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Europae Archaeologiae Consilium

Climate Change and Archaeology

Edited by Hannah Fluck and Kate Guest

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Dr. Hannah Fluck, FSA, Head of Environmental Strategy, Historic England
Kate Guest, Senior Policy Adviser, Historic England

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Introduction/Foreword

Hannah Fluck

Anthropogenic climate change is already affecting our environment. Climate projections show that in Europe we can expect:

- changes in rainfall with increased drought, and desertification as well as increases in intensity and frequency of rainfall (sometimes in the same locations);
- increases in temperature, in winter and summer, increase in temperature and frequency of heatwaves;
- rising sea levels and groundwater fluctuations;
- warmer seas, ocean acidification and changes in oceanic currents

These climate drivers will result in changes in flora and fauna and changes in ground conditions which will affect archaeological desposits and structures. Moreover, human responses to the climate crisis also impact archaeological sites.

However, while our archaeological deposits and historic places are vulnerable to the impacts of climate change, our knowledge and skills as archaeologists are also relevant to supporting society in adapting to a changing climate and a low carbon future.

In July 2021 the EAC held its 22nd Heritage Management Annual Symposium on the topic of climate change and archaeology. The papers explored the challenges faced by archaeological sites as a result of a changing climate as well as some of the opportunities for discovery; the relationship between heritage and the wider environment, including biodiversity, and the long-term perspective on environmental change and human interaction that archaeology can bring.

The impact of the climate crisis on the conservation of archaeological sites was addressed with examples from Finland (Halinen *et al.*), Ireland (McCormick and Nicolas), Denmark (Frederiksen); Jones *et al.* explored the application of the 'Climate Vulnerability Index' to sites in in Scotland and how it might apply elsewhere and Kountouri *et al.* looked at the integration of climate change into cultural policies for world heritage sites in Greece.

The relationship between the impact of renewable energy upon archaeological sites was addressed with perspectives from world heritage sites (Virágos) and the Netherlands (Dutting and Boss), and the impact of carbon mitigation approaches such as tree planting (Cordemans *et al*).

Figure 1. Flooding around Tewkesbury, Gloucestershire, England. The town is an ancient settlement situated where the rivers Severn and Avon meet. © Historic England Archive

Several papers explored the opportunities for discovery, as well as associated challenges, presented by retreating glaciers (Nicolis and Stadler), or receding waters (Villa González).

The relationship between archaeological heritage and biodiversity was explored in Estonia (Kadakas) and the long-term perspective on environmental change and people's responses was considered with examples from Bulgaria (Preshlenov) and Austria (Kowarik).

Finally, the role of archaeology and heritage as inspiration for responses to the challenges of climate change was considered with examples from the Netherlands (Vreenegoor and Kosian) and England (Woodside).

As we address the causes and impacts of climate change, we should ensure that archaeology is part of that conversation. Archaeology can and should play a part in understanding the changes we face as a result of climate change but also in responding to them.

"Our culture and heritage are windows into millennia of human experience from which we can draw and use them to shape our strategies to adapt and to make our communities more resilient to climate change risks and challenges. Are we capable of projecting from our collective past into our shared future? I believe yes, we are. I believe this is not only possible, but it is imperative that we do so."

(Hoesung Lee, IPCC Chair, Opening address to the first ICOMOS-IPCC-UNESCO Co-sponsored Meeting on Culture, Heritage and Climate, 6 December 2021)

The full version of this paper is available at https://doi.org/10.11141/ia.60.1

How is Climate Change Affecting Finnish Archaeological Cultural Heritage?

Petri Halinen*[1], *Marianna Niukkanen* and *Niko Anttiroiko

[1] Finnish Heritage Agency. petri.halinen@museovirasto.fi

Keywords: erosion, climate change, wind erosion, renewable energy, forests and archaeological heritage

The distance between the southern- and northernmost points of Finland is long, over 1,000 km. The south has a lot of forests, and factors that impact windiness are on the rise, thereby affecting our archaeological cultural heritage as well. Storms are becoming more common, which causes damage – occasionally extensive – in Finnish forests: due to storms, thousands of trees may fall in both localised and larger areas causing widespread harm. One recent example is from a few years ago from the Åland islands. Trees torn up by their roots during storms resulted in damage to several archaeological sites, including Stone Age dwelling sites and Iron Age burial mounds.

Climate change is affecting temperatures, humidity and wind conditions. These changes are made evident by the fact that glaciers – areas covered by snow and permafrost – have shrunk in the Arctic regions, and the average temperatures throughout the whole of Finland have risen. In Northern Lapland, both palsas (permanently frozen peat) and the snow-covered fells and permafrost areas have reduced in size, or even disappeared. In the high mountains of Scandinavia, the snow-covered areas have diminished considerably, revealing objects made of organic materials, some of which date back several thousand years. In Finland all-year snow has never covered wider areas. It occurs only in patches in the mountainous region of North-West Lapland. These patches are diminishing as well. Actually, the all-year snow on the Finnish fells probably melted during the warm period coinciding with the Viking Age. Unfortunately, any objects made of organic materials and exposed back then would have been destroyed by the Middle Ages at the latest.

In Northern Lapland's fells, the northern boreal zone (white birch zone) and the boreal zone (coniferous zone), the wind tends to be stronger and windiness and storms have become more common. The average temperature has also risen, which causes autumn to be longer, while winter and spring are shorter. This in turn results in worsening erosion, both in the fells and the white birch zone. Increased erosion accelerates the loss of fine sediments, which subsequently leads to the destruction of archaeological remains. In the white birch zone, wind erosion transfers sand from one glaciofluvial

deposit to another, destroying and burying relics (e.g. settlement sites are destroyed and trapping pits are buried).

As harsh winds are becoming more prevalent and causing trees to fall on power lines, Finnish legislation has been changed in order to have overhead lines replaced with underground ones. This in turn means that harm may come to archaeological sites due to the thousands of kilometres of new power cable trenches being dug. As a result, relics may accidentally be damaged. However, it also means that more archaeological sites get studied, which increases our knowledge of our archaeological cultural heritage.

In order to mitigate climate change, society is transitioning to favour renewable energy solutions. Therefore, new wind turbines are being built both at sea and on elevated locations on land. The land in these areas has never been used for this purpose before, which makes it necessary to assess the impact of these projects on the archaeological cultural heritage. The impact is not limited to just the actual wind turbines, but also includes the building of new roads, power lines and other infrastructure to often remote areas. Therefore, many archaeological surveys, inventories and excavations are being carried out at new locations.

According to estimates, the temperatures will continue to rise, which will shorten the amount of time when the ground is covered by snow each year. This will influence the way in which forestry work is carried out: archaeologists recommend that forestry work be done while the ground is bearing, i.e. in the winter, whenever work is conducted near archaeological sites or other archaeological cultural heritage, but in the southern parts of Finland this period will become shorter or even disappear completely. Because forest harvesters tend to be large and heavy, their wheels can easily sink more than half a metre into the soft and wet soil, causing damage.

Furthermore, climate change increases the number of European spruce bark beetles that may cause significant harm to spruce forests. As the trees killed by beetle larvae are more easily toppled over by storms, this could increase damages to archaeological sites. The roots of these trees lift up the soil, causing surface damage to relics, because many of Finland's Stone Age settlement sites are located on sandy soil and their strata of occupation earth are located only approximately 5–50 cm below the surface. The damage caused by the soil being lifted up by the roots takes place approximately 0–30 cm underground, i.e. the surface strata of settlements. Moreover, both the surface and lower strata of cairns and mounds may be destroyed.

Warmer winters and less snow mean that metal detectorists are currently able to operate all year round, when it was previously impossible to use a metal detector in the winter because of the snow cover and frozen soil. Furthermore, it also means that professional archaeologists can also carry out field work throughout the year at least in some parts of Finland.

In addition to the above, climate change is known to affect underwater archaeological cultural heritage, although these processes are still insufficiently understood.

Archaeologists are hardly able to stop climate change or prevent its impact on ancient relics. We can, however, try to verify and monitor some of the effects. The Finnish Heritage Agency and Oulu University have launched a project aimed at automatic detection of cultural heritage objects from LiDAR data with machine learning techniques. The project also aims to develop methods for semi-automatic monitoring of natural and human-induced changes affecting archaeological sites. In the coming years, such efforts could help us better understand the impact climate change has on archaeological cultural heritage, and to base our responses on data, instead of guesswork.

Impacts of Climate Change on Coastal Archaeological Sites in County Kerry, Ireland

Fergus McCormick[1] and ***Melissa Nicolas***[2]

[1] OPW Senior Architect, Office of Public Works, Ireland. fergus.mccormick@opw.ie
[2] OPW Architectural Graduate.

Keywords: climate change, coastal archaeology, coast, coastal sites, County Kerry, Dunbeg Promontory Fort, Skellig Michael

This paper reviews three sites in County Kerry, Ireland, which are threatened by climate change impacts, and the risk mitigation currently undertaken by the Office of Public Works (OPW) to both protect these sites and those who visit them.

Case Study 1 – Dunbeg Promontory Fort (*An Dún Beag*), County Kerry, Ireland

1. Introduction and background

Dunbeg Promontory Fort is located on a sheer cliff overlooking the Dingle Peninsula in County Kerry, Ireland. It is a National Monument site in state guardianship and is one of the Wild Atlantic Way coastal touring sites. A local family privately owns the access path to the site. The fort contains four outer defensive banks of stone and earth. Inside the fort are the remains of a drystone Clochán (beehive hut) and a souterrain.

Dunbeg Promontory Fort is a National Monument (No. 177) protected under the National Monuments (Amendment) Act, 1994 and listed under the Record of Monuments and Places (RMP) number KE052-270. Dunbeg Promontory Fort is a designated Special Protection Area (SPA) protected under the EU Birds Directive.

2. Climate change impact

The location of Dunbeg Fort is making it vulnerable to natural weather events and is threatening the site's existence. The fort suffered from extensive coastal erosion in the early 19th century, and in the 1977 OPW carried out an archaeological excavation to record the site and its history before any further damage could occur. The excavations

Figure 1. Aerial view of Dunbeg Fort, showing coastal erosion. © OPW

were carried out by archaeologist Terry Barry. Further locations have been excavated in 2018 by archaeologist Laurence Dunne.

A considerable part of the cliff collapsed into the sea in recent years due to the increased frequency and severity of storms and precipitation. This has led to significant loss of the historic fabric and archaeological elements. The site is particularly vulnerable during the winter season between December and February due to its exposed location. A storm in January 2014 caused a portion of the cliff to collapse into the sea. Between 2017 and 2018, severe weather caused further damage and a significant part of the historic fabric including the entranceway was lost into the sea.

3. OPW climate change risk mitigation

OPW has adopted a policy of managed retreat for the site. The aim was to adapt to the present climate effects and to provide safe access for visitors. After the dramatic 2017 cliff collapse, the OPW applied for a Ministerial Consent from the Department of Housing, Local Government and Heritage (DHLGH) to erect a boundary fence that kept visitors and tourists away from the dangerous parts of the site. Access could not be allowed until a safety risk assessment was carried out and a report was issued. OPW commissioned consultant engineers to carry out a geo-physical survey of the site.

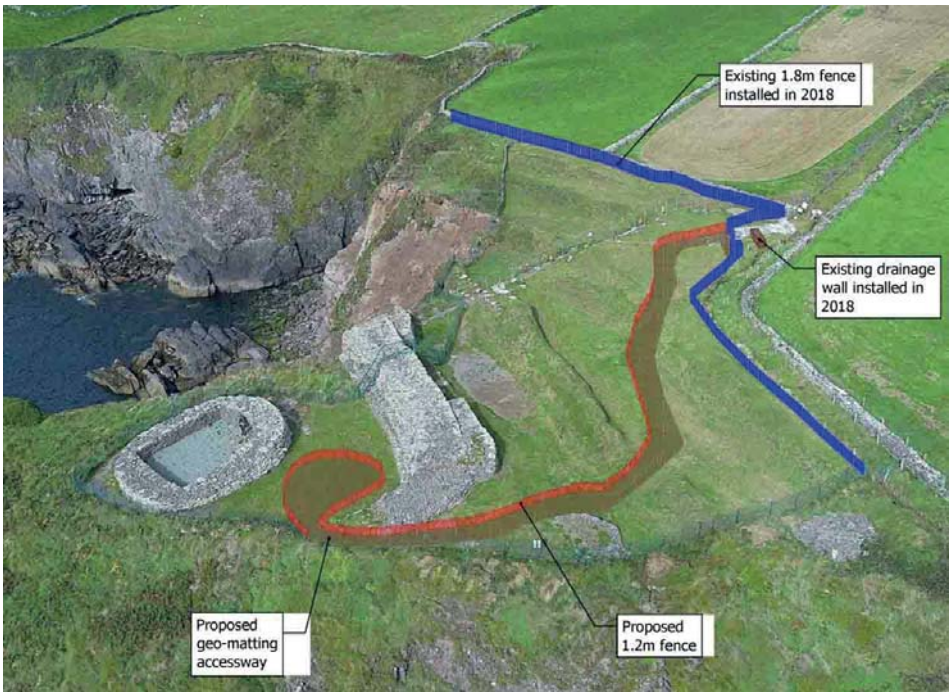

Figure 2. Drawing of proposed fencing installed in 2019. © OPW

The site will now be continuously monitored to ensure visitors safety. The Discovery Programme has also surveyed the site using Unmanned Aerial Vehicle (UAV) mapping. It is worth noting that in the case of sudden and dramatic collapse, the site will be closed immediately and access will be restricted to OPW personnel only.

OPW applied for a second Ministerial Consent in 2018/2019 to install fencing to limit visitors' access to specific areas that are considered safe. The existing drainage system has also been repaired and a new drainage wall has been constructed to redirect floodwater from the site. Dunbeg Fort was reopened in 2019 to allow the visitors to visit the site and benefit the local tourist economy. However, the drainage repairs carried out in 2019 were insufficient to keep away flooding from the site. As a result, the OPW have installed new culvert drainage pipework to mitigate the risk of flooding.

The OPW and DHLGH will install interpretation signage on site that will include a brief history of the site and educational information on climate change. The aim is to raise awareness of the visitors about the impact and challenges caused by climate change on the site.

Further coastal erosion to the site caused by climate change is progressive and inevitable. The repair works on site have required substantial labour and financial

Figure 3. New Safety fencing installed in 2019 by OPW to allow safe access to the site for visitors. © OPW

resources. A large range of specialists have been involved with the proposed works including the DHLGH archaeologists, OPW architects, consultant engineers, consultant archaeologists, OPW direct labour force etc. Local landowners and politicians have also been consulted. The site has been accurately surveyed to assess the damage and ongoing erosion. By keeping the site accessible to visitors, the OPW hopes to raise awareness of the public and visitors to the effects of climate change on coastal heritage sites.

Case Study 2 – Skellig Michael (*Sceilg Mhichíl*), County Kerry, Ireland

1. Introduction and background

Skellig Michael is an island located 13km off the South Kerry Coast and is home to an early medieval monastic site. It was founded by saint Fionán in the 6th century. The medieval monastery is dramatically situated on the top of the rocky island in the Atlantic Ocean. Due to climate change and increasingly rough sea, the monks later transferred to the mainland at Ballinskelligs Priory. The monastery came into state care in 1880 and the OPW took on responsibility for managing and maintaining the monastic site. The island also contains two lighthouses, the lower lighthouse and upper lighthouse, built by the Commissioners of Irish Lights in 1821. They represent good examples of typical 19th-century lighthouse architecture and are the subject of proposed long-term repair and restoration works by the OPW.

Figure 4. Aerial view of Dunbeg Fort.
© OPW

Skellig Michael was inscribed on the World Heritage List in 1996 for its unique cultural and natural attributes. The uniqueness of the dry-stone monastic structures displays the architectural achievement of the monks in such a remote and severe environment. The island is also important for being a destination for breeding seabirds and has a unique eco-system. Skellig Michael is a designated Special Area of Conservation (SAC) under the Habitats Directive (92/43/EEC) and a designated Special Protected Area (SPA) under the Birds Directive (79/409/EEC). Both directives form part of Natura 2000, a European network of protected sites.

2. Climate change impact

One section of the monastery retaining wall at Skellig Michael has become structurally unstable due to the increase in rainfall and rainwater draining through it. The OPW has commissioned the Discovery Programme to monitor the movement of the wall on a yearly basis. The OPW is proposing the careful dismantling and rebuilding of the wall to address the rainwater drainage issue. The monastery wall will have to be carefully reconstructed without compromising the site's authenticity and Outstanding Universal Value (OUV). A digital survey of the Monastery and retaining wall is required

Figure 5. Aerial view of the monastery at Skellig Michael. © Department of Housing, Local Government and Heritage (DHLGH)

Figure 6. Monastery Retaining Wall in danger of collapse. © OPW

to determine the conservation methods to be adopted by OPW. The OPW is in the process of appointing a survey company to carry out a digital survey of the Monastery.

In recent years, increased rainfall has also resulted in increased rock fall that is damaging the fabric of the site and threatening the safety of both OPW staff and visitors to the island. In 2017, a rock fall occurred near the guides' accommodation, causing a major safety risk for staff. The increased rock fall at the time caused damage to the lighthouse road, an important architectural feature. The erosion is also the result of natural causes such as wildlife burrowing on site. Another serious rock fall occurred in July 2020 near the OPW workers huts. This has highlighted the urgency of installing new permanent crash decks to protect OPW workers in area at high risk from rock fall events.

3. OPW climate change risk mitigation

Presently, the OPW carries out maintenance works four weeks prior to the opening of the island for visitors during summer. The island is open to visitors from May to October during the summer season. The physical nature of the island and the uneven monastic steps are challenging to visitors and can cause serious accidents and injuries. The OPW has carried out two rescue exercises in 2019 that involved bringing a dummy casualty from the monastery to the pier on a stretcher. The Irish Coastguard Mountain Rescue team were involved in the rescue exercise and it is envisaged that a rescue exercise will take place during June of every year.

Rock fall is a high-risk threat to the safety of OPW staff and visitors. Both rock fall and increased rainwater are damaging the unique historic fabric of the site. The OPW has

Figure 7. Rock Fall in 2020. © OPW

installed temporary crash decks in locations with high occurrence of rock falls. It is proposed to install permanent robust crash decks in three critical locations on the lighthouse road. The OPW commissioned consultant structural engineers to design the crash decks and it is proposed to install them in the 2021/2022 season.

The increase in sea levels, sea swells and the increasing severity of storms have also been affecting access to the landing pier. The number of days when tourists can access the island during the summer tourist season has been steadily decreasing. The viability of the island as a tourist destination will be affected by climate change. The OPW are exploring long-term solutions to enhance the landing to the island and compensate for rising sea levels. The OPW will keep maintaining and carrying out repairs to the existing pier as required to ensure safe landing onto the island.

The OPW will also install new visitors' dry toilets in the 2021 season near the helipad on the lighthouse road. There are currently no visitors' toilets on the island. Improving toilets and hygiene facilities on the island has become a necessity following the Covid-19 pandemic. The installation of tourists' toilet are important for the viability of Skellig Michael as a World Heritage site and tourists destination.

Figure 8. Aerial view of Ballinskelligs Priory. © Department of Housing, Local Government and Heritage (DHLGH)

The OPW have commissioned Carrig Conservation International in 2021 to carry out a Climate Vulnerability Assessment (CVA) of Skellig Michael. The aim of this report is to assess the impacts and risks caused by climate change on Skellig Michael. The report will provide recommendations that the OPW will take into consideration when tackling the impacts of climate change on the historic fabric.

Case Study 3 – Ballinskelligs Priory (*Prioreacht Bhaile An Sceilg*), County Kerry, Ireland

1. Introduction and background

Ballinskelligs Priory is located on the west shore of Ballinskelligs bay in county Kerry. It was founded by the monks who came to the mainland from Skellig Michael between the 12th and 13th centuries. The remaining structures on site date back to the 15th century. They include two churches that have windows and doors with dressed stones, and a cloister garth with a large hall. Ballinskelligs Priory is one of the significant spiritual sites dedicated to St Michael in the area. It is a destination for visitors searching for spirituality and history. Its location on the Wild Atlantic Way also makes it a main

Figure 9. Aerial view of Ballinskelligs Priory and the existing concrete sea wall.
© Department of Housing, Local Government and Heritage (DHLGH)

tourist destination. The site contains a large graveyard that is still used by the local community.

2. Climate change impact

A significant amount of this historic site has been lost to coastal erosion throughout the years. As a result, a concrete sea wall was built in the 1950s to prevent further loss of the historic fabric. The sea wall is now deteriorating and is in urgent need of upgrading and repair. The OPW has been carrying out conservation and repair works to the priory for the past 10 years. In recent years, the increasing storm surge and water penetration to the site and over the sea wall has caused damage to the ruined structures and threatened their survival.

3. OPW climate change risk mitigation

The OPW commissioned a structural inspection and report for proposed repairs to the sea wall in September 2019. The OPW has also commissioned conservation consultants to carry out a climate change risk assessment on the site, the first one of its kind on a national monument site in Ireland. The aim of the risk assessment is to identify the potential risks to the site and to develop a Climate Change Adaptation Guide. The OPW has also commissioned The Discovery Programme to carry out a scan survey of the site and to monitor the coastal erosion on an annual basis.

The OPW is gathering a team of various consulting experts to advice on the most practicable solution for protection of the site from flood damage and erosion. The expert bodies consulted consist of OPW architects, Kerry County Council, OPW Flood Risk Management Section engineers, consultant structural engineers, DHLGH archaeologists and consultant archaeologists. The repair works to the sea wall will be technically challenging and expensive and have to be carefully discussed with all stakeholders. Any proposed methods for the enhancement and repair of the sea wall must not compromise or damage the ecosystem of the bay. A foreshore license from Kerry County Council to carry out the works will be required. A Ministerial Consent for carrying out works to the National Monument will also be required from DHLGH.

The repair works to the sea wall at Ballinskelligs Priory are a challenging task. The works will have to be carried out in a sustainable manner and the project has to be accurately costed. The health and safety of the workers on site will be prioritised especially during high tide and the completed works will have to be protected from any potential damage. Once repairs to the sea wall are completed, Ballinskelligs Priory will become a case study for other vulnerable heritage sites in the area.

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Scheduled Monuments and Sites at Risk of Coastal Erosion: Danish Heritage Legislation and Actions

Pernille Denise Frederiksen

Danish Agency for Culture and Palaces. pdf@slks.dk

Keywords: scheduled monuments, coastal erosion, Denmark, climate change, coastal heritage, coast, Danish Agency for Culture and Palaces, heritage protection

Climate change is now a reality that looms larger than ever before in our everyday life. Global warming, rising sea levels, and extreme weather conditions are major international issues: no longer just theoretical predictions, but real threats causing serious damage to property every year. Climate change has a great number of economic costs for society – costs that will only increase in the future as the world faces more severe weather extremes and rises in water level.

With its long coastline and relatively flat landscape, Denmark is especially vulnerable to extreme wind and weather conditions. More frequent coastal erosion and flood events result in destructive consequences for the country's fixed cultural heritage (e.g., burial mounds, monuments, megaliths), which cannot be recreated without loss of authenticity and source value.

Made urgent by recent years' more severe weather extremes, the threat that coastal erosion poses to cultural heritage sites has come to attention in a series of cases. For example, in 2014 a beach visitor has found the remains of a Bronze Age sword (1500–1300 BCE) on the beach below the eroded Bronze Age mound, Lars Jens' Barrow at Kerteminde on the Danish island of Funen.

These cases, along with ongoing scientific data, make it clear that naturally occurring damage is bringing about a gradual degradation of the cultural heritage located in immediate proximity to the Danish coast, potentially leading to the loss of valuable knowledge regarding Denmark's cultural history. Scheduled monuments and sites – those historic resources receiving legal protection – constitute a special category of coastal cultural heritage. They are covered by a protection regime that is legally unenforceable under present circumstances.

The issue of monuments and sites threatened by coastal erosion is interesting in that Danish society has instituted a conservation system that cannot be sustained because

Figure 1. Bronze Age barrow damaged by coastal erosion - Kerteminde, Funen.
© Pernille Denise Frederiksen (2017)

of escalating weather conditions. This poses major administrative challenges to the country's cultural heritage authorities. There is therefore an urgent need for an administrative decision to be made in this area and for a forward-looking strategy to manage the growing incidence of climate-related damage to the country's scheduled monuments.

Denmark has approximately 32,000 scheduled monuments scattered throughout the country. They include sites and monuments ranging from Stone Age megaliths dating to around 3500–3200 BCE, to military sites from the two World Wars of the twentieth century. This high figure includes monuments both large and small, from individual rock carving motifs to big Viking fortresses. Scheduled monuments have been legally protected from changes to their physical condition since 1937 and are now mentioned in the Danish Museum Act. Danish legislation on monuments is restrictive: the default position is that no changes at all may be made to historic monuments and sites. However, the Danish Agency for Culture and Palaces, the country's cultural heritage authority, is able to grant an exemption for changes when the particular situation is determined to involve a special case. As an example, temporary arrangements and festival events on larger, more robust sites, such as castle grounds. Archaeological investigations also require an exemption, as they are by their nature destructive.

In years to come, as coastal erosion and flood events in Denmark increase due to climate change and disaster events, the country's cultural heritage authorities will face major challenges, including a growing number of cases concerning destruction of cultural heritage. In this context, there are grounds for re-evaluating some quite fundamental concepts and principles of current cultural heritage practice in Denmark,

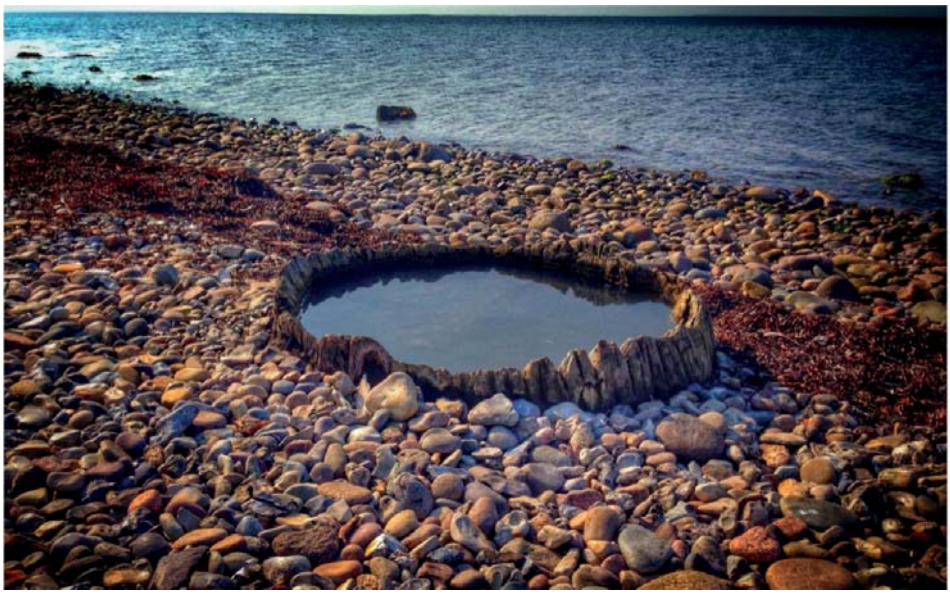

Figure 2. Bonze Age well and medieval holy spring at risk of coastal erosion, Samsø.
© Pernille Denise Frederiksen (2016)

which places an especially high value on authenticity, integrity, and restoration. Above all, this means breaking with a long-standing "hands-off" management tradition, which needs to adapt to tackle the future challenges of cultural heritage in a world of global warming and increased natural disasters.

In 2015–2016, to develop an overview of the threat facing scheduled monuments and sites, the Danish Agency for Culture and Palaces carried out a survey of all scheduled monuments and sites in the country threatened by coastal erosion. This national survey shows that 711 scheduled monuments and sites are located within 50 metres of the coast, and 92 of those are already undergoing some form of degradation.

With this survey in hand, it is now possible to prioritise specific management plans for monuments in peril and properly direct broad-scale management of monuments in decay. A variety of administrative measures are available, depending on the condition and type of monument and the nature of the threat.

Possible measures in this context include: 1) 'letting nature take its course'; 2) ongoing monitoring and inspection; 3) coastal protection; 4) relocation or restoration and; 5) archaeological excavation or recording. Historically, very few monuments threatened by degradation have been relocated or investigated archaeologically because of the restrictive legislation. All five of these measures have been previously used, but only in sporadic fashion, never under an overall national action plan.

It is important that future measures to protect scheduled monuments and sites follow an overall national strategy and are carried out in collaboration with the relevant regional and local authorities to prevent important cultural history from being lost to posterity.

The Memory of the Glaciers. First World War Archaeology in Glacial Contexts in the Trentino Alps

Franco Nicolis

Director, Archaeological Heritage Office of the Province of Trento, Italy. franco.nicolis@provincia.tn.it

Keywords: First World War, WWI, Trentino Alps, glacier archaeology, White War, Punta Linke, Punta Linke project

For several years, the absence of regular snowfall in the Alps has prevented glacial basins from compensating for the effects of summer melting. The consequences of these natural events include an increasingly frequent emergence of traces left by the presence of man in the mountains, traces which have been sealed for decades, centuries, or even millennia by the layers of snow. The sensational finding in September 1991, at an altitude of 3210 metres, of the "Iceman", a Copper Age mummy in South Tyrol is now part of collective consciousness.

The sudden change in conditions caused by the acceleration in the melting of the glaciers has led to a crisis concerning the recovery and conservation of finds, as their materials are usually extremely sensitive to changing environmental conditions. Furthermore, the geographical location of the sites is at high altitudes, where rapid changes in weather and the alpine terrain often cause major logistical problems to be solved in a sometimes very limited operational time frame.

The plundering of sites by collectors who cause gradual destruction of the contexts represents a further problem.

The challenge represented by the emergence of an increasing number of finds, which must be dealt with using scientific methods, is a direct concern for archaeologists, who find themselves at the forefront in difficult recovery procedures aiming to acquire as much information as possible regarding cultural settings dating back to very different periods.

In the alpine Trentino region (Northern Italy), which was part of the Austrian-Hungarian empire until 1918, the so-called "White War" took place. This peculiar aspect of the First World War was fought at very high altitudes, often above 3,000 metres, and even in the glacial environment.

Nowadays, the consequences of global warming also include the increasingly frequent emergence of traces left by the impact of the White War on alpine environments: large

Figure 1. © Ufficio beni archeologici – Provincia autonoma di Trento

amounts of material abandoned by the armies facing each other, but also corpses of soldiers.

The archaeological approach to this kind of evidence needs to find the right balance between scientific methodology and ethical issues which arise from the fact that we are excavating "identities" in the field of memory, though the great part of these identities is now "unknown soldiers." According to Armando De Guio's definition, this is the "archaeology of the grandfather" (de Guido *et al.* 2013).

The Punta Linke Project

Punta Linke (in the Ortles Cevedale group, 3629 metres a.s.l.) was one of the most important Austro-Hungarian positions of the Alpine front during the First World War, a front which, in that area, ran along the frontier between the Kingdom of Italy and the Austro-Hungarian Empire. The Punta Linke Project consists of the comprehensive investigation, documentation, and recovery of the entire context of a military installation.

Figure 2. © Ufficio beni archeologici – Provincia autonoma di Trento

The site of Punta Linke is characterised by the presence of two cableways, the first connecting it with the valley-bottom at Pejo (1170 metres a.s.l.) and the other with the important garrison located on the south-eastern slope of Palon de la Mare, today known as "Coston delle barache brusàde" ("the slope of the burnt huts"), at about 3300 metres a.s.l., in the heart of the Forni Glacier.

The transit station for the cableway, built within the glacial deposit, consists of a hut with a flat roof and rectangular plan. Inside there is a place for the diesel engine, which was originally placed on a cast-iron structure fixed to a concrete base. On the other side is a small workshop for the maintenance of the cableway. We have found a range of accessories and spare parts on the floor, many tins that must have contained food rations, woollen gloves, crampons, glacier goggles, alpenstocks, and other personal items.

Among the paper items hanging on the walls of the hut, alongside a handwritten sheet with rules for the smooth operation of the cableway, we have found a centre-spread of the *Wiener Bilder* newspaper showing people queuing for bread in Vienna and a postcard showing a sleeping girl addressed to one Georg Kristoff, with a note, in Czech, signed "your abandoned love."

Behind the hut, there was a 30-metre-long tunnel dug into the permafrost and rock, which allowed the carts to pass under the mountain ridge undercover and then from the exit of the tunnel to take the last section of the cableway to the "Coston delle barache brusàde," a stretch of approximately 1300 metres. In the tunnel, we have found the disassembled engine in various parts and its cast-iron body.

Outside the cabin, in a store carved into the ice, we have found most of the mobiliary artefacts, probably in transit from one cableway station to another. We have recovered many tools, numerous rolls of barbed wire, equipment for the cableway, many shields, helmets, a tub for sauerkraut, etc. Of great interest was finding a hundred or so overshoes made of rye straw, worn by the soldiers during guard duties. The soles of the overshoes are sometimes made of small wooden elements; one of them bore the stamp "Kriegsgefangenenlager Kleinmünchen," the prisoner of war camp at Kleinmünchen, near Linz in Austria. In fact, these straw overshoes had often been made by prisoners of war, who at Kleinmünchen were mainly Russians. Other soles had a name written on them (e.g., Antonio, Januk), probably indicating the user of the overshoes.

The archaeological fieldwork has allowed the complete recovery of the Punta Linke context. We relocated all the material found during the research, including the engine, inside the transit station. Still in place are all of the original structures of the tunnel, freed from the ice and the material found there, including a range of tools, ropes, an abandoned cableway car, and a large firewood store.

Today the trek to the site of Punta Linke, in an environment of great charm and with a climb of a few hours along a high-altitude path, prepares visitors and hikers for a different approach than usual to WWI sites and helps them prepare for the unusual, a multisensory experience.

And at Punta Linke, the most profound experience is that of smell; the smells given off by the overshoes, the tarred paper, the engine, the wooden hut: it is the same smell they gave a hundred years ago, and that remained trapped in the ice until today.

At Punta Linke, there are no glass cases to come between the visitor, the materiality, and the sensoriality of memory; there are no lenses that filter, there are no information panels. At Punta Linke, one does not have to understand the war; one should feel, breathe, smell it. At Punta Linke, war is its smell.

Corpses of soldiers

In the summer of 1952, the bodies of five First World War soldiers from the Alpine Corps were found on the Adamello glacier.

After the discovery, the writer and journalist Dino Buzzati inveighed against those who wished to "*destroy the magnificent coffin*" that had conserved them after their death in "*pure and silent sleep, in the maximum serenity and beauty that the human mind can*

conceive."[1] Today, nearly seventy years after these words, those marvellous crystalline coffins are dissolving.

Between 2007 and 2017, the Archaeological Heritage Office of the Autonomous Province of Trento intervened on numerous occasions, in agreement and with the collaboration of the relevant institutions, the Italian Ministry of Defence's General Office responsible for fallen soldiers, the Austrian Black Cross, and the Carabinieri Corps.

In August 2012, it was thus possible to recover the remains of two soldiers from the Austro-Hungarian army in a crevasse on the Presena glacier, at an altitude of 3000 m. They emerged after 100 years, hidden by what appeared to be a pile of rags, in just a short distance from the lift system. They were lying in an almost fraternal embrace. When the hail of shrapnel hit, they were probably not even 18 years old. Their uniforms showed signs of the sharp knives of their enemies: clear-cut, vertical, accurate incisions with no tearing, inflicted to extract everything they had in their pockets. Perhaps, for this reason, the two young men had nothing personal left on them.

In 2016 and 2017, the bodies of two Italian soldiers from the Alpine Corps were recovered in the Adamello mountains. The first had a balaclava pulled over his face, along with a handmade ring on his finger; some telephone cable was tied around his waist. There was nothing to reveal his identity.

The second Italian soldier was found no more than 100 m from his companion. He, too, had a telephone cable wound around his body. He was still wearing his boots, but only shreds of his jacket and waistcoat have remained. He was found with a balaclava and some personal objects: a small ring, a pipe, a pen made of bullet casings. It was not possible to recover the metal case containing the military ID tag, but he had something else very important with him.

During investigations of the body, a cloth bag was identified inside his jacket, containing numerous paper items that had been seriously compromised. Inside the cloth bag, we have found fragments of some postcards, a postal receipt, the remains of a prayer card. On some of these documents, faded as a result of time and the poor conservation conditions, the same name, and surname appeared. In the end, it was possible to identify the alpine soldier and find out what had happened to him: Beretta Rodolfo, son of Paolo, a soldier in the 5th Alpine Regiment, Val d'Intelvi Battalion, 244th Company, born on 13 May 1886 in Besana Brianza, military district Monza, died on 8 November 1916 at two-thirty, "*because he was buried under an avalanche while transporting provisions from Passo Lares to Passo Cavento (Adamello)*."

Global warming is affecting alpine territories and the lives of the people living there. Archaeology has a major role in preventing that cultural, historical, memorial, personal heritage still trapped inside the "crystal coffin" of the alpine glaciers as they are destroyed. It is a moral duty that the Archaeological Heritage Office of the

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[1] *Corriere della Sera*, 13 August 1952

Autonomous Province of Trento has taken on in the last few years, also following the dramatic climate change that is changing the face of our glaciers.

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Developing Climate Risk Assessments for World Heritage: the Climate Vulnerability Index

***Rebecca Jones*[1], *Mairi Davies*[2], *Jon Day*[3] and *Scott Heron*[3]**

[1] Historic Environment Scotland and James Cook University. rebecca.jones@hes.scot
[2] Historic Environment Scotland
[3] James Cook University, Australia

Keywords: climate heritage, world heritage, Scotland, CVI: Climate Vulnerability Index

Climate change is recognised as the fastest growing threat to World Heritage (WH) properties by ICOMOS and the IUCN. The Climate Vulnerability Index (CVI) was first piloted at the Natural WH property of Shark Bay, Western Australia in 2018; the first application to a Cultural WH property took place in April 2019 at the Heart of Neolithic Orkney in Scotland.

Figure 1. Workshop participants discussing climate risks at Skara Brae, Orkney.

Figure 2. Damage to the footpath at the Ring of Brodgar, Orkney, taken in 2019.
© Historic Environment Scotland

Figure 3. Participants at the online Old and New Towns of Edinburgh workshop

Figure 4. Dr Scott Heron presenting the CVI at the 43rd World Heritage Committee in Baku, Azerbaijan

The CVI methodology was developed as a tool to assess climate risks that is applicable to all types of WH properties around the world. It is intended to be rapid, systematic, repeatable and flexible – and therefore adaptable to the wide array of properties. There has been significant interest in the CVI for both WH and other heritage properties. One key feature of the CVI is the assessment of the community associated with the site, thereby giving an assessment both of the vulnerability of the recognised site values to climate change and also the economic, social and cultural impacts.

With applications now developing globally (see www.cvi-heritage.org), HES was successful in getting grant funding from the Royal Society of Edinburgh to develop more CVI applications for Scottish WH properties, starting with Edinburgh in May/June 2021.

In this paper, we outline the results of the workshops for Orkney and Edinburgh and how we propose to embed the results in the on-going adaptive management of the sites.

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Energy for the Past

Monica K. Dütting[1] and ***Jolanda Bos***

Archaeologist, Tilburg Municipality. monica.dutting@tilburg.nl

Keywords: energy, green energy, regional energy deal, energy and archaeology, energy technology, impact of green energy on archaeological sites, constructions and archaeology

Climate change and its future effects have prompted governments to take giant strides in order to harness new sources of energy and advance the use of 'green energy'.

The Netherlands, together with 195 other countries, signed the Paris Climate Agreement in 2015. In the years following, a National Climate Agreement was negotiated and signed by a wide variety of actors in the public, economic, environmental, energy, construction and social sectors. Over 600 major and minor rules and regulations were agreed upon, concerning mobility, energy resources, industrial production, environment, farming, and construction.

In order to implement the agreements on greener energy resources, regional energy deals have been struck, bringing together the energy demand and the possibilities of energy production of non-fossil fuels on a regional scale. In most of these regional energy deals, civil organisations and/or the public have been engaged. While constructing these deals civil organisations and environmental activists have worked towards minimizing the effects on inhabitants, landscapes, and nature of the regions.

Until now cultural heritage, and especially archaeology, has been largely absent from these deals. We argue that this is partly caused by insufficient technical know-how by both policy makers and archaeologists about the construction and transport of new energy. This has prevented a full understanding of the impact of new energy on archaeological and historical sites and structures, and limited adequate protective action.

This lecture seeks to bridge this knowledge gap by presenting technical aspects of solar, wind and (geo)thermal energy and exploring the way these developments impact the archaeological record. We will also look into possible strategies for preserving the past and advancing a greener future.

The Guadalperal Dolmen (Cáceres, Spain). Archaeological and Heritage Protection Interventions when an Artificially Submerged Archaeological Site Resurfaces due to Climatic Factors

Ángel José Villa González

Archaeology area of the Ministry of Culture and Sports of Spain. angel.villa@cultura.gob.es

Keywords: Guadalperal dolmen, Iberian Peninsula, drought, reservoir

In 2019, the Iberian Peninsula suffered the worst drought in recent decades. The lack of rain and the water shedding to feed the rivers meant a clear reduction in water levels at Spanish reservoirs. This situation allowed previously flooded lands to re-emerge on the surface, and in many cases, they were accessible on foot, as happened at the Valdecañas reservoir (Cáceres).

Several heritage and archaeological sites, such as the Roman city of Augustóbriga, and the protohistoric dolmen of Guadalperal were completely submerged in 1963 because of the reservoir built in this area. The Dolmen of Guadalperal, due to its spectacular nature aroused great expectation and attracted several curious visitors and the media, who understood that this was a unique opportunity to visit it. The responsible administrations therefore needed to act by protecting and archaeologically studying the site. It is a corridor tomb with a funerary chamber of about 5m in diameter and 10m of passage corridor. Because of its typology and part of its associated material culture, the dolmen construction can be placed between the fourth and third millennium BCE, but other ceramic and lithic industry elements suggest an earlier first phase of use. It was excavated between 1925 and 1927 by the archaeologist Hugo Obermaier.

After being submerged in the reservoir, some of its orthostats' upper parts are visible in summer, but climate change means that it is sometimes completely uncovered and can be "easily" accessed by foot, as happened in 2019. All this activity alerted both the surrounding towns, such as Peralada de la Mata, and the various national administrations involved: the Central Government, as the land is state-owned (when the reservoir was created, it was purchased by the Government and became part of the Tagus River Basin, currently under the Ministry of Ecological Transition and Demographic Challenge) and the Regional Government (Regional Government of Extremadura), as it is responsible for some of the archaeological and heritage protection competences (transferred by the Central Government).

Figure 1. © Ministry of Culture and Sports of Spain

The first actions were carried out in 2019 by the Department of Fine Arts of the Spanish Ministry of Culture and Sports. The situation of the land was verified in situ and some initial emergency measures for its stabilisation were carried out. In October 2019, the waters of the reservoir rose again, which meant that the site was once again inaccessible. In May 2020, the Ministry of Culture and Sports drew up a contract with the University of Alcalá de Henares for conducting, with its researchers, the documentation and archaeological intervention on the megalithic complex and its surroundings.

Four phases were carried out: the first two involved cataloguing, documentation, intensive prospecting, and general evaluation of the surroundings. Meanwhile, the second two were devoted to the archaeological intervention and detailed study of the site.

Figure 2. © Ministry of Culture and Sports of Spain

The full version of this paper is available at https://doi.org/10.11141/ia.60.4

The Impact of EU Climate Policy on Archaeology – Making choices

***Emmet Byrnes*[1], *Vince Holyoak*[2] and *Karl Cordemans*[3]**

[1] Forest Service Inspectorate, Department of Agriculture, Food and the Marine, Ireland
[2] Strategy & Listing, Historic England
[3] Flemish Land Agency, Flanders. Karl.Cordemans@vlm.be

Keywords: afforestation, Green Deal, biodiversity, tree planting, forest management

To mitigate the impact of climate change, the European Commission has launched the Green Deal. One of the key elements herein that was adopted in May 2020 is the Biodiversity Strategy. This strategy contains several measures, to be achieved by 2030, and includes the planting of 3 billion trees across the 27 Member States. Since afforestation is considered a rather cheap method to capture carbon there is little doubt that this target will be met.

However, planting 3 billion additional trees in Europe is unlikely within the framework of forest management and afforestation sectors. Foresters replant the logged sites anyway, as part of good forestry practices. Most agricultural land stays stably under cultivation due to CAP measures. Furthermore, large parts of marginal, abandoned, or degraded lands have already been covered by forests, largely due to EU-supported measures. The question thus remains, where will the planting take place?

Another aspect is the impact of different methods of afforestation and forest management on archaeological sites and features. This paper explores, compares, and contrasts the tension between archaeology and biodiversity. It will discuss the challenges for sustaining the heritage and the historic character with regard to forestry and woodland, and the differing national approaches to doing so.

Postglacial Black Sea Level Rising, Urban Development and Adaption of Historic Places. A Case Study of the City-Peninsula of Nesebar, Bulgaria

Hristo Preshlenov

National Archaeological Institute with Museum – Bulgarian Academy of Sciences.
hristo.preshlenov@abv.bg

Keywords: Sea level fluctuations, abrasion, urban spatial changes and recovery, geomorphological, archaeological and historical mapping, Unesco's "city-museum" of Nesebar

As a material environment reflecting social living conditions in development, the city necessarily requires the construction of architectural types, ensembles, and facilities that can provide conditions for the realisation of its functions and give a unique physiognomy and monumentality to the urban environment.

Its spatial development on the Nesebar peninsula is dependent on the dynamics of negative geodynamic processes of both an endogenous (modern movements of the earth's crust, earthquakes) and an exogenous (abrasion, erosion, collapses) nature, the activation of which is accelerated by the eustatic fluctuations at sea level.

Figure 1. Nesebar Peninsula in the 21st century (after ИСМ Компания)

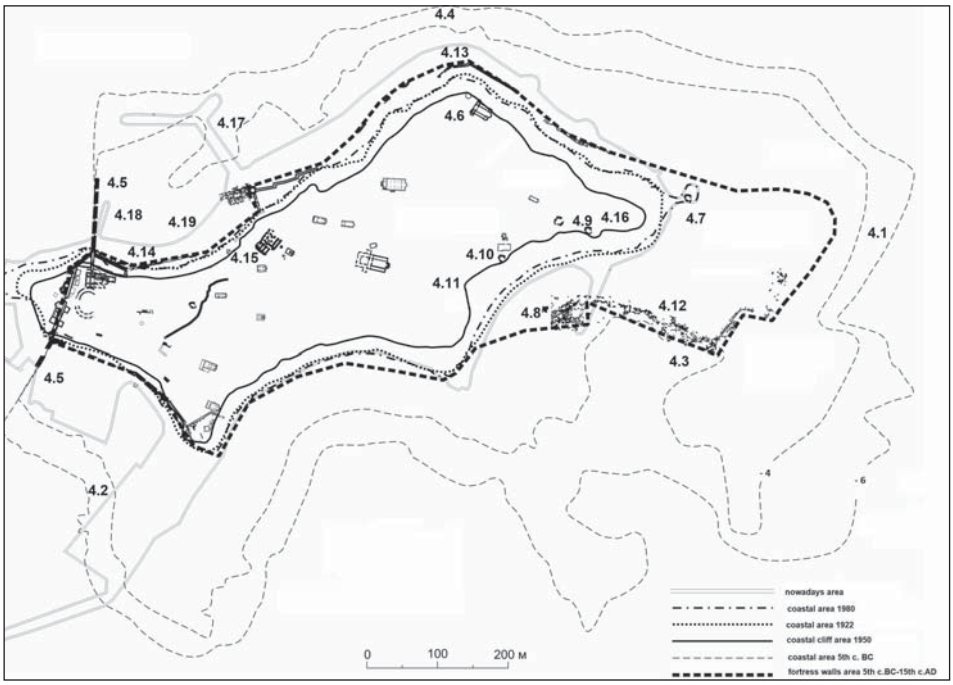


Figure 2. Location plan scheme of the urban spaces and coastal lines mentioned in the text.
© H. Preshlenov

These geological benchmarks, conditioning, but also conditioned by, postglacial climate changes; the necessity of their correlation with the archaeological database (fortifications, infrastructure, including port aquatory and territory, communication approaches, and sacred and profane constructions in the coastal zone); their impact on the spatial development of the urban structures of the peninsula and on the modern coastal protection of the city-peninsula of Nesebar (UNESCO World Heritage Site since 1983), which follow the optimal choice of the ancient and medieval builders, are visible even today, two and a half millennia after the foundation of Mesambrian polis.

Figure 3. Crescented Thracian wall. © B. Zhablenski

Figure 4. Northeastern peninsula terraces and the Monastery basilica St. Virgin Eleusa. © H. Preshlenov

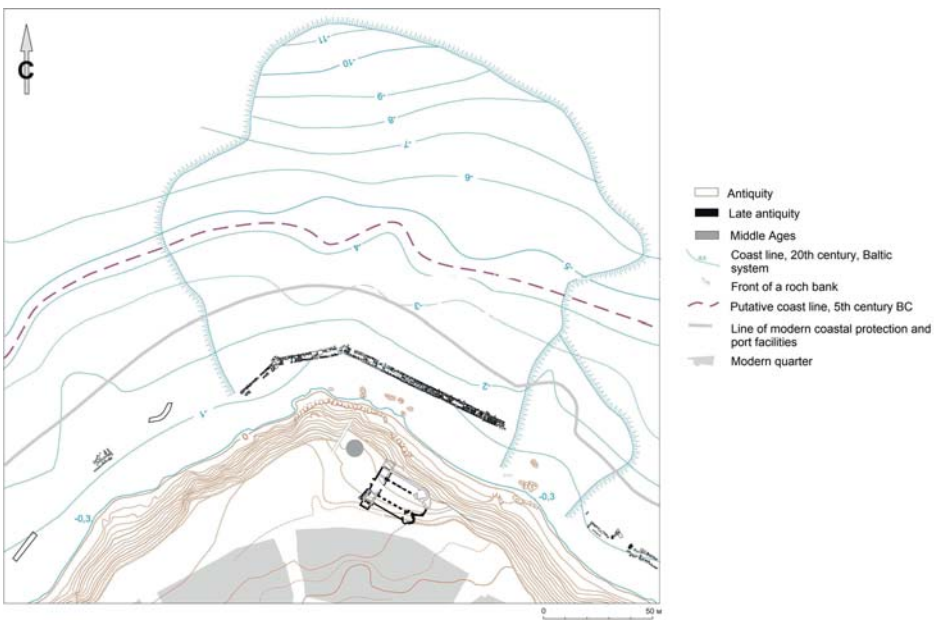


Figure 5. Nesebar Peninsula at the beginning of modern coastal fortification works. From the archive of L. Ognenova-Marinova

The full version of this paper is available at https://doi.org/10.11141/ia.60.5

Using Cultural Heritage and Historical Analyses for Current and Future Problems with Too Much and Too Little Water

Ellen Vreenegoor[1] and ***Menne Kosian***

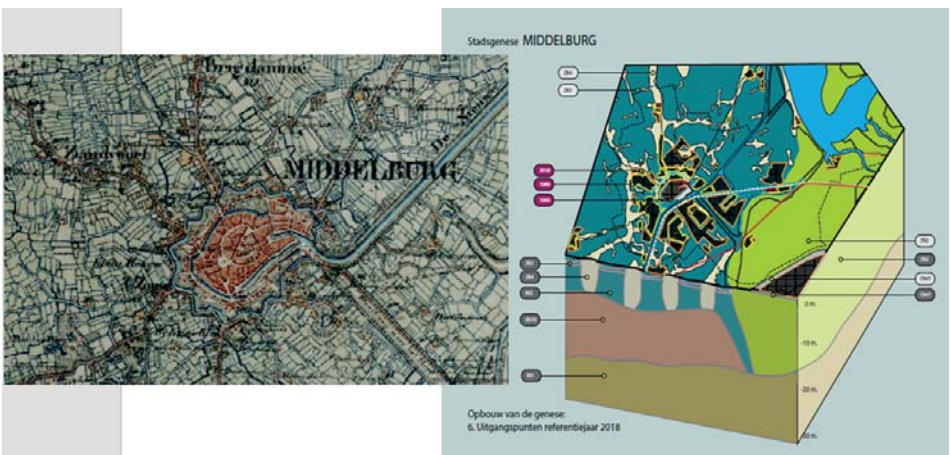
[1] Cultural Heritage Agency of the Netherlands. e.vreenegoor@cultureelerfgoed.nl

Keywords: heritage, adaptation strategies, historical maps, water systems

The Netherlands are part of the Rhine-Meuse-Scheldt delta. The majority of the country is low lying and thus prone to flooding. That is the reason why the Netherlands has a long tradition of water management.

The National Public Works Agency of road and water management (Ministry of Infrastructure and Water) and the water boards try to create extra space for the rivers and streams, but also try to get rid of excess water as soon as possible. That means that along the rivers all trees and shrubberies have to move to lead the water through. And in smaller streams all remains of watermills, locks and shacks have to be removed for the same purpose. Sand and clay distraction along the riverside and in old riverbeds

Figure 1. Historic map and 3-D model of the development of the city of Middelburg



disturb the historic landscapes as well as the covered archaeologic landscapes with the promises to make new nature and make the area safer from flooding.

If we look closer at sites where (pre)historical people used to live along rivers or streams we can see how they used the water systems and usually choose the best places to stay. We study the possibilities to re-use those systems and elements for storing water during periods of too much water (flooding) so we can re-use it in dry periods.

We make analyses using historical maps to understand the water system and the changes made through the centuries. With this historical knowledge we can find new solutions for current and future problems caused by climate change.

The full version of this paper is available at https://doi.org/10.11141/ia.60.6

Let's All Sit Down at a Table and Discuss. Could protecting World Heritage Sites and the Renewable Energy Transition Go Hand in Hand?

Réka Virágos

Programme Specialist, UNESCO World Heritage Centre. r.viragos@unesco.org

Keywords: adaptation to climate change, renewable energy transition, wind energy development, cultural and natural World Heritage, protection and management, dialogue, sharing information and knowledge

Adaptation to climate change and mitigating potential negative impacts is a challenging task for heritage managers. UNESCO's pilot project to develop a guidance tool focusing on wind energy projects started from the assumption that appropriate guidance could help avoid conflict between the inevitable need for shifting energy production to renewable sources and protecting cultural and natural World Heritage. For this reason, the target audience of the planned document includes site managers, national focal points, national/regional/local level decision making authorities for project applications, and wind energy specialists (planners, developers, national level decision makers in renewable energy policies).

One of the challenges of the project lies in the fact that the protection and management of World Heritage properties are guided both by many diversified international textual resources, and the national legal frameworks. Development projects should all be authorised based on the national/regional application frameworks, while States Parties should also ensure that, if the planned or proposed projects relate to a World Heritage property, the World Heritage Convention is equally respected.

The objective of the guidance is to provide both sides with easy to understand and easy to use information (both on wind energy processes and needs and World Heritage protection and management) and highlight challenging points. The guidance provides tools that relate to processes to be followed during planning specific wind energy projects (like walkthroughs of steps on how to assess potential impacts), but also possibilities for providing protection by proactive conservation actions.

Researching Change – Understanding Change – Facing Change. 3500 Years of Human-Environment Relations in the Hallstatt/Dachstein Region

Kerstin Kowarik[1] and ***Hans Reschreiter***

[1] Natural History Museum Vienna, Department of Prehistory. kerstin.kowarik@NHM-WIEN.AC.AT

Keywords: Hallstatt High Valley, Dachstein, salt mine, salt mining, industrial heritage, adaptation, skills, climate change, citizen science

The Hallstatt High Valley represents one of Europe's oldest cultural and industrial landscapes. For millennia this remote alpine valley was the demographic and economic center of a wide region. In this landscape the venture of large scale underground salt mining spans from the present day back to the Bronze Age. The oldest secure evidence for large-scale underground salt mining dates to the 14th century BC. But various indicators point towards a much older tradition of salt production, reaching far into Neolithic times.

The extraordinary preservation conditions in the salt mines and the variety of archaeological, historical and environmental sources allow for unique insights into prehistoric technology, raw material management, working processes and human-environment relations.

Figure 1. The UNESCO World Heritage Area Hallstatt-Dachstein Salzkammergut seen from Graseck. © D. Brandner

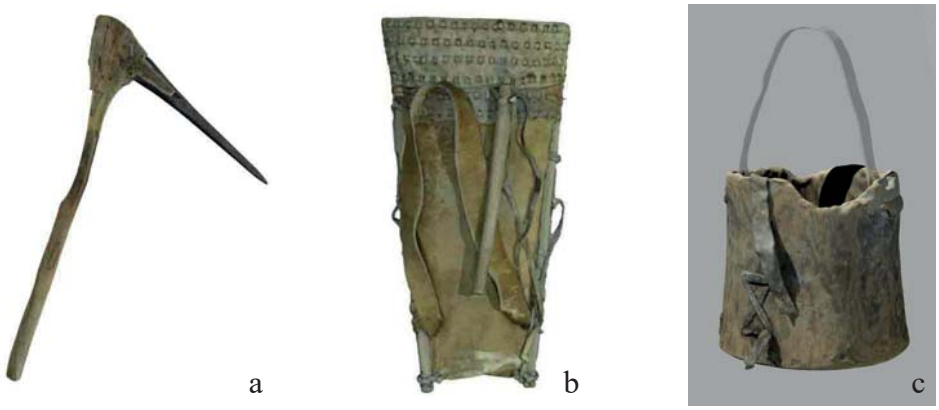


Figure 2. Archaeological finds from the salt mines in 3 D: a) Iron Age pick, b) Bronze Age carrying sack, c) Bronze Age bucket, to explore more finds from Hallstatt in 3 D follow this link https://skfb.ly/onSNI. © D. Brandner/NHM Vienna

Figure 3. The karstic plateau of the Dachstein massive, to explore this landscape in 360° follow this link https://kuula.co/share/7vdXr/collection/7kFr9?logo=0&info=1&fs=1&vr=1&sd=1&thumbs=1, © D. Brandner

Figure 4. a-b Outreach activities span from local science fairs to exhibitions in the Natural History Museum to virtual projects, H. Pernkopf/Salzwelten

The Hallstatt/Dachstein region represents an alpine environment, where the evolution of human-environment relations can be tracked over a long time period. Recent research has focused on the impact of natural extreme events on these highly sophisticated socio-economic systems (Festi et al. 2021, Knierzinger et al. 2021). Through this research it was possible to document the high degree of resilience of Bronze Age and Iron Age communities in the face of devastating natural extreme events such as mass movements and substantial climate change.

In this presentation we propose to address through this case study the themes of understanding past adaptation strategies and facing future challenges, operationalizing archaeological skills for mitigation strategies and also to explore the role of archaeologists based on our longstanding experiences in public relations and citizen science work in the Hallstatt region.

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The full version of this paper is available at https://doi.org/10.11141/ia.60.7

Integrating Climate Change into Protection Cultural Policies in Greece: the Management Plans of World Heritage Properties as a Case Study

Elena Kountouri*[1], *Constantina Benissi* and *Sofia Spyropoulou

[1] Hellenic Ministry of Culture and Sports, Directorate of Prehistoric and Classical Antiquities.
ekountouri@culture.gr

Keywords: world heritage, world heritage and climate change, UNESCO World Heritage, Greek world heritage, climate change policy

The emerging need to secure the long-term preservation of the archaeological sites and monuments of Greece against the growing threats of climate change is considered

Figure 1. The archaeological site of Olympia is surrounded by extensive forests, thus always being at risk from fires, the occurrence and spreading of which is influenced by climate change.
©Hellenic Ministry of Culture and Sports

Figure 2. In Crete, rising sea levels and intense waves threaten the sea fortress of Koules in Heraklion. ©Hellenic Ministry of Culture and Sports

a pressing issue for the Hellenic Ministry of Culture and Sports. The impacts of climate and weather-related risks (extreme weather events associated with floods and intense and gusty winds, forest fires, drought-erosion-landslides, rising sea-levels, etc.) are recognized as imminent threats that compromise the integrity and values of the cultural and natural environment.

During the past few years a systematic and targeted national effort is being implemented with the view to improve the resilience of cultural sites to climate change. Within this framework, central and regional policies are drafted that address heritage needs and provide the methodology and technical tools to identify, measure, evaluate and counter the impacts of climate change to cultural heritage on a medium and long-

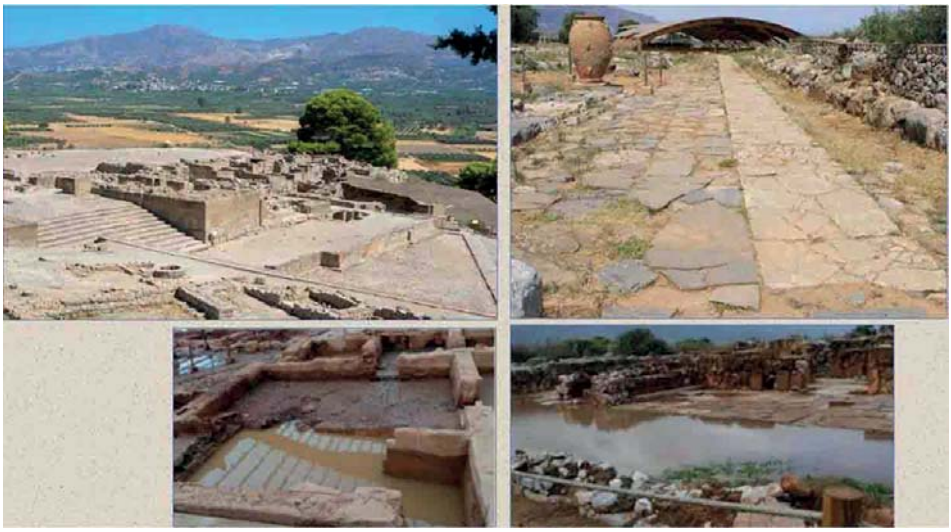

Figure 3. The Minoan Palace of Malia, Crete, is frequently flooded during winter.
©Hellenic Ministry of Culture and Sports

term basis. As part of this process, climate change is being taken into consideration within the framework of drafting integrated management plans for fifteen Greek cultural properties which are inscribed on the UNESCO World Heritage List, an ongoing European-funded project undertaken by the Directorate of Prehistoric and Classical Antiquities of the Ministry of Culture and Sports.

This paper attempts to highlight the pilot character of these plans for integrating into management policies climate-related aspects that need to be addressed in a coordinated manner both in order to achieve the national goals regarding the preservation and adaption of cultural heritage to the effects of climate change, and to prevent and mitigate the specific dangers not only for the World Heritage Properties but, gradually, for all Greek cultural monuments and archaeological sites.

The full version of this paper is available at
https://doi.org/10.11141/ia.60.8

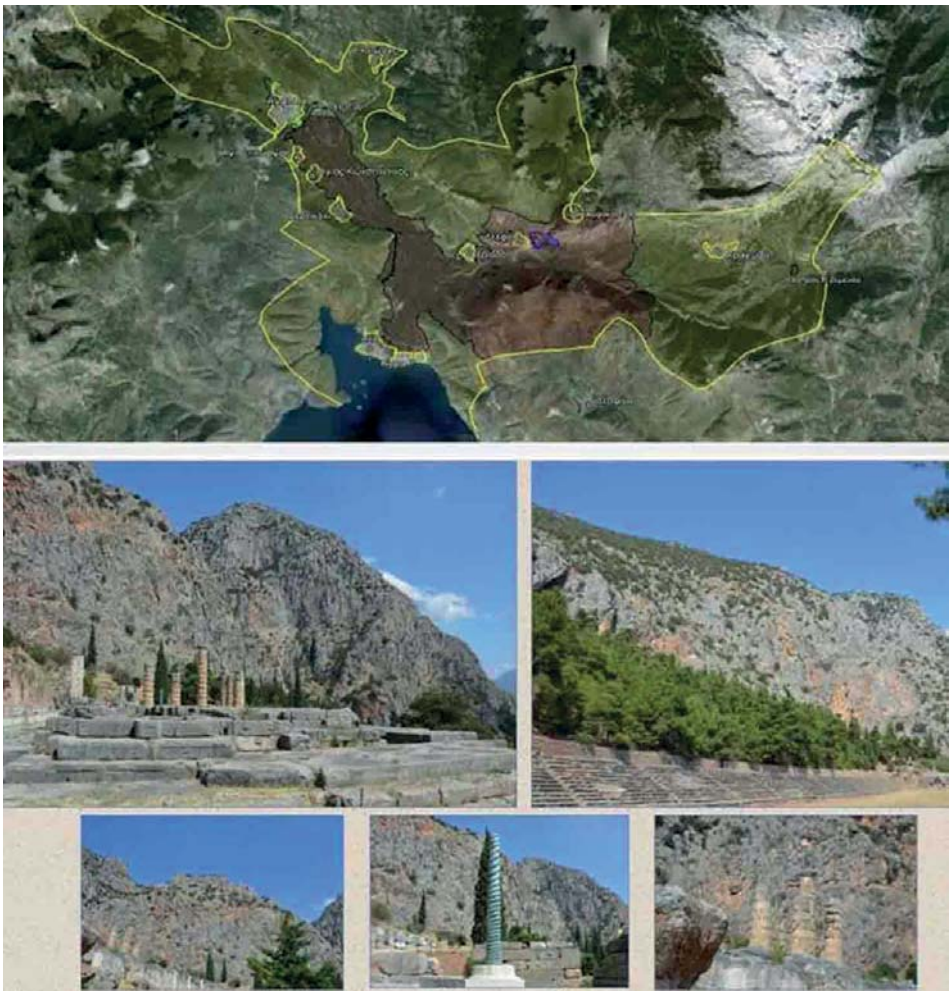

Figure 4. At the archaeological site of Delphi, rock-falls could be a threat for monuments and visitors, rendering parts of the sanctuary inaccessible. ©Hellenic Ministry of Culture and Sports

Archaeological Heritage as a Sustainer of Biodiversity

Ulla Kadakas

National Heritage Board, Estonia. Ulla.Kadakas@muinsuskaitseamet.ee

Keywords: Estonia, biodiversity, agricultural heritage, bioheritage, habitat

The forces of nature have shaped the post-glacial landscape, but in densely populated Europe, even in its northern periphery, man has been the main factor. Elsewhere for a longer period, but in Estonia during the last 3,000 years, the landscape has been changed significantly as a result of agricultural practices. Farms and villages are surrounded by intensively farmed fields, but meadows and pastures, forests and bogs, which lie between or further beyond them, have been less affected by intense farming and forest management. Therefore, it is natural that the areas of preserved early agricultural landscape are situated within today's grasslands, pastures and forests.

Such heritage landscapes, including ancient field systems (stone piles and fences), stone graves, inhumation and cremation cemeteries, enclosures and fortresses, fell out of use as fields long ago. Therefore, these have maintained their rich biodiversity as grasslands for thousands of years due to usage for cattle breeding. Among these, the wooded meadows and alvars of western and northern Estonia are especially rich in biological species.

The industrial turn of the 20th century meant not only the development of industry, the intensification of mining etc., but also the transformation of agriculture and forestry into large-scale industry. The escalation of large monocultural fields and forests (tree fields) pose a threat to biodiversity as well as other problems (erosion, carbon emissions, drought, etc.). Due to large-scale fields, for example, meadow flora and fauna have significantly decreased in Estonia during the last century.

Estonian natural scientists have conducted a lot of research into biodiversity. The result of one such work is a publicly available map application where everyone can measure the rate of biodiversity on their plot and get suggestions on what to do to improve it (https://shiny.botany.ut.ee/rohemeeter/).

Archaeological monuments have not been mentioned among the landscape elements during the compilation of this mapping tool. However, the areas of ancient field systems, stone graves or other elements of archaeological heritage situated in the middle of intensely farmed fields, are clearly highlighted as places of biodiversity. For

Figure 1. Typical rural landscape in Northern Estonia – stone graves from Bronze and Iron Age are situating in the middle of the field

all of them, the most favourable conservation environment is permanent grassland or pasture.

In the paper, I show that archaeological heritage can provide more than a sense of identity and humanitarian knowledge of human origins and activities in the landscape. Archaeological sites provide valuable habitats for insects, birds, open-air flora within the modern monoculture of agricultural lands. In the case of archaeological monuments, situated within economical forests, it is important not to manage the forest with methods of regeneration felling, but rather with methods of continuous cover forestry, which sustains both heritage and old biomes. Thus, in addition to providing temporal depth to the cultural landscape around us, rural archaeological heritage can also be consciously used for sustaining natural diversity, which within monocultural landscapes is gradually becoming a kind of heritage of its own – the bioheritage.

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Climate Change and Winners. Latest News on Glacier Archaeology in Western Austria

Harald Stadler[1] and ***Thomas Bachnetzer***

[1] Associated Professor, University of Innsbruck, Austria. Harald.Stadler@uibk.ac.at

Keywords: Austria, glacier archaeology, glacier, Alps, archaeological finds

In Austria, the retreat of glaciers is still in progress. Aside from Ötzi (the natural mummy discovered in 1991 in the Ötzal Alps), quite a lot of finds and features like weapons and depots from the Neolithic Period, up to WWI trenches and military aircraft of WWII, have been presented in various lectures and publications.

The intention of this paper is to give an overview of the latest news about archaeological sites and findings in Western Austria that were previously blocked up by glaciers but have become free of snow during the last ten years.

The paper will present wooden objects from the 7th century BC to medieval ones from the 13th century. Additonally, it will cover the remains of early alpine climbing, including bodies, equipment, or garbage from early mountain huts, but also bird migration accidents and their impact on environmental archaeology.

Figure 1. Vorderes Umbaltörl, East-Tyrol, Austria. Wooden object with hand carved notches for counting animals, mining work? Image/documentation. © Andreas Blaickner, Institute for Archaeologies, University Innsbruck

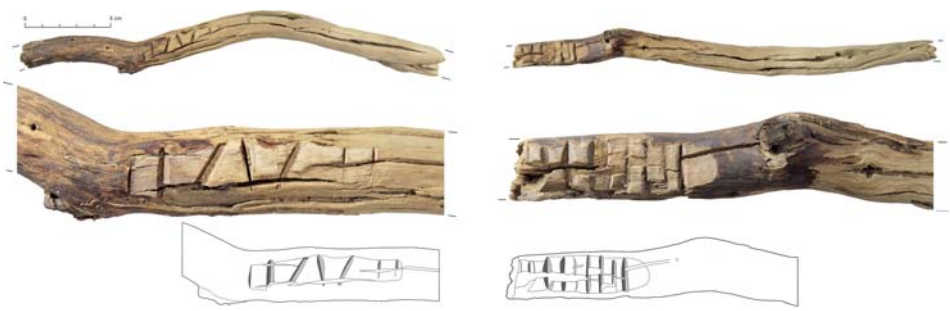

Figure 2. Großvenediger, Mullwitzkees. East-Tyrol, Austria. Metal flag in black, red and golden colour with unknown inscription and function.
Documentation: A. Blaickner, Institute for Archaeologies, Innsbruck

The paper deals with the huge information vaults on this topic, but also with the troubles occurring during scientific investigation, the problem of looting and the current situation of Glacier Archaeology in this Alpine Region.

COP26 and Beyond – Communicating Positive Action on Climate Change

Rob Woodside

Conservation & Estates Director (English Heritage) and Chair, Historic Environment Forum COP26 working group. Rob.Woodside@English-Heritage.org.uk

Keywords: COP26, climate change action, policy, Historic Environment Forum, heritage, Climate Heritage Network

This year (Covid allowing) delegates from around the world will be descending on Glasgow (Scotland) for the 26th UN Climate Change Conference of the Parties – better known as COP26. Hosted this year by the UK in partnership with Italy, it is thought to be the most significant event since the signing of the Paris Agreement at COP21 in 2015 where 195 governments around the world committed to keeping global warming within 1.5 degrees centigrade. Expect a lot of media coverage, high-handed pledges and concrete actions (well, we'll see….).

What opportunities might the focus on COP26 offer us as archaeologists and heritage managers in highlighting the potential risks of climate change to policy makers, the media, the public and indeed, each other? How can we use the inevitable attention the event will bring to flag up the positive actions we can take to mitigate and adapt to climate change? Could this offer a means of presenting the learnings we take from the past in order to help inform the future?

These are some of the questions raised by the Historic Environment Forum, a network of UK heritage bodies working together to bring shared approaches to the challenges we face in the sector. Having established a task and finish working group, our job now is to develop approaches to communicating why climate change matters to the heritage sector – and importantly, how we can present the sector as part of the solution, not a contribution to the problem.

This paper will explore how we are approaching the challenge of how different organisations across the sector can work together in developing a shared communications strategy. It will discuss how we aim to highlight potential risks and actions we are – and can – take to make a difference. It will also flag up the difficulties in defining the right audiences, voice and identity in an already crowded field whilst complementing the work of others, notably the Climate Heritage Network.

The paper will draw on a number of case studies that demonstrate the breadth and depth of our work across the UK heritage sector – and which we want to use in our communications as good examples of both the issues we face and the positive actions we can take.

The full version of this paper is available at https://doi.org/10.11141/ia.60.10

Peatlands, with their great significance to both the natural environment and the historic environment, are at risk from a variety of threats, including climate change. The Holme Fen post, Holme Fen National Nature Reserve (NNR), Cambridgeshire, was put into place in 1850 with its pointed top at ground level, to show and monitor the peat loss resulting from draining nearby Whittlesey Mere. This original post is recognised for its historic environment value through being added to the National Heritage List for England. © Zoë Hazell

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