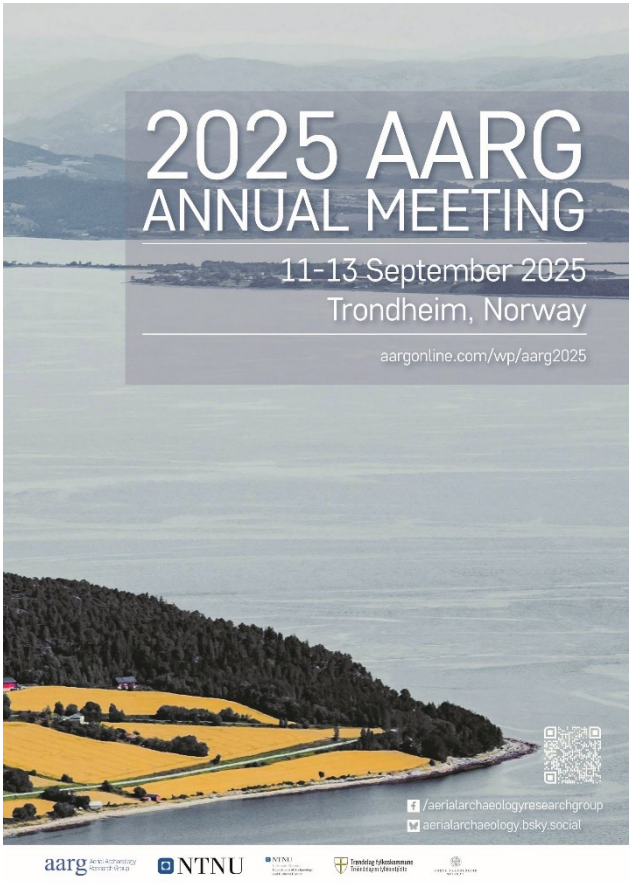

AARG 2025 ANNUAL MEETING

11-13 September 2025
Trondheim, Norway

Conference Information Booklet

Aerial Archaeology Research Group sees the aerial perspective as integral to the pursuit of key questions in archaeology and heritage, including landscape character, long term landscape change, human ecodynamics, and the experience of place. We are a community of archaeologists, heritage professionals, researchers, students and independent scholars dedicated to education, research and outreach initiatives involving the acquisition and application of data from airborne and spaceborne platforms. AARG provides opportunities for networking, mentorship, and exchanges of ideas on theories, methods and technologies related to aerial archaeology. The organization supports an annual conference, workshops, training schools, and publications. AARG is a Registered Charity no. SC023162.

The **Norwegian University of Science and Technology** (*Norges teknisk-naturvitenskapelige universitet, NTNU*) is an international oriented university with headquarters in Trondheim and campuses in Gjøvik and Ålesund. NTNU has a main profile in science and technology, a variety of programmes of professional study, and great academic breadth that also includes the humanities, social sciences, economics, medicine, health sciences, educational science, architecture, entrepreneurship, art disciplines and artistic activities. The university's root goes back to 1760 with the foundation of Det Trondhiemske Selskab (Trondheim Academy). A merger in 2016 made NTNU Norway's largest single university.

NTNU University Museum, Department of Archaeology and Cultural History (*NTNU Vitenskapsmuseet, Institutt for arkeologi og kulturhistorie*) studies pre-historic, historic, maritime, and Sami archaeology. It conducts archaeological excavations, hosts the Museum's cultural heritage conservation laboratory, and is responsible for the cultural history collections, as well as teaching the professional archaeology programme.

NORSK ARKEOLOGISK SELSKAP

The **Norwegian Archaeological Society** (*Norsk Arkeologisk Selskap*) was founded in 1936. The association currently consists of approximately 500 members who all share a passion for archaeology and cultural heritage, and is thus a platform where archaeologists, researchers, students, and all others who share an interest in archaeology can meet for the exchange of ideas and knowledge, socializing and inspiration. *Viking* continues to be published annually, and the company supports archaeological research at home and abroad through the Archaeological Fund.

Trøndelag fylkeskommune
Tröndelagen fylhkentjielte

Trøndelag Fylkeskommune is the regional government of Trøndelag County in central Norway, created after the merger of Nord-Trøndelag and Sør-Trøndelag counties in 2018. The county has about 483,000 inhabitants, with Trondheim as its largest city (approx. 215,000), which also served as Norway's first capital from 1030 to 1217. Trøndelag is responsible for upper secondary education, public transport, regional development, culture, and county roads, and plays a key role in sustainability, innovation, and cooperation between urban and rural areas. The geographical centre of Norway lies in Steinkjer, and the region is home to seven national parks and two nature reserves. With strong institutions, heritage, and natural resources, the county fosters growth, welfare, and environmental responsibility.

Here to help

If you need to contact one of the conference organisers, please use the mobile numbers below. These can also be given to family or friends in the event that they are unable to contact you directly in an emergency.

Ole Risbøl **+47 948 27 086**

Łukasz Banaszek **+44 7785 761 069**

Welcome Reception & Conference venue

- **Wednesday 10th September 19:00 – 21:00**
- **Thursday 11th September 8:10 – 16:30**
- **Friday 12th September 8:10 – 16:00**

Dokkhuset
Dokkparken 4
7042 Trondheim

Open Street Map: https://osm.org/go/0W4tP0_ih?node=3108135885

Google Maps: https://maps.app.goo.gl/DA8ecTVBeWjGtSTa9

Accessibility

All rooms within Dokkhuset are wheelchair accessible. The entrance has step-free access. The conference is taking place entirely on the ground floor where disabled toilet facilities also are found.

Conference dinner

- **Friday 12th September 19:00 – 21:00**

Frati Restaurant
Kongens gate 20
7011 Trondheim

Open Street Map: https://osm.org/go/0W4tNBWKM?node=3985333057

Google Maps: https://maps.app.goo.gl/C51TiGGAzBdEZm8C7

Accessibility

Frati Restaurant is wheelchair accessible and has disabled toilet facilities.

Halsstein-Alstadhaug-Tautra-Evenhus Field trip

- **Saturday 13th September 8:30 – 17:00**

Meeting point

NTNU University Museum
Erling Skakkes gate 47B
7012 Trondheim

Open Street Map: https://osm.org/go/0W4tGfNWB?node=3108135915

Google Maps: https://maps.app.goo.gl/rQUZoYfKHUPVZAfJ7

Timetable

Please refer to the following itinerary for key timings:

	Start	End
Gather at NTNU University Museum	8:30	8:45
Halsstein hillfort visit	10:15	11:15
Alstadhaug cultural environment visit	11:25	12:00
Tautra monastery visit + lunch break	12:45	14:45
Evenhus rock carvings site	14:55	15:25
Return travel to Trondheim	15:25	16:50

Accessibility

Halsstein hillfort: App. 300 meters to walk slightly uphill on a relatively uneven footpath.

Alstadhaug cultural environment: Drive-in.

Tautra monastery: Drive-in.

Evenhus rock carving site: Short walking distance but last part in uneven terrain.

Guided tour of Trondheim

- **Saturday 13th September 10:00 – 11:30**

Meeting point

Erkebispegården
Kongsgårdsgata 1A
7013 Trondheim

Open Street Map: https://osm.org/go/0W4tMM17Q?node=2957446682

Google Maps: https://maps.app.goo.gl/1vAHQHxxuYs9qnkN8

General information

Lying on the south shore of the Trondheimsfjord, at the mouth of the river Nidelva, Trondheim is the third largest in the country but retains the intimate charm of a smaller town. Its location at the crossroads of land and sea has shaped it into a city deeply connected to both its Viking past and its present role as a forward-looking centre of research, sustainability, and culture.

Originally founded in 997 as Nidaros by Viking King Olav Tryggvason, Trondheim was once the capital of Norway and remains a city of significant historical importance. It became the religious centre of the country during the Middle Ages. The blend of old and new is a defining characteristic of Trondheim, where modern design often coexists gracefully with historical structures, creating a dynamic and layered urban experience.

Beyond its historical significance, Trondheim is a centre for knowledge and innovation. It is home to the Norwegian University of Science and Technology (NTNU), the country's largest university, and a key player in research and development in fields such as engineering, marine technology, and environmental science. The university, along with SINTEF, one of Europe's largest independent research organizations, positions Trondheim at the forefront of technological advancement and sustainable development.

Transportation to and within Trondheim is efficient and traveller-friendly. The city is served by Trondheim Airport, Værnes, which offers both domestic and international flights. Trains, buses, and ferries provide excellent connectivity to other parts of Norway and within the Trøndelag region. Within the city, public transport is reliable and includes electric buses, trams, and a network of boats. Walking is a pleasant and practical option in the compact city centre, and Trondheim's embrace of cycling infrastructure makes biking a popular choice among locals and visitors alike.

To help plan your trip we suggest that you take a look at the Visit Trondheim website.

Getting to Trondheim

Air

Trondheim Værnes airport is Norway's third largest airport, which has direct flights to/from most airports in Norway and several international cities – London Gatwick, Amsterdam, Copenhagen, Stockholm, Helsinki, Riga, Gdansk, Krakow, Dubrovnik, Split, Nice, Barcelona, Alicante and Malaga. The route Trondheim – Oslo is one of Europe's busiest air routes, with around 30 daily departures. The bus from the airport to Trondheim city is located directly outside the arrival hall. The ride takes about 40 minutes from the airport to the city centre with 15-minute departures for most of the day.

More info:

- Avinor
- Værnes Expressen (Airport bus shuttle)
- AtB (Trøndelag region public transport)
- Vy (Norwegian Railway Company)

Rail

Arriving in Trondheim by train is relaxing and convenient since Trondheim Sentralstasjon is located downtown in the city centre next to the harbour. There are two lines connecting Oslo and Trondheim, with approximately seven departures a day.

- Dovrebanen
- Rørosbanen

For those who want to experience magnificent nature and culture history. Consider for instance a stop at the mountain mining town of Røros which is a UNESCO world heritage site.

Road

Norway's longest road, the European route E6 north-south motorway, passes through Trondheim.

Accommodation

In Trondheim there is a range of accommodations at your disposal. Many of the hotels that are located in the city are within walking distance to all of the great sites and restaurants.

- Most hotel options can be found on Visit Trondheim or Booking.com.
- B&Bs and Guest Houses can also offer a budget friendly alternative to a hotel. Search Visit Trondheim or Booking.com.
- A wide range of properties are available via Airbnb across the city.

Visitor attractions

More information on various attractions and activities can be found on Visit Trondheim.

Getting around Trondheim

Bus

The bus network, operated by AtB, runs throughout most of the city and its suburbs. Details of routes and timetables can be found here AtB. If you want to use bus services it is recommended that you download the AtB app.

Cycling

Trondheim City Bike is an app-based bike sharing service with more than 700 bikes and 67 bike stations around the city. You register and easily unlock a bicycle via the Trondheim Bysykkel app.

E-scooters are available to hire across the city, provided by these companies:

- Ryde
- Voi
- Tier

2025 AARG ANNUAL MEETING

11-13 September 2025
Trondheim, Norway

aargonline.com/wp/aarg2025

/aerialarchaeologyresearchgroup
aerialarchaeology.bsky.social

aarg Aerial Archaeology Research Group
NTNU
NTNU University Museum Department of Archaeology and Cultural History
Trøndelag fylkeskommune Tröndelagen fylhkentjielte
NORSK ARKEOLOGISK SELSKAP

Conference Programme

Wednesday, 10th September

19:00-21:00	Welcome reception

Thursday, 11th September

08:10-08:30	Registration	
08:30-09:00	Welcome	
Session: Pushing the boundaries of survey with UAS		
09:00-09:20	James Bonsall & Liamóg Roche	Heat and heritage at Carrowmore, Co. Sligo: Thermal imaging and the rediscovery of Ireland's lost megaliths
09:20-09:40	Ulrike Thüring, Manuel J. H. Peters & Patrick Roberts	Deploying UAV-based LiDAR for investigating urbanisation and land use change: challenges and prospects
09:40-10:00	Magnar Mojaren Gran & Dag Øyvind Engtrø Solem	Identifying cropmarks with height data by means of photogrammetry: Workflow and results from analysis of two buried Iron Age sites in Trøndelag, Norway
10:00-10:20	Øyvind Ødegård	Multi-method approach to surveying of regulated hydropower works
10:20-10:50	Coffee break	
Session: AI and automation		
10:50-11:10	Cecilia Ulfhielm	Using AI to uncover the past in Digital Terrain Models
11:10-11:30	Gabriele Ciccone, Nicodemo Abate & Nicola Masini	SADA: AI-powered remote sensing analysis for archaeology – a user-friendly, ChatGPT-co-created tool for non-experts
11:30-11:50	Jun Yang, Rong Zhao & Xiangning Zhang	Research on the forgetting problem of base classes knowledge for few-shot object detection in remote sensing images
11:50-12:10	Simon Crutchley	Using a combination of image sampling and data analysis to improve automatic data generation
12:10-13:10	Lunch break	
Session: Risks, threats, and monitoring		
13:10-13:30	Matthew Oakey	The role of aerial survey in supporting Historic England's heritage at risk programme
13:30-13:50	Hrvoje Kalafatić, Bartul Šiljeg, Rajna Šošić-Klindžić & Borna Sabljak	Remote detection of looting-threatened archaeological sites using LiDAR: Case studies of medieval hillforts and Roman barrows in continental Croatia
13:50-14:10	Robert Bewley	Monitoring the cultural heritage of the Middle East from the air

14:10-14:30	Lidia Żuk, Julia Holzner, Sławomir Królewicz, Simon Plank, Renata Graf & Włodek Rączkowski	Climate change and archaeological heritage at risk: monitoring water level changes at the lakeshore fortified settlement in Smuszewo (Poland) using Earth Observation data
14:30-14:50	Jo Sindre P. Eidshaug & Øyvind Ødegård	Coastal erosion and cultural heritage in the rapidly warming Arctic: LiDAR-based monitoring in Svalbard and Nordland County
14:50-15:40	Coffee break and **poster session**	
15:40-16:30	**AARG AGM**	

Friday, 12th September

Session: Citizen science and war heritage		
08:10-08:30	Ole Risbøl	LiDAR, legacy, and laypeople - Experiences from two citizen science projects
08:30-08:50	Marcin Banat	Galindian Saga: Potential earthwork traces of Scandinavian in northeastern Poland
08:50-09:10	Julian Cadamarteri	Mapping landscapes of occupation at Lade, Trondheim
09:10-09:30	Kristoffer Eliassen Grini & Marek E. Jasinski	Predicting the buried past: Aerial approaches to locating hidden graves in the Falstad forest, Norway
09:30-09:50	Grzegorz Kiarszys & Marek Lemiesz	27 Days of 'Russkij Mir' in Yahidne and its material legacy: The archaeology of a war crime
09:50-10:20	Coffee break	
Session: Aerial archaeology from East to West		
10:20-10:40	Brian Shanahan	The view from above: Aerial archaeology down under
10:40-11:00	Peter Heimermann	Evaluating digital surface models, RGB and multispectral orthomosaics for UAV-based remote sensing in Mongolia
11:00-11:20	Marek Hladík, Katarína Hladíková, David Cibulka & Tibor Lieskovský	Remote sensing and predictive modelling for the detection of endangered archaeological landscapes in Central Europe
11:20-11:40	Martin Gojda, Petr Krištuf & Jan Turek	Air-detected cropmarks of the Hill of Říp Neolithic sacred landscape in the heart of Europe
11:40-12:00	Michael Doneus & Nives Doneus	Detecting Roman surveying of municipal territories on the northern Adriatic islands, Croatia, from ALS-based Digital Terrain Models
12:00-13:00	Lunch break	

Session: Aerial archaeology from North to South		
13:00-13:20	Lars Forseth	A lucky strike! Photographing cropmarks in central Trøndelag in 2007. Contexts and follow-up.
13:20-13:40	Bo Ejstrud	Survey strategies: a comparison
13:40-14:00	Alison Deegan	A thousand metres wide, thousands of years deep: the archaeological landscapes at the foot of the Lincoln Edge
14:00-14:20	Wendy Morrison	'Stand back from the platform – train of thought approaching!': LiDAR prospection and hilltop settlement
14:20-14:40	Maria Lucrècia Centelles-Fullana, Carmen Cuenca-García & Valeria Martín Sidro	Using ALS for Iron Age archaeology in the Valencian region (Spain): the Sensing Iberianscapes project experience
14:40-15:10	Coffee break	
Session: Stop and reflect!		
15:10-15:30	Piotr Wroniecki	Perfect Data, imperfect past. LIDAR interpretation in the face of archaeological realities
15:30-15:50	Sally Evans	SWOT analysis for aerial survey
15:50-16:00	Wrap-up	

Saturday, 13th September

09:00-17:00	Fieldtrip to Halsstein hillfort, Alstadhaug cultural environment, Tautra monastery and Evenhus rock carvings (lunch provided)
10:00-11:30	Guided tour of Trondheim (by Axel Christophersen)

Abstracts

Day 1. Thursday 11th September

Session: Pushing the boundaries of survey with UAS		
09:00-09:20	James Bonsall & Liamóg Roche	Heat and heritage at Carrowmore, Co. Sligo: Thermal imaging and the rediscovery of Ireland's lost megaliths
09:20-09:40	Ulrike Thüring, Manuel J. H. Peters & Patrick Roberts	Deploying UAV-based LiDAR for investigating urbanisation and land use change: Challenges and prospects
09:40-10:00	Magnar Mojaren Gran & Dag Øyvind Engtrø Solem	Identifying cropmarks with height data by means of photogrammetry: Workflow and results from analysis of two buried Iron Age sites in Trøndelag, Norway.
10:00-10:20	Øyvind Ødegård	Multi-method approach to surveying of regulated hydropower works

Heat and heritage at Carrowmore, Co. Sligo: thermal imaging and the rediscovery of Ireland's lost megaliths

James Bonsall (Archaeological Management Solutions (AMS) Ltd., Ireland)
Liamóg Roche (Archaeological Management Solutions (AMS) Ltd., Ireland)

This paper will look at the outcomes of recently acquired LiDAR, thermal imagery and orthophotography at Carrowmore Megalithic Cemetery, Sligo, Ireland. As part of the Royal Irish Academy-funded project Beyond the Tombs: Carrowmore and its Cultural Landscape, a series of high-resolution UAS-based remote sensing surveys were undertaken at the Carrowmore Megalithic Cemetery. As one of the key components of the Passage Tomb Landscape of County Sligo, Carrowmore holds a central position in Ireland's prehistoric cultural heritage. This project has applied advanced, high-resolution remote sensing techniques and archaeological geophysical data collection at Carrowmore and to embed it within a database of all recorded cultural heritage, from field boundaries to folklore to enhance understanding, management, and conservation of this globally significant prehistoric landscape.

A formal survey undertaken in 1837 by George Petrie (an archaeologist from the Ordnance Survey), recorded 68 sites at Carrowmore, and today only 45 sites are visible. Petrie also noted other sites he had been made aware of, which had been destroyed earlier; speculating that 100-200 monuments may have once existed within the wider Carrowmore area. The removal of many monuments - as well as quarrying activities continuing well into the 20th century - has led to a significant loss. This project is crucial to the study of a landscape that may harbour previously unrecorded megalithic tombs.

The project employed a DJI Matrice 300 RTK UAS platform equipped with LiDAR, RGB and thermal imagery cameras. The thermal and orthophotography surveys were aided by an unexpectedly warm climate in spring 2025, leading to high soil moisture deficits. These in turn created strong temperature and moisture contrasts for subsurface archaeology. The surveys successfully identified a range of previously undocumented archaeological features, including stone sockets of previously unrecorded passage tombs, ditched enclosures, and linear stone-

built structures. In addition, previously unrecorded stones or stone sockets surrounding known monuments were also identified. The project also demonstrated the value of identifying stones of differing geology via their varied ability to retain and emit heat. Most UAS-detected features were identified via subtle thermal contrasts, whereas LiDAR surveys failed to image them, underscoring the usefulness of radiometric thermal imaging to complement other methods of detection for buried archaeological remains that have no surface expression. The identification of such anomalies within and around the known monument core expands the spatial and cultural dimensions of the Carrowmore complex, offering new insights into the organisation and extent of Neolithic activity, as well as the later 19th century removal of monuments.

Deploying UAV-based LiDAR for investigating urbanisation and land use change: Challenges and prospects

Ulrike Thüring (Max Planck Institute of Geoanthropology, Department of Coevolution of Land Use and Urbanisation, Germany)
Manuel J. H. Peters (Max Planck Institute of Geoanthropology, Department of Coevolution of Land Use and Urbanisation, Germany)
Patrick Roberts (Max Planck Institute of Geoanthropology, Department of Coevolution of Land Use and Urbanisation, Germany)

The Department of Coevolution of Land Use and Urbanisation at the Max Planck Institute of Geoanthropology, Jena, explores the complex interactions between urban change, land use dynamics, and transformations in the Earth system. Global intensification of land use is increasingly recognised as a core driver of the 'Great Acceleration' in human–environment relations and a defining characteristic of the Anthropocene.

To study these processes, we use multiple methods including unmanned aerial vehicles (UAVs) equipped with remote sensing technologies, particularly LiDAR systems, to collect high-resolution topographic data. Our UAV fleet includes several small DJI drones, as well as a fuel-powered octocopter capable of carrying payloads up to 10 kg, allowing the deployment of advanced LiDAR instruments over a range of terrains. Planned surveys across multiple sites will enable us to investigate settlement patterns and associated land use changes over different periods and landscapes.

This presentation highlights the methodological framework, focusing on the technical and operational challenges of using large-payload UAVs for scientific data acquisition. These include legal and regulatory constraints (such as flight permissions and export regulations), logistical considerations and technical challenges. Preliminary test flights have demonstrated both the potential and the complexity of operating such systems in archaeological and geoanthropological research contexts.

Ultimately, this project aims to contribute to a deeper understanding of how urban expansion has historically shaped terrestrial ecosystems and focuses on the deployment strategy and initial outcomes of the UAV-LiDAR surveys.

Identifying cropmarks with height data by means of photogrammetry: Workflow and results from analysis of two buried Iron Age sites in Trøndelag, Norway.

Magnar Mojaren Gran (NTNU University Museum, Department of Archaeology and Cultural History, Norway)
Dag Øyvind Engtrø Solem (Norwegian Institute for Cultural Heritage Research, Norway)

Archaeological cropmark identification has traditionally been carried out by aerial photography, capturing variations in crop colour due to differential growth caused by the presence of archaeological features underground. This method has been a cornerstone in aerial archaeology and continues to yield new finds to this day. Despite its success, it has some limitations, mainly the time-sensitive dependence on the right conditions for the crop marks to appear.

Other methods such as multi- and hyperspectral imaging are also used by archaeologists to detect differential growth patterns and expand on conventional aerial photography by detecting differences in plant chlorophyll not visible in ordinary RGB imagery. Thermal photography detects the ground's capacity to store thermal energy, where similar conditions as for differential growth can reveal underground structures in the soil itself.

Spectral and thermal imaging can give good results regardless of the growing season, whereas traditional aerial photography benefits greatly from varying weather conditions where drought, for instance, enhances the contrast caused by the differential growth.

However, both spectral and thermal imaging require specialized sensors, which can be costly. Thus, a more reasonable way of expanding on traditional aerial photography is to utilize height data to detect differential growth patterns. The revolution of UAV mapping has led to low-cost camera drones becoming a part of the archaeologists' toolbox, allowing for detailed documentation of differential growth patterns using ordinary drone-based photogrammetry.

In this paper, the workflow and the results of repeated mapping of two sites with distinct crop marks using height data from aerial photogrammetry will be presented. The crop marks originate from Iron Age longhouses and burial mound ring ditches. Prior to the aerial mapping, both sites were surveyed using ground penetrating radar to establish a baseline for assessing the accuracy of the aerial photogrammetry. Multispectral, thermal, and RGB imagery were also collected for comparison.

The case studies indicate that crop marks can be detected earlier in the growth season, when adopting height data as opposed to regular RGB imagery. It also demonstrates that the method can provide useful results, even in years with poor conditions for RGB imagery. These results highlight the potential of photogrammetric height data as a cost-effective and accessible tool for enhancing cropmark detection in archaeological prospection.

Multi-method approach to surveying of regulated hydropower works

Øyvind Ødegård (NTNU University Museum, Department of Archaeology and Cultural History, Norway)

From the 1950s through the 1970s, Norway undertook extensive hydropower development to meet growing demands for electricity. These projects involved large-scale regulation through the construction of dams, reservoirs, and power plants, significantly altering the natural states of lakes and rivers. At the time, legal frameworks for cultural heritage protection and

archaeological assessment were either inadequate or entirely absent. As a result, these developments proceeded with minimal or no archaeological surveying, leading to the irreversible loss or inaccessibility of substantial cultural heritage.

Now, fifty years later, many of the original hydropower licenses are due for renewal, presenting a unique opportunity to address past oversights in heritage management. In recognition of the damage inflicted on Norway's cultural heritage, national authorities have allocated resources to a program designed to mitigate the consequences of earlier watercourse regulation.

In collaboration with Nordland County Council and the Sámi Parliament, NTNU University Museum is leading an ongoing project to document cultural heritage in and around Røssvatnet in Nordland County. Human activity in the area spans from late Mesolithic hunting and foraging to Sámi settlements, continuing into recent times. The temporal scope thus covers several millennia, reflecting a rich and diverse cultural landscape.

Numerous finds reported by archaeologists and members of the local public during low water levels in spring and summer indicate a high density of cultural remains. One of the main aims of the current project is to deploy a suite of technological platforms for remote sensing—operated from the air, on land, and both on and under water—to develop best practices for archaeological investigation of such regulated lake environments.

Over two field seasons, data have been collected using UAV-based LiDAR and Structure-from-Motion (SfM) photogrammetry, ground-based geophysical instruments, and side-scan and multibeam echosounders. These techniques were deployed at selected locations and are currently under analysis to assess their performance and refine survey strategies tailored to Røssvatnet's unique conditions.

Field operations were scheduled across distinct seasonal windows. During short periods between snowmelt and rising water levels, traditional archaeological surveys were conducted on the exposed lakebed in tandem with geophysical methods and UAV-based mapping. In late autumn and early winter, when water levels were elevated but before ice cover, selected areas were surveyed using underwater acoustic systems mounted on an Unmanned Surface Vehicle (USV), enabling acquisition of high-resolution bathymetric data overlapping with aerial datasets. Additionally, backscatter data from the multibeam echosounder were processed similarly to side-scan sonar to generate detailed lakebed imagery. One area of particular interest—Straumen in Tustervatnet—contains several registered archaeological sites that are exposed in spring but submerged during most of the year. This site has been surveyed using multiple sensor modalities to produce a complementary dataset of high value for research and development on detection, monitoring, and change analysis.

In this paper, we present preliminary results from two field campaigns and critically assess the performance and applicability of the integrated methods for archaeological documentation in water bodies affected by hydropower regulation, such as dammed lakes and controlled rivers.

Session: AI and automation		
10:50-11:10	Cecilia Ulfhielm	Using AI to uncover the past in Digital Terrain Models
11:10-11:30	Gabriele Ciccone, Nicodemo Abate & Nicola Masini	SADA: AI-powered remote sensing analysis for archaeology – A user friendly, ChatGPT-co-created tool for non-experts

11:30-11:50	Jun Yang, Rong Zhao & Xiangning Zhang	Research on the forgetting problem of base classes knowledge for few-shot object detection in remote sensing images
11:50-12:10	Simon Crutchley	Using a combination of image sampling and data analysis to improve automatic data generation

Using AI to uncover the past in Digital Terrain Models

Cecilia Ulfhielm (Swedish Forest Agency, Sweden)

In 2022, the Swedish Government tasked the Swedish Forest Agency (Skogsstyrelsen) and the Swedish Environmental Protection Agency (Naturvårdsverket) with developing a range of digital geographic knowledge bases for natural and cultural environmental values in forests, to act as a complement to field inventories. These knowledge bases aim to objectively identify features in the natural environment, including cultural heritage sites, that may be significant for forest management planning, efforts related to biodiversity, and national climate and environmental goals. The knowledge bases are designed to indicate the probability of the presence of various values and to facilitate for landowners and authorities when conducting more in-depth assessments of the forest's natural and cultural values, as well as for other purposes. The digital knowledge bases produced are to be open and free of charge.

At the start of the government assignment, input was gathered from the forestry sector and other stakeholders regarding the types of cultural heritage sites where gaining a better understanding and knowledge base was important. This has so far resulted in the development of AI models for charcoal production pits, tar kilns, pitfall traps, and most recently, clearance cairn areas. In the summer of 2025, a selection of the detected pitfall traps and clearance cairn areas will be validated in the field with the help of both external and internal personnel. In the spring/summer of 2025, we will also begin work with identify Iron Age farms on the islands of Öland and Gotland using AI, and we hope we will also be able to present this work at the conference.

SADA: AI-powered remote sensing analysis for archaeology – A user friendly, ChatGPT-co-created tool for non-experts

Gabriele Ciccone (ISPC-CNR, Italy)
Nicodemo Abate (ISPC-CNR, Italy)
Nicola Masini (ISPC-CNR, Italy)

Artificial Intelligence (AI) is transforming archaeological research, yet its adoption is often hindered by technical complexity and the need for specialized expertise. To bridge this gap, we present SADA (Smart Anomaly Detection Assistant), an AI-driven remote sensing tool co-developed with ChatGPT.

Designed for archaeologists with little or no background in remote sensing, SADA consolidates multiple analytical methods into a single, accessible application. A key strength of SADA is its intuitive and user-friendly interface, which simplifies advanced AI-driven image processing. Integrated tooltips provide step-by-step guidance, enabling researchers to apply complex analytical techniques with ease.

The system includes automated statistical anomaly detection methods such as PCA, K-Means clustering, Isolation Forest, SVM, DBSCAN and Local Outlier Factor, as well as spatial analysis tools like LISA. Additional functionalities include histogram equalization and transformation to enhance image contrast, raster-based calculations for custom index generation, and mask creation and selection tools to isolate areas of interest with precision.

Developed with ChatGPT's assistance, SADA also highlights the potential of human-AI collaborative coding in archaeology. This approach accelerates development while optimizing algorithms and enhancing usability through interdisciplinary innovation. SADA is being developed by CNR - ISPC within the PNRR CHANGES project (Spoke 5) and will be released as open-source software, following the approach of other ISPC-CNR tools such as ATON and Extended Matrix.

This ensures maximum accessibility, transparency, and adaptability, allowing the archaeological and heritage science community to expand its functionalities according to specific needs. By democratizing AI-powered remote sensing, SADA aligns with the goals of the Managing Artificial Intelligence in Archaeology COST Action (CA23141), fostering a more inclusive and data-driven approach to heritage management. The presentation will showcase SADA's real-world applications, development process, and future implications for AI-assisted archaeological research.

Research on the forgetting problem of base classes knowledge for few-shot object detection in remote sensing images

Jun Yang (School of Electronic and Information Engineering, Lanzhou Jiaotong University, Faculty of Geomatics, Lanzhou Jiaotong University, China)
Rong Zhao (School of Electronic and Information Engineering, Lanzhou Jiaotong University, China)
Xiangning Zhang (Faculty of Geomatics, Lanzhou Jiaotong University, China)

We propose a transfer learning-based few-shot object detection model for remote sensing images that addresses catastrophic forgetting and low detection accuracy on base classes. Firstly, during the fine-tuning stage with few samples, we propose a dual-branch evolution module, which evolves the original branch into parallel base classes and novel classes branches. By applying a selective freezing strategy, the model effectively alleviates the catastrophic forgetting of base classes knowledge and improves the detection accuracy of novel classes. Secondly, we introduce a category-separation ROI detector, which performs separate detection on novel classes and base classes samples. Distillation loss is used to guide the training of the novel classes detection head, addressing the issue of low detection accuracy caused by complex backgrounds in remote sensing images, thereby improving the accuracy of few-shot object detection. In the 10-shot task setting, compared with TFA, the proposed algorithm achieves a 16.5% and 1.0% increase in novel classes and base classes mAP, respectively, on the NWPU VHR-10.v2 dataset, and a 15.6% and 9.5% increase in novel classes and base classes mAP, respectively, on the DIOR dataset. Experimental results demonstrate that the proposed algorithm outperforms existing algorithms in terms of both base classes and novel classes detection results.

Using a combination of image sampling and data analysis to improve automatic data generation

Simon Crutchley (Historic England, England)

Historic England and its predecessor organisations have been carrying out mapping and recording of archaeological features and landscapes across England since the late 1980s. Whilst later projects, since the late 1990s have been carried out in a digital environment and have created fully accessible digital records, the early projects were carried out by hand, producing inked overlays. These were initially scanned and turned into rasters and then subsequently auto vectorised to create digital features. However, these had no logic in terms of their form and where features overlapped, they were treated as single features. Furthermore, there was no object data attached to any feature beyond its size.

In 2023 HE commissioned an Indian geospatial company DSM Geodata to create monument polygons, based on the mapped data, plus the database information created at the same time. Whilst the results were generally very positive, because they were not archaeologists, there was a certain amount of confusion.

Last year, as part of a liaison with UCL on another project, we began talks with the University of Zurich where one of their partners was looking at using AI to interrogate various datasets. After further discussions, it seemed as though there might be the possibility to use this as a means for checking the accuracy of the data we had acquired from DSM.

The project has been innovative, in that it is looking not just at the morphological form of the data as analysed through segmented image files, but also at the archaeological data, based on the attached database records. It is hoped that by learning roughly what size and shape various types of archaeological features are, it will be possible to give a higher probability to the attached data.

As an example, one of the key issues with the original data was the overlapping and superimposition of features; there were numerous examples where a prehistoric enclosure sitting within an area of medieval ridge and furrow cultivation was incorrectly identified as the latter. The hope is that the additional data will mean that the algorithm will identify the feature as an enclosure, because the combination of the image, the vector data with an area, and the database entry will combine to rule out the interpretation as a block of ridge and furrow.

The project is ongoing, but I hope to have some results by the time of the conference.

Session: Risks, threats, and monitoring		
13:10-13:30	Matthew Oakey	The role of aerial survey in supporting Historic England's Heritage at Risk Programme
13:30-13:50	Hrvoje Kalafatić, Bartul Šiljeg, Rajna Šošić-Klindžić & Borna Sabljak	Remote detection of looting-threatened archaeological sites using LiDAR: Case studies of medieval hillforts and Roman barrows in continental Croatia
13:50-14:10	Robert Bewley	Monitoring the cultural heritage of the Middle East from the air

14:10-14:30	Lidia Żuk, Julia Holzner, Sławomir Królewicz, Simon Plank, Renata Graf & Włodek Rączkowski	Climate change and archaeological heritage at risk: monitoring water level changes at the lakeshore fortified settlement in Smuszewo (Poland) using Earth Observation data.
14:30-14:50	Jo Sindre P. Eidshaug & Øyvind Ødegård	Coastal erosion and cultural heritage in the rapidly warming Arctic: LiDAR-based monitoring in Svalbard and Nordland County

The role of aerial survey in supporting Historic England's Heritage at Risk Programme

Matthew Oakey (Historic England, England)

Historic England's Heritage at Risk (HAR) Programme works with owners, friends groups, developers and other stakeholders to find solutions for 'at risk' historic places and sites across England. An important output of the programme is the Heritage at Risk Register – a dynamic picture of the sites most at risk and most in need of safeguarding for the future. Its scope covers a wide range of heritage asset types encompassing archaeology, designed landscapes, battlefields and built heritage.

As an official statistic, produced on behalf of the UK government, a robust evidence base is important. A recent review of the HAR programme identified a number of opportunities to more effectively use airborne remote sensing data to contribute to HAR monitoring. This builds on a history of site monitoring through Historic England's flying programme. A number of pilot projects are currently in development which will explore how new aerial reconnaissance and analysis of existing imagery could be more effectively integrated into the HAR methodology.

This paper will assess the potential for aerial photography and LiDAR to inform HAR risk assessments. It will explore how better targeting of reconnaissance photography, analysis of historical and current imagery, and improved information flowlines can enhance HAR data and lead to an improved evidence base and better heritage management outcomes.

Remote detection of looting-threatened archaeological sites using LiDAR: Case studies of medieval hillforts and Roman barrows in continental Croatia

Hrvoje Kalafatić (Institute of Archaeology, Zagreb, Croatia)
Bartul Šiljeg (Institute of Archaeology, Zagreb, Croatia)
Rajna Šošić-Klindžić (Faculty of Humanities, University of Zagreb, Croatia)
Borna Sabljak (Faculty of Humanities, University of Zagreb, Croatia)

The increasing threat of looting to archaeological heritage calls for efficient and non-invasive methods of site detection and monitoring. This paper presents the application of airborne LiDAR (Light Detection and Ranging) technology in identifying and documenting previously unrecorded medieval hillforts and Roman barrows in remote and forested landscapes of continental Croatia. By analysing micro-topographical features invisible to the naked eye or obscured by vegetation, LiDAR enables the recognition of subtle anthropogenic forms indicative of settlement or burial activity. Particular focus is placed on sites at high risk of looting, where characteristic looting pits were identified through LiDAR data analysis and subsequently confirmed through targeted field surveys. This integrated approach highlights the

value of combining remote sensing with ground verification to enhance both archaeological research and the protection of endangered cultural heritage.

Monitoring the cultural heritage of the Middle East from the air

Robert Bewley (University of Oxford, England)

For the best part of three decades an aerial archaeology project based in the Middle East (especially Jordan) has been recording and monitoring archaeological sites from the air (see www.apaame.org). Since 2015 the Endangered Archaeology in the Middle East and North Africa (https://eamena.org/) project has also been using satellite imagery to assess threats to sites. Increasingly many of these sites and landscapes are under greater threat, from urban expansion, damaging agricultural practices, looting, water management, tourism and conflict. This paper will provide a number of examples of important archaeological sites which have been damaged and destroyed, possible mitigation strategies and the future plans for further aerial monitoring.

Climate change and archaeological heritage at risk: monitoring water level changes at the lakeshore fortified settlement in Smuszewo (Poland) using Earth Observation data.

Lidia Żuk (Faculty of Archaeology, Adam Mickiewicz University, Poland)
Julia Holzner (German Aerospace Center – DLR, Germany)
Sławomir Królewicz (Faculty of Geographical and Geological Sciences, Adam Mickiewicz University, Poland)
Simon Plank (German Aerospace Center – DLR, Germany)
Renata Graf (Faculty of Geographical and Geological Sciences, Adam Mickiewicz University, Poland)
Włodek Rączkowski (Faculty of Archaeology, Adam Mickiewicz University, Poland)

Climate change increasingly threatens archaeological heritage, especially in dynamic environments like lakeshores. This study investigates the potential of high-resolution satellite imagery for detecting and monitoring subtle environmental changes. Specifically, it focuses on water level fluctuations in small inland water bodies – such as lakes – that can affect the preservation or degradation of fragile archaeological materials. Earth Observation (EO) programmes provide consistent, long-term, and large-scale data that are essential for understanding and monitoring heritage threats. The potential of EO data has been explored in various initiatives, including the EU-funded TRIQUETRA project (Toolbox for assessing and mitigating Climate Change risks and hazards threatening cultural heritage), which assessed their use for monitoring climate-related hazards. While the temporal resolution of these datasets is often sufficient, a critical question remains: can current spatial resolutions detect very subtle changes in relatively small features, such as water level variations in small lakes?

One such case is the lakeshore site in Smuszewo (Poland) where well-preserved wooden structures – both on land and on the shoreline – were identified during archaeological surveys since the late 20th century. Environmental changes, including decreasing water levels, eutrophication, and peatland drainage, may increasingly expose these relics to harmful conditions, accelerating their deterioration. Understanding both seasonal and long-term lake dynamics is therefore vital for preservation. As part of the TRIQUETRA project, detailed site observations—such as water level measurements and UAV-based high-resolution digital

elevation models and orthophotoplans—have revealed both seasonal water level patterns and extreme events caused by drought or heavy precipitation over the past three years. However, the ultimate goal is to translate these detailed, site-specific insights into a transferable tool for use in less-surveyed areas, relying solely on Earth Observation data.

This research will explore whether high-resolution satellite imagery – particularly from PlanetScope – can effectively detect minor water level changes in small lakes. The proposed workflow includes:

1. Selection of key extreme events (droughts/floods) from the past decade using meteorological data with corresponding EO data,
2. AI-based analysis of PlanetScope imagery (supported by Sentinel-2), to map water extent,
3. Validation using very high-resolution remote sensing data (orthophotomaps and WorldView images), and
4. Integration of water extent data with digital elevation models to calculate metric water level changes.

Ultimately, we seek to provide tools for assessing the impact of climate change on lake systems and cultural heritage—particularly the effects of increasing temperatures on seasonal water condition, including extreme events. The results will hopefully contribute to integrating EO technologies into heritage monitoring and climate adaptation strategies, offering practical insights into bridging the scale gap between environmental processes and cultural heritage protection.

Coastal erosion and cultural heritage in the rapidly warming Arctic: LiDAR-based monitoring in Svalbard and Nordland County

Jo Sindre P. Eidshaug (NTNU University Museum, Department of Archaeology and Cultural History, Norway)
Øyvind Ødegård (NTNU University Museum, Department of Archaeology and Cultural History, Norway)

The Arctic is warming at rates that by far exceed those of the global average, Svalbard being one of the places on Earth that has seen the highest increase in mean temperatures in the last decades. Climate change is a wicked problem affecting nearly every aspect of the Arctic, including ecosystems, Indigenous and local communities, economic activities, and geopolitics. Coastal erosion, rising seas, melting glaciers, and thawing permafrost represent serious threats to the coastal built environment, including all too often neglected cultural heritage. The millions of sites located along the coastlines around the world are testimonies of human maritime history and irreplaceable archives of human knowledge—even more so, perhaps, as the third science revolution is sweeping the discipline of archaeology. However, the potential of aDNA and stable isotopes is rapidly vanishing as coastal sites erode and microbial degradation accelerates—long before it was unleashed.

It is an overarching political goal of The Government to preserve Svalbard's unique wilderness, and this includes its internationally important natural and cultural heritage. Yet, hundreds of heritage sites in the archipelago, including hunting stations, industrial sites, and unusually well-preserved whaler graves from the 17th and 18th centuries, are likely to be lost within a few decades. In Svalbard (discovered AD 1596), all cultural features older than 1946 are automatically protected. As Norwegian sovereignty of the archipelago was first recognized in 1920 (Svalbard Treaty), Norway is custodian for heritage sites representing maritime

(economic) and polar activities of various European nationalities, especially those of the Dutch, British, Russian, and Norwegian. Preserving cultural heritage in Svalbard thus is a responsibility that matters on a continental level.

In addition, climate change-related processes unfolding in Svalbard today amount to a strong warning about what will be happening on the Norwegian mainland in the near future, especially in the northern part of the country, such as Nordland County. Enhancing our understanding of processes in Svalbard will certainly aid predictions and advance planning on the mainland, where archaeological records from the entire post-glacial period (nearly 12000 years) can be found on raised beaches along the coastline. On the Norwegian mainland, all cultural heritage features older than 1537 are automatically protected by law.

In this paper, we will take you through the dire prospects for cultural heritage sites in the rapidly warming Arctic and introduce a new project that will utilize historical aerial photographs, satellite imagery, and LiDAR data to identify, study, and monitor coastal erosion and vulnerable coastal sites in Svalbard and Nordland County. How many coastal sites will be lost in ten, twenty, and fifty years due to climate change? Do we even know exactly what we stand to lose, how to make priorities? The main aim of the project is to develop strategies for sustainable and cost-effective monitoring to preserve vulnerable coastal cultural heritage features and the knowledge contained in them.

Poster session

The impact of World War II and the communist regime in the context of the Czech borderland landscape

Klára Hanáková (University of West Bohemia, Czechia)

The landscape in the border region - the so-called Sudetenland - was considerably transformed by the Communist regime in terms of settlement activity and changes in land use. These changes can be observed using aerial surveys regularly taken by the Czech army for some areas as early as the late 1940s. In this poster, we will focus on the survey of the area around the town of Kraslice, which is close to the state border. The author of the paper explores the changes in the landscape in the area from the 1950s to the beginning of the 21st century, when we can observe the reduction of residential activity in the border zones, the construction of protective border zones, etc.

The rise, stagnation and fall of Brdy ironworks in the 20th century

Tomáš Kroupa (Department of Archaeology, Faculty of Arts, University of West Bohemia in Pilsen, Czechia)

The poster aims to evaluate the industrial landscape of ironworks in western Bohemia, the Czech Republic. Using historical cartographical sources and historical aerial images, the transformation of production areas and settlement patterns is analysed and evaluated. The region's industry underwent a significant shift in scale and intensity during the 20th century, presumably with the major change in the logistical process due to the construction of the railway. These changes sparked consequent transformations of settlement strategy which then changed the whole landscape around the areas of production.

Drone-based magnetometer survey of Roman forts in the Northern Black Sea area (Ukraine)

Kseniia Bondar (Institute of Geophysics, Polish Academy of Sciences, Taras Shevchenko National University of Kyiv, Ukraine)
Roman Kozlenko (National Historical-Archaeological Reserve "Olbia", National Academy of Sciences)
Vlad Kozak («Postup Foundation» Charity Foundation, Poland)
Ievgen Poliachenko (Institute of Geophysics, National Academy of Sciences of Ukraine, Ukraine, «Postup Foundation» Charity Foundation, Poland)
Semen Cherkes (Institute of Geophysics, National Academy of Sciences of Ukraine, Ukraine, «Postup Foundation» Charity Foundation, Poland)
Iryna Sheiko (Institute of Archaeology, National Academy of Sciences of Ukraine, Ukraine)

Drone-based magnetometer surveys have proven to be highly effective in mapping archaeological sites. Unmanned Aerial Vehicle (UAV) magnetometry systems, currently employed in demining operations in Ukraine, demonstrate sufficient accuracy, spatial resolution, and sensitivity to detect subtle magnetic anomalies beneath the surface—such as those generated by buried architectural remains, artefacts, or ancient burial grounds.

The objective of this study was to apply this highly efficient geophysical method to investigate and clarify the structure of the Roman fort Kamianka V, which was established in the first century AD along the northwestern frontier of the Olbian state in the Northern Pontic region.

In addition, we measured a previously undocumented structure approximately 1.9 km southeast of Kamianka V, revealed satellite imagery analysis. This feature closely resembles the shape and dimensions of the internal fortifications of the main site. It is located in proximity to the Dovha Mohyla burial mound and near a field road leading toward Olbia Pontica.

The deployment of UAV-based magnetometry significantly enhanced the scope of the investigation by enabling the efficient and detailed survey of both sites and their surrounding areas, thus contributing valuable data for archaeological interpretation and preservation planning.

NDVI applications in extensive archaeological survey: Revealing hidden structures in Central Italy

Marco Milanese (University of Sassari, Italy)
Riccardo Pellegrini (Independent Researcher, Italy)
Leila Moshfegh Monazah (University of Sassari, Italy)

Among the technological applications in extensive archaeological survey, NDVI (Normalized Difference Vegetation Index) technology is certainly one of the most interesting. The potential of the method is particularly significant for investigations in areas that are fully or partially covered by dense vegetation, due to the sensors' ability to analyse the health status and differential growth of vegetation.

The case study presented in this paper concerns preventive archaeological investigations carried out along the Civitavecchia–Fiumicino highway route, specifically for the laying of fiber optic cables. The use of NDVI technology contributed to the identification of the remains of a large Roman villa, which were concealed by vegetation. The site was subsequently subjected

to the excavation of some rooms of the villa, which featured mosaic floors, and a 3D reconstruction of the context was produced.

Urbanization and structural transformation of the mountainous regions of northern Iraq

Lenka Starková (Department of History, Palacký University Olomouc, Czechia)
Karel Nováček (Department of History, Palacký University Olomouc, Czechia)

This poster presents an analysis of the process of rural urbanisation in the mountain and valley regions of Iraqi Kurdistan, focusing on a case study area of approximately 500 km² in the region of Koya district, Erbil Governorate. The research explores the transformation of rural settlement structure in the last half century, tracing the evolution from traditional dispersed or nucleated sites to contemporary urbanized settlements and expansion zones.

The evolution of urban and rural structures is examined at both macro and micro scales - from regional network relationships to the fine-grained detail of building typologies and land parcels. The study also addresses the critical relationship between settlement patterns and access to key natural resources, particularly water, arable land and traditional grazing areas. These environmental factors have historically influenced both the location and morphology of settlements and play a crucial role in their long-term sustainability in a challenging landscape.

Methodologically, the research is based on the integration of multi-source geospatial data, including remote sensing datasets, ground LiDAR scanning and aerial photogrammetry, complemented by fieldwork and historical cartographic analysis. Results include diachronic comparisons of spatial change and modelling of settlement evolution in relation to changing environmental, socio-economic and political conditions.

The results contribute to a deeper understanding of human-landscape interactions in the mountainous regions of the Middle East and provide a basis for planning sustainable development in these often overlooked areas.

Spared or demolished? When burial mounds got in the way of the Atlantic Wall

Janne Porsgaard Dam (Danish Centre for Aerial Archaeology, Denmark)

This study explores how remote sensing can be retrospectively applied to examine the German Wehrmacht's treatment of protected archaeological heritage in Denmark during the Second World War.

In 1943–1944, the Atlantic Wall was significantly expanded, and several hundred kilometres of anti-tank ditches were constructed across Denmark. In some areas, these construction projects came into conflict with protected archaeological sites, such as burial mounds.

Official SS guidelines stated that such sites should be preserved, not only for their historical value, but also for political and ideological reasons – including their perceived connection to a shared Germanic past.

Through analyses of Royal Air Force aerial photographs from 1945, a series of case studies reveals how the German Wehrmacht responded to (some) visible archaeological sites in the landscape.

Galindian Saga: Potential earthwork traces of Scandinavian activity in northeastern Poland

Marcin Banat (Independent researcher, Poland)

Poster presents a multi-faceted reconstruction of the medieval landscape, including:

- Reconstructed historical water levels based on terrain analysis and archaeological data
- Cross-sectional drawings of hydrotechnical and defensive structures (harbours, earthwalls, strongholds
- water and communication routes, with contextual references to settlement patterns
- Visibility and line-of-sight analyses between signalling points
- Comparative tables illustrating functional and architectural differences across object groups
- 3D visualizations of landscape and period-accurate buildings, infrastructure and watercrafts.

An Early Iron Age palisaded enclosure in a multi-phase setting: Bleakmoor Hill

Kimberley Teale (Archaeological Research Services Ltd, England)

Bleakmoor Hill is a hilltop forming a false crest on a steep hillside on the outermost margin of the Cheviot Hills in Northumberland. Atop it sits the Scheduled Monument 'Bleakmoor Hill Palisaded Enclosure' (NHLE no. 1008562). First listed in 1984, the site is described as a small, defended site of domestic function dating to the Late Bronze Age or Early Iron Age (c.550-440 BC).

Following archaeological investigations in 1979 and 1996, in 2016 Archaeological Research Services Ltd (ARS Ltd) conducted a phased programme of works to understand the form, phasing and date of the archaeological remains at Bleakmoor Hill together with information on the condition of preservation.

New investigations at the Palisade were undertaken in 2025 involving detailed aerial investigations comprising high-resolution LiDAR and multispectral imagery as well as new aerial imagery, along with an intensive geochemical and magnetic susceptibility survey. Along with evidence from on-going excavations adjacent to the palisade, the new evidence is shedding light and context to a fascinating multi-phase site.

Reconstructing the Roman landscape of the greater Zagreb region (Croatia) through ALS Interpretation

Sara Popović (Arheoprojekt, Croatia)
Marko Rukavina (Faculty of Architecture, University of Zagreb, Croatia)

This paper presents the results of the research of the previously unknown ancient land division in the Zagreb metropolitan area (Croatia). Initial analysis of the available digital terrain model (DTM), created for the City of Zagreb in 2012, provided only limited insight into the ancient landscape, however, national airborne laser scanning (ALS) conducted in 2023 enabled examination of much broader area.

Interpretation of the ALS data of an area of 1,080 km² revealed landscape structures consistent with the Roman metric system of land division of 20 x 20 acti, i.e., approximately 710 x 710

meters, spanning across 700 km². Two distinct land division layouts with different orientations were identified.

At numerous locations regular rows of Noric-Pannonian type tumuli were detected aligned with the centuriation axes, with a total of 575 tumuli identified. Tumuli were also found along ancient communication routes, although these routes did not always align with the observed land division patterns. In total, the interpretation of the ALS data revealed approximately 11 kilometres of main Roman roads and around 30 kilometres of vicinal roads.

Field surveys only covered a limited portion of the area examined on ALS. Tumuli were recognized in the terrain morphology, while the remains of centuriation could only rarely be observed as slight depressions to the surrounding terrain.

This research significantly enhances our understanding of the ancient landscape in the Zagreb region.

Advancement of relief interpretation with a complex combination of visualisation techniques in rendering details of past settlement structural elements

Žiga Kokalj (Research Centre of the Slovenian Academy of Sciences and Arts, Slovenia)
Nejc Čož (Postgraduate School, Research Centre of the Slovenian Academy of Sciences and Arts, Slovenia)

Enhanced multi-scale topographic position (version 4, e^{4}MSTP) is a prime example of a (very) complex combination that merges a multiscale terrain representation and local morphological information. It fuses the red-toned slope with a combination of positive and negative openness and local dominance, merged SVF computed with two different radii and histogram stretches, and multi-scale topographic position. The resulting colour combinations take time to become familiar with, but allow for better recognition of topographical features of various scales. This version excels at revealing subtle topographic variations in extremely flat areas. If colours are distracting, they can be removed by displaying e^{4}MSTP with a luminosity blend mode. As a multi-scale technique, e^{4}MSTP is particularly suited for detection/recognition rather than detailed interpretation. However, when fused with the *Combined Visualisation for Archaeological Topography* (Combined VAT), this limitation is largely mitigated. The computation of e^{4}MSTP is included into the Relief Visualisation Toolbox (Python library and QGIS plugin).

Integrated approaches to archiving, preserving, and accessing remote sensing data

Susan Curran (The Discovery Programme, Ireland)
Anthony Corns (The Discovery Programme, Ireland)
Lesley Davidson (The Discovery Programme, Ireland)

Over the past three decades, the Discovery Programme has employed a diverse suite of remote sensing technologies—including LiDAR (ALS), geophysical survey, and UAV-based imaging—to investigate Ireland's rich archaeological heritage. This poster presents an integrated digital framework developed to consolidate these heterogeneous datasets, ensuring their long-term preservation and enhancing accessibility in line with FAIR (Findable, Accessible, Interoperable, Reusable) data principles. Central to this initiative is the use of trusted repositories and geospatial services that support both scholarly research and public

engagement. Using the archaeological landscapes of Tara as a case study, the poster highlights the practical challenges of data harmonisation, metadata standardisation, and digital curation, while also showcasing the opportunities for enriched interpretation and collaborative research. The work underscores the importance of sustainable digital infrastructures in safeguarding cultural heritage and promoting interdisciplinary access to remote sensing data.

Hidden medieval and modern settlement landscapes in south-western Germany

Ralf Hesse-Zubrzycki (State Office for Cultural Heritage Baden-Württemberg, Germany)

More than one third of the area of Baden-Württemberg, south-western Germany, are today covered by forest. Forest cover has, however, significantly changed over the past millennium. In the Black Forest, for example, historical maps show than some areas which are now almost completely forested had only around 30% forest cover in the late 18th century. In many regions, former field systems and networks of hollow ways can be recognized in visualisations based on airborne LiDAR data. Data quality constraints of the first (finished 2008) state-wide LiDAR survey, however, limited the detectability of most deserted settlements from the medieval and early modern periods: buildings constructed of timber and loam usually leave almost no remains in the surface relief after their demise. The data based on the second state-wide LiDAR survey (finished 2022) now reveal in many cases house footprints, structural remains or cellar depressions in addition to a much better visibility of the field systems associated with the settlements. The poster will present examples for medieval as well as early modern deserted settlements and highlight the massive land use changes which can be reconstructed from historical maps and airborne LiDAR data.

EAC Lidar Guidelines - an Introduction and How To

Rebecca Bennett (PTS Consultancy, United Kingdom)

The EAC Lidar Guidelines were launched this spring with the aim of bringing together a reference document that combines the experience of colleagues across Europe. Totalling 175 pages, the Guidelines are both broad in scope and detailed. This poster highlights the topics covered, printable resources and how make the most of the guidelines. It includes links to additional resources for teaching and dissemination including a video introduction and slidepack.

Day 2. Friday 12th September

Session: Citizen science and war heritage		
08:10-08:30	Ole Risbøl	LiDAR, legacy, and laypeople – Experiences from two citizen science projects
08:30-05:50	Marcin Banat	Galindian Saga: Potential earthwork traces of Scandinavian activity in northeastern Poland
08:50-09:10	Julian Cadamarteri	Mapping landscapes of occupation at Lade, Trondheim
09:10-09:30	Kristoffer Eliassen Grini & Marek E. Jasinski	Predicting the buried past: Aerial approaches to locating hidden graves in the Falstad Forest, Norway
09:30-09:50	Grzegorz Kiarszys & Marek Lemiesz	27 days of 'Russkij Mir' in Yahidne and its material legacy: The archaeology of a war crime

LiDAR, legacy, and laypeople – Experiences from two citizen science projects

Ole Risbøl (Norwegian University of Science and Technology, Norway)

Citizen science in archaeology refers to the involvement of non-professional individuals or communities in archaeological research. Participants contribute to tasks such as data collection, documentation, analysis, or monitoring, often under the guidance of professional archaeologists. The aim is to expand research capacity, enhance public engagement, and foster shared stewardship of cultural heritage.

The increasing number of citizen science projects within archaeology includes several where the use of LiDAR data is pivotal. These projects can broadly be divided into two groups based on their methodological approach. The first involves experts interpreting LiDAR datasets, with volunteers invited to conduct or join the field verification of the results obtained. The second involves non-professional volunteers interpreting the LiDAR datasets, followed by field checks undertaken by archaeologists—sometimes in cooperation with non-professional individuals or communities.

This paper presents two Norwegian citizen science projects, each employing one of these distinct approaches. The aim of both projects is twofold: to improve the management of cultural heritage in forested areas and to advance research into human utilisation of outfield resources and landscapes. The national cultural heritage database is invaluable for both management and research purposes. However, it remains an inadequate and lopsided tool, as cultural heritage in forested areas is significantly under-represented. Addressing this shortfall requires improvement, and the use of LiDAR data, coupled with the involvement of volunteers, has proven to be an effective solution.

The presentation will focus on the results from the two projects, as well as lessons learnt from working with volunteers.

Galindian Saga: potential earthwork traces of Scandinavian activity in northeastern Poland

Marcin Banat (Independent researcher, Poland)

This presentation explores the possibility of early Scandinavian presence in the historical region of Galindia, today known as Warmia and Masuria in northeastern Poland—a land once described by Tacitus and Ptolemy.

Using LiDAR scans, archival and contemporary aerial imagery, and historical maps, a physiotherapist and his father (both non-archaeologists) identified and verified in the field numerous structures suggestive of deliberate human activity. To determine the origin and timeline of these features, author analysed accessible archaeological and historical sources pertaining to the region. Through comparison with similar Viking-era structures across the Baltic and Atlantic Sea basin, a hypothesis emerged suggesting the existence of a Scandinavian diaspora or trade emporium—previously undocumented—spanning an area of approximately 25 x 25 km. This site may have served as a nodal point on a long-distance route connecting the Baltic Sea with Kyiv.

The proposed site includes numerous hydroengineering, defensive, and settlement-related structures, such as:

- Harbours, canals, portages, and deepened channels
- Fortified settlements and concentric building layouts
- Earth ramparts totalling over 11.5 km in length
- A system of 16 observation or signal towers along waterways and land routes

Additionally, an onomastic analysis reveals over 20 place names in the region that may relate to Norse mythology, inland navigation terminology, and resources essential for shipbuilding.

The presentation will be preceded by a regional geographical and hydrological introduction and an overview of the local historical-archaeological context of the early medieval period. The final section presents the timeline of the discoverers attempts to engage with the academic community, his personal journey, and a vision for the future utilization of these findings.

Three thematic posters—Light, Water, and Earth—form an integral part of the presentation, visually representing the essence of the Galindian Saga.

Mapping landscapes of occupation at Lade, Trondheim

Julian Cadamarteri (NIKU, Norway)

During the German occupation of Norway 1940-45 the occupying forces built up and fortified large areas of Norway. The Lade peninsula close to Trondheim, which is mentioned in the Viking sagas as the seat of the local magnates, was heavily militarized in support of the Kriegsmarine presence in Trondheim. An airfield, anti-aircraft batteries and ancillary structures were constructed. The landscape of occupation at Lade has been mapped using historic aerial photographs. By comparing a series of aerial photographs from different periods it is possible to trace what was built during the occupation and what has been removed by development in the post-war period. This provides a quick method for mapping areas of German activity during the war as well as for identifying remaining structures and areas where good preservation of archaeological deposits predating 1940 may be expected.

Predicting the buried past: Aerial approaches to locating hidden graves in the Falstad Forest, Norway

Kristoffer Eliassen Grini (The Falstad Center for Human Rights, Norway)
Marek E. Jasinski (NTNU Norwegian University of Science and Technology, Norway)

The Falstad Forest is a national memorial site in Levanger, Central Norway, where possibly 200 Norwegian political prisoners and foreign POWs were executed and buried by the Gestapo during World War II. Despite post-war recovery efforts, at least 100 victims remain unaccounted for. The project Predicting the Buried Past combines historical research, non-invasive archaeological techniques, and digital technologies to locate missing graves without disturbing the legally protected memorial landscape. Central to this approach is the use of drone-based LiDAR surveys to create a digital terrain model of the forested site. Given challenges such as dense vegetation and strict protection regulations, the aim is that modelling of LiDAR data enables identification of areas of interest. This will provide a foundation for further investigations utilising historical sources, ground surveys, and geophysical methods, minimizing the impact on the site itself. This paper will present the initial results from the LiDAR-based landscape analysis and discuss how aerial survey technologies contribute to monitoring, safeguarding, and planning further archaeological investigations at this WWII heritage site. The investigations in the Falstad Forest will serve as a case study for developing a methodology to locate hidden graves, contribute to how aerial archaeology can contribute to investigation and recovery at sites affected by war and human rights violations, and finally, restoring post-mortem human dignity of the missing persons by detecting and identifying their graves and giving them a proper burial.

27d of 'Russkij Mir' in Yahidne and its material legacy: The archaeology of a war crime

Grzegorz Kiarszys (Department of Archaeology, Szczecin University, Poland)
Marek Lemiesz (National Institute of Cultural Heritage of Poland, Poland)

Yahidne, a small village located over 100 km northeast of Kyiv near Chernihiv, Ukraine, became the site of a war crime during the early stages of the full-scale Russian invasion in 2022. On March 3, just seven days after the invasion began, Russian forces from the 55th Guards Mountain Motor Rifle Brigade (stationed in Kyzyl, Tuva Republic) entered the village. Failing to capture Chernihiv, the Russian army resorted to terrorizing the civilian population, executing some unarmed residents on sight.

The local school was turned into a temporary Russian garrison, with soldiers occupying its upper floors. Villagers were forcibly gathered and confined in the school's basement, which became a makeshift prison. Over 350 civilians, including more than 70 children, were crammed into approximately 200 square meters of space. The youngest victim was just 1.5 months old, while the oldest was 93 years old. Conditions in the basement were inhumane. Prisoners had no access to toilets, clean water, or adequate food. The lack of ventilation made the space damp and suffocating. According to testimonies, Russian soldiers regularly tortured and harassed the captives.

After 27 days of captivity, on March 31, 2022, Russian troops withdrew from Yahidne in the face of a Ukrainian counteroffensive. As they retreated, they looted the school and surrounding homes, destroying everything they could not take with them.

This war crime left behind a significant amount of material evidence. Ukrainian investigators meticulously collected proof, including DNA samples, leading to the identification of many perpetrators. Among the recovered items were personal and military belongings of Russian soldiers—uniforms, newspapers, half-eaten military rations, cigarette butts, and other discarded objects.

The school itself, which had been transformed into both a prison and a temporary garrison, bore clear traces of the occupation. The interior was devastated—educational materials, furniture, textbooks, and other teaching aids were either destroyed or defaced. The basement walls were covered with children's drawings, creating a haunting contrast to the horrors that unfolded there. Deprived of daylight and any sense of time, prisoners scratched a makeshift calendar onto the walls to track the passing days and nights. On the doors of one room, they recorded the names of villagers executed by Russian soldiers, as well as those who died in the suffocating basement. These seemingly ordinary markings offer valuable insights into the conditions endured by the victims and the behaviour of the occupying forces. They stand as tangible evidence of the tragedy that took place in Yahidne.

In 2023, the interior of the Yahidne School was digitally scanned as part of a Ukrainian-Polish initiative led by the ministries of culture of both nations. This project resulted in the creation of 3D scans, CAD plans of the building, and a comprehensive photographic record. The National Institute of Cultural Heritage of Poland supervised the work. Simultaneously, the local museum catalogued selected artefacts found at the crime scene, including personal belongings, remnants of military equipment, and other items—silent witnesses to the atrocities committed in Yahidne. Another crucial source of information is high-resolution satellite imagery recorded during the Russian occupation. These images document the scale of destruction, showing craters from explosions, burning buildings, fields and forests set ablaze, field fortifications, and military vehicles stationed near the school.

In this presentation, we will emphasize the potential of digital tools in documenting war crimes and disseminating knowledge to a wider audience. The use of remote sensing, 3D scanning, and high-resolution satellite imagery offers not only incontrovertible evidence but also a means of preserving memory and ensuring accountability.

Session: Aerial Archaeology from East to West		
10:20-10:40	Brian Shanahan	The view from above: Aerial archaeology down under
10:40-11:00	Peter Heimermann	Evaluating Digital Surface Models, RGB and multispectral orthomosaics for UAV-based remote sensing in Mongolia
11:00-11:20	Marek Hladík, Katarína Hladíková, David Cibulka & Tibor Lieskovský	Remote sensing and predictive modelling for the detection of endangered archaeological landscapes in Central Europe
11:20-11:40	Martin Gojda, Petr Krištuf & Jan Turek	Air-detected cropmarks of the Hill of Říp Neolithic sacred landscape in the heart of Europe
11:40-12:00	Michael Doneus & Nives Doneus	Detecting Roman surveying of municipal territories on the northern Adriatic islands, Croatia, from ALS-based Digital Terrain Models

The view from above: Aerial archaeology down under

Brian Shanahan (Extent Heritage, Australia)

Australia's landscapes preserve a rich and complex archaeological record, much of it hidden from ground view. Aerial archaeology — the use of drones, aircraft, and satellite technologies to detect and interpret sites — is revolutionising the way we uncover both ancient and more recent histories.

My early career and experience was shaped through the use of survey, aerial analysis, geophysical survey and excavation of complex medieval and early modern Irish relict landscapes. Australia, where I have lived for over a decade, presents a very different opportunity and horizon for these techniques. The land is geologically ancient and Aboriginal people have lived here since deep time, maintaining an enduring connection today. Simultaneously, Australia as a nation and settler state is very young- the product of the twilight years of British Imperialism of the late eighteenth century onwards. Consequently, cultural landscapes in Australia can comprise of ancient landforms imbued with Aboriginal peoples' connections, stories and occupation spanning over 40,000 years, alongside physically and biologically transformative but temporally shallow colonial pastoral and agricultural landscapes, mining landscapes, towns and cities. Where to for aerial archaeology in this land?

This paper will provide an overview of the challenges and opportunities presented by using aerial archaeology, remote sensing and archaeological survey to document, analyse and to communicate aspects of Australia's past. It will present a series of key case studies to demonstrate how aerial archaeology is contributing to our understanding of Australian cultural landscapes, encompassing many millennia of human occupation. It will explore how aerial methods have illuminated Aboriginal cultural landscapes, including stone arrangements, and fish traps, alongside the often-overlooked material traces of Australia's colonial and industrial past. From mapping long-abandoned gold rush mining landscapes, to identifying convict-era infrastructure and wartime sites such as air defences and air raid trenches, aerial archaeology reveals patterns of historical change across the continent. Through selected case studies, the paper will examine how techniques such as photogrammetry and LiDAR are used to document, protect, and reinterpret both Indigenous and historical archaeological sites. Importantly, the talk will also address the ethical dimensions of this work, particularly the importance of collaboration with Indigenous communities and heritage stakeholders, as aerial archaeology reshapes the narratives of Australia's deep and more recent past.

Evaluating Digital Surface Models, RGB and multispectral orthomosaics for uav-based remote sensing in Mongolia

Peter Heimermann (University of Bonn, Germany)

The Bonn Center for Digital Humanities (BCDH) contributes to the DFG-funded project "Urban Impacts on the Mongolian Plateau: Entanglements of Economy, City, and Environment ", which investigates urban structures from the Mongol Empire era (1206–1368) and their environmental impact. The subproject "Virtual Landscape and Multispectral Survey" focuses on the applicability of UAV-based remote sensing methods in Mongolia.

Between 2022 and 2024, several UAV campaigns were conducted using a fixed-wing drone equipped with both multispectral and RGB sensors. These surveys produced high-resolution

digital surface models (DSMs), as well as RGB and multispectral orthomosaics. A total of 23 archaeological sites covering approximately 10,000 hectares were documented.

To ensure a diverse and versatile dataset, sites from different historical periods (Mongol [1206–1368] and Manchu [18th c.–1911]) and climatic zones (Central Mongolia and the Gobi Desert) were included. Several sites were also surveyed multiple times in different seasons and years, allowing for diachronic and climatic comparisons, as well as multitemporal analysis of drone-based remote sensing data.

The evaluation proceeded in two steps. First, a preliminary selection of vegetation indices (VIs) was made based on their potential to detect archaeological structures. To identify the most effective indices, quantitative contrast analyses were performed on 40 different VIs and four individual bands across selected sites surveyed in both May and September. This enabled a seasonal assessment of index performance and the identification of the most promising candidates for further use.

In a second step, the selected indices were compared to the RGB and DSM datasets. For this, detailed manual mapping of all archaeological structures was carried out using the different data derivatives. Each structure was classified into several categories to facilitate a structured comparison.

Key research questions included:
How many structures are visible in each dataset?
What types of structures can be identified?

How do disturbance factors like livestock trampling, modern agricultural practices, or dense vegetation impact visibility?

Thanks to the diversity of the dataset, we are able to make broad assessments of the strengths and limitations of various remote sensing methods across different site types, climatic zones, and seasons in Mongolia. The findings highlight which sensor combinations are indispensable for particular environments and archaeological contexts.

Beyond data evaluation, the final outcome of the project includes detailed site plans for all documented locations. These plans will not only support archaeological interpretation but also serve as tools for monitoring preservation conditions, helping to identify dominant threats in a landscape where heritage protection has long been neglected.

Remote sensing and predictive modelling for the detection of endangered archaeological landscapes in Central Europe

Marek Hladík (Institute of Archaeology Czech Academy of Science, Czechia)
Katarína Hladíková (Slovak National Museum – Archaeological Museum, Slovakia)
David Cibulka (Institute of Archaeology Czech Academy of Science, Czechia)
Tibor Lieskovský (Slovak University of Technology - Department of Theoretical Geodesy and Geoinformatics, Slovakia)

The Morava River Basin, located along the present-day border between Slovakia and the Czech Republic, preserves a rich cultural landscape shaped by successive populations (Germanic tribes, Avars, Slavs) throughout the first millennium AD. These groups left behind a diverse range of archaeological features—hillforts, settlements, flat and barrow cemeteries

– embedded within distinctive geomorphological settings such as levees, river terraces, and visually dominant elevations.

Among these, particular attention is paid to sites with long-term settlement continuity from the Late Prehistoric period through the Early Middle Ages. These areas offer excellent conditions for interdisciplinary research into human-environment interaction and for modelling settlement dynamics across time.

In this presentation, we introduce a three-tiered research approach that integrates predictive modelling, remote sensing (especially airborne laser scanning – ALS), and non-invasive geophysical survey. Remote sensing plays a central role in identifying anthropogenic features in fragile and dynamic landscapes and allows us to monitor relief changes associated with long-term human activity. This is especially valuable in areas increasingly affected by environmental pressures such as intensive agriculture, urban development, or climate-related change.

Our workflow begins with predictive modelling to assess the potential presence of archaeological sites. Remote sensing techniques, including ALS, are then used to detect landscape anomalies and possible archaeological traces in the most promising areas. Finally, targeted geophysical surveys help to confirm and refine our interpretations without the need for excavation.

This methodology highlights the value of integrated remote sensing techniques in both archaeological discovery and heritage management. It provides a model for surveying and safeguarding cultural heritage in vulnerable landscapes experiencing environmental, social, or developmental change.

Air-detected cropmarks of the Hill of Říp Neolithic sacred landscape in the heart of Europe

Martin Gojda (Dept. of Archaeology, University of West Bohemia, Czechia)
Petr Krištuf (Dept. of Archaeology, University of West Bohemia, Czechia)
Jan Turek (Dept. of Archaeology, University of West Bohemia, Czechia)

The paper brings results of a long-term research of one of the most spectacular prehistoric and early medieval landscapes in Bohemia, a natural plateau raised above the most fertile Elbe river lowland part of the country and crowned by the Hill of Říp – a landscape node traditionally (since the early 12th century) connected with the mythical beginnings of the Czech history, concretely with the arrival of the earliest groups of Slavs headed by their leader named Boemus. Via a systematic large-scale aerial reconnaissance carried out since the 1990´ (and supported by the application of other non-invasive field methods and carefully assorted test excavations) a noticeable concentration of early Neolithic long barrows and ceremonial sites (large ditched enclosures) has been detected on the territory of the Říp plateau. Due to lack of archaeological evidence on settlements datable to the same period we have concluded that in the Neolithic the landscape around the Hill had been understood by the then population as exclusively sacred area connected with funerary rituals and probably ceremonial communication with their deity personified to the Hill of Říp. Supportive to this interpretation is also the fact that in prehistory the Hill - as a dominant natural monument extremely well visible from a long distance - was never fortified and turned to a common profane settlement (hillfort).

Detecting Roman surveying of municipal territories on the northern Adriatic islands, Croatia, from ALS-based Digital Terrain Models

Michael Doneus (Department of Prehistoric and Historical Archaeology, University of Vienna, Austria)
Nives Doneus (Vienna Institute for Archaeological Science (VIAS), University of Vienna, Austria)

Mediterranean dry stone wall landscapes are highly complex aggregations of events and processes. As presented at the AARG Annual Meeting in 2023, such landscapes can be adequately addressed through the use of ALS data and a spatio-temporal approach within the framework of GIS and a Harris matrix. This research has revealed a wealth of information about a complex sequence of human activities, including dry stone wall remains of a presumed Roman land division on the island of Cres.

This year's presentation will focus on research carried out over the past two years. It will show that Roman surveying remains are preserved beneath modern and medieval agro-pastoral structures. An absolute chronology was obtained using the OSL profiling and dating method (OSL-PD), which gave a date range of 200 ± 100 AD for the island of Cres. These dates have been further confirmed by the interpretation results of the state ALS survey data from other islands in the Kvarner Bay. As a consequence, this study provides the first clear evidence for Roman surveying of municipal land on the Croatian islands.

Session: Aerial archaeology from north to south		
13:00-13:20	Lars Forseth	A lucky strike! Photographing cropmarks in central Trøndelag in 2007. Contexts and follow-up.
13:20-13:40	Bo Ejstrud	Survey strategies: a comparison
13:40-14:00	Alison Deegan	A thousand metres wide, thousands of years deep: the archaeological landscapes at the foot of the Lincoln Edge.
14:00-14:20	Wendy Morrison	'Stand back from the platform – train of thought approaching!': LiDAR prospection and hilltop settlement
14:20-14:40	Maria Lucrècia Centelles-Fullana, Carmen Cuenca-García & Valeria Martín Sidro	Using ALS for Iron Age archaeology in the Valencian region (Spain): the Sensing Iberianscapes project experience.

A lucky strike! Photographing cropmarks in central Trøndelag in 2007. Contexts and follow-up.

Lars Forseth (Trøndelag County Council, Norway)

Summer 2007 was unusually dry in central Trøndelag. A text message in early July from an archaeologist at Stiklestad indicated that cropmarks was visible at a previous known burial field at the Stiklestad far. Luckily, we had recently bought a good Nikon Digital SLR with GPS. We also knew about a company in Verdal that could fly us with a helicopter over the site.

The first flight showed a lot of cropmarks at Stiklestad, but also Vinne and later Vinnan (Stjørdal).

Through about 6 flights in July/August we could record these sites. In 2020/21 there was again dry summer. This time we went for drones! These gave the advantage of georeferenced images.

The sites found have been recorded in the national sites & monuments database. This paper will explore their contexts and show how data of this type can be used with other data to give better understanding of the sites for further analysis and research.

Survey strategies: a comparison

Bo Ejstrud (Danish Centre for Aerial Archaeology, Holstebro Museum, Denmark)

With more than 30 years of aerial surveying, archaeologists at Holstebro Museum have accumulated a vast database of tracks and discoveries across Denmark. From 2023 we chose to completely shift survey strategies, changing from what could be termed ‘non-random walks’ between areas of particular interest, to systematic sampling in parallel survey lines.

This presentation will present and contrast the two approaches. It will discuss both the immediate output of the two strategies, as well as the wider implications in terms of sampling in aerial archaeology.

Having used two very different sampling strategies in the same landscape is a strong point of departure for such a discussion. It is also an opportunity to present and evaluate more than 30 years of aerial archaeology efforts from Holstebro Museum.

A thousand metres wide, thousands of years deep: the archaeological landscapes at the foot of the Lincoln Edge.

Alison Deegan (Freelance, England)

Along the western edge of the Lincolnshire Wolds, where the chalk uplands descend abruptly into the valley of the River Ancholme, there is a narrow strip of land occupied by a string of spring-line villages. Examination of a wide range of aerial sources from 1940s verticals to recent LiDAR imagery has revealed complex and overlapping archaeological landscapes around and between these villages. In the 1940s there were near-continuous earthwork ridge and furrow, and medieval settlement remains. Later in the 20th century, when these are levelled by ploughing, the remains of Iron Age and Roman settlements and Bronze Age barrows began to appear as cropmarks and the complexity and intensity of these continues to increase.

This work has revealed interesting relationships. This densely used and occupied strip of land lies between the more sparsely populated valley floor and chalk upland to the west and east. Furthermore, there are hints that some elements of the Iron Age and Roman landscapes persisted into the medieval period. Investigating this potential continuity has highlighted the importance and challenges of maintaining spatial accuracy when mapping from very varied aerial sources.

The North Lincolnshire Air Photo and LiDAR mapping project is funded by Historic England.

'Stand back from the platform – train of thought approaching!': LiDAR prospection and hilltop settlement

Wendy Morrison (Chilterns National Landscape, England)

At the 2025 Iron Age Dialogues conference in Cardiff, noted hillfort scholar Graeme Guilbert posited a thought – what if hut platforms were not exactly what – and more importantly where- we always expect them to be? What might unenclosed hilltops have to say for themselves, if we would only look closer? This paper attempts to bolster Gilbert's suggestion with a case study from the Chiltern National Landscape LiDAR dataset, one of the largest and highest resolution of its kind in the world, covering 1440 km.

Using ALS for Iron Age archaeology in the Valencian region (Spain): the Sensing Iberianscapes project experience.

Maria Lucrècia Centelles-Fullana (Department of Prehistory, Archaeology and Ancient History, Universitat de València, Spain)
Carmen Cuenca-García (Department of Prehistory, Archaeology and Ancient History, Universitat de València, Spain)
Valeria Martín Sidro (Department of Prehistory, Archaeology and Ancient History, Universitat de València, Spain)

The Sensing Iberianscapes project is dedicated to the study of Iron Age settlements in the Valencian region and other relevant sites linked to Iberian culture in Spain. We employ a multiscalar and minimally invasive approach, integrating methods such as remote sensing, surface geophysics, and soil analysis. Our aim is to explore, analyse, and compare vast landscapes as well as specific archaeological elements in detail.

Airborne Laser Scanning (ALS), also known as LiDAR, plays a significant role in our project. This technology has provided valuable insights for archaeological studies all over the world (Vinci et al., 2024; Bennet et al., 2025). Also in Spain, various works have incorporated ALS technology in archaeology, although most were not focused on the Valencian area (Cerrillo Cuenca and López, 2020).

We want to present the advances of the Sensing Iberianscapes project using both open-source ALS datasets from the Spanish Geographic Institute (IGN) national surveys, and specific surveys conducted on archaeological sites using drone-mounted LiDAR sensors.

Additionally, we intend to explore the use of multi-temporal ALS datasets combined with aerial and satellite imagery to maximize the information obtained and to monitor archaeological sites over time.

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Session: Stop and reflect!		
15:10-15:30	Piotr Wroniecki	Perfect data, imperfect past. LiDAR interpretation in the face of archaeological realities
15:30-15:50	Sally Evans	SWOT analysis for aerial survey

Perfect data, imperfect past. LiDAR interpretation in the face of archaeological realities

Piotr Wroniecki (Montefortino Prospection & Digitalisation, Switzerland)

ALS/LiDAR technology has changed how we see archaeological landscapes but there is a problem with taking this data at face value. Although it is an elementary mistake, what we see today is often mistaken for what existed in the past. The visible surface is just one piece of a much more complex puzzle, shaped by erosion, deposition, and human activity over centuries. ALS/LiDAR gives us a very good but ultimately flawed beginning despite the impressive technological aspect, a starting point for investigation, not its end. While we are rightly impressed by the precision of new technology, we must not forget that it us that still need to do the work, to think like archaeologists and to maintain a vision of all the processes that could have shaped a site from its creation to today.

This critical perspective is becoming even more important as non-invasive datasets increasingly guide heritage protection decisions. While this trend is positive in many ways, there is a growing risk. Non-specialists, often dazzled by the technology, misinterpret surface features without considering the underlying complexities. This can lead to serious practical problems: protecting only visible earthworks while overlooking subsurface structures, misunderstanding the size or shape of features, or even assigning cultural or chronological identities based only on their present morphology. These pitfalls are not theoretical. They have real consequences for how heritage is managed, protected, or even lost.

Through selected case studies, I would like to present examples of misreading ALS/LiDAR data can lead to mistakes on the ground, and argue for a more cautious approach or rather more informed approach. No matter how advanced our tools become, the fundamental work of archaeology remains aware that the landscape is the product of many layers of change and that the digger we deep (literally or allegorically) the more details we uncover and nothing is ever is at looks on the surface.

SWOT analysis for aerial survey

Sally Evans (Historic England, England)

With the 60th anniversary of the Air Photo Unit this November and the Aerial Archaeology Research Group (AARG) going from strength to strength with a history stretching over 40 years, it is timely to study the current state of aerial archaeology in 2025. This paper aims to better understand the current position of aerial archaeology and to identify areas we can harness in the future. While focussing on aerial archaeology generally it will include some case studies from work at Historic England. To shape the paper, a SWOT analysis (Strengths, Weaknesses, Opportunities and Threats) is used.

Among items to be discussed:

• Strengths: Aerial archaeology remains flexible in its application - from large area mapping informing characterisation, to updating scheduling information, to monument identification and protection. It is cost effective and as an aerial archaeology community we have proven to be adaptable by continually developing and incorporating new methods.

• Weaknesses: silo working and the lack of opportunities for skill sharing. Although aerial survey methods have become democratised, thanks to the availability of online sources and the relative low cost of drones, there is a general lack of interpretation skills across the heritage sector. Access to physical archives remains a significant challenge

• Opportunities: There are significant opportunities in developing guidance, potentially thinking more broadly across the sector, particularly following the success of the recently published EAC LiDAR guidance. Training initiatives, such as apprenticeships and grant-funded projects with a training element, can help address skill gaps. AARG has had a long history of training students and the AARG community itself is a valuable resource.

• Threats: Resourcing, both in terms of staff and funding remains a critical threat, the potential loss of expertise is also a significant concern. A lack of understanding of the idiosyncrasies of historic aerial archaeology mapping, particularly low spatial accuracy for older products and issues this brings further challenges, including reduced confidence in aerial archaeology as a discipline.

To these can also be added issues such as Artificial Intelligence (AI), which may fall under multiple categories depending on the context and provenance of such endeavours.

The paper aims to initiate a conversation between AARG members about how we as aerial archaeologists can improve and develop? What is AARG's role in this evolving landscape?"