Aerial and other remote-sensing techniques have yet to realize their full potential in many parts of Europe. In some countries of northern, eastern and southern Europe they have hardly been applied at all. The aim of the ArchaeoLandscapes Europe project (ArcLand; http://www.arcland.eu/) is to address this imbalance and to create conditions for the regular use of these strikingly successful techniques across the continent as a whole.

The ArcLand project is funded by the European Union within the framework of the Culture 2007-2013 framework (ArcLand 2010-1486 / 001-001; CUT-MULT7, Strand 1.1 Multi-Annual Cooperation Projects). Co-organising partners receive a total funding of 2.5 million Euros over the length of the project (September 2010 - September 2015), another 2.5 million Euros are be provided by the partners themselves. Public awareness and dissemination of challenging skills in aerial and remote sensing techniques, at a very European scale, will be achieved by the ArchaeoLandscapes project through the following key actions (WP):

1. By creating an ultimately self-supporting ArchaeoLandscapes Network, with a small central secretariat, to provide leadership, coordination and advice on the use for heritage purposes of aerial photography, remote sensing and landscape studies.
2. By using traditional and innovative methods to publicize the value of aerial survey, remote sensing and landscape studies amongst the general public, students, teachers and all those who explore, enjoy or care for cultural landscapes and heritage sites across Europe.
3. By promoting the pan-European exchange of people, skills and understanding through meetings, workshops, exchange visits, placements and opportunities for specialist training and employment.
4. By enhancing the teaching of remote sensing and landscape studies through courses for students and teachers, and in the longer term, through a European Masters degree in remote sensing and heritage management.
5. By securing the better exploitation of existing air-photo archives across Europe by researching, assessing and publicizing their potential for heritage interpretation and landscape conservation.
6. By providing support for aerial survey, remote sensing and landscape exploration in countries relatively new to their use, especially in northern, eastern and southern Europe.
7. By further exploring the uses of laser, satellite and other forms of remote sensing and web-based geographical system in archaeological and landscape research, conservation and public education.
8. By providing technical guidance and advice on best practice in aerial survey, remote sensing and landscape studies, with a particular emphasis conservation and heritage management. One of ArcLand’s main objectives was the organisation of different events to foster the knowledge about the use of modern remote sensing and surveying techniques for archaeology both within the archaeological and cultural heritage community as well as for the broader public. Within this scope the 77 project partners (http://www.arcland.eu/about/partners) organised six aerial archaeology training schools, 22 workshops (dealing with aerial image archives, geophysics, satellite imagery, LiDAR/Airborne Laser Scanning, GIS etc.), 15 conferences, symposia and public workshops as well as numerous sessions at various national and international conferences including a large number of public and conference presentations. 13 grants for internships at various project partner institutes provided support for students and young professionals to gain more insight into topics like Airphoto Archiving, Management & Interpretation, GIS Integration of Remote Sensing Data, Predictive Modelling and GIS & Aerial Archaeology.

This book represents the outcome of nearly five years of work of project partners from all over Europe and beyond which were presented by the project’s final conference “Sensing the Past – New Approaches to European Landscapes”, held at the Goethe University in Frankfurt from 24th - 26th February 2015 as part or the obligations of ArcLand’s WP 2.

It compiles information about the remote sensing and surveying methods currently being used by archaeologists and cultural heritage professionals to explore, document and manage landscapes and the heritage within, based on the work of all project partners between 2010 and 2015 and presented as oral talk or poster at the Frankfurt conference. The conference would not have been possible without the help of numerous people. My sincerest thanks go to all project partners for their contributions, to the Department of Archaeology of the Goethe University Frankfurt, namely to Ute Mangold-Scherer for her great support, and to Alexander Rick and his team from the Frankfurt University media lab for making it easily possible that the presentations were available online soon after the conference. [http://www.arcland.eu/news/1845] I would also like to thank Pete Horne (English Heritage) for editing the texts of this publication and Ian McCarthy (The Discovery Programme, Dublin) for his work on this book, for the layout of the ArcLand website as well as for the ArcLand travelling exhibition “Traces of the Past” [http://www.arcland.eu/outreach/exhibitions/1641].

Many thanks also to my colleagues at the Roman-Germanic Commission in Frankfurt (Christoph Andreas Kracht, Dominic Mernberger, Eleonore Pepe, Kai Radolf, Nadine Baumann, Nina Dworschak, Ruth Beusing) as well as to the student volunteers (Jonas Gregorio de Souza / Exeter University, Katherine McCormack / University College Dublin, Łukasz Banaszek / Poznan University, Mikolaj Kostyra / Poznan University, Roman Brejcha / Platen University, Sarah Delaney / University College Dublin), all of them helped so efficiently and joyfully before and during the conference.

The conference not only marked an important milestone of the project’s lifespan, it also was the official start of the ArcLand successor, ArchaeoLandscapes International (http://www.arcland.eu/news/1846). Reflecting the interests of the International Society for Archaeological Prospection (ISAP) and Aerial Archaeology Research Group (AARG) memberships and those of the current ArchaeoLandscapes Europe network, the central aim of ArchaeoLandscapes International is the promotion of non-destructive prospecting methods for archaeological investigations. In particular it:

- considers all methods of remote sensing, aerial archaeology, ground-based geophysical and geochemical prospection and surface survey;
- is concerned with archaeological investigations on all scales, from monuments and sites to landscapes, along with their analysis and interpretation;
- has an international remit in archaeological research and membership;
- is a liaison partner for other organisations and institutions with regards to archaeological prospecting in landscape archaeology;
- promotes the use of archaeological prospecting as a method of archaeological enquiry;
- facilitates education in these methods;
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- An image-based digital retrospection of a demolished village Breginj and its landscape change analysis
  
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AERIAL PHOTOGRAPHY AND AERIAL ARCHIVES
Introduction

For many years now, Leuven University (KU Leuven) has been carrying out traditional aerial archaeology. This has led to the discovery of many new archaeological sites, especially in the fertile loess belt in central Belgium.

In the last decade, a prevalent growth of interest in archaeological heritage management has prompted the discussion of how to improve insights into the processes that have formed the natural and cultural ecosystem of which these archaeological sites are a part. Aerial archaeology has also proved to be very effective for the updating of inventories of archaeological sites, for the appraisal of the archaeological potential of wide areas, for the search for specific marks on previously detected sites, for the identification of features on older aerial photographs and for the periodic assessment of sites, monuments and historic landscapes.

Aerial archaeology at the Leuven University (Belgium)

A large number of crop marks reveal a complex site, probably with elements from different periods.

A nice surprise at the end of the day: a series of ring ditches indicate a number of elite graves.

Archaeology in rural areas

Although conditions for the proper management of the heritage in a rural environment need to be improved in future, we are happy to note that the management of archaeological sites is now being given priority and that a variety of new measures and tasks are being devised to prevent information from classified sites and as yet undiscovered sites from being lost.

In the past, the main interest was focused on buildings’ heritage but we are pleased to see that nowadays more attention is paid to the management of larger areas, not only for the benefit of the individual remains but to make a link between the various interests of economic activities, the enlargement of residential areas and the preservation of biologically important areas and historical landscapes.

Partnership with local services

With this poster, we want to illustrate a few of our more recent discoveries in the eastern parts of Flanders and especially the positive results of our cooperation with the Inter-Municipal Archaeological Service PORTIVA, which is active in a vast region in the heart of the Hesbaye loess area. Large scale agricultural activities in this highly fertile county cause vast erosion processes on the tops and slopes of the undulating landscape, and archaeological sites are in extreme danger of rapidly disappearing.

The enhanced exchange of information about archaeological sites between both our services has proved to be very fruitful and is an example of a more effective management of Belgium’s archaeological heritage.

BELGIUM

Location

1 Flanders, Tienen

Historical sites are often threatened by the expansion of modern infrastructure.

Erosion processes are a serious threat to the preservation of archaeological remains in the subsoil, especially in the Hesbaye loess zone.
Aerial archaeology in Denmark

Lis Helles Olesen
1. Holstebro Museum, Denmark

Introduction

In 2008 Holstebro Museum secured funding for a research project aimed at examining the potential for aerial archaeology in Denmark: An aerial view of the past – Aerial archaeology in Denmark. The project ran until the middle of 2013, but further funding was secured, enabling it to continue until 2018. Total funding is around €1.33 million. The timing of the project proved fortunate in that, in 2009, it could become integrated into the ArchaeoLandscapes Europe project.

A brief presentation of the project: An aerial view of the past – Aerial archaeology in Denmark

The aim of the project is to draw attention to and to investigate the unique potential inherent in aerial archaeology with respect to research, communication and education and the planning process. It focuses on several different aspects:

- Aerial surveys
- Studies of existing vertical photos
- Modern technology, e.g. Airborne Laser Scanning
- An overview of aerial photos covering Denmark
- National and international collaboration with institutions such as the International Aerial Archaeology Training School
- Monitoring of scheduled ancient monuments from the air
- Communication and education

The first five of these will be briefly outlined below.

Aerial survey

The aspects that have received greatest emphasis are aerial surveys and studies of vertical photos. A very brief account of the results of these is given here. Between 2008 and 2012, 745 sites showing marks of prehistoric and historic features were recorded (Fig. 1). The localities span the period from the Mesolithic to recent times, with the majority being from the Iron Age/Viking Age. 84% of the recorded localities were previously unknown localities (Fig. 4). As an example the ploughed-down burial mounds will be mentioned here.

Studies of vertical photos

Nine areas, each of about 105 km², were selected with the aim of investigating and demonstrating the amount of cultural heritage that can be obtained through studies of aerial photos. All the areas were examined on four different aerial photo series and on the hillshade model from the Danish Elevation Model. Three of the series are in black and white and were photographed in spring, while the fourth is in colour and was photographed in summer. A total of 2746 localities have been recorded of which 61% were previously unknown (Fig. 4). As an example the ploughed-down burial mounds will be mentioned here. They comprise 86% of the localities and represent an increase of 34% relative to existing records. The increase is of approximately the same magnitude on clay and sandy soils, with an average of just less than one new burial mound per km². If these data are representative, this situation corresponds to the detection of around 33,400 new ploughed-down burial mounds in Denmark.

Airborne Laser Scanning

The Danish Digital Elevation Model is freely available on the Internet. It has considerable research potential, but with only 0.45 points recorded per m², also has certain limitations, for example with respect to dense conifer plantations. We wanted to investigate whether better results could be achieved with a more detailed laser scan and in October 2010 an area of 45 km², which included both open land and forest, was surveyed. On open land, no better results were obtained with respect to ploughed-down features. In the woodland, on the other hand, a wealth of new cultural-historical traces was revealed, which were not visible on the Danish Digital Elevation Model. In particular, these included small burial mounds, details of larger burial mounds, sunken roads, Celtic fields and WWII structures. This excellent scan still has much unexploited potential and we are happy to make it available to others who wish to continue work on it.

Overview of aerial photos in Denmark

The registration of aerial photos in the archives has a high priority in the ArchaeoLandscapes project. In our project we produced an overview of aerial photos covering Denmark. It was published in book form in 2011, together with a history of aerial archaeology and its applications.1 A large body of material is available for Denmark: most of it is kept in the Royal Library in Copenhagen. In 2010, it contained around 5.5 million aerial photos; 2 million verticals and 3.5 million obliques. A remarkable number of series providing national coverage of Denmark is available on the Internet: Luftwaffe 1944, RAF 1945, US Air Force 1954, COWI 1995, 1999, 2002, 2004, 2006, 2008, 2010, 2012 and the Danish Digital Elevation Model.2

Aerial Archaeology Training School

We organised an Aerial Archaeology Training School, running from 2nd-8th July 2011, in partnership with ArchaeoLandscapes and LAND Aerial Archaeological Network Denmark. It brought together nine tutors and 16 students from 11 different countries across Europe in an intensive programme of ground-based instruction and in-air experience above the archaeologically-rich landscapes of western Jutland (Fig. 5).

Over five days the students were introduced to the general principles of archaeological aerial survey, as well as the basic procedures of photo interpretation and mapping for communication with the general public, researchers and planners. All students also took part in supervised flights from Stauning Airport, seeking out and photographing some of Western Jutland’s distinctive prehistoric, Viking and later archaeological sites. Throughout the training school emphasis was laid on the ways in which aerial evidence can broaden professional and academic understanding of past societies and capture the imagination of the general public, helping them appreciate the value of the often fragile traces of the past that lie half-hidden in the landscape around them.

Conclusions and future perspectives

All our results indicate that the use of aerial photography in archaeology has great potential in Denmark. The project will carry out further aerial surveys and studies of vertical photos, national and international collaboration, communication and education initiatives, geophysical investigations and the production of an exhibition.

Notes:

Literature:

Fig. 1: All 745 sites located in our aerial surveys in the period 2008-2012 are marked with a red dot. Drawing Ebbe Schlosser Mauritsen.

Fig. 2: Pithouses with surrounding fence and entrance. Hyllerslev, southwest Jutland. Photo 0577, 22.07.13, Lis Helles Olesen.

Fig. 3: An Early Iron Age linear village which presumably was built on either side of a road. Brv Gårde, western Jutland. Photo 0471, 01.07.10, Lis Helles Olesen.

Fig. 4: Observed traces from studies of verticals organised by feature/structure type.

Fig. 5: All the students and tutors at the Aerial Archaeology Training School. Photo Velling Højskole.
An image-based digital retrospection of a demolished village Breginj and its landscape change analysis

Tatjana Veljanovski1 / Žiga Kokalj1 2 1. Research Centre of the Slovenian Academy of Sciences and Arts / 2. Centre of Excellence for Space Sciences and Technologies

Introduction
The mountain village of Breginj was for centuries the centre of a self-sufficient and highly organized local community. Its extraordinary folk architecture was protected as a first category cultural monument. This lively area bordering Italy was subject to politically driven decisions after it was severely struck by two successive earthquakes. The way of life has changed and the situation has left striking evidence in the landscape evolution of the past decades.

With this contribution we aim to raise awareness and show the potential of historical photography and a digital image-based retrospection of places that may no longer exist, but have left important traces in human and landscape history. Having in mind the retrospection of a lost village and its relevance through time we used historic aerial photographs and two different approaches to obtain:

• a detailed 3D village reconstruction (with SfM modelling) and
• a landscape change study (with object-based image analysis).

Breginj and image-based digital retrospection
Cultural heritage is frequently photographed. It may be destroyed or altered, and photographs become the only evidence of its existence and modification. In the case of Breginj, the village completely changed its location and structure. This, together with the general depopulation of rural areas, gradually resulted in a change in the way of life and the use of the surrounding land.

Our question was how, where, and to what extent can the landscape change in a few decades? Modern image processing techniques support the production of a variety of digital approximations of historical objects. Digital reconstruction of demolished Breginj is important because it:

• enables a spatial and temporal retrospection of the historic processes, and the preservation and dissemination of the memory of this once remarkable village, and
• gives measurable evidence of the effects of post-earthquake reconstruction and political decisions on the structure and function of the landscape and people.

Structure-from-Motion derived digital model
A series of six vertical aerial photographs was taken after the first earthquake in May 1976 to observe the destruction. We used these images to create a digital reconstruction of the demolished village using the Structure-from-Motion technique. The photographs were taken in a single flight line and every point on the ground can only be seen on a maximum of three images, which is not the best arrangement for this type of reconstruction. Despite this, two detailed elevation models were produced: the first from full resolution images and the second from reduced resolution images (by 55%). The latter model better defines the buildings despite the same processing settings. Because the reconstruction is only based on aerial photographs so far, the computed model is not of the best quality, but it still provides a good basis for a retrospection of the settlement.

ObIA land cover change
Object-based image analysis (ObIA) is an approach to semantically analyse imagery that was developed for the classification of very high resolution imagery. Image-objects represent ‘meaningful’ entities or scene components that are distinguishable and form the geographical space evidenced in an image. ObIA consists of two distinct steps: segmentation (deletion of homogeneous zones) and classification (semantic grouping of segments). The result is a classified geographical space, according to its natural elements, land cover or land uses. ObIA of imagery from different periods enables quantitative and contextual tracing of changes in the landscape.

Conclusion
Photographs of the old village of Breginj can no longer be taken. But 3D reconstructions based on historic images might add to cultural resource management and services. A successful retrospection of landscape change and social processes demonstrates that aerial imagery can be a valuable resource for geographers, historians, and archaeologists.

Landscape changes around Breginj from 1975 to 2011. The village itself was relocated and the buildings (in red) are now much more dispersed. Pastures, meadows (both yellow), and fields (orange) are shrinking and giving way to forests (green).
Archaeological landscape in Romania: 10 years of surveys and documentation

Introduction

It is now 10 years since the former Institute for Cultural Memory-CIMEC (www.cimec.ro), today part of the National Heritage Institute (patrimoniu.gov.ro), started aerial and cartographical surveys in order to improve the National Archaeological Record (www.cimec.ro), mainly in Southern Romania along the Lower Danube Plain, Central Dobrudja, and up to Sub-Carpathian Hills but also in Northern Romania, Botoșani County. We have established the geographical location and context for known archaeological sites, identified unknown features and recorded changes in the landscape, combining aerial surveys with the study of historical maps and GIS techniques.

The main activities were: aerial photo investigation (25 flights & 7500 images), image interpretation and digital archive creation, using aerial imagery to map 3000 archaeological sites, updating the spatial distribution of settlements in Romania (13,756 places) and creating a cooperation network of Razelm Lake.

The operation will continue until the entire collection is completed. The photo archive is accessible on-line through a web site and a dedicated web GIS application entitled “Landscapes” (www.persaj-archeologie.nl).

After implementing the pilot project Mostiștea Valley (2005-2007) under the auspices of the “European Landscapes-Past, Present and Future” European project, we continued the aerial investigation of the Southern Romanian Plain (Neajlov, Argeș, Teleorman, Ialomița and Olt rivers), in Ilfov and Prahova Counties, along the motorways in construction (A2 Bucharest-Mediașa-Constanța, A3 Bucharest-Ploiești and Sibiu-Oraștie-Deva) and between the Danube and Black Sea in Central Dobrudja, in order to enliven the National Archaeological Map of Romania (map.cimec.ro). The main outcome is a database that contains almost 4000 processed photos from around 7500 photos taken from air. We assigned precise geographical coordinates and metadata such as: the nearest settlement, date of flight, county, mark type, general observation and landscape changes.

Using aerial orthophotoplans for sites inventory: The archaeological repertoire of Botoșani County

We contributed to the county sites inventory. Our main activity was to map archaeological sites using both topographical maps and orthophotoplans produced by the Topographic Military Directorate. All the 1809 sites were vectorised in a GIS project (using polygons as geometry) and were recorded in the National Archaeological Record. Additional resources and techniques were used: satellite imagery and field surveys. Information was provided about administrative location, state of conservation, levels of natural or human risks, type of habitation, time span and bibliography.

The project was carried out in partnership with Ph.D. Octavian Liviu Șovan from Botoșani County Culture Directorate. The outcome was a volume accompanied by a DVD with topographic maps of each administrative entity, scale between 1:20,000 and 1:25,000, obtained both by vectorising settlements, roads, contour lines, rivers and lakes from orthophotoplans, and using different DEMs (www.cimec.ro/arheologie/repertoriul-botosani/index.html). Copies of the volume were sent to local authorities and schools to be used in heritage conservation and education programs.

A successful project: Archaeological landscapes. Outlook, history and evolution (2014)

The project was developed by the National Heritage Institute (CIMEC Department) in partnership with the National History Museum of Romania, University of Bucharest (Geography Department), the Topography Military Directorate and UMR 7041 ArScAn-Équipe Archéologies Environnementales (France). The project, funded by the Romanian Ministry of Culture, was placed under the auspices of ArcLand and supported its goals and activities by promoting the concept of archaeological landscape and its research methods within the Romanian scientific field, and by raising awareness of the intrinsic value of heritage among specialists, historians, cultural operators, students and the wider public.

The final event was an international conference entitled “Approaches to Archaeological Landscapes. Tools, Methodology and Case Studies (22nd-23rd October 2014, Bucharest). The event brought together 30 specialists, foreigners and Romansans, among them also ArcLand members, who tackled the topic of the archaeological landscape concept, displayed different methodologies and shared their experience in the field of landscape studies. An aerial photos exhibition hosted at the National History Museum of Romania accompanied the event.

The project will continue to take into consideration the complex evolution of the territory, modern approaches and cutting-edge technologies, to provide a comprehensive and accurate representation of the area, serving the needs of the present and the future.
Archaeology from above: The Aerial Archaeology Research Group

Rachel Opitz

1. Aerial Archaeology Research Group / CAST, University of Arkansas, USA

Introduction

What is it about the airborne perspective that fascinates us? Aerial photography was introduced into archaeology early in the 20th century as formal field methods were crystallizing, and continues to evolve alongside the wider discipline.

The view from above has become central to regional and landscape studies, monitoring and heritage management efforts, research on the rural world, and the integrated study of the remains of past human and natural activities, events and processes. Aerial archaeology plays an important role in today’s and the future’s archaeologies.

A brief (unofficial) history of AARG

AARG, the Aerial Archaeology Research Group, grew out of a group of working archaeologists interested in the problems of aerial information – description, depiction, interpretation and integration. Early years focused on meetings and discussions of the interpretation of air photos, drawing conventions for mapping and classifications of features, and integration of this information with the broader archaeological record. While debate on these ideas continues, the methodological remit of AARG has expanded from photos to any method of prospection carried out from an airborne perspective.

A brief (unofficial) history of AARG

A brief (unofficial) history of AARG

A brief (unofficial) history of AARG

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Topics at meetings range from the practical and technical, touching on questions of management, image processing, and data integration, to the theoretical, exploring the intersections of the airborne methods with landscape archaeology, environmental archaeology, and keeping people in the picture. AARG, has been going for over 30 years, expanding from a membership primarily from the UK to broad participation across Europe. As it has evolved, taking in new methods and developing a more reflexive bent, it remains focused on practice, occasionally irreverent and with its feet ever so slightly off the ground.

AARG and ArcLand

ArcLand and AARG share a core interest in past and present landscapes, and in expanding access to and understanding of the tools, methods, and frameworks for studying landscape through survey and remote sensing. As documenters and interpreters, AARG members are active participants in the ArcLand network and governance, promoting aerial methods and the associated large scale, integrationist approaches. AARG and ArcLand have co-sponsored several workshops and publications. AARG members are found across the ArcLand working parties, and contribute to best practices guidance, work with archives that are repositories for information on much of Europe’s pre-industrial agriculture state, engage in outreach to raise public awareness of landscape heritage and aerial archives, and promote the exchange of ideas and expertise across national and regional divides.

AARG activities

AARG’s Annual Meeting is the group’s main event, providing an opportunity to share ongoing projects and current practices, reflect on the direction of the field, and introduce new practitioners to the community. AARG engages in training and outreach activities, holding or contributing expertise to flying schools and workshops on topics including airborne laserscanning, image interpretation, and integration of aerial survey with ground based fieldwork and desktop mapping exercises. AARG supports the publication of monographs and articles relevant to the group’s interests, as well as producing a newsletter, promoting new research and best practices in the field.
Defence in the rhythm of Richard Wagner’s music: The last days of ‘Fortress Küstrin’

Grzegorz Szalański / Grzegorz Kiarszys
1. Szczecin University, Department of Archaeology

Introduction
Kostrzyn (German Küstrin) is located at the confluence of the Warta and the Oder rivers. Since 1537 the town was gradually transformed into a mighty fortress. The stronghold of Küstrin gained its final shape in the second half of the 19th century. At that time the spatial plan of the town took on its characteristic shape of an irregular hexagon surrounded by six bastions.

At the turn of the 20th century the fortifications lost their military meaning and were gradually dismantled. That situation substantially changed on 28th of November 1944, when general Heinz Guderian ordered new fortification works. On 25th of January 1945 Küstrin was officially declared a stronghold of the Third Reich. It became the ‘Gates to Berlin’, an important strongpoint of the Nibelungs’ Line (German Nibelungstellung).

The Nibelungs’ Line was a romantic metaphor inspired by Germanic mythology.

However, the heavy fighting for the old part of the town continued. Finally, on the 30th of March 1945 the fortress of Küstrin was surrendered.

The aftermath
The siege of Küstrin lasted for almost 60 days. 637 German soldiers were killed and 5995 were considered to be missing. About 6000 Red Army soldiers died in this battle. The fall of Küstrin opened the way to Berlin. The Red Army troops were only 80km from their final destination - the capital of the Third Reich. The last, ruthless contest for the title and the glory of the conqueror of Berlin had begun between Marshal Zhukov and Marshal Koniev.

Artillery barrages and heavy street fighting turned Küstrin into rubble. After the war the town was placed under Polish administration. The decision was made to not rebuild the old town. The bricks from demolished buildings were collected and transported for the rebuilding of Warsaw. For many years Kostrzyn was a restricted area because of a military base for rocket and engineering troops located within the New District of town.

The fall of the fortress
Küstrin was located in a very convenient defensive position. The proximity of two major rivers and vast marshlands surrounding the town produced very difficult conditions for the approaching Red Army soldiers. During the winter time the frozen Oder river was an advantage to the assaulting Red Army soldiers. However, the ice was too thin to allow tanks and mobile rocket launchers to cross the river.

The strategic situation of Küstrin changed on the 31st of January 1945 when Soviet troops gained a bridgehead on the western bank of the Oder river, about 17 kilometres to the north of the town, in the region of Kienitz village. During the next few days another lodgement on the western bank of the Oder river was captured. It was situated about 16 kilometres to the south of the town, near Górzyca village. With the beginning of spring the ice melted and the level of the water table grew, covering the bridges built by the Red Army troops with a thin layer of water (25-30cm). For a while they became ‘invisible’ to the Luftwaffe pilots.

After over a month of fighting, in the first half of March 1945 the Red Army troops captured the New Town district of Küstrin. Josef Stalin was convinced that the siege was over. He congratulated the soldiers in the Order No. 300 and presented some of them with badges. Soviet propaganda started to celebrate the victory.

Fig. 1: The Fortress of Küstrin. German aerial intelligence photograph taken on 13th of March 1945 (© TARA).

Fig. 2: The example of the wooden bridge built by the Red Army engineering troops within just several days (the photography on the left was taken on 11.04.1945, the photography on the right was taken on 14.04.1945) (© TARA).

Fig. 3: System of trenches built by the Red Army soldiers on the western bank of the Oder River (photography taken on 08.04.1945) (© TARA).

Fig. 4: On the left the German topographical map of Küstrin (Messtischblatt from 1936). On the right the soviet map of Küstrin from 1949.

Fig. 5: The ruins of the Fortress Küstrin in 1975. The only cleaned up area is the cemetery of the Red Army soldiers located within the Bastion König (© CODGiK).

Fig. 6: Kostrzyn (© TARA).
Introduction

One of the eight collaborative actions of ArchaeoLandscapes (Action 5) is to secure the better exploitation of aerial photographic archives across Europe, recognising that their potential for landscape and archaeological studies is largely un-assessed, and that their role in documentation and conservation is generally poorly developed. While it was recognized that the full exploitation of these archives is a long-term objective, this contribution presents a summary of what has been achieved for Action 5 so far, and what has been learnt to date that might inform future progress.

What have we achieved?

Action 5 activities have focussed on promoting awareness amongst a range of archaeological, landscape and heritage professionals, and on sharing experience and skills. Recognising that uneven knowledge of where aerial photographs might exist is a major limitation to their exploitation, an ‘Archives Survey’ was launched to identify such resources. The index achieved is a first step, reflecting those areas where the survey was actively promoted. Guidance for using particular archives has also been developed, including guidelines to accessing and using the more than 500,000 images in the known collections of World War I aerial photographs (http://www.arcland.eu/archives/wwi-archives). Conferences and workshops have been held with the aim of sharing knowledge and experience, reaching out to new audiences and developing networks. There include ‘Recovering Lost Landscapes’ (Belgrade, November 2013), ‘Patterns, Processes & Understanding’ (Poznan, April 2014), and ‘Conflict landscapes and archaeology from above’ (Ypres, May 2014), selected papers from which are being published (below). Publications of work with historic aerial archives across Europe, recognising that their potential for landscape and archaeological studies is largely un-assessed, and that their role in documentation and conservation is generally poorly developed.

Lessons learnt

These activities have reinforced the value of historical aerial imagery for documentation/detection and landscape history, and increasingly, with developments in software, as sources of 3D data. However, there has also been a growing appreciation of the difficulties in developing use of archives. Access is not always easy for a variety of reasons, including military secrecy, costs and the commercial imperatives of some custodians. Finding aids and the metadata required to undertake a first-stage assessment of imagery for a particular purpose may not be available or even exist. This can make the exploration of an archive very time-consuming and expensive, and may result in disappointment. Furthermore, most aerial photographic archives were not created to serve the archaeological profession, and may result in disappointment. Furthermore, most aerial photographic archives were not created to serve the archaeological profession, and may result in disappointment. Furthermore, most aerial photographic archives were not created to serve the archaeological profession, and may result in disappointment. Furthermore, most aerial photographic archives were not created to serve the archaeological profession, and may result in disappointment. Furthermore, most aerial photographic archives were not created to serve the archaeological profession, and may result in disappointment. Furthermore, most aerial photographic archives were not created to serve the archaeological profession, and may result in disappointment.

This has major implications for the strategies to promote the better exploitation of such archives, as these require recognition of the realities of dealing with archives on the one hand, and a consideration of the wider context of our own work, on the other. Amongst the issues for consideration is that archaeological projects often deal with relatively small areas, and that there is a real cost/benefit assessment to investing in cataloguing to create access. Investment by an archive in individual projects may have limited benefits, for example if that requires extensive work on uncatalogued material, and overall this compounds the fact that archaeology usually has little money and therefore limited leverage.

This general situation begs the question of whether archaeology can generate a better sense of common purpose with archives and other interested parties by considering the wider context of our work. Such an approach is partly about the potential role of large-scale, well-funded projects. To secure such projects demands greater archaeological engagement with broader-based agendas, almost certainly needs to be progressed at regional or trans-national scales and requires wider context for the archaeological imperatives, for example, in that provided by the European Landscape Convention and broad-brush landscape characterisation and management, neither of which has attracted much interest amongst archaeologists (see http://hila.rahms.gov.uk/ for an example of such an approach. However, as an approach that recognises landscapes as dynamic and creates broad-brush large area mapping, it is not only a tool for management and developing land use policy and spatial planning, but also provides an overview of landscape history, land use patterns and their impact on archaeological detection. Thus, it gives valuable context for much of what is done in the framework of landscape archaeology that could help generate greater leverage and funding through larger projects that may provide a cost-effective stimulus to mass-cataloguing or digitisation. For the specific objectives of ArcLand’s Action 5, it is also an approach that promotes the importance of the earliest aerial photographs of Europe as an important ‘baseline’ from which to consider impacts of later landscape change. Finally, it is worth noting that investment is necessary to preserve and curate these collections as historic assets in their own right.

Historic aerial photographic archives: Reflections and lessons learned

Dave Cowley1

1. RCAHMS (from 1st October 2015 – Historic Environment Scotland)

Introduction

One of the eight collaborative actions of ArchaeoLandscapes (Action 5) is to secure the better exploitation of aerial photographic archives across Europe, recognising that their potential for landscape and archaeological studies is largely un-assessed, and that their role in documentation and conservation is generally poorly developed. While it was recognized that the full exploitation of these archives is a long-term objective, this contribution presents a summary of what has been achieved for Action 5 so far, and what has been learnt to date that might inform future progress.

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In Flanders earth: WW1 aerial photographs in a museum and landscape context

Birger Stichelbaut / Annick Vandenbilcke / Piet Chielens

1. In Flanders Fields Museum (IFFM), Ypres (Belgium)

Introduction

One of the focus points of the In Flanders Fields Museum is the conflict landscape of the First World War. Now that the last living witnesses who experienced the horrors of the First World have died, this war landscape is becoming the real ‘last witness’ of the conflict. During the First World War, millions of aerial photographs were taken by all combatant countries.

Those provide an unparalleled record of both the progress of the war and the destruction of the landscape. In the framework of the ArchaeoLandscapes project the In Flanders Fields Museum has explored the potential of using these photographs in an interactive museum setup and a mobile application. The goal of both applications is to learn about this landscape and to present it visually for visitors to the region.

In Flanders Earth

The first application is called In Flanders Earth (IFE) [Fig. 2 & 3]. It is essentially an interactive application highlighting the bird’s eye view of the conflict landscape of the First World War. It uses aerial photographs as a medium to provoke thoughts about the scale and intensity of this war in Belgium. The application consists of four large multi-touch screens that visitors can use to explore the war landscape in an interactive and dynamic manner. The content of IFE draws upon research carried out within the ArchaeoLandscapes project, where large numbers of historical aerial photographs were selected in archives, digitized, and georectified in a geographical information system.

The interface is inspired by Google Earth™ and combines three layers of information [Fig. 3]. An important layer is the present day aerial photo. A second layer of historical aerial photographs shows the war landscape on a regional scale. The third layer consists of hotspots, marked by large red icons, which are a selection of visually interesting case studies told by a sequence of aerial photographs and other historical documentation.

Visitors can navigate to the area they are interested in by clicking on the inset map, use the integrated address search engine or manually navigate on the present day aerial photo using multi-touch gestures. On the lower right hand side of the screen there are constantly updated thumbnails of aerial photographs that lie within the extent of the view. As soon as one clicks on a preview, the aerial photo is projected on the modern day aerial photo. One can zoom in and look at details of interest or can compare photographs of different dates. For a more in depth paper focusing on IFE see Stichelbaut & Chielens.

Mobile application

Within the framework of the ArchaeoLandscapes Europe project a mobile app is currently being developed. Visitors will explore the landscape in a number of walking routes guided by mobile devices featuring historical aerial photographs in combination with their position on the photograph. They will be able to walk on top of the trenches, see and experience how close the enemy frontlines were located to each other and be able to cross no man’s land – all in a landscape where the vast majority of the visible surface expressions of the war have long-since been buried.

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Introduction

One of the main catalysts for the foundation of the Institute of Archaeology was a systematic discovery and survey of Iceland’s heritage assets. At the time, in the mid-1990s, the number of heritage assets in the country was by no means clear. The state-compiled sites register (Friðlýstar fornminjar) included less than 500 sites, and continued instances of damage due to development and environmental change made clear the need for a comprehensive understanding of Iceland’s historical landscape. Beginning in Eyjafjörður, in the north of Iceland, the Institute began a programme based on desk-based survey, aerial reconnaissance and finally detailed description of every location in the field.

The Institute has located ca. 100,000 sites so far, many of which were entirely unknown and undocumented beforehand.

ÍSLEIF: Recording Iceland’s heritage

The ArcLand years

The number of known sites has increased substantially during the ArcLand project years. The database contained just over 86,000 sites in 2007 and has grown by 12,800 sites since. The increase has been influenced by the increased reliance on remote sensing methods, most notably in recent years by the use of UAV aerial photography.

The information collected has formed the foundations for a number of archaeological research and outreach projects. Of these the current major project is the on-going investigations of the long-term ecodynamic change in Mývatns-sveitand Skáftártunga (Comparing Island Ecodynamics), not to mention dozens of archaeological investigations conducted by the Institute. The reports on the ÍSLEIF survey fieldwork can be downloaded at our website. A pilot version of an online GIS where the survey and excavation data can be browsed and downloaded is underway and available online.

Orri Vésteinsson (Top) and Ágústa Edwald (Lower) record archaeological features for the Ísleif project.

A map of Iceland showing recently discovered sites in red.

A detailed map of the recently surveyed Kelduhverfi with some major site types highlighted.
Mapping Cretan heritage from the air: The challenge of mountainous landscape

Gianluca Cantoro¹
1. GeoSat ReSeArch Lab - IMS-FORTH (Crete, Greece)

Introduction

Despite the long and consolidated tradition of studies and researches in aerial archaeology, the challenge of mountainous landscapes still seems to be under-explored. Special tools are often required together with, perhaps, a different way of capturing the area of interest. Targeted flights over Eastern Crete (Greece) showed the high potential of the bird-eye view, revealing at the same time the difficulties in accurate photo-location. This presentation shows some results of that particular campaign and the important contribution made by the free software AutoGR-Toolkit, developed at the GeoSat ReSeArch Lab, IMS-FORTH.

Challenging mountains

The island of Crete, the largest of the Greek islands and among the largest in the Mediterranean Sea, is a mountainous piece of land with an elongated shape. Also described as a “mountain emerging out of the sea” (Matton 1957, 13), its main mountain range (about 52% of the entire territory) crosses the island from its eastern to its western edge. This main mountain range, taking up around 52% of the entire island, is named the Akrotiri or Kedrass Mountain and among the largest in the Mediterranean.”

And if this is a problem when dealing with almost flat fields, this becomes even more complex in mountainous rocky landscapes, since the more the field is corrugated, sloping or with tall features (far from being a rare case in aerial archaeology), the more ground control points are needed. And if the images to be georeferenced are in hundreds or thousands, as is the case when using UAV platforms for photogrammetric documentation (Remondino et al. 2011), an automated system may provide undeniable benefits in terms of speed and accuracy (Cantoro and Sarris 2012), AutoGR-Toolkit (Fig. 2) (http://www.ims.forth.gr/autoGeol/), developed by the GeoSat ReSeArch Lab - IMS-FORTH under the framework of ArchaeoLandscapes Europe, aims at helping amateurs and professionals dealing with large quantities of photographs or requiring high standards of accuracy in georeferencing, to reach their goal in no time.

A practical application of this software, using the thousands of photographs collected in the first extensive aerial archaeological survey in Crete - Greece (http://photogrammetry.ims.forth.gr/AerialRemoteSensing.php?proj=Crete) allowed us to identify numerous new sites and photogrammetrically document known ones with great accuracy. The footprint of each photograph – enriched with archaeological photointerpretation – is being integrated and implemented in a WEB accessible geodatabase built at the hosting institution (Fig. 3).

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Fig. 1: Printhesis IIias, Temenos – Heraklion, Crete (Greece). Defensive walls of the Byzantine Castle built by Nikforos Foka in 961 AD. In red the profile of the hardly accessible walls undermined by the collapse, highlighted in blue. (PH. Gianluca Cantoro).

Fig. 2: Screenshots of the main tools inside the free software AutoGR-Toolkit: Main menu (Top left), GGrab (Lower left), AutoGR-SIFT (Top right) and Photogrammetry-GuiZ (Lower right).

Fig. 3: Two previews of the working platform for the creation of the WebGIS. In the top screenshot, two flights – with their paths, photo stations and footprints – are presented on a Google Earth background. In the lower, image selection with photo-info-panel (including camera pitch) and preview.
The Blackstairs Mountains: South-East Ireland: Investigating the archaeological potential of the Irish uplands

Introduction

The Blackstairs form a chain of high ground in South East Ireland covering parts of counties Carlow, Wexford and Kilkenny. These uplands are not only visible at ground level because of their dramatic rise from the low-lying Barrow Valley, but also from above due to land management in recent decades which has been one of abandonment, rough grazing and forestry planting. There had previously been no archaeological investigation into these uplands beyond basic recording. A history of burning episodes on the mountains, both controlled and accidental, has sometimes stripped the peat down to the bare bedrock. Such an event occurred in 2010 when burning over 2km² revealed many previously unidentified features including hut sites, cairns and pre-bog field walls. 70 new sites were recorded here through fieldwalking where only 16 had been recorded previously (Fig. 1). Was this an isolated occurrence or could it be replicated across the entire mountain range?

Methodology

To investigate the entire mountain range, a more rapid survey approach was needed. Historic aerial photographs and modern remote sensing techniques were unavailable and focus switched to open source imagery such as Bing and Google Earth. Bing imagery, in particular, proved to be an invaluable source revealing most of the newly identified sites. Desk-based analysis was followed up by 100% ground truthing, kite aerial photography and fieldwalking in targeted areas (Fig. 2). Ground truthing highlighted the importance of follow up confirmation, especially in upland landscapes. Some of the mapped features were revealed to be modern or natural, which most often occurred at rock outcrops or in extremely dense heather. The imagery was not detailed enough to pick up smaller features, especially cairns, which were later recorded through fieldwalking. The work was supported by local engagement and a citizen science programme both of which enhanced the understanding of what has been found.

Summary of results

The Blackstairs work has revealed 172 new sites (112 Bing, 10 Google Earth, 50 Fieldwalking) in the upland zone (200mOD+) where only 38 had been previously recorded (Fig. 3). These included hut sites, enclosures, sheepfolds, trackways, field systems, cultivation ridges, cairns, house structures and turf cutting remains (Fig. 4).

Local groups further assisted in the interpretation and modern understanding of many features. Uplands can be considered as unspoiled by humans and are designated as a Special Area of Conservation despite a poor understanding of the archaeological remains. Intensive survey has shown that this landscape was settled, moved through, farmed and exploited from prehistory to the modern period. Most significantly desk-based research, local engagement and fieldwork combined has demonstrated how the Great Irish Famine (1845-49), which is traditionally seen to have had little effect in the south-east, had a major negative impact on the population, settlement pattern and land-use of this region.

Future research

This project adds to the slowly increasing number of projects targeting Irish uplands and recognising their research potential. A case study using LiDAR and multispectral satellite imagery on known features in a similar landscape, the Dublin Mountains, revealed little more than was visible in open source imagery or fieldwalking due to the dense vegetation cover (Fig. 5). Future research would include targeted environmental analysis to gain a better understanding of the timing of its onset and the historical vegetation cover. Excavations may provide a tighter chronology especially for features which could date to any period (e.g. hut sites). Periodical burning episodes will be monitored into the future and exploited in order to capture as much information as possible before regrowth. In the meantime, fieldwalking and open source imagery offer a valuable and cost-effective survey method in order to gain a rapid assessment of the archaeological character of these landscapes.

Fig. 1: The results of a fieldwalking survey on Dranagh Mtn. following a fire incident.

Fig. 2: The sources used to investigate the landscape centred on the remainder of a cottiers house [c. early 19th C] on Knockroe Mtn. Co. Carlow.

Fig. 3: Distribution of archaeological features in the Blackstairs following intensive investigation. The large gaps still present in the uplands are due to forestry plantations.

Fig. 4: Some Comparative LiDAR Visualisations: A. Hut Site, Kilmashogue Mtn., Dublin; B. Bing Aerial Image; C. Multi-Directional Hillshade; D. Openness (Negative); E. Principal Components Analysis (RGB); F. Simple Local Relief Model. LiDAR provided by DLRCC. Produced using Relief Visualisation Toolbox (RVT) (Zakšek, K., Oštir, K., Kokalj, Ž. 2011 “Sky-View Factor as a Relief Visualization Technique”. Remote Sensing 3, 398-415; Kokalj, Ž., Zakšek, K., Oštir, K. 2011 “Application of Sky-View Factor for the Visualization of Historic Landscape Features in LiDAR-Derived Relief Models.” Antiquity 85, 327, 263-273).
The changing Romanian landscape: The importance of archival imagery

Introduction

Archives of historical vertical aerial and satellite photography exist around the world. The images they contain were taken for a variety of purposes, but often originate in military reconnaissance. Such archives offer huge, but largely untapped, potential to advance our understanding of past archaeological landscapes.

The photographs have a number of particular advantages over more recent aerial and satellite imagery. First and foremost, they provide a unique insight into the character of the landscape across large parts of Europe as it was some seventy or more years ago before the destructive impact of later twentieth century development, whether from the increasing mechanisation of agriculture, intensive industrialisation or urban expansion. Thus, they facilitate the recognition of archaeological features that have since been erased or severely damaged. Secondly, the character of the photographs, usually consisting of overlapping runs of vertical images, provides more systematic block coverage than traditional archaeological, observer-directed aerial reconnaissance. This encourages a more landscape-focused approach, which better enables the identification of more ephemeral remains, such as roads, trackways, field systems and cultivation traces. In addition, because of the stereographic nature of much of the coverage, the photographs can be more than a two dimensional medium.

Though most countries possess their own national archives, the largest and most well-known international archives are the National Collection of Aerial Photography (NCAP) in Edinburgh, the Imperial War Museum in London, the National Archives and Records Administration (NARA) in Maryland, and the declassified intelligence satellite photographs held by the United States Geological Survey. Between them these archives hold tens of millions of vertical photographs of Europe from the First World War onwards. One of the main problems in utilising this archival photography, however, is its accessibility, which varies considerably, not just between but even within archives. Thus the US declassified satellite photography is readily accessible and can be searched online. By way of contrast, however, of the four main Second World War collections held by NCAP, only the Allied Central Interpretation Unit material covering western Europe currently has an on-line catalogue, while there are currently no readily accessible geographical finding aids for the other three collections.

Fortunately, a high proportion of the historical aerial photographs held by NARA is geographically indexed, but the finding aids are not available on-line. Two case studies from Dobrogea in eastern Romania highlight the potential of this photography. The Valu lui Traian is a multi-phase linear rampart and ditch system, with associated fortifications, whose character and date are poorly understood. Archival aerial photography (from both World Wars) and CORONA satellite imagery, in conjunction with modern observer-directed oblique reconnaissance and Romanian mapping ortho-photographs, has facilitated a re-assessment and re-mapping of the fortifications. This has clarified their distinctive characteristics, demonstrated their complex history of development and supported their interpretation as predominantly Roman in construction, analogous with frontier barriers in Britain and Germany.

The same photographic sources, with the exception of imagery from World War I, have also enabled the mapping of some 8700 burial tumuli. This has in turn facilitated the analysis of patterns of clustering of the barrows, hinting at the presence of a number of previously unsuspected settlement foci of Hellenistic and Roman date.

Fig. 1: Corona image from 1966 showing forts and fortlets at the eastern end of the Large Earthen Wall (US Geological Survey).

Fig. 2: Corona image from 1966 showing cemeteries of tumuli around the ancient town of Callatis (Mangalia) (US Geological Survey).

Fig. 3: MAPRIW photograph from 1966 showing a large fort on the Stone Wall at Cumpana [Licensor NCAP/aerial.rcahms.gov.uk].

Fig. 4: Luftwaffe photograph from 1940 showing cluster of tumuli at Fantana Mare [Licensor NCAP/aerial.rcahms.gov.uk].

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University of Foggia integrated archaeological research in Northern Apulia

Volpe Giuliano / Goffredo Roberto / Romano Angelo Valentino / Galano Marianna / Maulucci Paolo / Volpe Valeria
1. University of Foggia

Introduction

The University of Foggia equipe has carried out an integrated programme of archaeological research in northern Apulia concerning not only the flat area of the so called ‘Tavoliere delle Puglie’, but also the coastal Adriatic area and the inland mountains.

Research in the Roman town of Salapia

The Archaeological Team of the University of Foggia (directed by Dr. Roberto Goffredo, in collaboration with the Davidson College – N. C. – USA (directed by dr. Darian M. Totten), has launched a research project in the area of the ancient Lake of Salpi, which corresponds to the Saline basin of Margherita di Savoia along the Adriatic coast. The project aims to locate and study the Roman town of Salapia, partially covered by the medieval settlement of Salpi, and its port.

Two campaigns of systematic, intensive excavation and geophysical prospection have so far been conducted, in 2013 and 2014, covering 16 continuous hectares up to the edge of the lake itself. Structures of an imperial and late antique domus and evidence of a tannery, have been found during the intensive field survey and geophysical prospection on the hilltop and the coastal plain surrounding it.

Aerial archaeology in the Tavoliere delle Puglie

An intensive programme of aerial survey and analysis of aerial photos has been conducted in recent years in northern Apulia by the University of Foggia, involving many degree, MA and PhD students. The work on the huge AP archive, set up in the last twelve years, involved not only making a catalogue, but also the analysis, orthorectification and mapping of thousands of APs both oblique and vertical.