

Climate Change Adaptation Guidance – Archaeology & Landscape

Archaeological Earthworks

Climate change vulnerability: medium

Archaeological earthworks – introduction

From motte and bailey castles, to hillforts and field systems, our archaeological earthworks are large and numerous, and can be found in both urban and rural settings.

Although not all earthworks are designated heritage assets, they are usually recorded, (including their extent) in the local and national historic environment records. Some are scheduled monuments, such as the great henge at Avebury and Offa's Dyke – an earthen boundary more than 149 miles (240km) long close to the border between Wales and England, but many earthworks are not designated heritage assets.

Earthworks sometimes stretch across whole landscapes as field boundaries, drainage interventions, roads, water management systems, field systems, park pales and even decorative features.

Threats to earthworks include development, livestock, access, setting intrusion, scarring, demolition/flattening, natural weathering, tree throw and animal burrowing. Extensive burrows and setts can even cause the collapse of entire features over time. All of these threats can be compounded by climate processes, which means that our earthworks can deteriorate quickly if they are not actively managed to prevent rapid deterioration and loss.

Image credits: Ridge and furrow at Ilam (© National Trust Images/Joe Cornish)



Archaeological earthworks – why do they matter?

Often constructed as cuttings, embankments or mounded earth, earthworks are naturally vulnerable to weathering. They are usually exposed to the elements and present an irregular form compared to the natural topography. Climate hazards and their predicted increase in severity are also likely to cause more frequent and dramatic changes to soil plasticity and water tables. Clay beds are likely to be affected in particular, resulting in landslides and subsidence.

Already visible at the coast and at some other types of assets (see Buried Archaeological Remains), it is likely that large areas of the Midlands and the south of England where clay beds prevail will also be affected by climate change.

Where earthworks are already in poor condition as a result of access/livestock erosion, for example, climate processes are likely to exacerbate and accelerate their deteriorating condition through weathering and erosion.

The survival of earthworks in the landscape is not inevitable. Many were lost in the 20th century when permanent pasture was ploughed up and evidence of past farming practices was lost. Although it is inevitable that most features will degrade over time and eventually disappear, those that remain hold the imprint of human activity on the land over thousands of years, a record with which our built heritage assets and their associated collections cannot compare.

Pests and disease have also increased with climate change. Several species of tree have already been affected with the visible impact spreading across the countryside. Most recently, ash die back has taken hold. As trees succumb to infection, they become more vulnerable to wind throw. Depending on the tree, a storm event can uproot large sections of earthworks together with the tree, disturbing archaeological remains that may otherwise have lain in situ since their construction.

Proactive management of archaeological earthworks is important to prevent the unnecessary loss of archaeological context, form and continuity.



Tree management, Lydford Gorge (© National Trust Images/Mel Peters)



Archaeological earthworks – hazards, impacts and options

Hazard	Impact	Options
Flooding	Waterlogging of earthworks, exposure and washing away of earthworks and/or composition material, compounded by impacts from access/land management	Attenuation (vegetation and nature-based solutions to reduce rate of flow and level of flow affecting the site), hard attenuation/diversion (intervening through groundworks and/or civil engineering to divert water away from the affected site), look to reduce or segment access during wetter months, reactive repairs to eroded areas, proactive interventions with more flood-resistant materials to areas repeatedly affected
Drought	Drying out of remains including cracking and bare ground, compounded by impacts from access/land management	Look at potential to increase resilience through groundwater retention capabilities of site, such as blocking land drains (simultaneous consideration of buried remains will be necessary), consider stocking density during summer months, look at compounding factors/interventions such as supplementary feeders and salt licks, consider access changes where different paths are encouraged to spread the loading of the site from visitors, avoid access with horses or bikes
Heat	Wildfire causing charring of remains from intense heat and fire above ground	Fire breaks in the landscape, avoid keeping fuel stores close to archaeologically sensitive sites, ban disposable BBQs from sites, ban hot works from sites during dry weather (e.g. hot works are not permitted at NT places at any time)
Storm damage	Erosion, scarring of surfaces that lead to deeper erosion and exposure of remains, loss of ground surface protection	Reactive maintenance whereby erosion and scarring are simply repaired quickly to avoid deeper erosion, look at investing in geo-textiles and sward changes through land management to build resilience into ground cover, avoid bare ground, if appropriate, construct earthwork runnels to divert flows away from sensitive areas, avoid stocking with horses or cattle
Coastal erosion/ landslide/ cliff fall	Loss or partial loss of features and sites, exposure of remains, loss of legibility in the landscape	Rescue archaeology if needed, preservation by record (e.g. LiDAR, aerial photography), recovery of significant archaeological remains for display/archive, opportunities for community engagement and coping with loss through cultural interventions as well as practical management pathways (options and thresholds agreed to determine at what point sites should be addressed through preservation strategies)
Prolonged rainfall	Waterlogging and loss of surface cover protection	Erosion repair, investigate drainage options, improve rainwater capture, storage and drainage of site (including underground storage potential and diversion of rainwater ingress across the site), geophysical survey where remains are exposed, excavation if appropriate

Archaeological earthworks – options & thresholds

Climate change affects the ability of archaeological earthworks to cope with hazards and compounding impacts, such as land management.

This should be considered when revising management plans and maintenance regimes for earthworks, and when determining thresholds for adapting and making changes. Floods, storms, drought, shrink/swell and landslides all have the potential to affect earthworks, which will worsen with more extreme weather events.

Specific options for adaptation measures include:

Drainage – should be investigated to help avoid damage to sites from floods and storms, by diverting water away from vulnerable areas, especially where these are also principal access points. Interventions can be hard (drains, gullies designed with an appropriate historic environment professional) or nature-based with synergies for natural flood management, water storage and rainwater harvesting.

Land Management – earthworks are most vulnerable when under cultivation. The most effective method to build resilience is to stop arable cultivation and establish a low-impact grazing regime. Sheep or cattle are preferable to horses and pigs, which can cause considerable damage. If a site is compacted and overgrazed, its ability to retain water will be poor, which may allow bare patches to develop. This encourages animal burrowing and access scarring, which are exacerbated by extreme weather events. Reducing stocking density and the grazing period will improve drought resilience. Non-intrusive survey – particularly for areas of woodland, affected by pests and disease, which need to be clear felled. Rapid remote sensing with Light Distance and Ranging survey (LiDAR) can be used to help identify significant remains across a large area, which enables targeted management of those sites. Where sites are at risk of being lost to coastal erosion, preservation by record (aerial photography and geospatial imaging techniques), can help to expand the local historic environment record.

Intrusive survey – while physical remains may be of lower significance than legibility or form, some features such as barrows can yield considerable archaeological findings (see Buried Archaeological Remains). Permissions will be needed for this type of adaptive measure and should be a last resort because all such techniques are destructive to in situ remains.

Engagement and activity - telling the story of our past is crucial to learning to adapt to the future. Archaeological earthworks make up the outdoor collection of artefacts that represent our impact on the landscape over time. They present an opportunity to learn about past lives, practices and places, and can shift our understanding of a place. Adaptive measures with archaeological interest provide the opportunity to engage local communities to share and participate in the conservation of the historic environment.

Reactive repair – where erosion or scarring occurs, temporarily fencing these areas to allow sites to be repaired and regenerate ground cover may be essential to their longterm survival and resilience.

Consents and permissions

Thresholds & tipping points

At what point might you diverge from your current maintenance/management strategy? What are the events/impacts that may trigger this change of approach (action/philosophy)?

- Frequency of maintenance interventions
- Quantity of material being sourced to fill washed out/eroded areas
- · Extent of material being exposed
- Quality of survival (if a monitoring regime is in place and can be demonstrated to be deteriorating with repeat weather-related events)
- Increase in standing water (affecting ability of the site to dry out)
- Extent of measures to maintain (resource, impacts on aesthetics, finance)
- Impact on archaeology and/or natural environment is unsustainable and negatively impacting significance
- Opportunity for arable reversion through a change in tenancy or new agri-environment scheme

One option is to do nothing and another will be to maintain the site as it is. Sometimes, the historic environment is not well maintained and the most effective approach to resist climate hazards and impacts, and to improve the site's adaptive capacity is to activate a regular maintenance regime. Some interventions, even maintenance, may require scheduled monument consent, including planting, changes in land management (requiring a class consent) and any kind of development (including access).

Archaeological earthworks – worked pathway example

This application of pathways and thresholds to a real site example shows how and when your adaptive response to climate hazards may change and evolve.

Working with a multi-disciplinary group to think about options and thresholds for a typical site is key. This cannot be done in isolation as there are significant implications for impacts on more than one aspect; for example, archaeology, ecology, aesthetics and access. It is more effective to bring together the right people to work on a mutually acceptable solution for a period of time between thresholds for change.

Although a land parcel containing earthworks is likely to be managed for other purposes, such as farming, gardening or recreation, interventions can have an impact on the significance of the earthworks and the wider historic environment. Interventions may range from naturebased mitigation to climate action, to adaptive measures that prevent loss or conserve heritage values. Therefore, significance should always inform the approach and, where necessary, be weighed against the benefits and drawbacks of action/inaction.

These options must not be selected in isolation from the unique characteristics, significance, vulnerabilities and land use of your specific site, and this may mean that different adaptive pathways apply in each specific context. The worked example below is based on the hillfort at Croft Ambrey, owned by the National Trust, and is a hypothetical example demonstrating potential measures and thresholds rather than an actual dynamic adaptive policy pathway. This asset is already experiencing some footpath erosion, but its resilience is generally good based on a sensitive grazing regime under an agri-environment scheme and conservation management plan, together with active management by countryside teams.

Seasonal access to vulnerable areas Increase & spread access provision Reduce stocking density Reduce grazing period Reactive erosion repairs Maintain grazing regime

Time/frequency and intensity of climate extremes





(Response thresholds are most likely to be based on the level of erosion seen on the ground, and access is likely to be limited as a last resort. Access and public benefit of the conservation of features are key to their management objectives. However, access is also linked to safety and specific trigger points are partially dependent on permissions from statutory bodies, funding from agri-environment schemes and their prescriptions for the site. The success of interventions is partially dependent on interaction, advocacy and story-telling to connect people with the asset and its plight. See the How to Use this Climate Adaptation Guidance section for further information on the Dynamic Adaptive Policy Pathways approach¹ and how to choose pathways from the range of options.)

Image credits:

Croft Ambrey: the ramparts of hillforts are often attractive to walkers as access routes, and they are sometimes vulnerable to erosion and scarring depending on levels of access and livestock, compounded by climate hazards such as drought and intense rainfall (© National Trust Images/Robert Morris)

¹ Dynamic Adaptive Policy Pathways Approach (<u>Haasnoot, Kwakkel, Walker & Ter Maat</u>)

Case studies, signposting and references

Over time, earthworks will gradually become less prominent in the landscape. The rate of change is linked largely to land management, but will be accelerated by climate hazards where resilience is low and other pressures are high.

Although adaptive measures and thresholds for changing land management approaches and targeted excavation/recording are possible, some features (particularly in coastal areas) are already being lost. In these cases, soft adaptation measures around understanding loss and prioritising engagement will be key to adapting.

At Dinas Dinlle in north Wales, the ramparts of an Iron Age hillfort are gradually being eroded by the sea. The steep access causes runnels, exacerbated by storm events, which leads to erosion of the ramparts. The site is owned by the National Trust and has been managed under pasture for many years. With permission from Cadw, footpath erosion is now controlled through path surfacing using wooden slats dug into the side of the hill and through the enclosure, running along the top of the cliff. While there is nothing to be done about the earthwork disappearing over time from coastal processes, the interior of the site has benefited from a programme of works under the CHERISH project, which has helped to explore and understand the site's archaeological remains before they are lost to erosion.

The Roman road between Chester and Segontium (Caernarfon) is still used by farmers, walkers and riders. Some sections of the road are visible and one sunken part acts as a conduit for water draining from the mountain. Historically, a system of side ditches and culverts managed the water. Over recent years, the quantity of water has been exceeding the capacity of these features. The surface has been scoured to a metre deep in some places. Maintenance is key to protecting against further significant damage. The Snowdonia National Park Authority, Conwy Council and Cadw have worked together to clear silt from considerable sections of the ditches and culverts, and repaired areas which has helped them to cope better with peak flows.



Signposting & other guidance of relevance/use

Natural England's countryside stewardship scheme's legacy guidance on managing historic environment features provides useful advice and illustrations on the preservation of earthworks² The basic information on earthwork management is available on gov.uk.³ Further information on generally understanding woodlands and the historic environment also gives advice on earthworks in these environments.⁴

When considering options, always **consult a historic environment specialist** such as an archaeologist to check the implications of any proposal. It is possible that options would need a variety of consents including, but not limited to, drainage consents, scheduled monument consent, class consents associated with land use and permissions from various statutory bodies. Some works involving physical interventions may also require planning permission so it is advisable to consult a local planning adviser before designing works.

Image credits:

Dinas Dinlle Hillfort roundhouse excavations and recording in 2021 (© Crown: CHERISH PROJECT. Produced with EU funds through the Ireland Wales Co-operation Programme 2014-2022)

References:

² Illustrated guide to managing historic environment features (TIN086, 2010) <u>http://publications.naturalengland.org.uk/publication/9005?category=31009</u>
³ Gov.uk guidance on managing earthworks <u>https://www.gov.uk/guidance/sites-of-special-scientific-interest-and-historical-monuments#scheduled-monuments</u>
⁴ The historic environment and woodland management (TIN001, 2009) <u>http://publications.naturalengland.org.uk/publication/22007?category=31009</u>