



EAC Occasional Paper No. 5

Remote Sensing for Archaeological Heritage Management

Edited by David C Cowley

Remote sensing is one of the main foundations of archaeological data, underpinning knowledge and understanding of the historic environment. The volume, arising from a symposium organised by the Europae Archaeologiae Consilium (EAC) and the Aerial Archaeology Research Group (AARG), provides up to date expert statements on the methodologies, achievements and potential of remote sensing with a particular focus on archaeological heritage management. Well-established approaches and techniques are set alongside new technologies and data-sources, with discussion covering relative merits and applicability, and the need for integrated approaches to understanding and managing the landscape. Discussions cover aerial photography, both modern and historic, LiDAR, satellite imagery, multi-and hyper-spectral data, sonar and geophysical survey, addressing both terrestrial and maritime contexts. Case studies drawn from the contrasting landscapes of Europe illustrate best practice and innovative projects.

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Airborne Laser Scan (LiDAR) of a forested area before and after filtering

(St. Anna in der Wüste, Austria). © *Michael Doneus and Klaus Löcker, LBI-ARCHPRO, Vienna*

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1 | Remote sensing for archaeological heritage management

David C Cowley and Kristín Huld Sigurðardóttir

Abstract: This introductory paper defines the scope of remote sensing in this volume and introduces the key themes of landscape, management, integration and communication. The broad structure of the volume is outlined.

Introduction

This collection of papers arises from a symposium held in Reykjavik, Iceland, between the 25th and 27th of March 2010, organised by the Europae Archaeologiae Consilium (EAC) and the Aerial Archaeology Research Group (AARG) to review remote sensing for archaeological heritage management at the start of the 21st century. Remote sensing techniques, here taken to include airborne, underwater and geophysical recording, underpin much of what is known about the past, in both terrestrial and maritime contexts. Traditional aerial reconnaissance in light aircraft and recording using hand-held oblique photographs, for example, has revolutionised our knowledge of the past in many lowland arable areas. These well-established techniques continue to demonstrate their value by increasing what we know, while new approaches, for example in multi- and hyper-spectral data collection, challenge the ways in which we see the past, opening up massive new potential. Airborne Laser Scanning has rapidly established its credentials in recording the earth's surface rapidly, and clearly enough to reveal fine archaeological detail, even under a woodland canopy. Equally, the vast – and untapped – collections of aerial images from the past 70 years hold a massive potential to document the historic environment, some of it now destroyed by development in the second half of the 20th century.

These recording and prospection techniques, new and long established, are part of the very foundations of our knowledge of the past and should inform its effective management. However, this statement cannot be taken for granted, as there are often major dislocations between different parts of the profession. For example, the outcomes of national survey and mapping programmes are not routinely regarded as of any direct relevance by academics and other parts of the profession, for whom excavated and published material is key. Equally the relationship between data collection and informed management may not be as strong as it could be, even though remote sensing (data collection) is central to informing cultural resource managers of what is there. There should be a widespread understanding of these connections amongst archaeologists and heritage managers, but this is clearly not always the case and informed dialogue is needed. This can promote mutual understanding, where on the one hand cultural resource managers appreciate the technical issues and potential of the

various techniques, and on the other the application of remote sensing properly supports management in its wider sense. At present, this connection is most often made in a site/area specific context, and is not as common at a landscape scale, though this volume amply illustrates that it is happening.

Central to this relationship is the connection between *knowledge* (ever more data) and *understanding* (interpretation) – and how this informs management. Effective and sustainable management, the central remit of EAC, has to be the key driver in developing these remote sensing approaches. Without this focus the acquisition of aerial photographs or other data sources may become little more than 'stamp collecting', and while academic research pays dividends in other ways, without a clear connection into management of the archaeological resource in the present – for the future – it runs the risk of being an essentially self-indulgent and introspective pursuit.

From site to landscape

Remote sensing techniques support the basics of discovering sites and monuments and creating reliable records, but also sustain registration and large-scale mapping, without which the environment cannot be effectively understood, characterised and managed for the future. These developments in the remote sensing techniques used by archaeologists have been accompanied by changing perspectives, especially in a shift of focus from traditional archaeological *sites* to *landscapes*, and to more broadly-based inventories of monument types that include recent military and industrial heritage.

This is valuable as it feeds directly into wider perspectives grounded in landscape, principally the European Landscape Convention (ELC) which aims to promote integrated landscape protection, management and planning. Landscape is explicitly recognised as a basic component of cultural heritage, which should be integrated with government policy. It enshrines the importance of the common landscape, as well as those that might be designated as rare or special, and is applicable in both maritime and terrestrial environments.

Management

The ELC, as a pan-European directive that encourages active engagement in understanding our complex and diverse landscapes, has as much to recommend it to remote sensing archaeologists as a means of contextualizing and establishing the management relevance of their work, as it does to Cultural Resource Managers tasked with implementing strategies to manage this resource. It is in force and commits its signatories to integrated landscape protection and management built on understanding, especially, for example, the in-depth knowledge illustrated by Dominic Powlesland in the work of The Landscape Research Centre (this volume). This type of approach is driven by a desire to improve knowledge and to develop the tools to see and analyse the landscape. This is especially important as considerations of landscape are often dominated by, or at least biased towards, those with a 'natural landscape' agenda – a concept that has no legitimacy anywhere in Europe, where all landscapes are cultural, even if the degree to which this is the case varies.

This concept is at the heart of attempts to understand and manage the past and the historic environment in which we live. Multi-scale analyses, from site level considerations to landscape-scale characterisation, are required to grasp what may be there to manage, and to prioritise qualitatively and quantitatively what is protected and how mitigation strategies can be designed if preservation *in situ* is not an option. Broad-brush characterisation of landscapes to outline general attributes can be valuable to create an overview. The historic environment is a mosaic of spatial and chronological attributes producing often complex palimpsests, all of which pose challenges to understanding. Characterisation of the landscape may provide a useful way to help match survey techniques to contexts, identifying strengths and weaknesses and adapting accordingly. Equally, assessments of information content (i.e. the potential contribution to knowledge that sites may have now or in the future) based on an appreciation of monument condition, for example, may enhance the future value of preserved monuments, while also helping to determine responses to threat through protection or planning processes. Heritage professionals cannot save everything, but by drawing on data that has both time-depth and spatial breadth created in a real-world context, they can promote robust frameworks for managing the environment.

Integration, communication and dissemination

A key theme of this volume is the importance of integrating techniques and data in understandings of the archaeological resource base from which both narratives and management strategies can be built. Beyond this basic requirement to integrate and utilize complementary approaches and datasets, there is a clear need for effective communication and working between different heritage professionals including the academic world, and across national and regional boundaries. These issues were aired during round-table discussion

at the symposium where the differing motivations for policy makers and academics, for example, were made clear. However, various projects reported in this volume are excellent examples of the benefits that arise from good connections between researchers, policy makers and heritage managers, and are cause to be optimistic. There remains a strong need to extend this good practice more widely, effectively integrating research priorities with the demands of heritage management.

It will be clear from the papers in this volume that the change in approaches has often been dramatic, but that progress is not always even across Europe, as should be expected with differing landscapes and traditions. The symposium aimed to promote dialogue and understanding between different areas of the heritage field and to communicate the possibilities of differing approaches to colleagues across Europe. This aim is fundamental to the published volume – to promote mutual understanding and successful dialogue, and to encourage the continued adoption and development of best practice.

'Best practice' does not refer to a 'one size fits all' approach – but rather the informed application of techniques that are appropriate to particular contexts and fit for the purpose in hand. Thus detailed mapping can sit alongside broad-brush characterisation in supporting differing management issues, from the level of individual monuments to entire landscape areas. A critical view of what is fit for purpose is vital – guarding both against the danger of embracing 'new' approaches simply because they are new, and the inertia of embedded traditions in heritage management. Ready accessibility to data is vital if it is to feed effectively into planning, and effective dissemination requires imaginative and integrated approaches that break down the 'silos' into which some information is consigned.

The importance of challenging established practice and in particular breaking down compartmentalised approaches that reflect vested interests, entrenched positions and inter-institutional competition is illustrated in papers from Italy (Ch 3 – *Campana*) and Poland (Ch 13 – *Rączkowski*). In the former case an innovative and cost-effective approach developed for a large-scale infrastructure project, and validated by a national committee, was rejected by the autonomous regional heritage administration. In Poland, the difficulties of integrating compartmentalised institutional datasets are well illustrated. In both cases the cost effective recording and management of the historic environment is not necessarily to the fore, as tradition, vested interest and resistance to change exert an undesirable influence. This is an important area where the EAC can promote the creation of guidance in heritage management policy that supports the implementation of best practice. Just demonstrating best practice and potential gains from its use, as in the Italian case, is not enough. The political dimension of decision-making, especially in compartmentalised management structures, also needs to be pushed forward.

Structure of the volume

The majority of the papers in this volume were presented in Reykjavik though they have been supplemented by several specially commissioned contributions. The contributors come from a variety of universities and national and regional heritage institutions, and include academics as well as data-collectors and those involved in everyday conservation and protection of the historic environment. Thus, it should be noted that the views of authors do not necessarily represent a 'national' or institutional view, and may also include critical remarks which reflect the authors' own opinion. These are, however, presented in a spirit to foster constructive dialogue.

The structure of the volume reflects the general approach taken at the symposium, beginning with general papers, and then exploring specific techniques, data sources and contexts before concluding with a series of case studies from the length and breadth of Europe.

In Part 1 the importance of making remote sensing work for the profession is explored in three papers that deal with both general issues and the place of integrated suites of remote sensed (and other) data in national and local contexts. The integration of techniques in identifying and mitigating development or otherwise managing often highly complex archaeology is discussed in studies from the UK (*Powlesland*) and Italy (*Campana*). The work of The Landscape Research Centre described by Powlesland may be a pinprick on the map of Europe, but is one of best-studied and understood archaeological landscapes in the world, and its results provide lessons from which we can all learn. The potential to develop best practice drawing on integrated suites of remote sensed and other data for major infrastructure projects is powerfully demonstrated by Campana, in a paper that also illustrates the problems of ensuring that best practice is adopted. This is not something that can be taken for granted, no matter how good a case is presented because such decisions are always at risk of being tainted by considerations of vested interests and traditions in power. Powlesland and Campana demonstrate the strength of integrated techniques in understanding the environment and providing a solid basis for management. In the third paper of this section our ability to explore, understand and interpret the landscape are further examined in a paper that stresses the importance of broad-brush characterisation to help match techniques to context (*Cowley*).

In Part 2 the challenges and potential of new technologies are discussed, which in exploring both terrestrial and maritime contexts show how new environments – under water and under woodland canopy in particular – have become ever more accessible. The engagement of archaeologists with new approaches has often been irregular, with costs and a lack of appropriate skills amongst the principal problems. This is gradually becoming less of an issue with the now well-established 'new' technology of Airborne Laser Scanning (*Doneus & Briese, Shaw & Corns*) but remains a significant challenge for the highly

complex data presented by multi- and hyper-spectral data (*Beck*) that is on the cutting edge of archaeological prospection. The effective use of such data is a keynote of a case study of integrated approaches from the UK (*Bennett et al.*), while the importance of 3D recording is also clearly stated (*Remondino*). The final two papers in this section explore geophysical survey techniques, in both terrestrial (*Gaffney & Gaffney*) and maritime (*Firth*) contexts, both papers emphasizing the importance of visualisations in understanding and communicating the past.

Part 3 turns to the fundamental contribution that remote sensing approaches can make to the creation and exploration of the archaeological resource base. Reliable inventories are central to informed management of cultural heritage, and papers from England (*Horne*), Poland (*Rączkowski*) and Germany (*Bofinger & Hesse*) illustrate differing approaches drawing on both traditional and cutting edge data sources to create extensive and consistent baseline datasets. The tremendous challenge of exploring and managing submerged palaeo-landscapes is laid out by *Fitch* and his collaborators, illustrating the potential value to archaeologists of data recorded by offshore industries for non-archaeological purposes. The dividend of opening up archival data as sources of otherwise unrecoverable heritage information is also underlined with reference to historic aerial photographs (*Ferguson*).

In Part 4 the importance of interpretation and understanding is explored in case studies from across the varied landscapes of Europe. The creation of broadly-based datasets that can be relied on by heritage managers and archaeological researchers requires understanding of source data in regional and local contexts. Exemplars of integrated approaches are illustrated from the Czech Republic (*Gojda*), France (*Georges-Leroy*) and Hungary (*Czajlik*), while the role that aerial photographs are playing in defining landscapes of national importance is discussed in an Icelandic case study (*Einarsson & Aldred*). The need for effective integration of planning and management with field strategies is further developed in a Slovenian case study (*Rutar & Črešnar*), while the importance of 'new' types of heritage contexts is shown through a consideration of the remains of World War I in Belgium (*Stichelbaut et al.*). Preliminary results from a five-year aerial archaeology project in Denmark (*Helles Olesen*) show the benefits of integrating traditional aerial reconnaissance and inspection of historic aerial photographs to record the historic environment, and in developing the use of the aerial perspective for monitoring monument condition. The penultimate paper, by *Palmer*, examines how expertise and experience is vital to securing the best use of aerial data (or any data for that matter). Illustrating the way in which he teaches/trains presents a model of best practice, but also raises the central theme of the final paper (*Musson*) where the needs for training and development are examined, in part taking an historical perspective but also laying out the challenges addressed in the European Union funded *ArchaeoLandscapes* project.

Remote sensing for archaeological heritage management

This volume, and the symposium on which it is based, originates in the work of the AARG/EAC working party established in early 2007 to work on the main areas of common ground between the organisations and in particular on the development of broad-based strategies, especially with reference to heritage management, standards and statements of best practice.

In compiling up-to-date statements of current practice in archaeological remote sensing this volume should help to encourage best practice across Europe. The key themes that run through the contributions are the importance of a management focus in a landscape context, the integration of techniques and thinking and

the promotion of approaches that are fit for defined purposes and specific contexts. We will conclude by stressing the need for statements of best practice to develop into published guidelines and standards that may be adopted even where the will is not yet present.

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