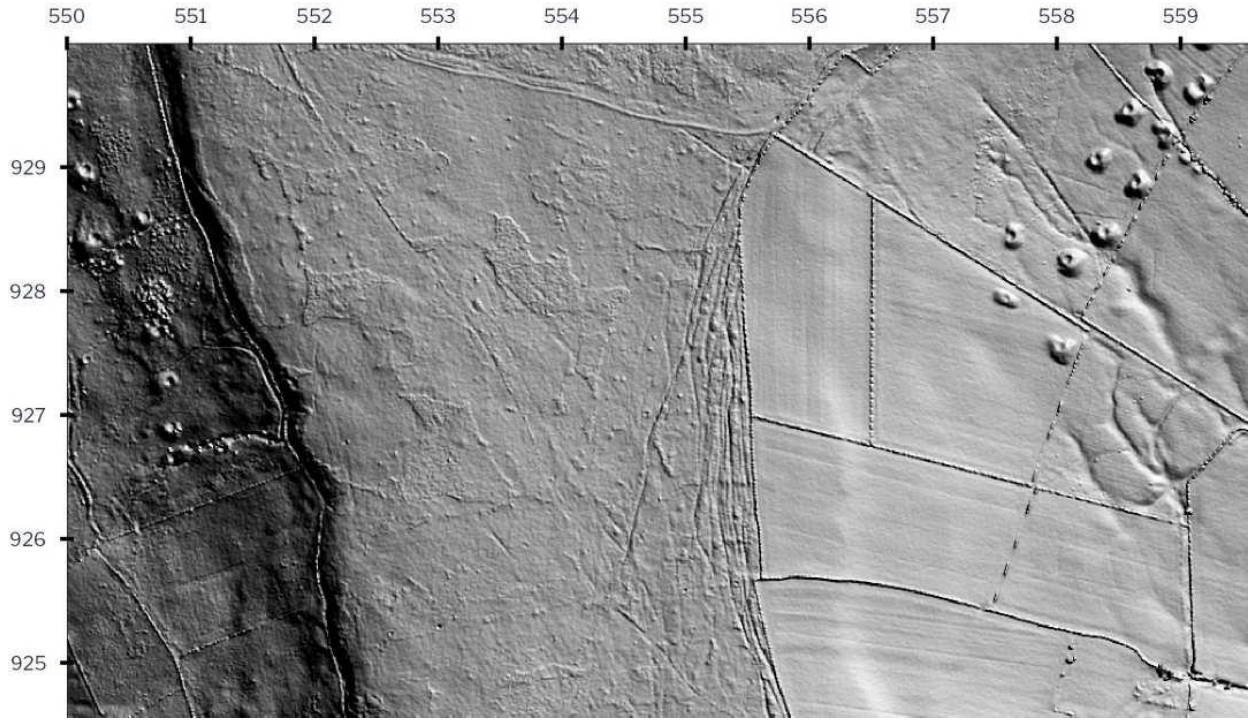

Fig. 6. Lots of small mounds can be seen here on the unenclosed moorland of Bumper Moor (km sq 5592); this is a very extensive Bronze Age cairnfield or field system. No sign of it survives within the ploughed fields to the E, where it may once have extended before the ground was ploughed. Although this cairnfield was known previously, there is almost certainly detail visible on the lidar imagery that will not be visible on air photography. Existing records should be checked against the lidar imagery. E and W of the moorland can be seen complexes of post-medieval bell pits, resulting from coal mining. The hollow ways running N-S along the margin of the enclosed land are another post-medieval feature that has been recorded.

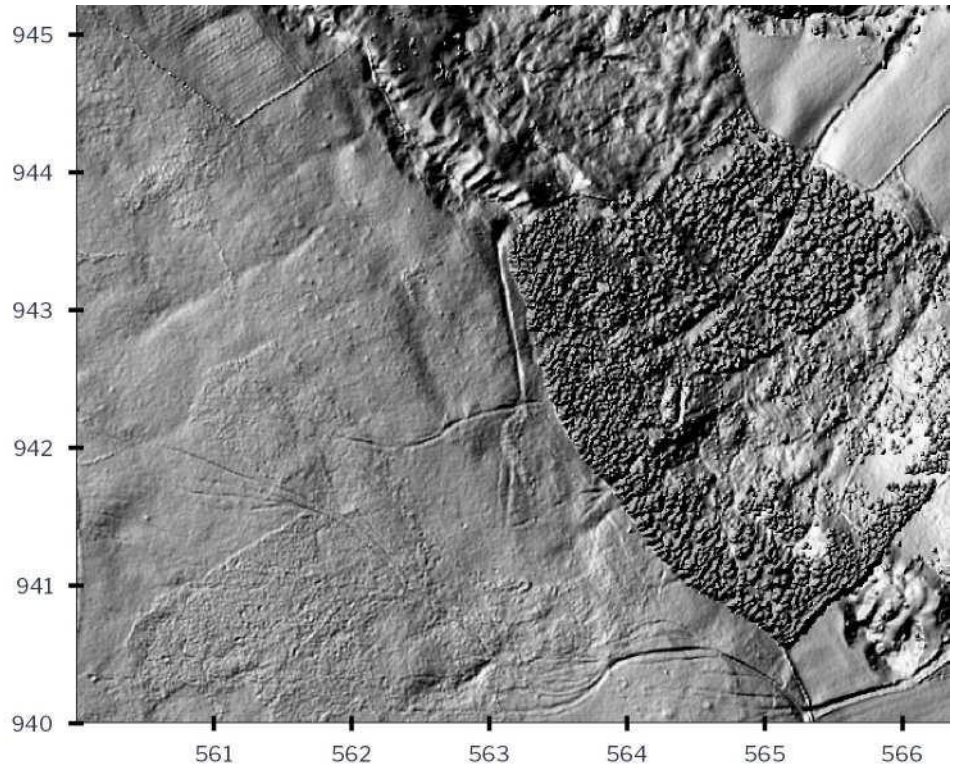

Fig. 7. This image shows a Bronze Age cairnfield on Wetherhouse Moor, SW of Fangdale Beck (km sq 5694); numerous cairns are visible in the NW quadrant of the image. The extent of the cairns seems to be greater than that recorded on the HER, and the lidar imagery should be carefully checked against existing records.

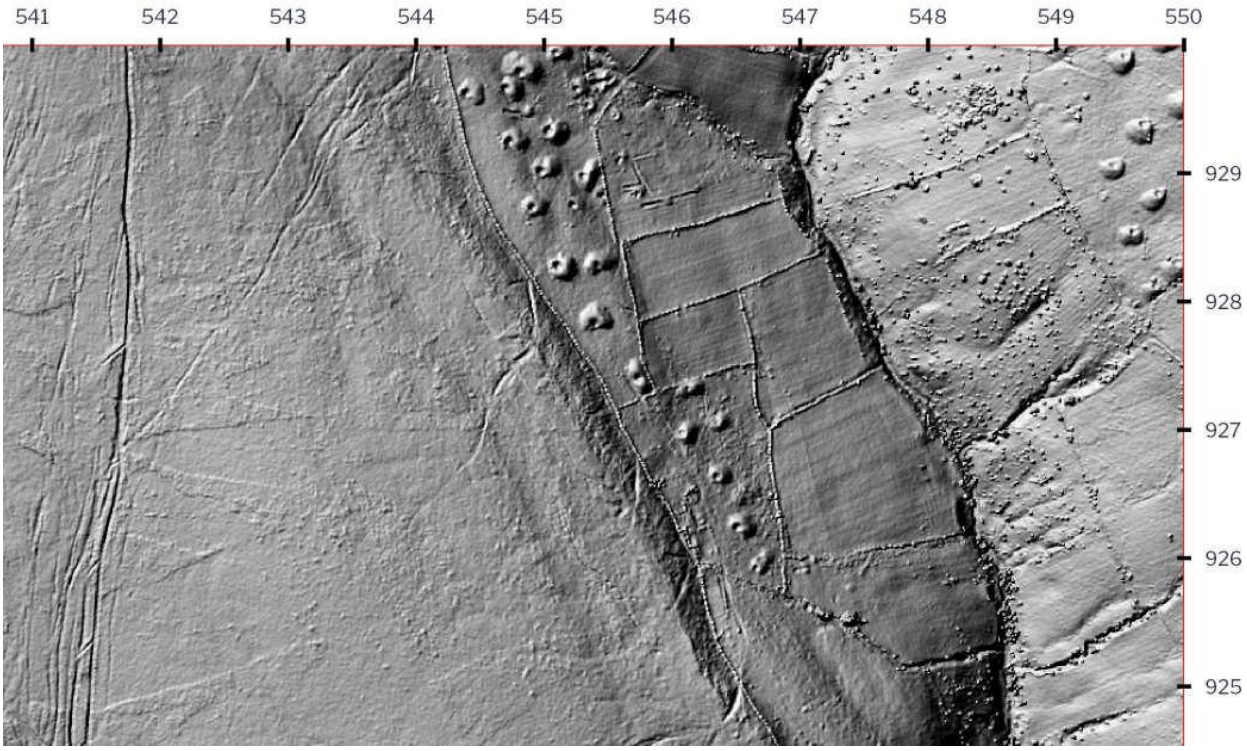

Fig. 8. Extending over the W half of this image are lots of small mounds, part of the very extensive Bronze Age field system on Hawnby Moor. The lidar imagery suggests this complex to be even more extensive than currently recorded on the HER. The doughnut-shaped mounds on the E half of the image are bell-pits resulting from post-medieval coal mining. The network of post-medieval hollow-ways, most obvious at the W margin of this image, has been recorded for the first time by this project, as have many similar complexes elsewhere within the project area.

Fig. 9. The HER records a 'cairn cemetery at Sunny Bank', with burials of Bronze Age and early medieval date. Several round mounds, all with central hollows, are visible here on lidar imagery, along with some apparent linear mounds which may be associated but could be natural. The field boundary visible right-of-centre is an ancient cross-dyke, possibly originally of late prehistoric or early medieval date. Several quarries of post-medieval date can also be clearly seen.

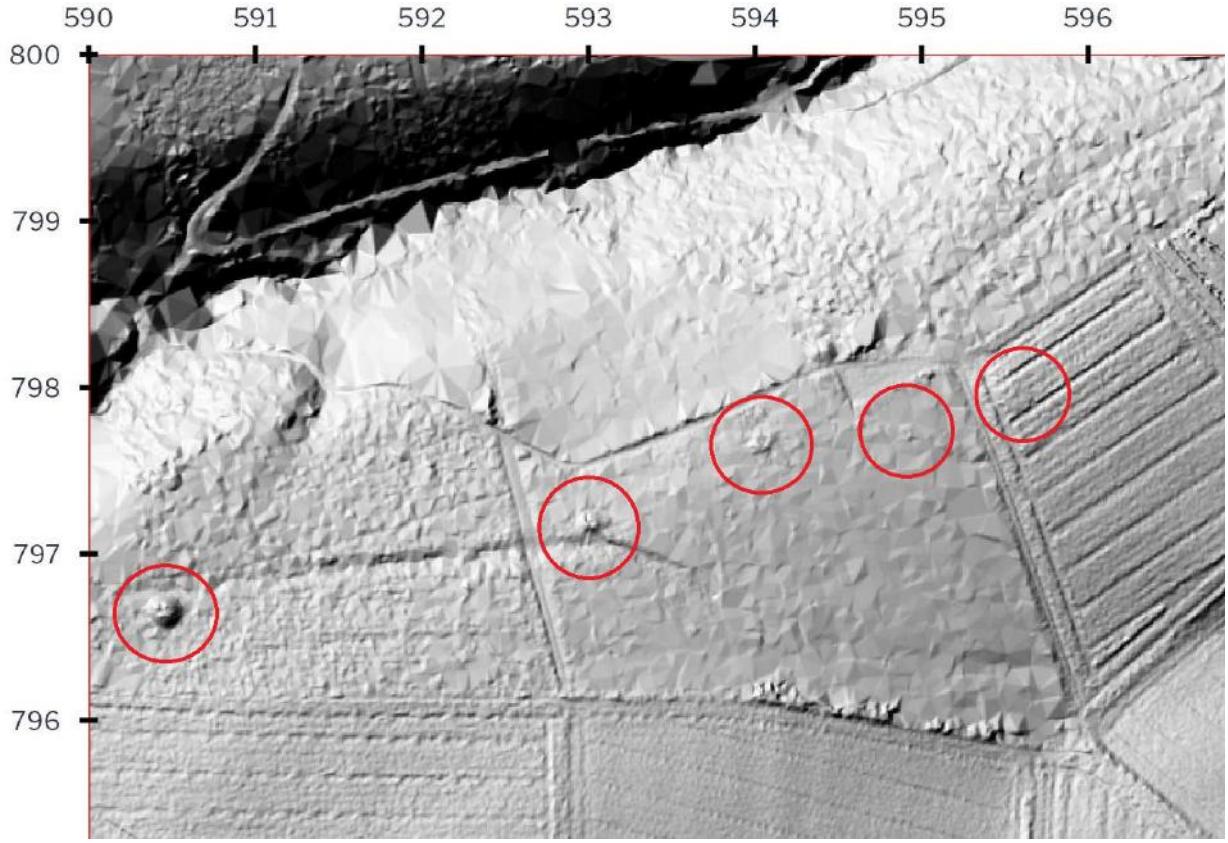

Fig. 10. Bronze Age round barrows in Dropping Gill Plantatation, c1km NE of Ampleforth. The easternmost example is beneath a crop and hardly shows up at all, as the lidar pulses have not penetrated through the dense crop to the ground surface. The others, within the plantation, all show as mounds, apparently with central hollows. Although these tumuli were all known previously and recorded on 19th-century OS maps, this demonstrates the effectiveness of DTM imagery for surveying woodland areas where the tree canopy is not too dense.

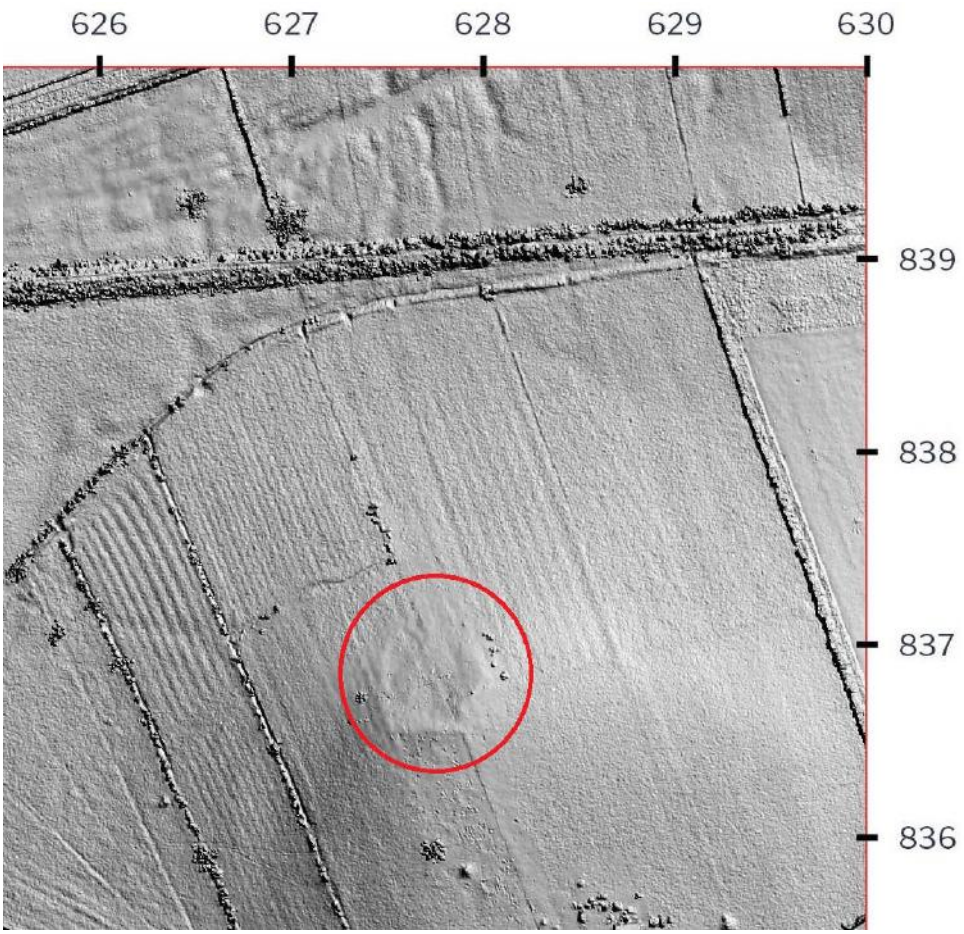

Fig. 11. Polygonal enclosure c70x50m, visible as an earthwork, underlying present-day field boundaries about 1km east of Helmsley. There are suggestions of internal features, possibly including at least one circular structure. This looks very much like a late prehistoric/Roman farmstead. It is partly overlain by straight (post-medieval) ridge-and-furrow. Potentially a very significant discovery; requires inspection on the ground. There is no obvious sign of a contemporary field system; if one ever existed, all remnants of it may have been destroyed by later ploughing.

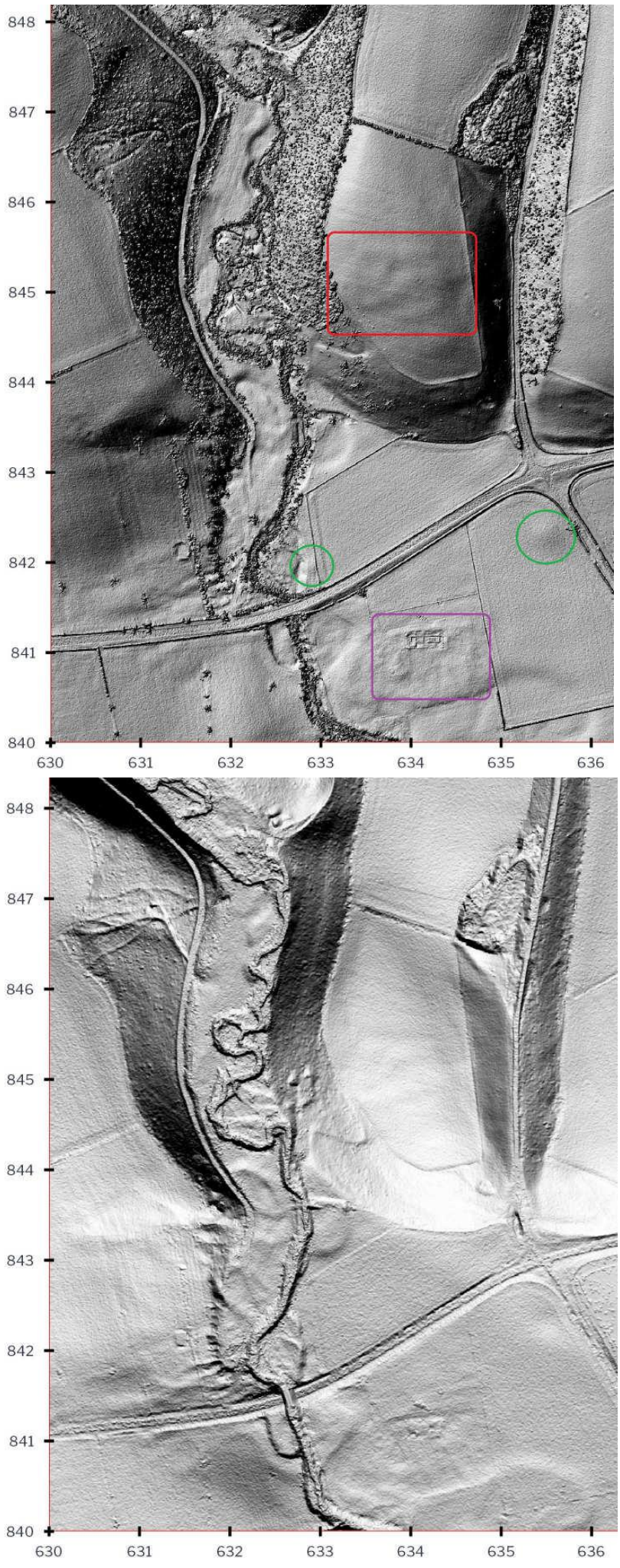

Fig. 12. DSM (top) and DTM (bottom) images of the landscape around Beadlam Roman villa, c1.5km east of Helmsley.

In the upper image, the site of the villa is outlined in purple; the walls of the consolidated part of the site are clearly visible, while the earthworks east and west of this seem to correspond to parts of the site that were excavated and backfilled. The two mounds ringed in green are burial mounds; a third is recorded between them (just north of the road to the north-west of the eastern one) but little if any sign of this can be seen here. The unusual earthworks outlined in red are of unknown origin; they could possibly relate to a late prehistoric or Roman settlement and field system. These features are less clear on the DTM image, but a large quarry and what appear to be 3 or 4 small quarries can be made out in the wooded areas with the trees stripped away.

Fig. 13. This image appears to show a rectilinear enclosure c60x60m immediately W of Barnclose Farm (km sq 5687). Given the known antiquity of the farmhouse, this could be a significant discovery, potentially relating to an early phase of the farm. Alternatively, it just might be an illusion caused by tracks and field boundaries. Would be worth checking on the ground.

Fig. 14. This image is of Easterside Farm (km sq 5589), and appears to show a previously unrecorded enclosure of some kind, with another enclosure in the field to the E. Further work will be necessary to establish the date and function of these features.

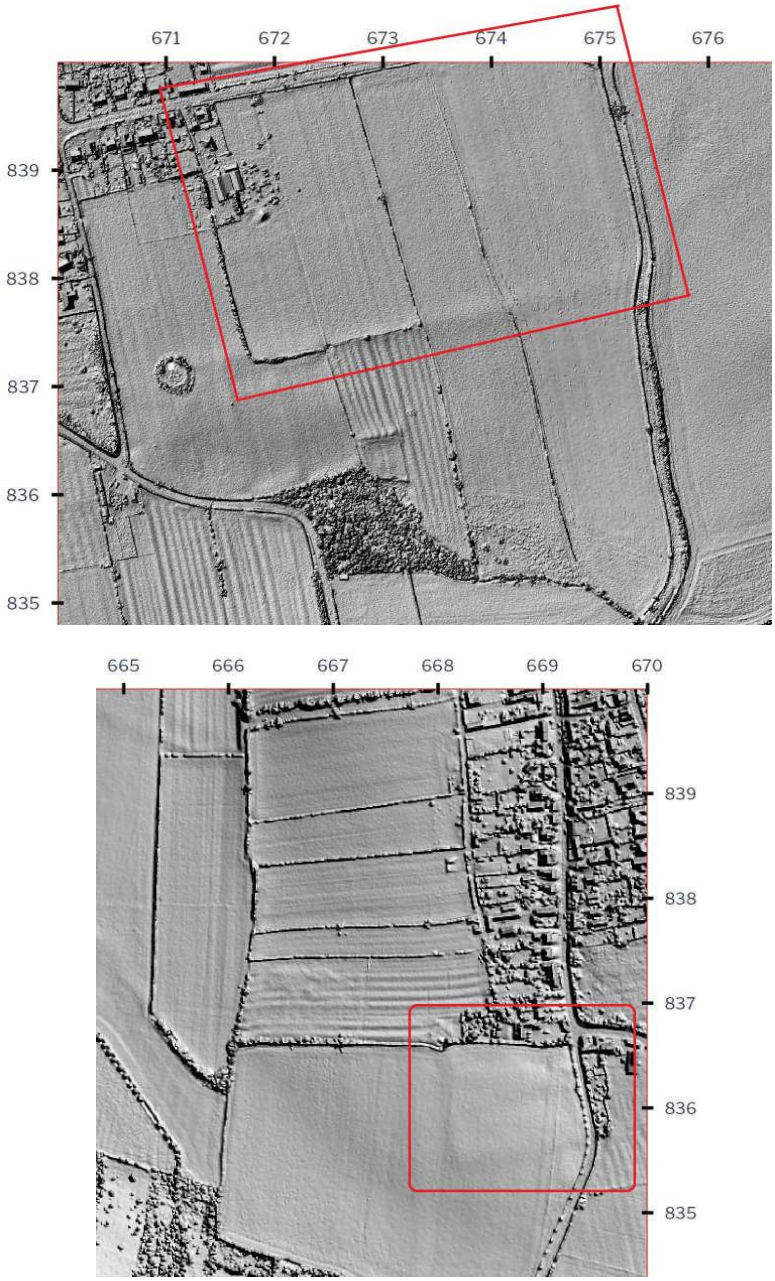

Fig. 15. Three lidar images of Wombleton village.

In the upper half of the top image, a combination of roads, old field boundaries, and present-day boundaries creates a large rectangle with curved corners that looks the right size and shape to be a Roman camp! While such an interpretation is not implied here, the site might be worth closer inspection; it lies about 10km north of the nearest known such camp on Diana Hill, Wath, and 12km south-west of the camp and forts at Cawthorn. In the central image, a large rectilinear enclosure can be seen at the south end of the village; this does not correlate with any field boundaries shown on historic OS maps, which have been completely ploughed flat in this area. Whatever it is, it appears to be partly overlain by the southern end of the village. The bottom image shows these areas within the context of the landscape around Wombleton.

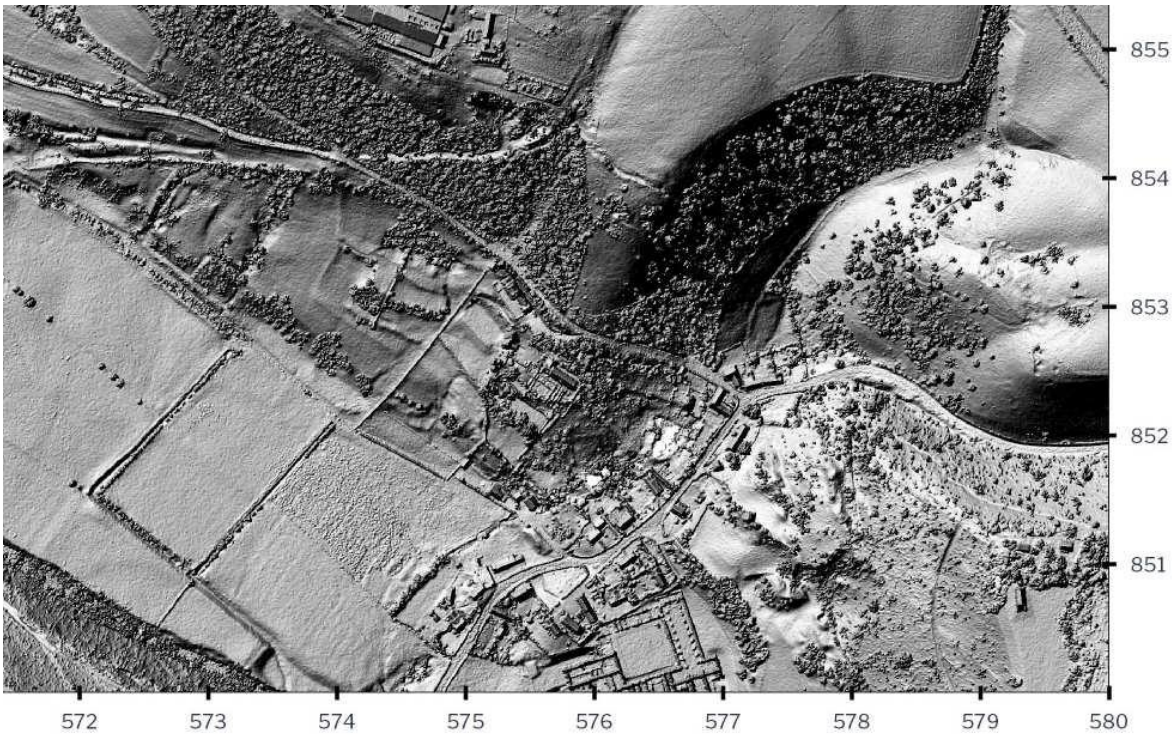

Fig. 16. This image shows the landscape immediately N of Rievaulx Abbey (km sq 5785). This is too complex for this project to record in detail, but several features show up very clearly, notably the terraces at the centre of the image and fishpond W of the abbey ruins. The slight earthworks at cSE57958530 are thought to be of an Iron Age settlement, demonstrating activity in the area at least 1000 years prior to the founding of the Abbey.

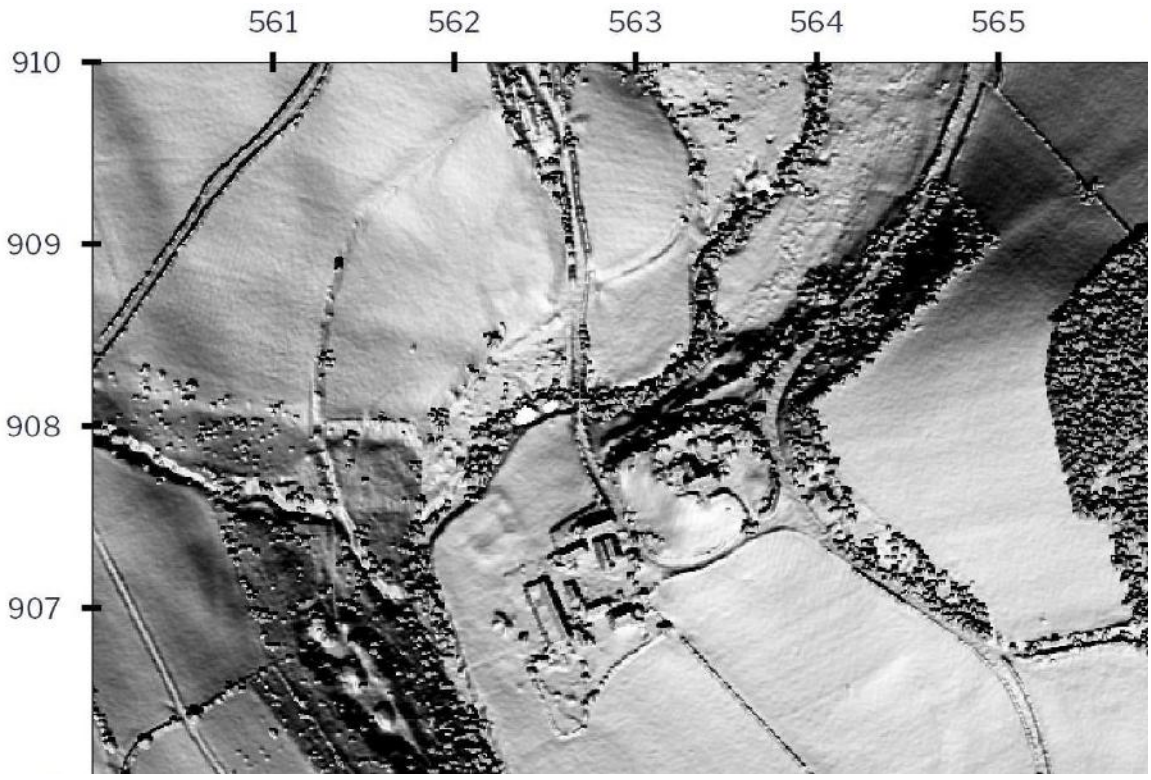

Fig. 17. Various slight earthworks are visible on lidar imagery around Laskill Grange (km sq 5690), notably a square-shaped building platform NW of the farm buildings. There may be a ditched enclosure around the house NE of the farm, which appears to occupy a level platform that could be artificial. The site is already recorded on the HER, but the lidar imagery appears to show previously unrecorded detail.

Fig. 18. Right on the edge of available lidar coverage (as many interesting sites often are!), this is Newlass Cistercian monastic grange, adjacent to New Leys Farm (km sq 5886). Several building platforms and other features are clearly visible, many of which are of medieval date. It will be very interesting to revisit such sites when seamless lidar imagery becomes available, hopefully within the next couple of years.

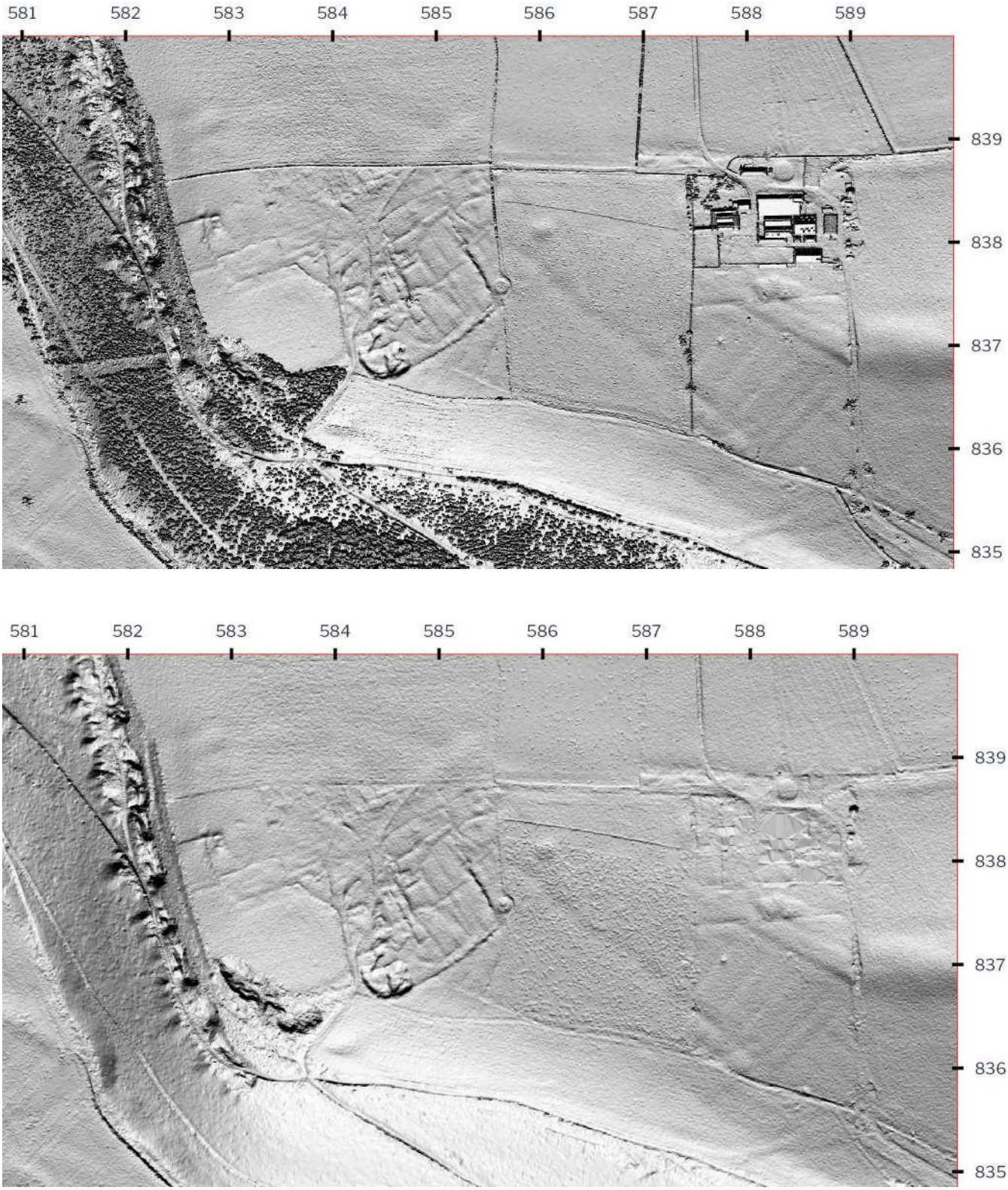

Fig. 19. DSM (above) and DTM (below) images of the landscape around the grange at Griff, a settlement recorded in the eleventh century and granted to Rievaulx at the time of its founding in 1131. The main complex of earthworks is clearly visible, and they can be seen to extend into the field to the N where they have been largely, but not entirely, flattened by ploughing. Evidence of a possibly contemporary field system can be seen to the E. Extensive evidence of quarrying, some of which presumably relates to the grange, can be clearly seen towards the W margin of the DTM image.

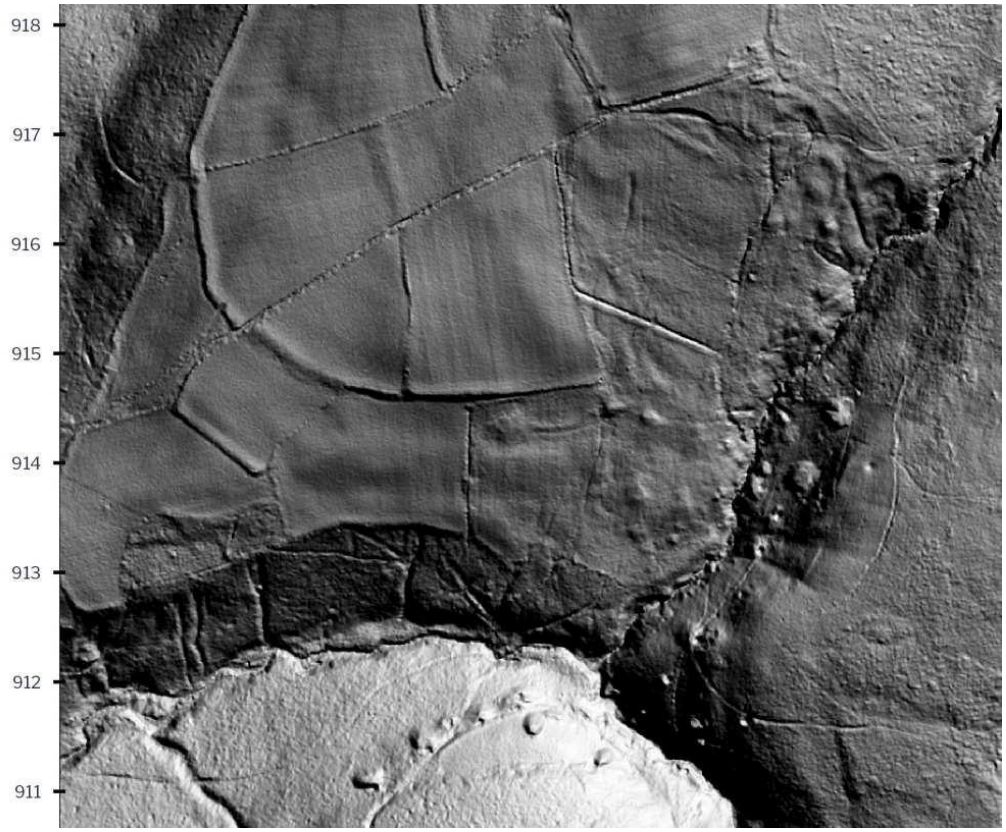

Fig. 20. This DTM image is of part of a busy landscape around the ruins of Carr Cote (visible to top-right) (km sq 5791). Many bell pits, for coal, are visible, most of which are in woodland and do not show up so clearly, if at all, on DSM imagery. The field system is very odd; it is possible that the very obvious curved boundary, now partly but not entirely overlain by present-day field boundaries, could relate to a medieval grange that is suggested but not proven here. This is definitely a landscape that demands close analysis in the field.

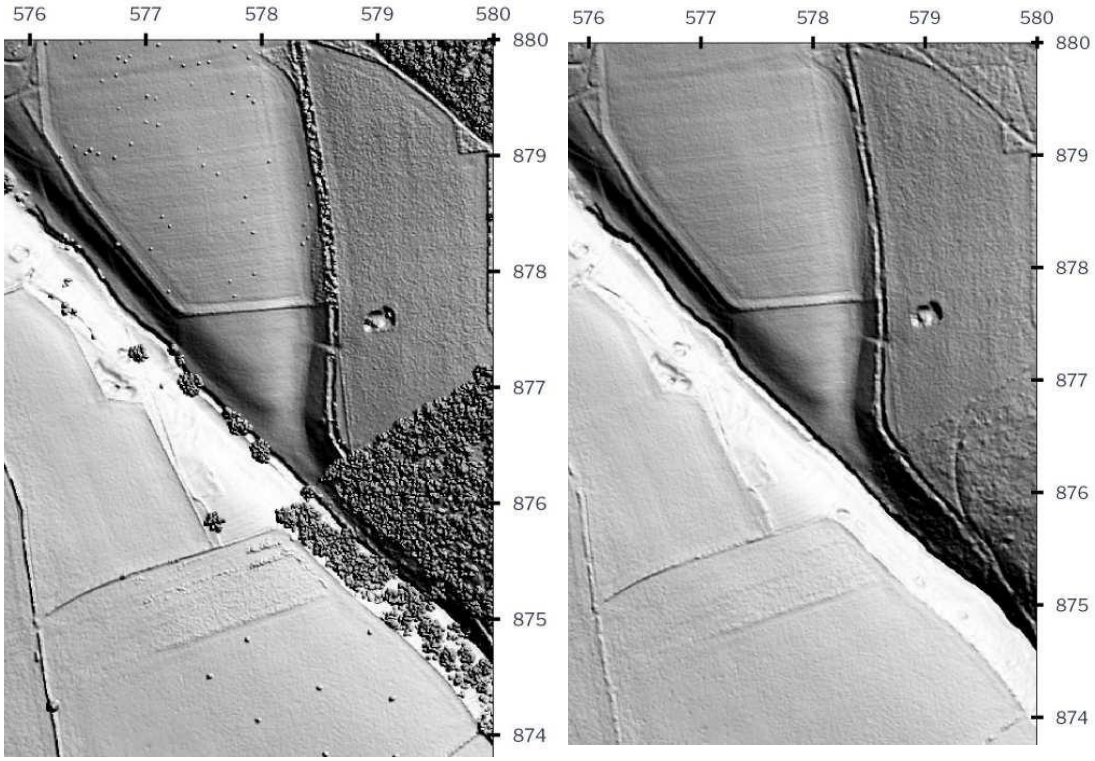

Fig. 21. These images show a medieval boundary dyke east of Oscar Park Farm (km sq 5787), best seen on DTM lidar imagery (right) which clearly shows the section beneath woodland. Other archaeological features of possible medieval date are also visible here, W of the stream, but they are better seen with the light from a different angle.

Fig. 22. The above image shows apparently medieval ridge-and-furrow west of Harome village. The field system was clearly more extensive than the surviving earthworks, and the effect of modern ploughing in smoothing the ground surface is obvious. The image below shows this area within the context of the landscape around Harome; remnants of ploughed-out post-medieval fields can be seen in places in addition to the surviving patches of ridge-and-furrow.

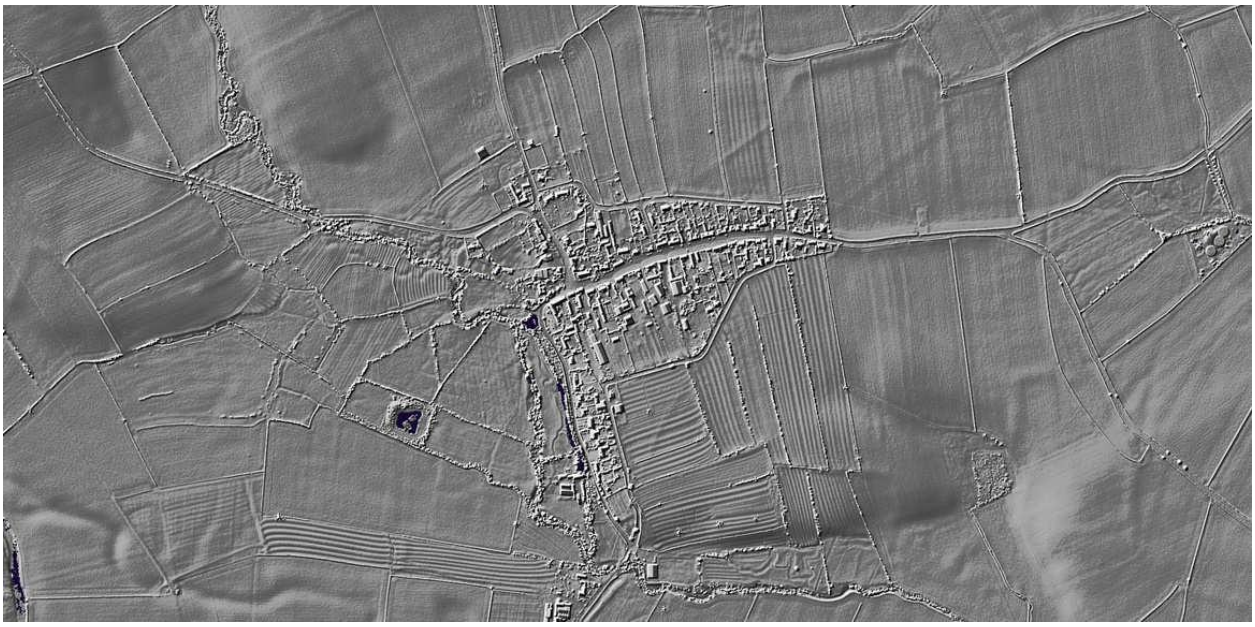

Fig 23. Small paddocks and possible building platforms visible as earthworks east of Surley Court (c2km south-east of Wombleton), adjacent to (but not encroached upon by) ridge-and-furrow of medieval character. Looks like evidence of medieval settlement, though could be later.

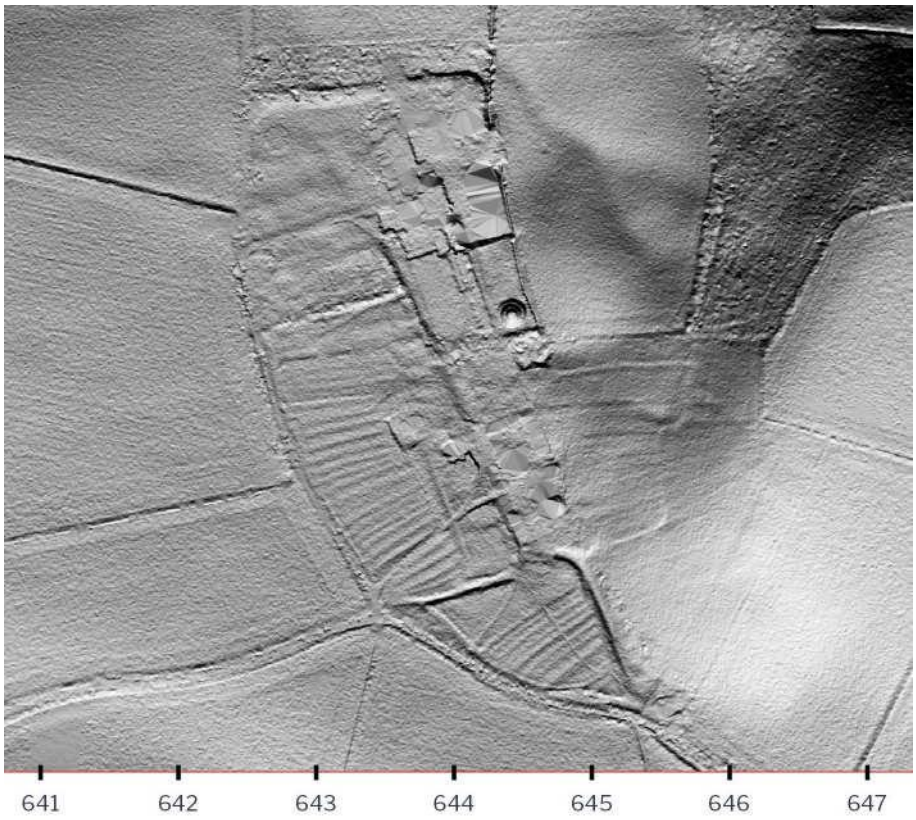

Fig. 24. Complex earthworks visible on DTM lidar imagery representing medieval settlement and field system at East Newton, roughly midway between Oswaldkirk and Nunnington. Lots of features are visible on the lidar imagery which should be checked against existing surveys to see whether it reveals any previously unrecorded detail. The field system presumably extended into surrounding fields, now all ploughed flat with no detail of any earthworks clearly discernible.

Fig. 25. Earthworks on south bank of the River Rye at West Ness. The enclosure at the bottom-right corner correlates with the 'Site of Ness Hall' shown on the OS 1st edition map (c1860). Other features are also visible in this area, and ridge-and-furrow fields extend from the south of the houses throughout the village. This all suggests a medieval pattern; while today's buildings are more recent, they may sit on the foundations of medieval precursors. The second image (below) shows this area within a wider landscape context; the heavily ploughed fields surrounding the village appear relatively featureless.

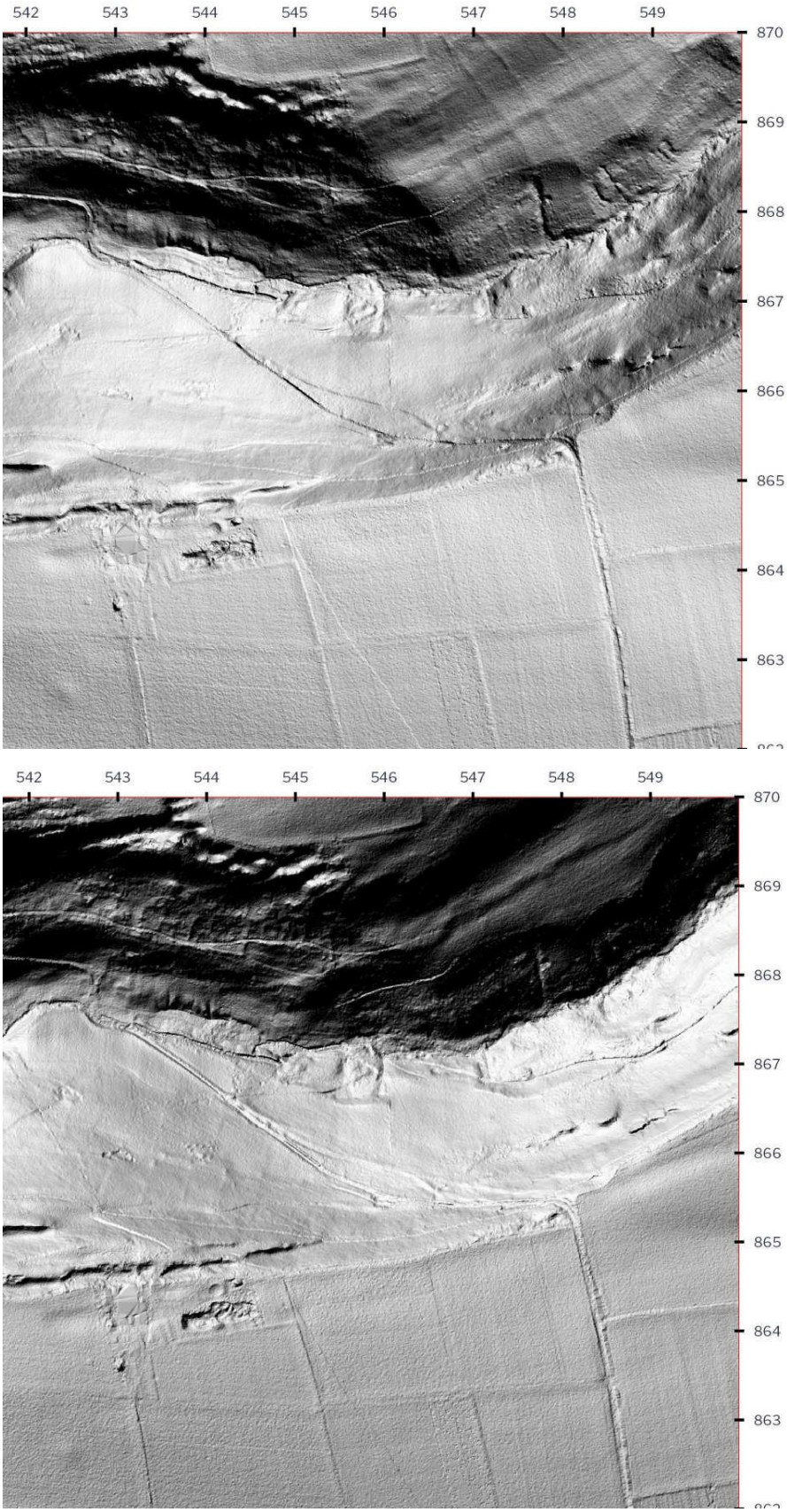

Fig. 26. These two DTM images show the same area, NW of Old Byland, with lighting from the NW (above) and NE (below). In the N third of the area, different earthworks can be seen in each image. Earthworks of a medieval or post-medieval field system can be seen in the NE corner of the upper image, while a complex of what appear to be small enclosures or fields (of unknown date) towards the NW corner shows up more clearly on the lower image. An unusual complex of very regular, small fields can be seen left-of-centre in both images, as can what is probably a previously unrecorded Bronze Age round barrow in the SW corner. None of these sites were recorded prior to the current project.

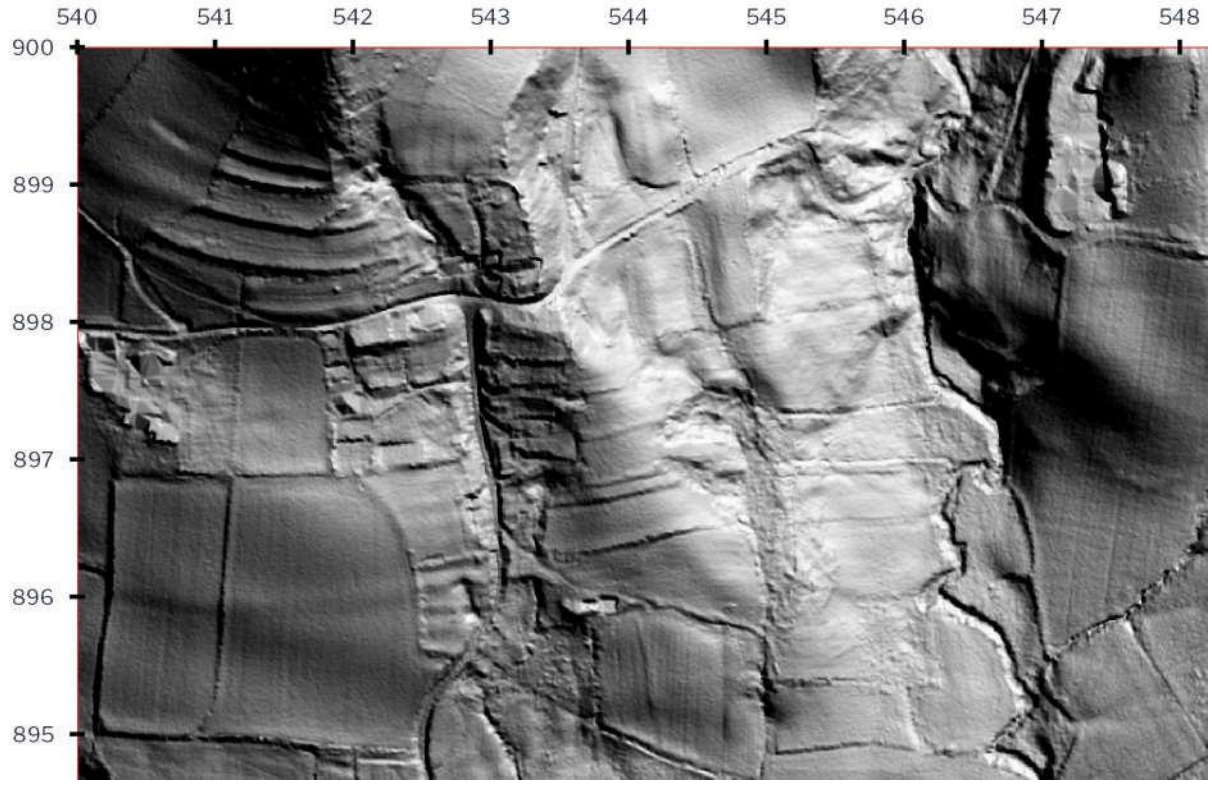

Fig. 27. This DTM image shows remnants of the medieval and post-medieval agricultural landscapes around the village of Hawnby (contrast with the front cover DSM image of this area). Well-preserved terraces can be seen at the NW corner, together with linear fields at the centre of the image that extend eastwards from the village.

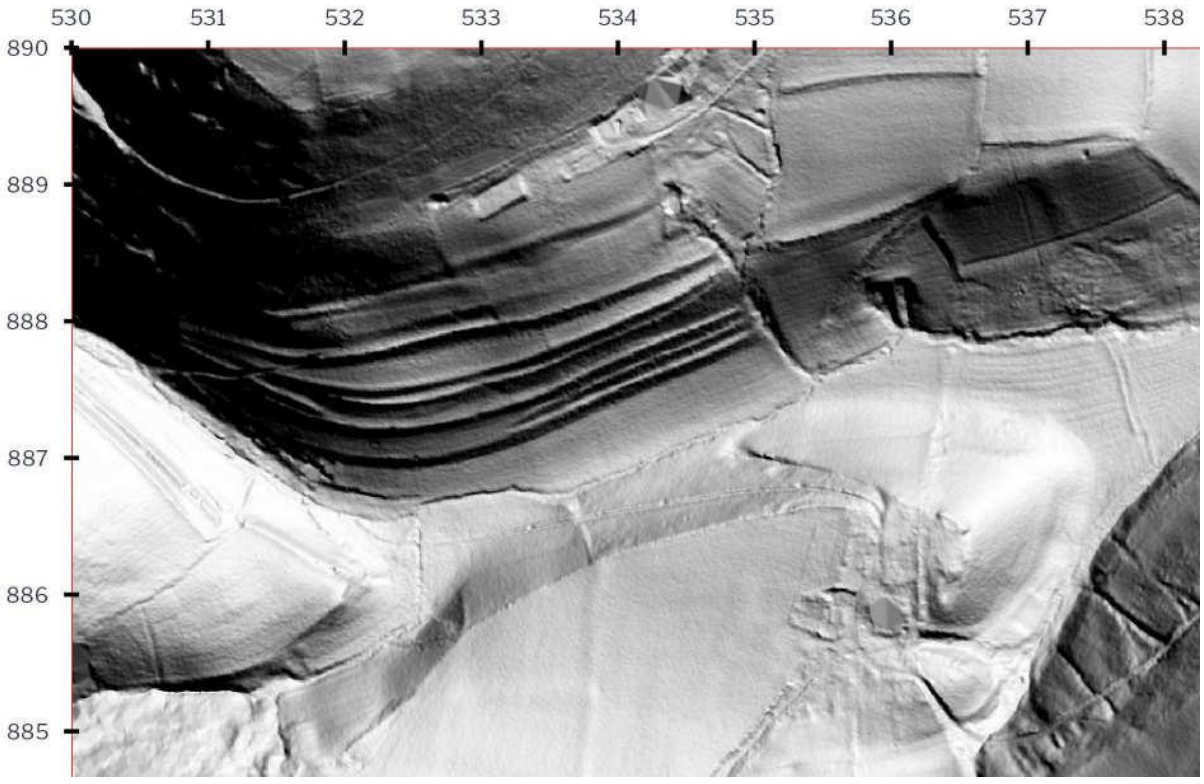

Fig. 28. DTM image showing well-preserved agricultural terraces in Sunnybank Wood, SW of Hawnby, together with traces of other medieval or post-medieval fields.

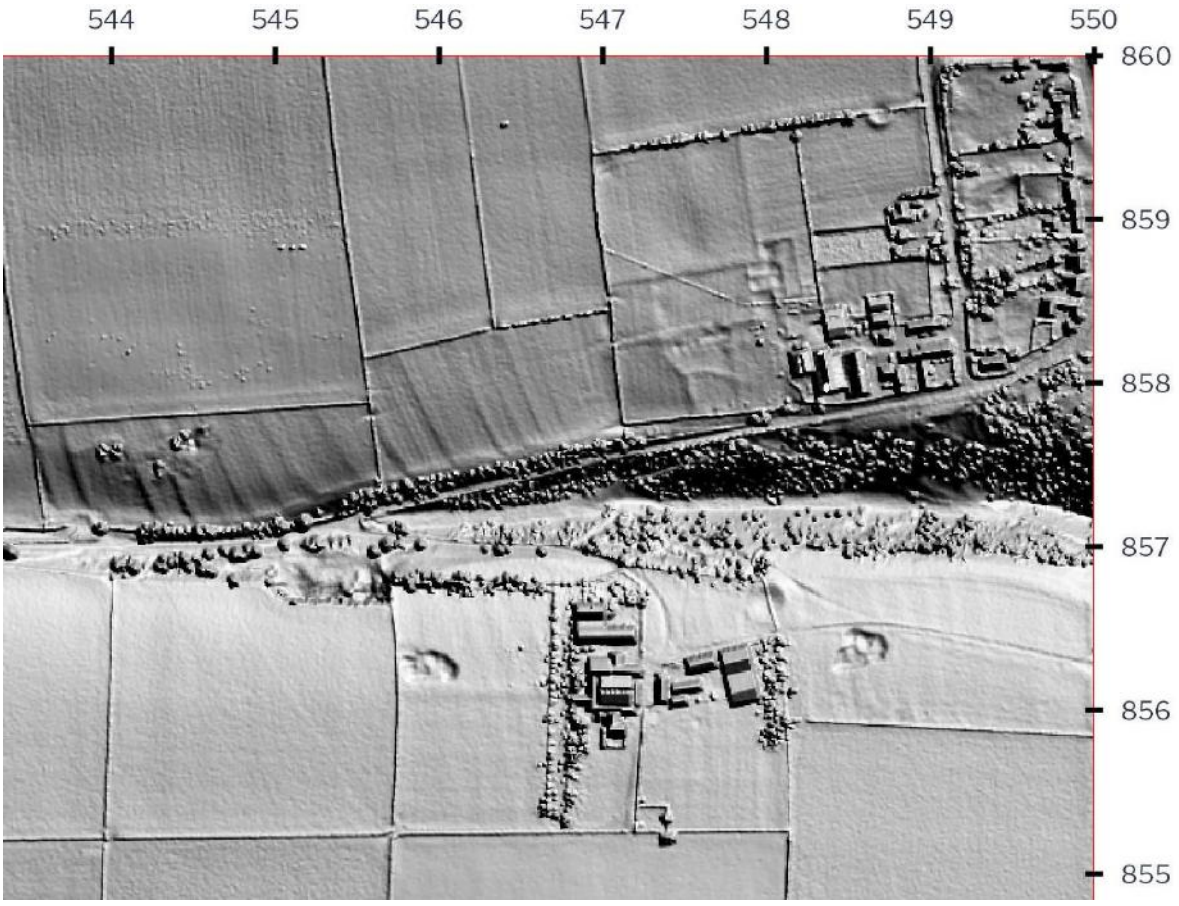

Fig. 29. This DSM image shows remnants of the medieval field system W of Old Byland, still clearly surviving as earthworks in some places though ploughed virtually flat in others. Earthworks of unknown date can also be seen immediately W of the village. Two old quarries, clearly cut into ridge-and-furrow, can be seen either side of Grange Farm in the S half of the image.

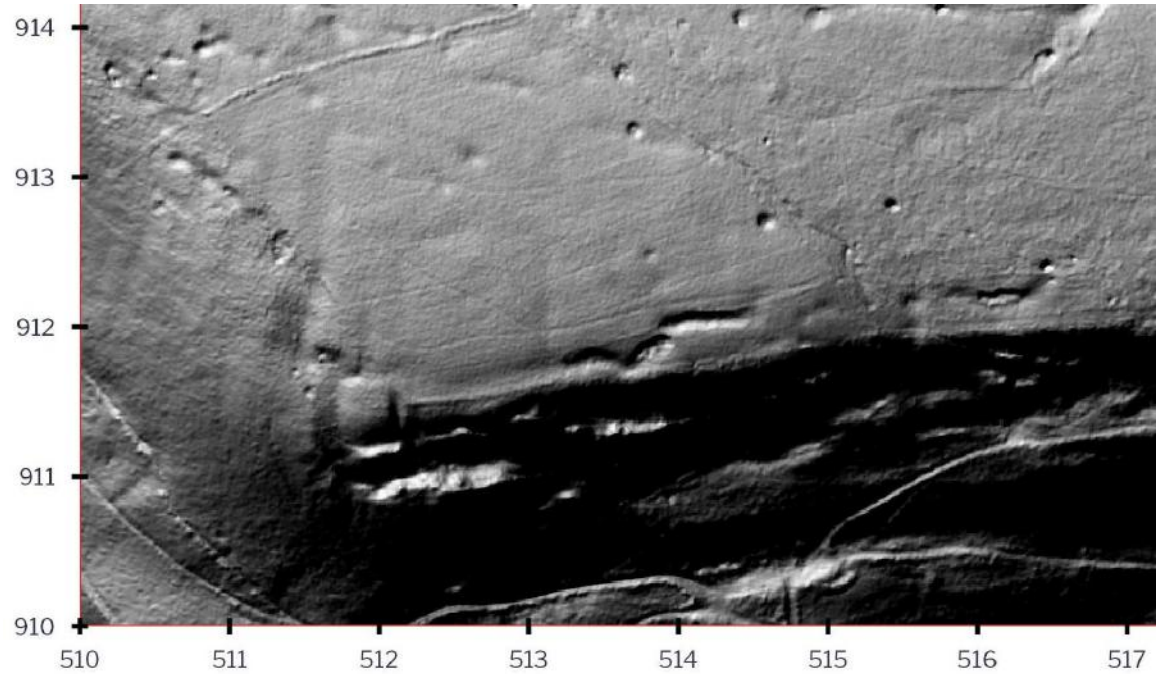

Fig. 30. This DTM image shows several linear features on North Moor that appear to be old field boundaries, presumably of post-medieval date, though they could be partly natural. A well-defined square enclosure can be seen towards the SW corner; this is tree-covered and not visible on the corresponding DSM image. The small circular features are natural sink-holes.

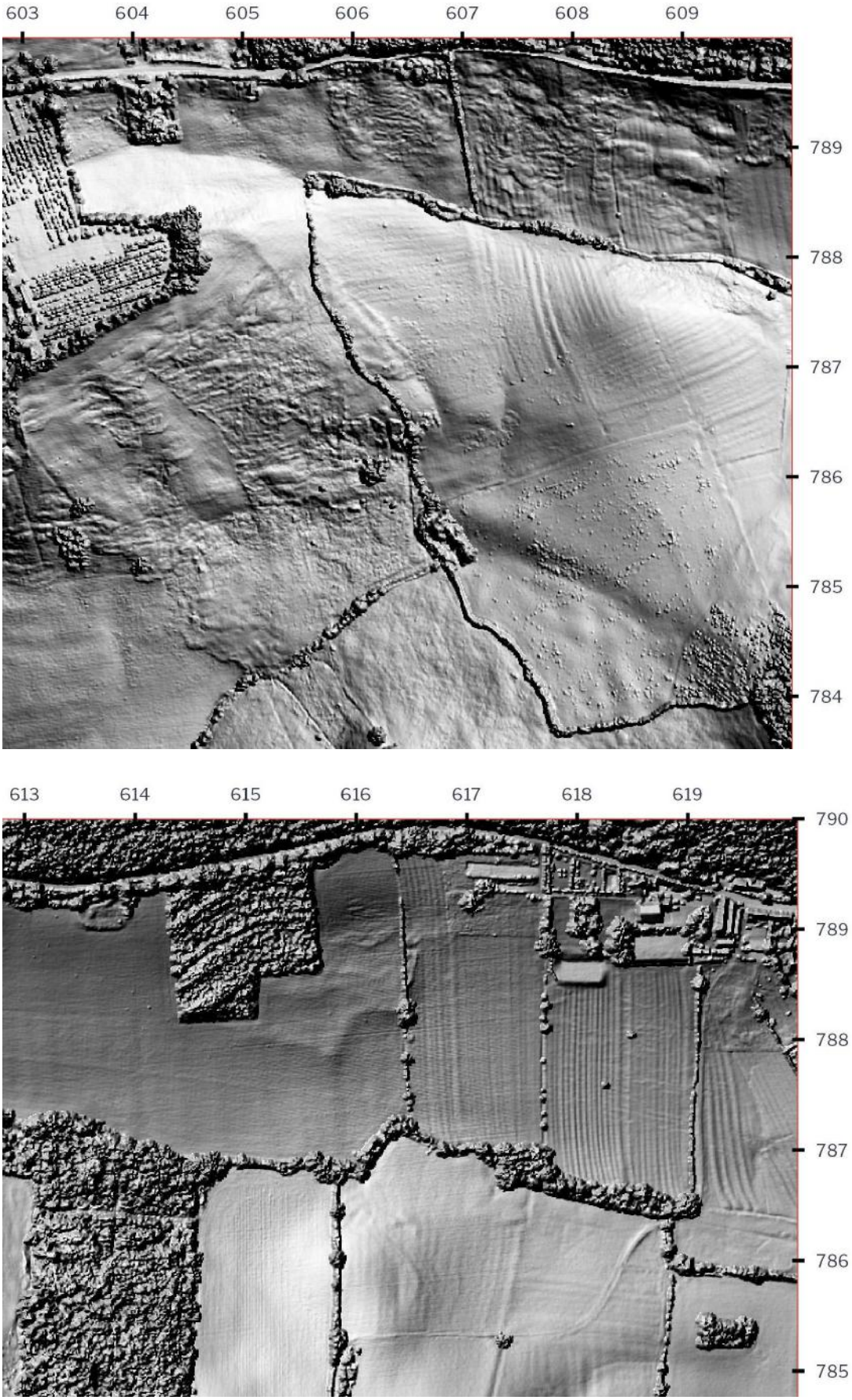

Fig. 31. Remnants of medieval and post-medieval ridge-and-furrow field systems can be seen E of Ampleforth Abbey (above) and S of Oswaldkirk Hall (below). It can be clearly seen how more recent ploughing has partially levelled the earthworks in places, and presumably completely flattened them elsewhere. In the lower image, a possible ancient enclosure can be seen SW of the plantation towards the NW corner, there is a suggestion that this could have been integrated within the ridge-and-furrow field system, in which case it could potentially have older origins.

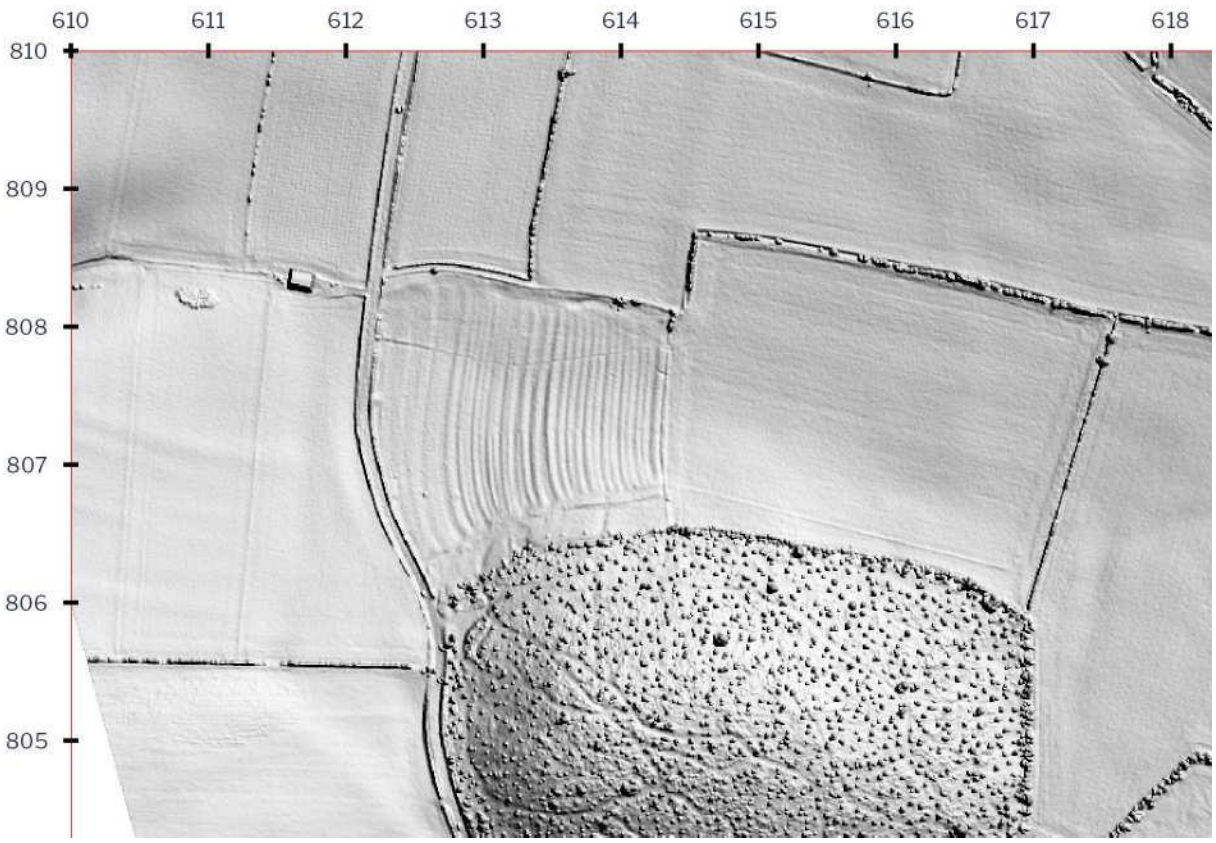

Fig. 32. An isolated patch of well-preserved ridge-and-furrow S of Sproxton. Presumably this was once much more extensive, but has been largely flattened by more recent ploughing.

Fig. 33. Slight remnants of medieval fields can be discerned in this image of Gilling East, but the picture is confused by more recent ploughing and housing, and by crops masking the ground surface in some of the fields at the time the lidar data was captured.

Fig. 34. This image suggests that the village of Sproxton was surrounded by an extensive ridge-and-furrow field system, but, as can clearly be seen here, much of it has now been ploughed away. The best-preserved surviving portion is to the W of the village, with earthworks that look to be classically medieval in character. Elsewhere, the ridges are narrower and straighter and are of post-medieval date. Many historic field boundaries, as shown on the OS 1st edition map in the mid 19th century, have been removed to create bigger fields. Several small circular earthworks can be seen interspersed within the field system; these were ponds.

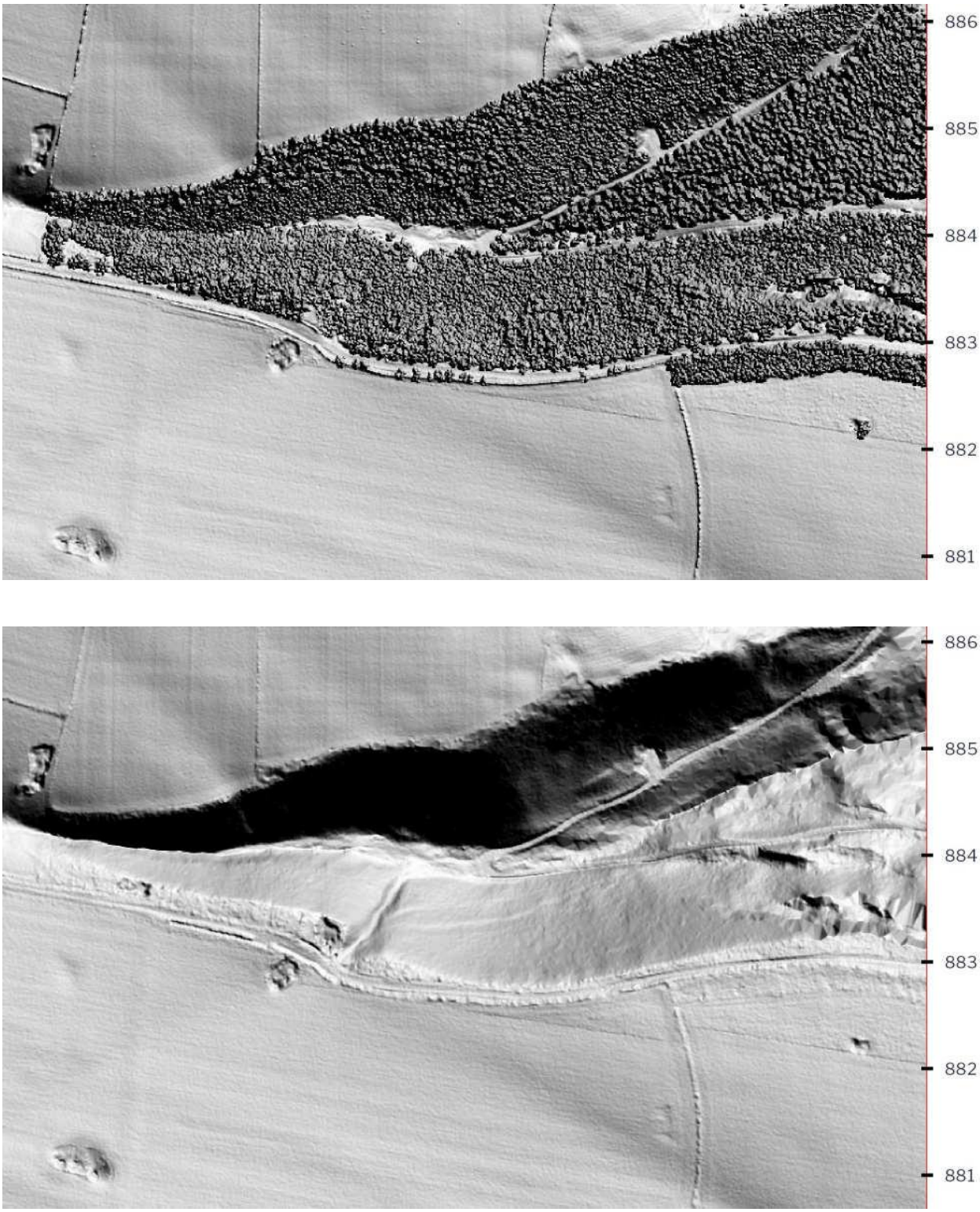

Fig 35. DSM (above) and DTM (below) images of the landscape around Peak Scar Wood, c2km SW of Hawnby, show several small post-medieval quarries, some of which can only be seen on the DTM imagery. Numerous similar sites have been recorded throughout the project area, often only visible on DTM imagery due to overlying woodland.

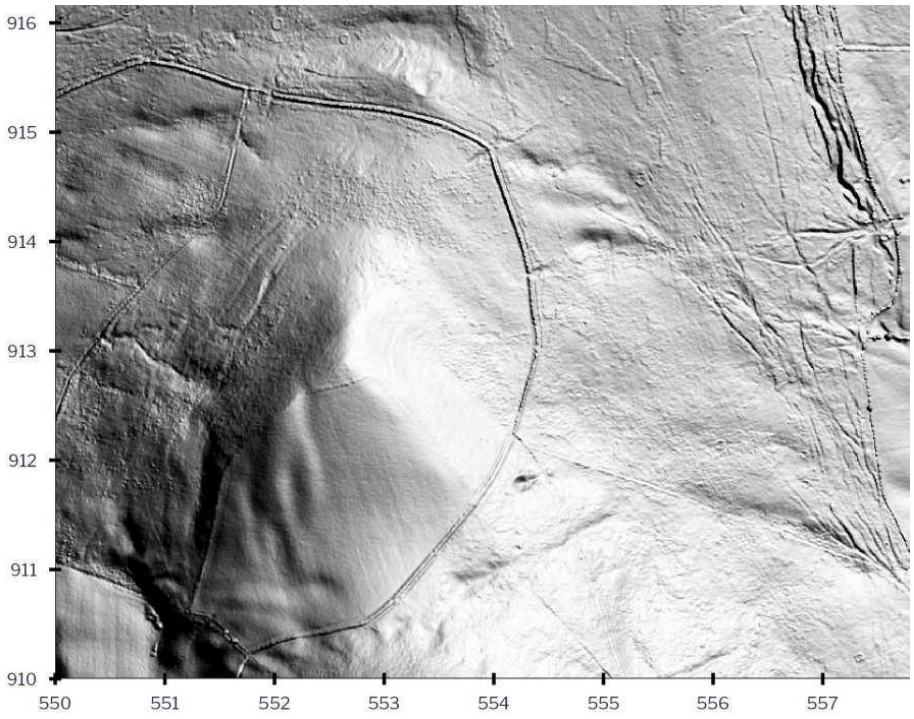

Fig. 36. This image has been chosen to illustrate a huge post-medieval agricultural enclosure on Pepper Hill (km sq 5591), and a complex of hollow ways to the E. This project has demonstrated that by far the biggest impact on the landscape, in terms of surviving earthworks (and the destruction of others, through ploughing) has occurred in post-medieval times. This is certainly not a surprise, but the extent to which remnants of post-medieval activity dominate the landscape appears to be greater than in many comparable landscapes subjected to similar surveys elsewhere.

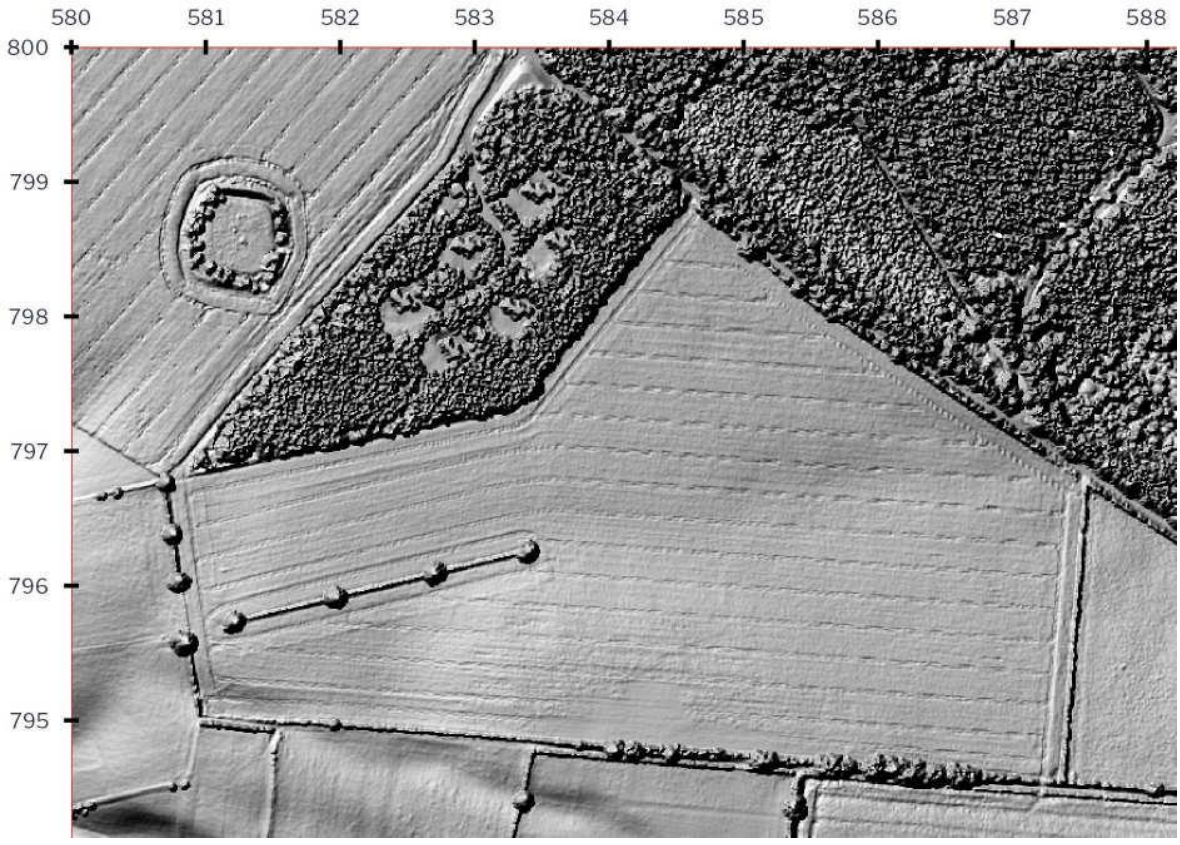

Fig. 37. The unusual earthwork in the NW corner of this image is Studfold Ring, a legally-protected scheduled monument 1km N of Ampleforth. For the purposes of this project it was classed as an unclassified earthwork of unknown date. Previously, it has been variously interpreted as a Neolithic henge, a Bronze or Iron Age enclosure, a medieval cattle or horse corral, and a multi-phase site perhaps with different purposes at different times. It illustrates perfectly that earthworks, even when this clear on lidar imagery and (as in this case) having been closely studied in the past, can defy definite interpretation. Excavation will be necessary to clarify its chronology and purpose(s).The rest of this image is typical of the landscape of Area 4, with heavily ploughed fields, some quite dense woodland plantations, and (as in the centre of the image) crops obscuring the ground surface at the time the lidar data was captured.

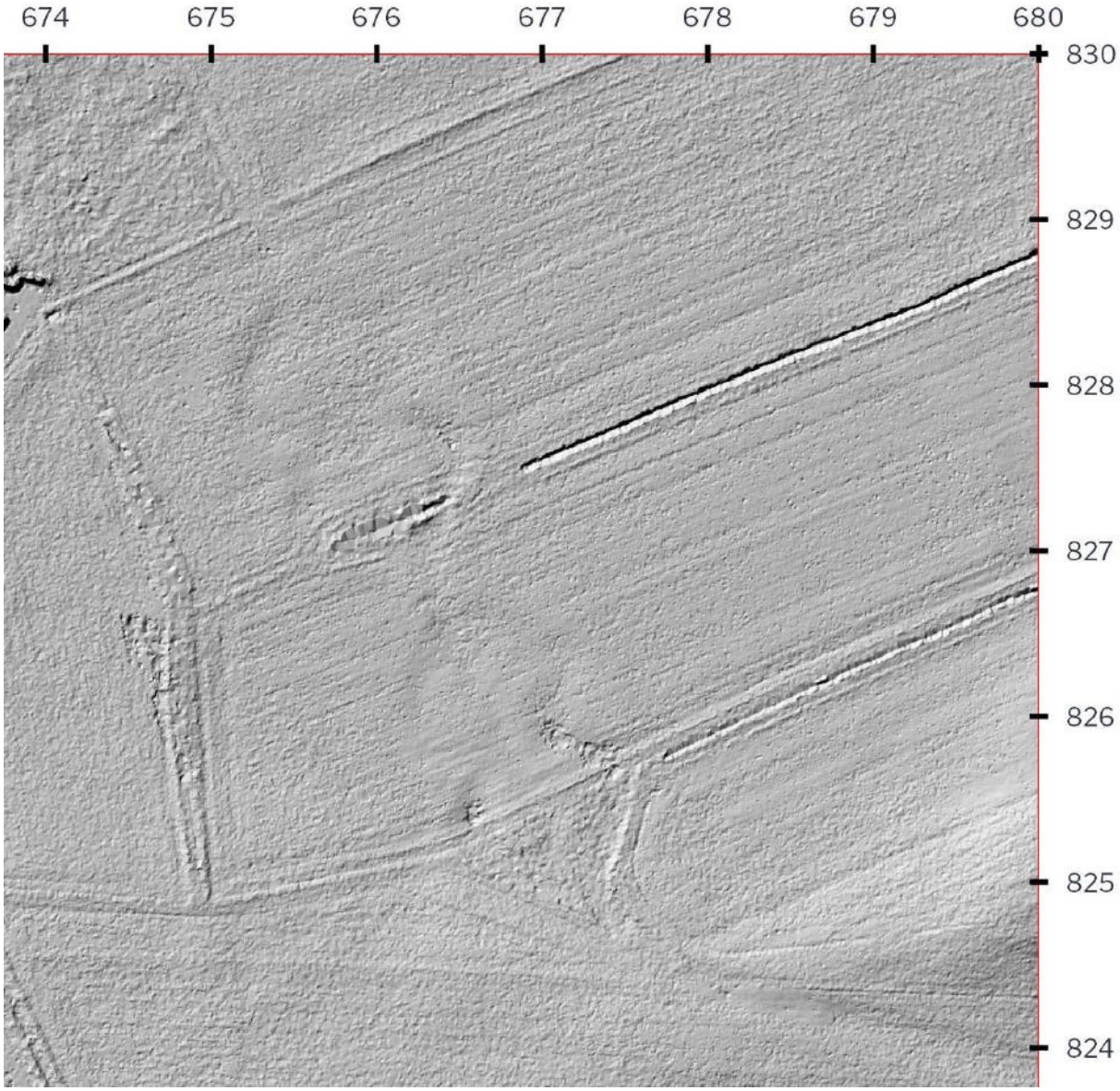

Fig. 38. Although initially rather confusing, analysis of mid 20th-century OS maps demonstrates that these curious earthworks correspond with features in the perimeter road around Wombleton Airfield. Remember to consult all available sources when attempting to interpret unusual things visible on lidar imagery!

References

This list is only of those works directly referenced in the text of this report. It is by no means a comprehensive bibliography for the project area.

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Spratt. D. A. 1989. *Linear Earthworks of the Tabular Hills, Northeast Yorkshire.* University of Sheffield.

Further reading (all available online, information supplied by Freya Horsefield):

Historic England and others have investigated areas of Rievaulx and Byland land in Ryedale:

Griff Grange: https://bit.ly/Griff2003

Rievaulx Abbey precinct: https://bit.ly/Rievaulx-Pearson2019

Byland Abbey precinct and extra-mural area: https://bit.ly/Byland2011

A grange of Byland Abbey: https://bit.ly/ColdCam

Parts of the North York Moors have been mapped archaeologically using aerial photographs https://bit.ly/NYM-NMP

Other known archaeological sites are noted on the Historic Environment Record: https://bit.ly/NYM-HER

Reports of geophysical surveys by Gerry McDonnell, Robert Vernon and Jane Wheeler, based initially at Bradford University, are variously available on Open Access repositories (Researchgate.net and Academia.edu – these require registration but are free) and Bradford University's repository: https://bradscholars.brad.ac.uk/ and the British Library ETHOS service https://ethos.bl.uk/Home.do

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