Discovery, Innovation and Science in the Historic Environment

RESEARCH

Historic England

ISSUE 19 · CLIMATE CHANGE SPECIAL 2021

Welcome…

…to this climate change special issue of Research magazine.

The climate crisis is affecting our historic environment: the impacts of warmer wetter winters, hotter summers, rising sea levels and changing patterns in our seasonal weather all exacerbate environmental hazards. Our historic environment is also an important resource for carbon reduction and helping places and communities adapt to future climates.

Here we present some of the ways in which Historic England and partners are working to help better understand and respond to these challenges.

To address climate change impacts, we need to know what hazards climate change will pose: this process is the subject of Joshua Deru's contribution 'Mapping Climate Change Hazards to Historic Sites'.

A hazard identified for many of England's regions is buildings overheating in summertime. Amad Kayani examines this topic in 'Overheating and Historic Buildings'.

Increasing resilience of places and communities to cope with climate change is an important goal of government policy. We are working with partners to develop tools that support this with reference to the historic environment. The 'Building Climate Resilience Through Community Landscapes and Cultural Heritage' project led by Professor Neil Macdonald will capture previous community adaptions from history.
In 'Historic Water Courses and Climate Change', Antony and Emma Firth report on a GIS-based management tool for mapping the history of watercourses and floodplains to inform their resilience to climate change.

Mark Cannata introduces readers to the 'Kassandra' methodology for creating adaptation scenarios for the built historic environment, which harnesses Building Information Modelling.

In 'Progress for Peatlands', Zoe Hazell explores the natural and historic value of peatlands and the efforts to manage and restore them.

Even with mitigation or adaption measures some parts of the historic environment may be lost. Tanya Venture sets out progress on a framework for dealing with loss: 'Articulating Loss: Understanding and Communicating the Loss of Coastal Heritage'.

Dr Hannah Fluck
Head of Environmental Strategy
with Historic England.

Front cover image: Planet Earth is heating up and showing signs of climate change, represented by this artist's impression. Original image © pixabay, https://creativecommons.org/publicdomain/zero/1.0/

We are the **public body** that **helps people** **care for, enjoy** and **celebrate** England's **spectacular** **historic environment**

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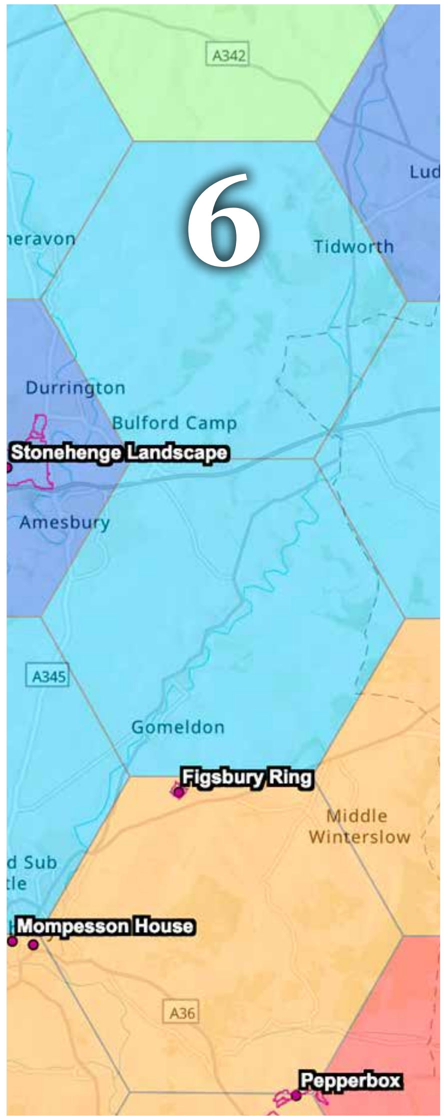

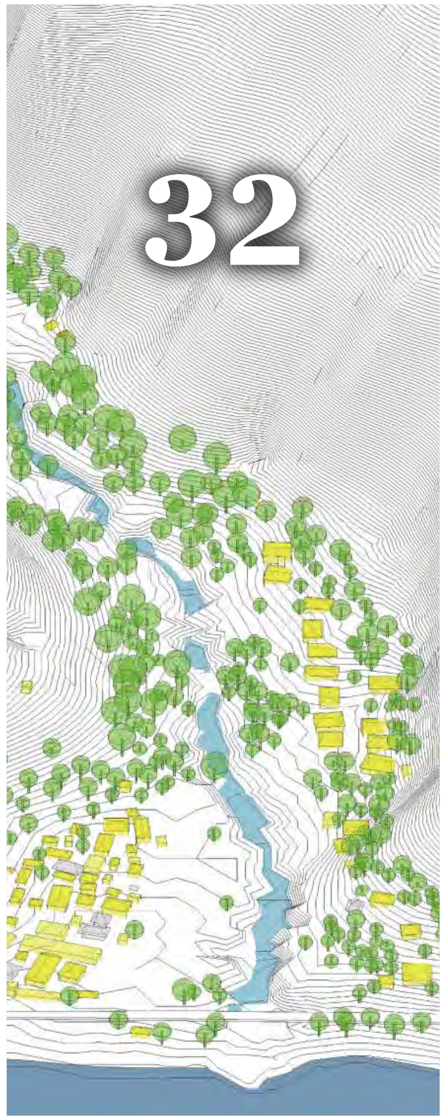

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Mapping climate hazards to historic sites

A novel cross-sector approach to mapping the key climate hazards faced by the historic environment.

Above: Map of key climate hazards within each region of England. © Joshua Deru, 3Keel LLP

About the climate hazard mapping initiative

Having survived many hundreds of years, many might assume that heritage sites and the historic environment would be able to withstand all possible threats posed by the natural environment. Recent research however, suggests that a rapidly changing climate will intensify existing threats and create new hazards, both to historic sites and to their inhabitants. The threats include overheating buildings leading to cracking of materials, sea level rises accelerating coastal erosion, and seasonal variations worsening the shrinking and swelling ('soil heave') of clay subsoils beneath historic buildings.

In order to address this, a consortium of UK heritage organisations (including Cadw in Wales, Department for Communities Northern Ireland, Historic Environment Scotland, Historic England, the National Trust and the National Trust for Scotland), have come together to develop a cross-sector approach to identifying and mapping the key climate hazards threatening UK heritage sites.

The approach, piloted by the National Trust in partnership with 3Keel (an Oxford-based sustainability advisory specialising in mitigation of and adaptation to climate change impacts), combines data on existing and projected weather patterns, underlying soil morphologies and hydrology with heritage site locations to map the present and future climate risks faced by these sites. >>

A rapidly changing climate will intensify existing threats and create new hazards, both to historic sites and to their inhabitants.

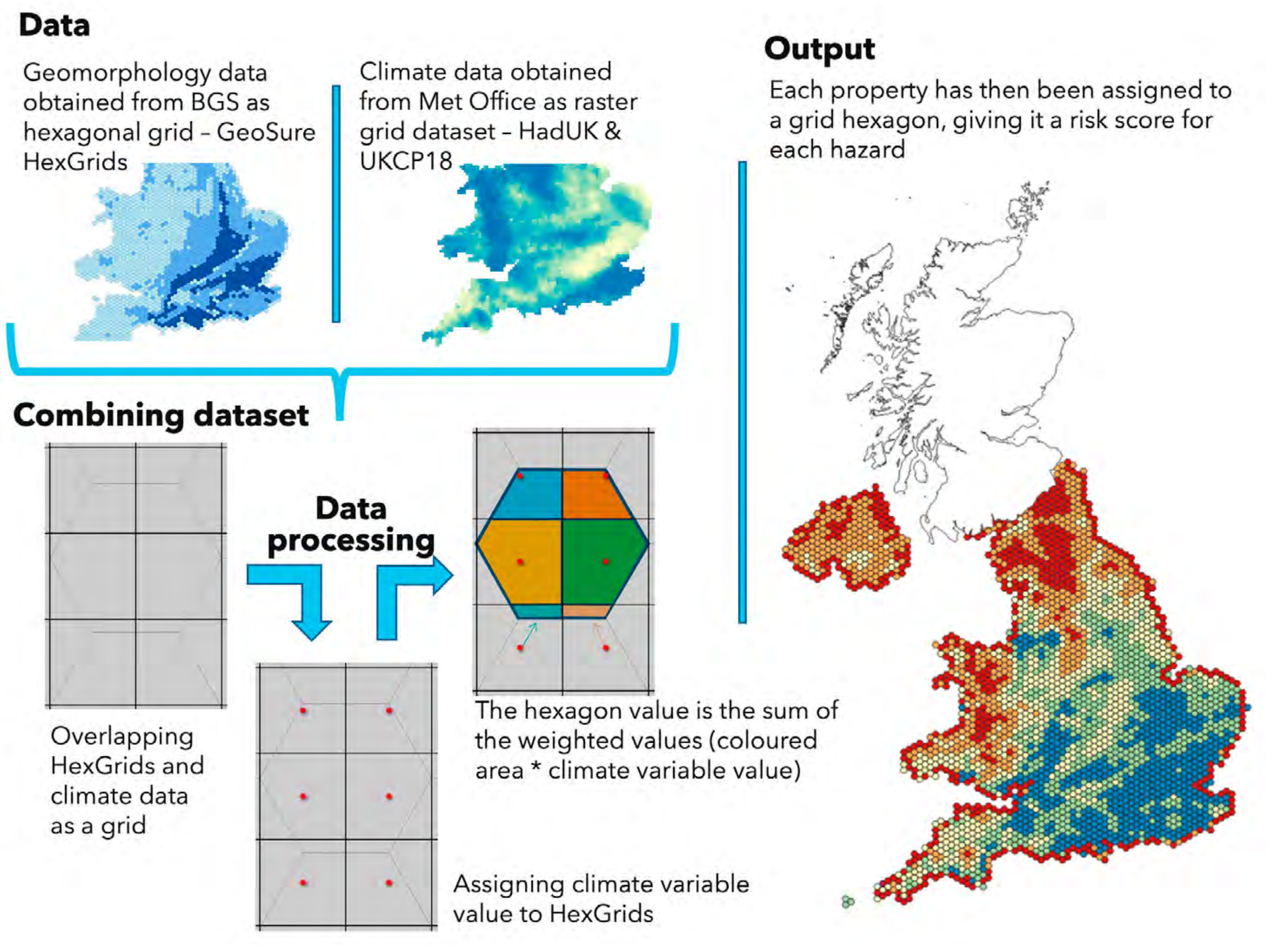
Understanding risks to sites

Through a process of stakeholder consultations, literature research, and site case studies, a number of hazards were initially identified as the key climate-related threats to heritage sites. These were overheating & humidity, flooding, slope failure leading to landslide, soil heave, storm damage, and coastal erosion.

By classifying each of these hazards and their relevance to sites, it was possible to identify 'thresholds' above which an increased level of climate risk was faced by sites. For example, wind gusts above 27 metres per second (60 miles per hour) would constitute 'storm winds', while precipitation above 50 millimetres per day would constitute 'extreme rain'.

Using GIS mapping it was then possible to combine thresholds and climate projections, provided by the Met Office for a business-as-usual scenario, with other data, for example, underlying soil types and stabilities, flood plain locations, coastal erosion rates) to develop a pilot tool mapping the likelihood of hazard occurrence in 5 kilometre hexagonal grids ('hexgrids') across the UK. Within each hexgrid the likelihood of each hazard is ranked 1-5 based on frequency/extent of crossing hazard thresholds, at present and in future.

Since then, a further iteration of the process has developed the tool, increasing coverage across the UK, adapting thresholds for regional variations, and assessing further risks such as drought and river scour.



Above left: GIS methodology for creating the HexGrid datasets. © Luis Felipe Velasquez, 3Keel LLP

A challenging outlook

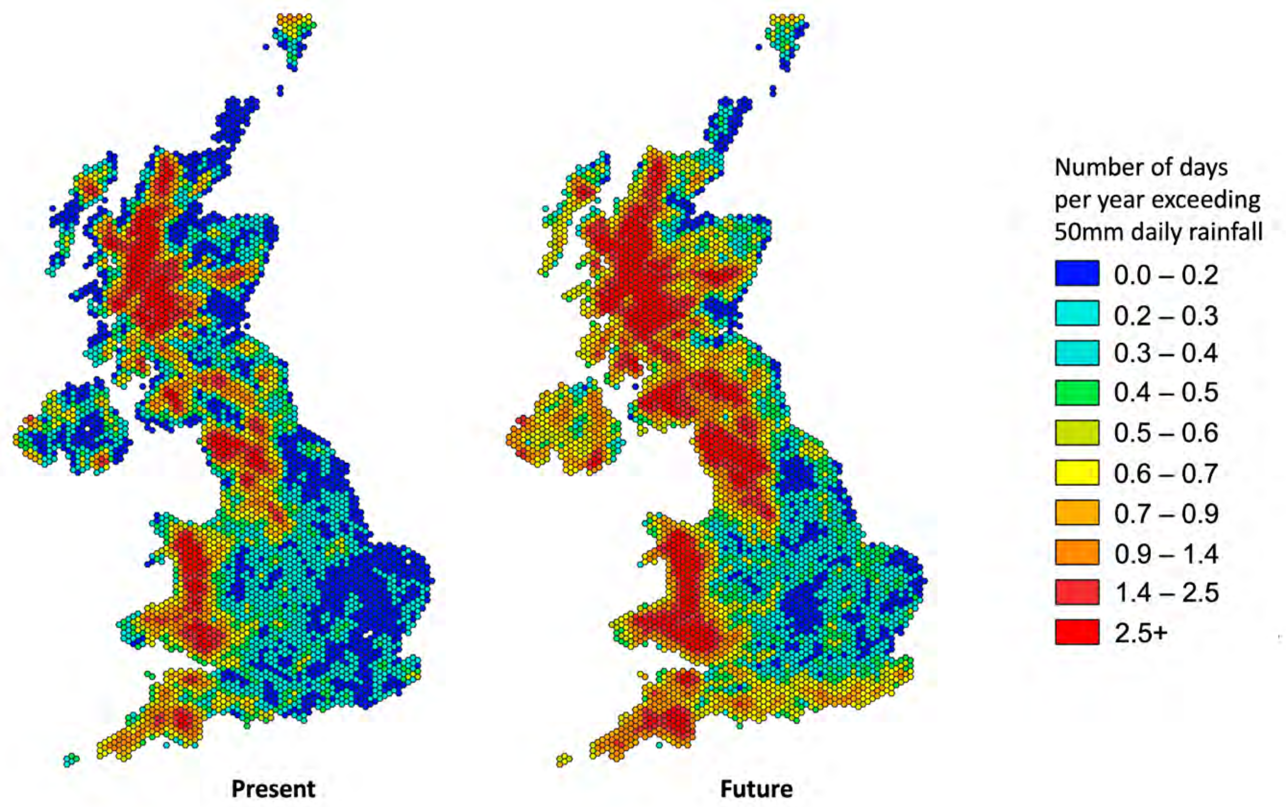
Looking at the data with regards to heritage assets on the National Heritage List for England, the analysis suggests an across-the-board intensification of climate-driven risks, with almost four in five sites facing high levels of risk from at least one hazard by the mid-late 21st century.

Overheating & humidity are set to become widespread and more intense, particularly in London and the South East of England, but with serious impacts reaching towards Yorkshire and inland parts of South West England. Similar patterns are expected for soil heave in clay-rich areas of England.

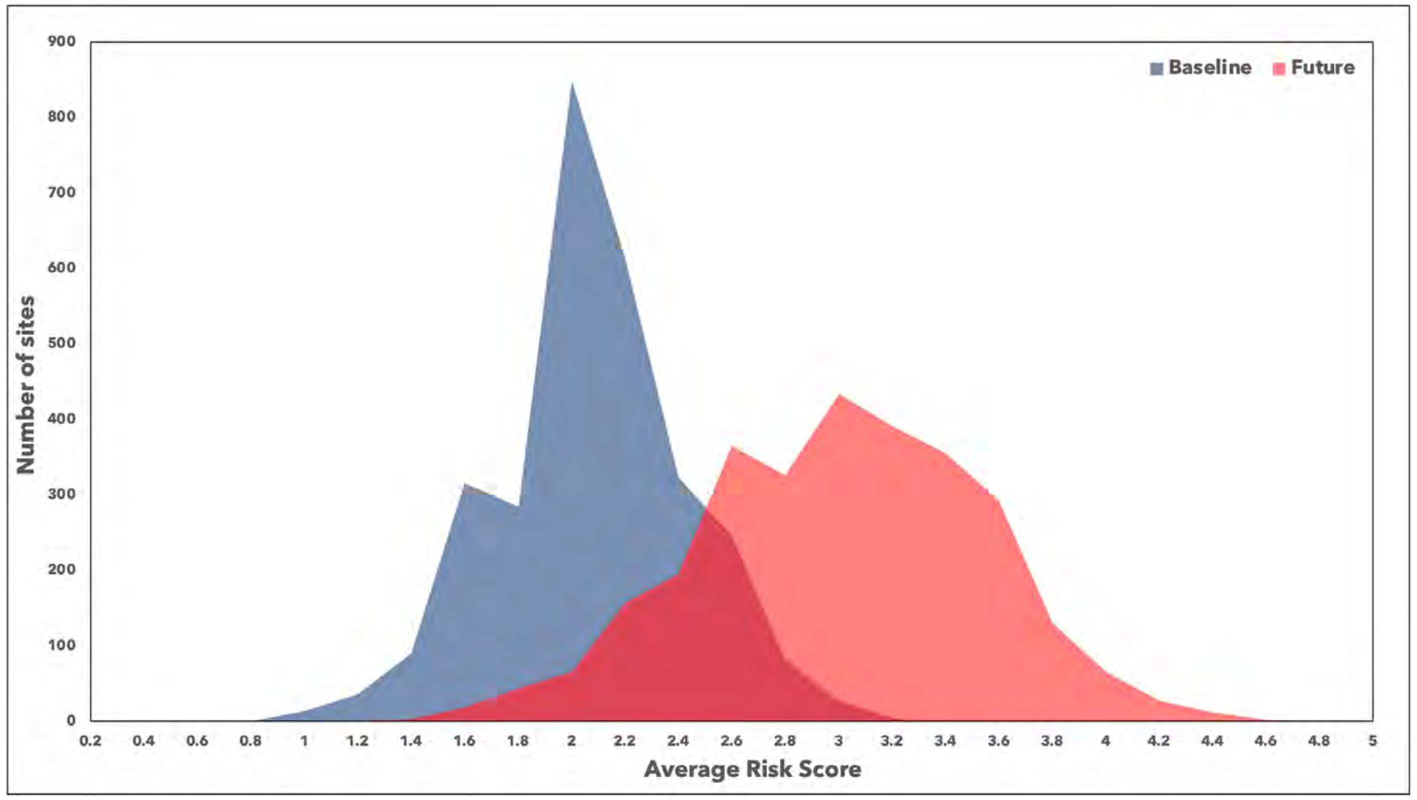
Slope failure and storm damage are set to become more prevalent in the South West, parts of the Midlands and the North West of England, while both flooding and coastal erosion are set to intensify around the UK.

A closer look at precipitation data shows that an increase in extreme conditions is projected, meaning that there will be extended dry spells with minimal rain followed by heavy downpours in short bursts: this combination will lead to increases in the frequency of both droughts and floods. >>

The analysis suggests an across-the-board intensification of climate-driven risks, with almost four in five sites facing high levels of risk from at least one hazard by the mid-late 21st century.



Above right: Map showing number of days per year exceeding 50mm rainfall. © Joshua Deru, 3Keel LLP



Left: Average risk scores of heritage assets on the National Heritage List for England across 6 key indicators (5 = highest).
© Joshua Deru, 3Keel LLP

Understanding and adapting

The tool and its underlying data have two main purposes. Firstly, they can be used as described above to provide a strategic picture of changes to climate-related risks to historic properties across organisations, guiding processes such as funding allocations and focus areas.

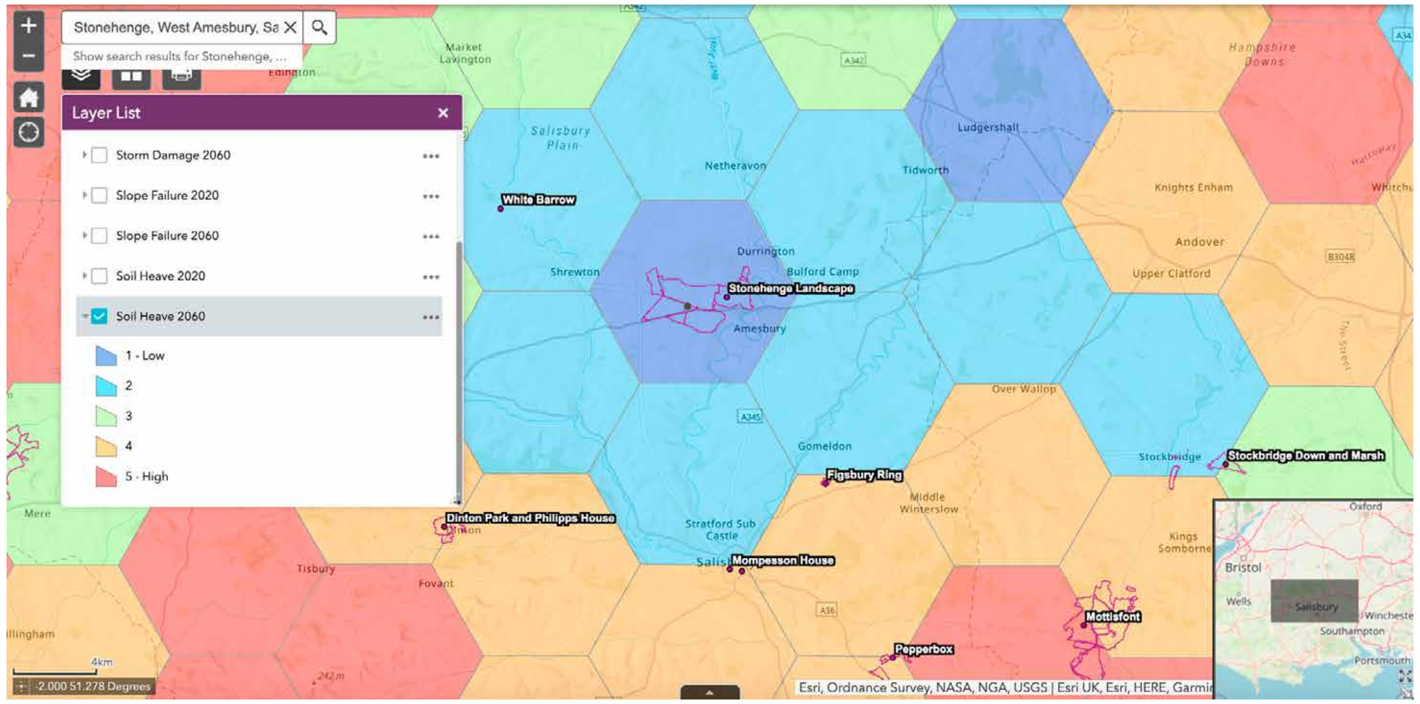
As well as this, the hexgrids can also be used to provide a localised background risk profile for individual assets. The background risk profile could be used by site managers, in conjunction with site analysis, to provide a consistent screening and mitigation planning framework; in essence, flagging potential risk factors that may become more (or less) of a problem for a property.

For example, curators of a site facing semi-regular issues from high temperatures at present may see that its risk level from overheating is set to increase dramatically in future, and therefore look more closely into how it might be adapted to cope with this change. Conversely, managers of a site facing infrequent risks from storm damage might see that its risk is set to stay at similar levels or even decrease and decide to focus on other key risks.

Taking action on the future

As COP26 in Glasgow passes into history, the results of this analysis clearly highlight the need for dramatic increases in levels of mitigation, but if the world takes concerted action now by reducing emissions - in the UK and globally - these scenarios might never occur. The heritage sector can play its part by reducing operational and supply chain emissions, but this can only succeed as part of a comprehensive national and global plan for a just transition to net zero.

However, some changes in the climate are inevitable, with at least 1 degree Celsius warming already 'locked in' due to historic emissions. As conservators of heritage and the historic environment, it is important that organisations such as Historic England simultaneously aim for a best-case scenario of limiting global temperature rise to safe levels, while also planning for worst-case impacts of dangerous levels of climate breakdown.



Right: Snapshot of hazard mapping tool, showing projected risk from soil heave in West Amesbury and the surrounding area.
© National Trust

It is important that organisations such as Historic England simultaneously aim for a best-case scenario of limiting global temperature rise to safe levels, while also planning for worst-case impacts of dangerous levels of climate breakdown.

As this work progresses, the aim is for the mapping tool to grow and develop for multiple purposes - assessing other hazards such as forest fires, expanding projections to a range of future scenarios, factoring in other risks elements such as vulnerability, and considering the adaptive capacity of heritage sites. Beyond COP26, the sector-wide steering group responsible for the research to date aims to develop a common approach to hazard mapping that is practical, adaptable and accessible to heritage and non-heritage organisations alike ■

The author

Joshua Deru
Climate Change Consultant, 3Keel LLP.

Josh works as part of the Climate Change team at 3Keel, specialising in technical research and analysis, communication of complex data, and strategic climate guidance. His work focuses on accelerating climate action and sparking genuine, systemic change across public, private and NGO sectors. Josh has worked extensively with the heritage sector to develop strategies for mitigation of and adaptation to the climate crisis.

Further Information

Climate risk mapping case study at the 3keel website 3keel https://www.3keel.com/climate-risk-mapping/

Overheating and historic buildings

Maintaining summertime comfort is an ever-increasing challenge under climate change pressures.

This article explores how occupant comfort in historic buildings is being challenged under the influence of global warming trends, using Historic England offices as a living laboratory to model, predict and measure overheating.

What is comfort?

Overheating can be loosely defined as occurring when internal temperatures increase to a point where occupants may experience discomfort. Whilst thermal comfort is inherently subjective and circumstantial, well-researched temperature metrics can be used to predict what comfort means for most people.

The factors driving heat-related discomfort can be both internal and external to a building. This can be broken down into internal heat gains from lighting, equipment or people and external heat gains driven by weather conditions. While it is relatively straightforward to influence our internal heat gains, environmental pressures posed through warmer weather are much more difficult to manage and contend with.

Factors driving heat-related discomfort can be both internal and external to a building.

Above: Aerial view of 24 Brooklands Avenue, Cambridge. Source: Google Maps

Given the United Kingdom's long-term seasonal trends towards hotter summers, overheating is becoming more of a concern, presenting challenges to how we maintain a healthy and comfortable internal environment all year round.

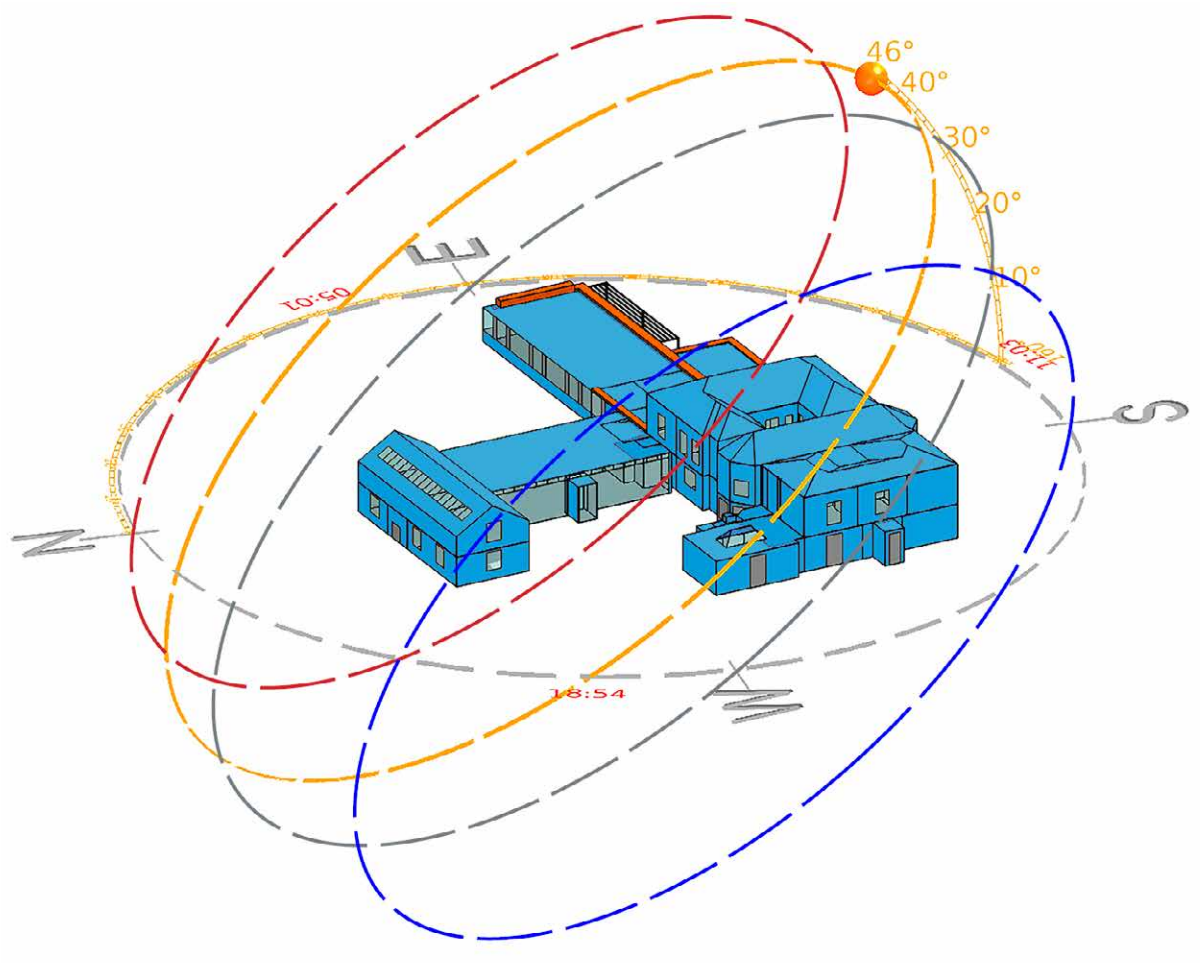
Despite all the measures being taken to control global warming, future weather predictions indicate hotter temperatures and highlights that overheating will be a growing issue.

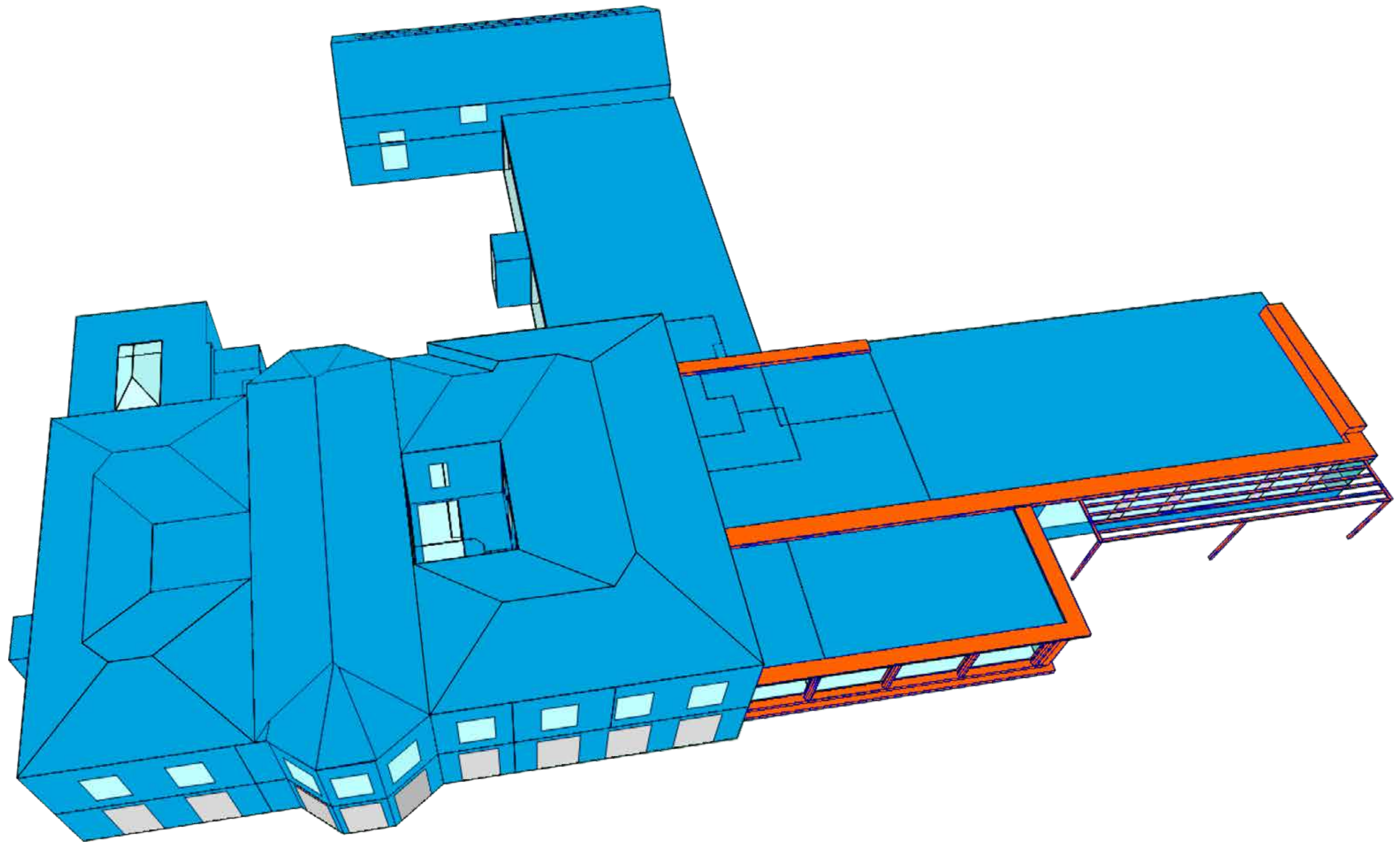
The research outlined here tries to quantify the extent of the problem and examines what can be done to make historic buildings more resilient to warmer weather whilst upholding our collective responsibility towards environmental sustainability. The aim of the research is to better understand how passive measures for summertime occupant comfort can be used to avoid the use of air conditioning and the generation of emissions, which would further accelerate climate change.

Identifying overheating risk

The Chartered Institute of Building Services Engineers (CIBSE) provide a structured methodology for assessing and reporting overheating risk in new and refurbished non-domestic buildings. The CIBSE's Technical Memoranda (TM) 52 aims to quantify overheating risk through measures that are based on the relationship between the external and internal air temperature as a proxy for occupant comfort inside a building. The CIBSE methodology is useful for understanding if and how overheating can occur within buildings and is broken up into three different criteria. >>

Overheating is becoming more of a concern, presenting challenges to how we maintain a healthy and comfortable internal environment all year round.





Criterion 1: the number of hours that the temperature difference between inside and outside is greater than 1 degree. When this happens, the day is classified as ‘warm’. For a building to be defined as not subject to overheating, warm conditions must not exceed 3% of the total hours.

Criterion 2: takes a weighted average of the temperature difference between inside and outside over the course of a day. This criterion quantifies the severity of a warm day and for a building to pass the value must not exceed 6 in a single day. This is calculated as a weighted average of the temperature difference and the duration over which it occurs and it is a unitless value.

Criterion 3: the temperature inside cannot be more than 4 degrees warmer than the external temperature at any point, placing an upper limit on internal temperatures.

As occupant comfort is tied to duration as well as temperature, each of the criteria focuses on a different aspect of overheating, which includes the duration and severity of heat build-up within a space in relation to the external temperature. A space is considered to pass if it complies with either criterion 1 & 2 or criteria 1 & 3. Applying this categorisation, it is possible to assess the risk of overheating across different rooms in a building through modelling the internal and outside air temperature and testing against each of the above criteria.

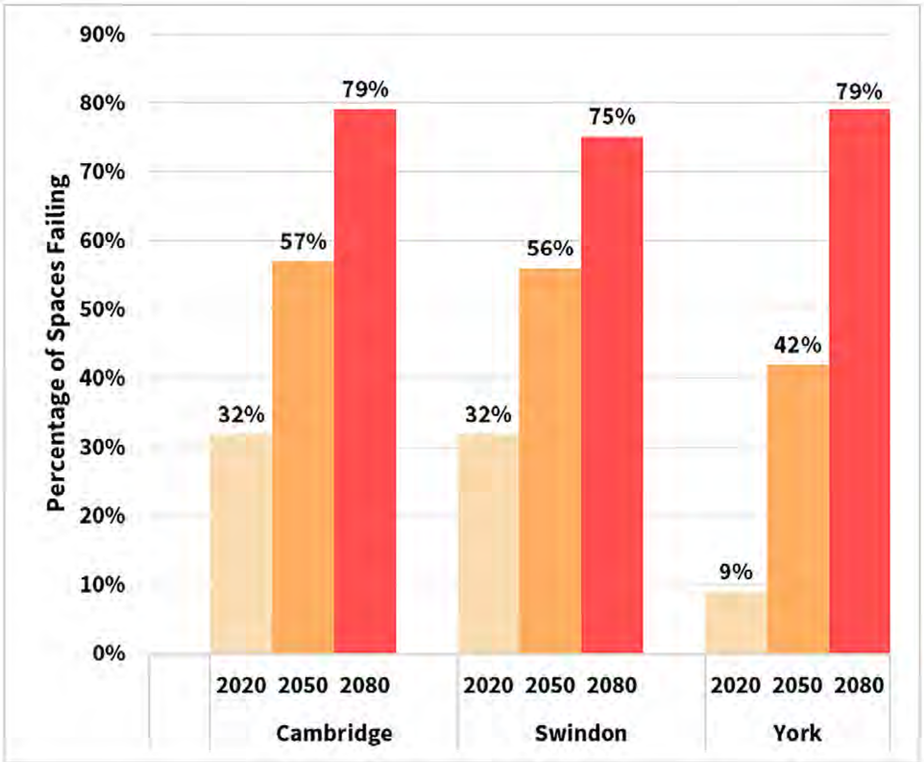
Modelling Historic England offices

Using dynamic thermal modelling software (IES-VE), virtual thermal models were generated for Historic England offices in Swindon, Cambridge and York. For each location, simulations were run with current (2020) and future weather data for 2050 and 2080 to understand present and future performance. These models can simulate internal conditions under the influence of different weather data and therefore are able to predict how susceptible the buildings will be to overheating according to the TM52 criteria.

Questions that dynamic thermal modelling can answer:

- Does the building comply with TM 52?
- How do the internal conditions vary over a year?
- How does the building react under future weather scenarios? >>

Above left and right: 3D geometry generated for 24 Brooklands Avenue in IES-VE. © Historic England



Above left: Percentage of occupied building spaces failing TM52 criteria for Cambridge, Swindon and York offices, under 2020, 2050 and 2080 weather files. © Historic England

Results vary across the different offices and are indicative of the mechanisms that are driving overheating within them, which depend on each building's unique form and fabric. All the offices assessed currently exhibit overheating risk and the severity of this is exacerbated under the influence of future weather files.

As expected, the modelling indicates that overheating is a growing issue for historic buildings.

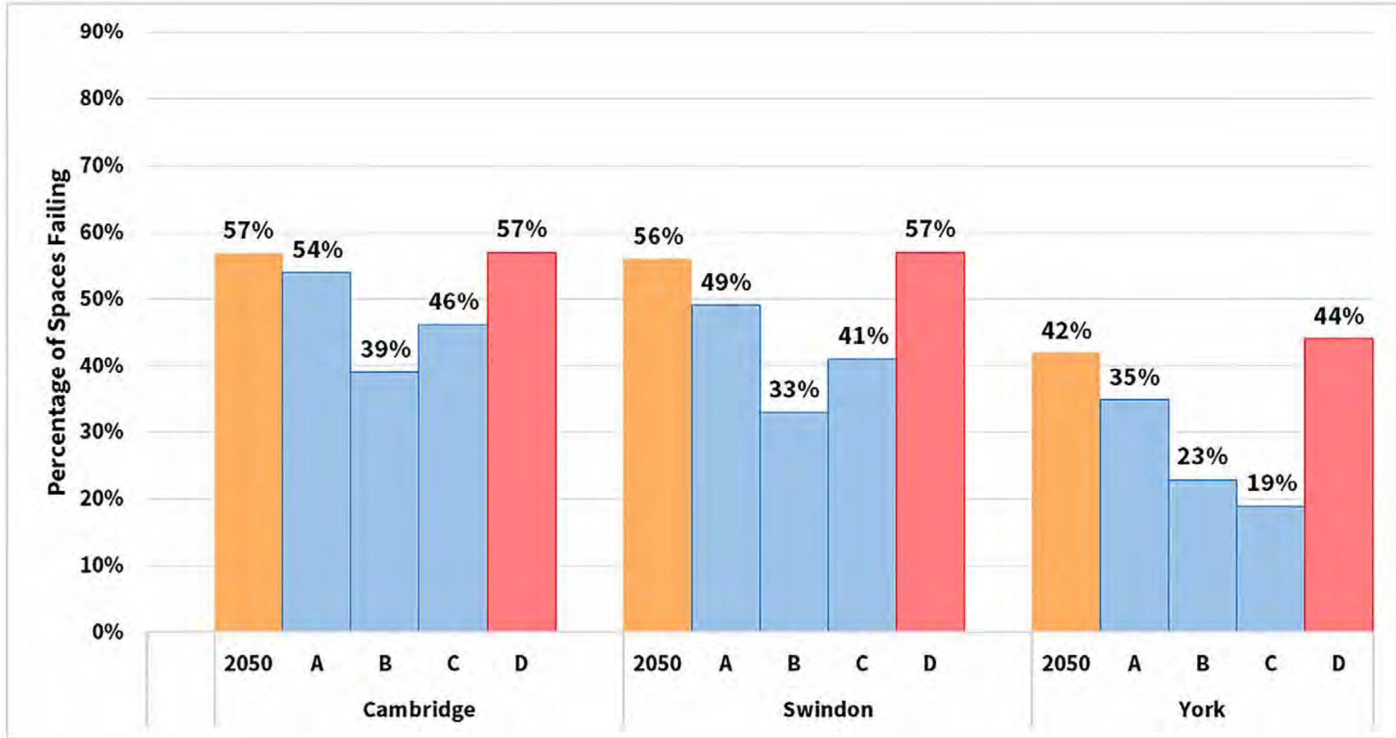
Making modifications to the baseline models for each office enabled testing different measures to assess how overheating could be feasibly reduced using passive measures. The baseline models were re-run under the following modifications and in the context of the future weather data for 2050:

A: Reduced occupancy to 90%
B: Solar control film applied to windows to reduce G-value (a measure of how much solar heat -infrared radiation- is allowed in through a particular part of a building) and solar gain admittance into the building
C: Night-time ventilation of 5 air changes per hour between midnight and 7am
D: Improved building airtightness from 0.7 to 0.55 air changes per hour of external infiltration.

Despite the introduction of passive measures, each office building still presents overheating risk to varying degrees, with the effectiveness of each measure varying across the modelled buildings.

Reduced occupancy reduces overheating, as expected due to a reduction in internal gains. This can be intuitively validated but it may not necessarily be considered a viable measure in the long-term for practical working spaces. Meanwhile, solar control and night-time ventilation both reduced the overheating risk, but the magnitude of this impact varies across the different offices by virtue of their unique form,

Despite the introduction of passive measures, each office building still presents overheating risk to varying degrees.



Above right: Percentage of occupied spaces failing TM 52 criteria after mitigation measures have been applied, taking 2050 weather data as the baseline. © Historic England

fabric build-ups and climates. Solar control film is observed as being most effective in offices that suffer from high solar gains in which orientation and window geometry are important influencing factors. Conversely, night-time ventilation appears to be most effective in offices with inadequate natural ventilation as this leads to the entrapment and build-up of warm air.

Interestingly, improving the airtightness of a building leads to greater overheating risk, suggesting that infiltration of external air is advantageous for summertime occupant comfort, when assessed against the TM 52 criteria. There is, therefore, a conflict between measures to promote winter and summer occupant comfort.

Greater airtightness increases overheating risk but is at odds with imperative towards insulating and sealing buildings for improved winter thermal performance. The focus on improving thermal fabric without considering overheating risk may be driving maladaptation against well-understood climate trends.

Improving air permeability increases overheating risk but is at odds with the imperative towards greater airtightness for improved winter thermal performance.

Understanding how temperatures vary in different rooms can inform a deeper understanding of overheating patterns. A snapshot of internal temperatures in the Cambridge office highlights areas that may require urgent attention.

Taking a more detailed look at results indicates that overheating is not a homogenous phenomenon and varies across different spaces within the building thermally and temporally. This is an important observation as it may enable the introduction of specific targeted overheating mitigation measures. >>

The focus on improving thermal fabric without considering overheating risk may be driving maladaptation against well-understood climate trends.

Monitoring Historic England offices

To validate the findings from the modelling, ongoing monitoring is being done across the simulated offices. This will enable the establishment of a real-world baseline, which can be compared to the relative improvement predicted bymodelling different scenarios.

Key research outcomes

The initial modelling of Historic England offices highlight that overheating can be a risk in historic buildings, leading to occupant discomfort and health and safety implications. Intuitively, and through modelling future weather files, this will become more severe in the future, impacting climate change resilience of historic buildings.

A key observation from this assessment was that each building's overheating profile is unique and influenced by a range of factors. Therefore, it is important to propose mitigation measures that are most effective towards addressing building-specific overheating drivers. As evidenced by the Historic England offices, the effectiveness of such measures varied across the different buildings. Furthermore, the extent to which passive measures can mitigate this is limited when applied in isolation. However, modelling these individually enables comparative assessment of their effectiveness as independent variables, which is beneficial for decision-making at a building management level.

The of dynamic thermal modelling tools can provide crucial insight into how different spaces within the building perform, which can inform a more targeted application of building interventions. Since overheating may be a zonal problem, this approach may minimise disruption to the existing building by supporting incremental improvements.

Dynamic thermal modelling presents advantages in predictive and remedial scenarios for overheating, under present-day and future weather conditions. It also offers detail that can inform means of comfort control on at a more zonal level within a building. Climate trends are well understood, but there remains a conundrum to be resolved when adapting historic buildings to meet seasonal needs for both summer and winter comfort ■

The author

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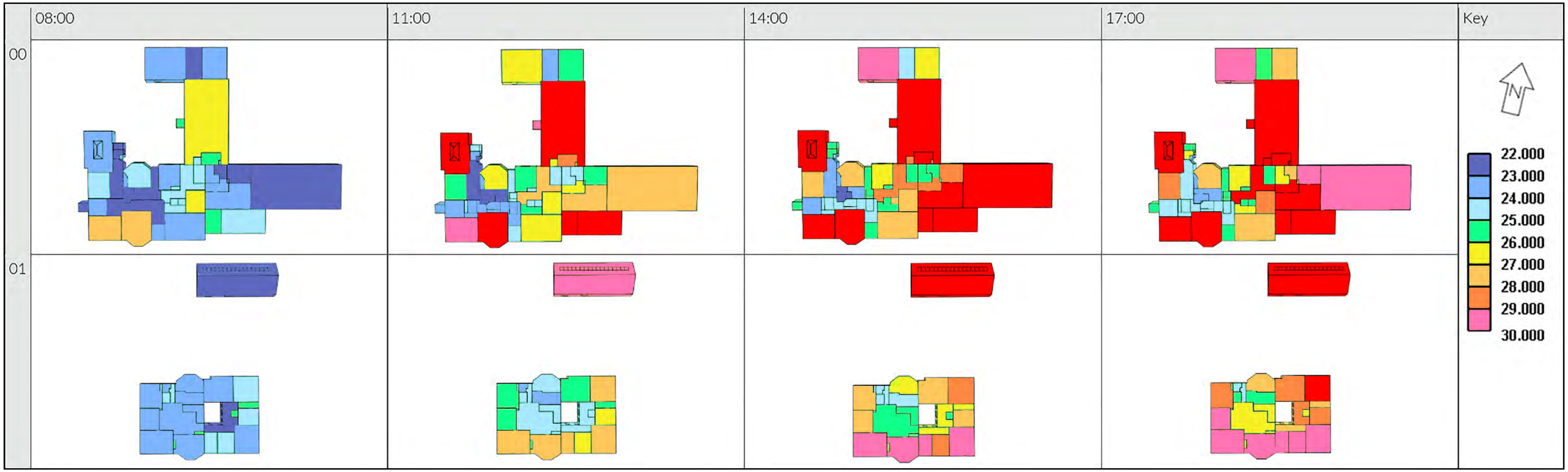
Building Services Engineer with Historic England

Amad is a Building Services Engineer working within the National Specialist Services Department where he applies environmental modelling tools alongside specialist knowledge of sustainable energy to support low carbon building services design. He is currently leading internal research on overheating and EPC certifications for historic buildings. Externally, he is working in collaboration with the University of Edinburgh where he is supervising MSc research on retrofit decision-making.

Further information

Historic England research into energy efficiency in historic buildings
https://historicengland.org.uk/research/current/conservation-research/energy-efficiency/

Webinar recording on the future summertime overheating risk
https://historicengland.org.uk/services-skills/training-skills/online-training/webinars/recordings/webinar-on-assessing-future-summertime-overheating-risk-in-historic-buildings/



Above: Operative temperature visualised for each room, for 2020 on a typical peak summer day (19th August 2020). © Historic England

Building climate resilience through community, landscapes and cultural heritage (‘Clandage’)

A project to capture local community experiences of historic adaption to climate and extreme weather.

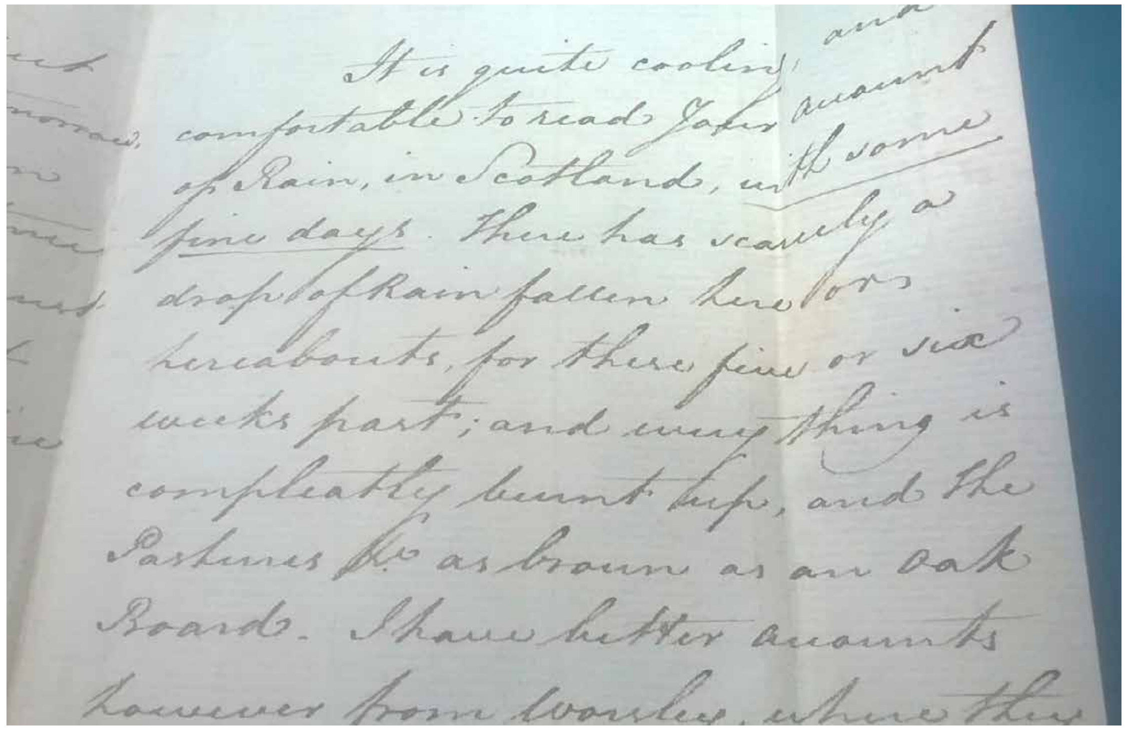
The Clandage project

The Clandage project (Building Climate Resilience through Communities, Landscapes and Cultural Heritage project) has been funded by the Arts and Humanities Research Council, through the UK Climate Resilience programme, to investigate how landscapes, communities and people have historically experienced, coped with and adapted to climate change and continue to do so.

There are three strands to the project, one in Staffordshire in partnership with the Staffordshire Record Office, another centred around the River Eden in Cumbria, working alongside researchers from Historic England, and the third working with the Museum & Tasglann nan Eilean Siar in the Outer Hebrides.

In all of the case study regions, the project is exploring how communities have adapted to climate change to become more resilient, but in each the approach and focus will be tailored to the different environments. Clandage addresses three long-term ambitions of the Flood and Coastal Erosion Risk Management (FCERM) 2020 strategy to develop:

i) climate resilient places;
ii) develop growth and infrastructure today that is resilient to tomorrow’s climate; and,
iii) a nation ready to respond and adapt to flooding and coastal change.


It is quite cooling and comfortable to read of the amount of Rain, in Scotland, with some fine days. There has scarcely a drop of Rain fallen here or hereabouts, for these five or six weeks past; and every thing is compleatly burnt up, and the Pastures &c as brown as an Oak Board. I have better accounts however from Worcester, where they

Above: Document detailing the weather in Staffordshire. © Staffordshire Record Office D593/K/1/3/6

Understanding past impacts of climate change

Historical records, archives and oral histories offer valuable avenues for investigating how landscapes, communities and people have adapted to climate change. These changes might have come through incremental modifications (potentially even unnoticed), or through rapid adjustments, potentially reflecting abrupt changes in an environment, whether physical or cultural. Adaptation has taken the form of landscape and community losses and gains.

Understanding how past changes impacted landscapes, communities and people provides a basis for examining how future changes may be managed and how adaption practices may be both implemented and communicated through a variety of mechanisms. Building resilience to the impacts of climate change at a range of spatial and temporal scales is an issue of global importance.

By exploring climate resilience at landscape scales (regions), within which different community’s function, we can examine contrasting cultural and environmental contexts. Context is an important influence on vulnerability, relative adaptability (including failure to adapt) and subsequent resilience in response to change. Previous research has focused predominantly on how communities have recorded and understood recent extreme events such as floods, storms and droughts, but has included only limited consideration of how these communities have historically responded and adapted to such events, thereby building both community and individual resilience. In considering the multidimensionality of disasters in the past, present and future we need to consider social vulnerability (a function of a society’s sensitivity and capacity to respond and recover to events), in doing so we deepen our own knowledge of social response to environmental change. >>

The approach to the case studies

Within the Clandage project we are predominantly working within the River Eden catchment focused on flooding in partnership with Historic England), with two additional smaller studies in the Outer Hebrides (storms) with the Museum & Tasglann nan Eilean Siar and Staffordshire (droughts) with Staffordshire Record Office, with each presenting a particular environmental hazard focus.

Across all three case studies we consider the importance of landscape and place in framing local understanding and perceptions of climate and weather. We also study how climate and weather have shaped local adaptation to climate change and interactions with landscapes, adaptations which have resulted in resilience and productive environments within which people and communities prosper. Throughout the project we are holding community events, such as creative poetry, storytelling events and walks and ‘creative artist activities’, as part of a broader community engagement process to build a record of local knowledge. These supplement existing archives that we have accessed including Historic Environment Records, historic maps, Environment Agency archives and organisation materials, regional and local archives and existing databases.

We are holding community events, such as creative poetry, storytelling events and walks and ‘creative artist activities’, as part of a broader community engagement process to build a record of local knowledge.

Below: One of the images used to prompt discussion and creativity during the online poetry workshops. © Staffordshire Record Office

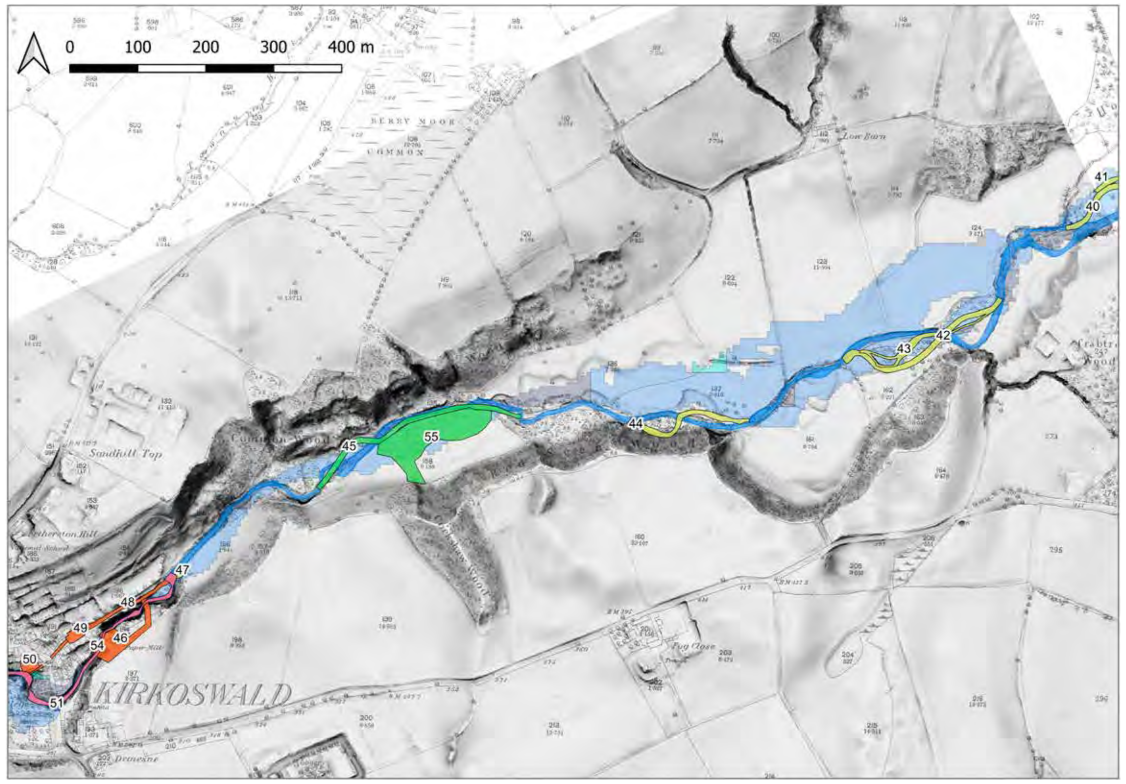
A toolkit using StoryMaps

The key output from Clandage’s work in the River Eden study will be a transferable toolkit for identifying, assessing, and characterising river heritage and materials in collaboration with local communities. The toolkit, developed in partnership with Historic England and Fiordr, will identify cultural and social records of significance and allow the impact of climate change on landscapes to be assessed. This will support managers and communities in respect of current landscapes and environments and inform future climate resilience planning.

The toolkit will produce StoryMaps, an ESRI product that enables the combination of GIS mapping to be augmented with textual (e.g. diary exerts) and visual materials (historic photographs). The StoryMaps will be made available to agencies and organisations, local authorities and communities. The toolkit will use a multifaceted approach of cataloguing features (historic, material and archival), supplemented by contemporary oral histories within a GIS environment using an approach previously developed by Historic England and Fjordr.

Throughout the process we are exploring how trajectories of vulnerability to events have changed over time. This will enable us to identify communities and landscapes most sensitive to future events and indicate where resilience may take different cultural forms. It will also help identify where opportunities exist to incorporate future climate change resilience.

Clandage is a study of how communities have responded through adaptation of skills, attitudes, values and behaviour, qualities that may be needed to live with ongoing uncertainty and vulnerability in the face of climate change ■



Left: Historic Watercourse Polygons (HWPs) indicating modifications and uses of the Raven Beck above Kirkoswald, drawing on historic OS mapping, lidar and risk of flooding data.

The authors

Prof. Neil Macdonald
Professor of Geography at the University of Liverpool.

Neil is a Geographer that works at the intersection of the physical environment and people. He has led several projects exploring historic extremes, particularly floods, droughts and storms within the UK, and Europe; using a range of historic archive materials together with environmental archives (e.g. sediments). Further details on the Clandage project can be found at: https://www.liverpool.ac.uk/geography-and-planning/research/clandage/

Dr Alice Harvey-Fishenden
Postdoctoral Researcher at the University of Liverpool.

Alice is a post-doctoral research associate at the University of Liverpool, working on the CLANDAGE project. Her AHRC funded PhD research focused on developing a better understanding of the societal impacts of droughts in the past, and how archive documents can be used to learn more about extreme weather conditions.

Dr Hannah Fluck
Head of Environmental Strategy with Historic England.

Hannah oversees Historic England's strategic work on climate change and is author of Historic England's first Climate Change Adaptation report. She is a contributing author to the third UK Climate Change Risk Assessment, a reviewer of the IPCC special report on Climate Change and Land and is a selected participant of the ICOMOS/IPCC/UNESCO Co-Sponsored Meeting on Culture, Heritage and Climate Change. She is also a founding steering committee member of the Climate Heritage Network.

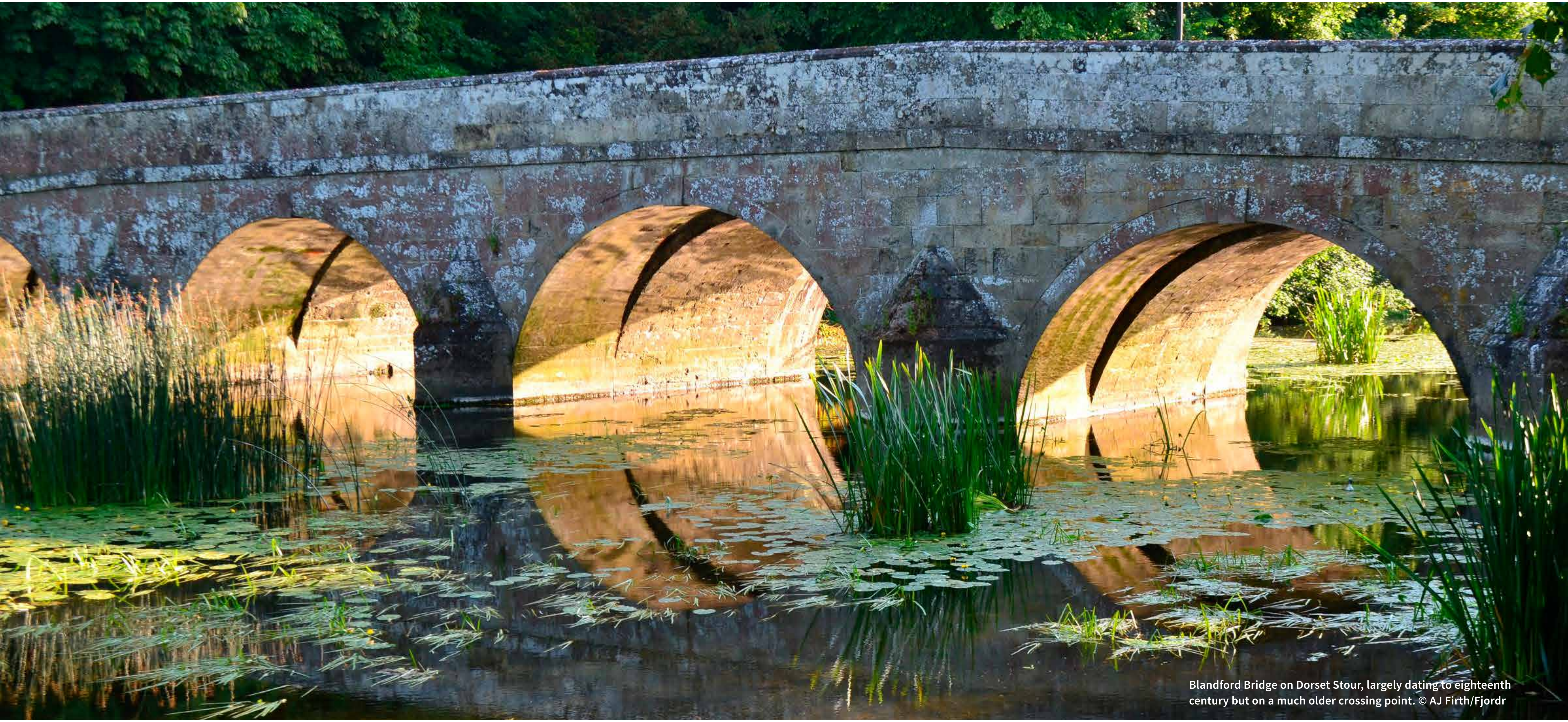
Further Information

Clandage – Building Climate Resilience through Community, Landscapes and Cultural Heritage, is an ongoing AHRC (AH/V003569/1) funded project, through the UK Climate Resilience programme (07/2020-06/2022). The project involves, the University of Liverpool, Glasgow, Northumbria and Historic England, Staffordshire Record Office, Museum & Tasglann nan Eilean Siar – Museums and Archives of the Outer Hebrides and Fjordr (http://www.fjordr.com).

Twitter: @FloodandDrought

Historic watercourses and climate change: mapping the history of rivers and floodplains

A management tool for historic watercourses using GIS mapping.



Blandford Bridge on Dorset Stour, largely dating to eighteenth century but on a much older crossing point. © AJ Firth/Fjordr

Historic England has funded the development of an innovative approach to rivers and floodplains that is now being applied to different catchments to address climate change and our responses to it. Recognising the degree to which rivers have been affected by human interventions over many centuries, Fjordr Limited – a historic environment consultancy specialising in inland waters – devised a catchment-based approach to mapping the historic character of watercourses. An initial pilot on the Dorset Stour has led to further projects to address the River Culm in Devon, the River Eden in Cumbria, and the River Thames in Oxfordshire, working with a range of partners.

Synthesising sources of information into a GIS

The approach draws together a wide range of different sources – such as archaeological records, maps, aerial imagery and lidar data – into a single, simple to use GIS layer that can be employed directly by catchment managers.

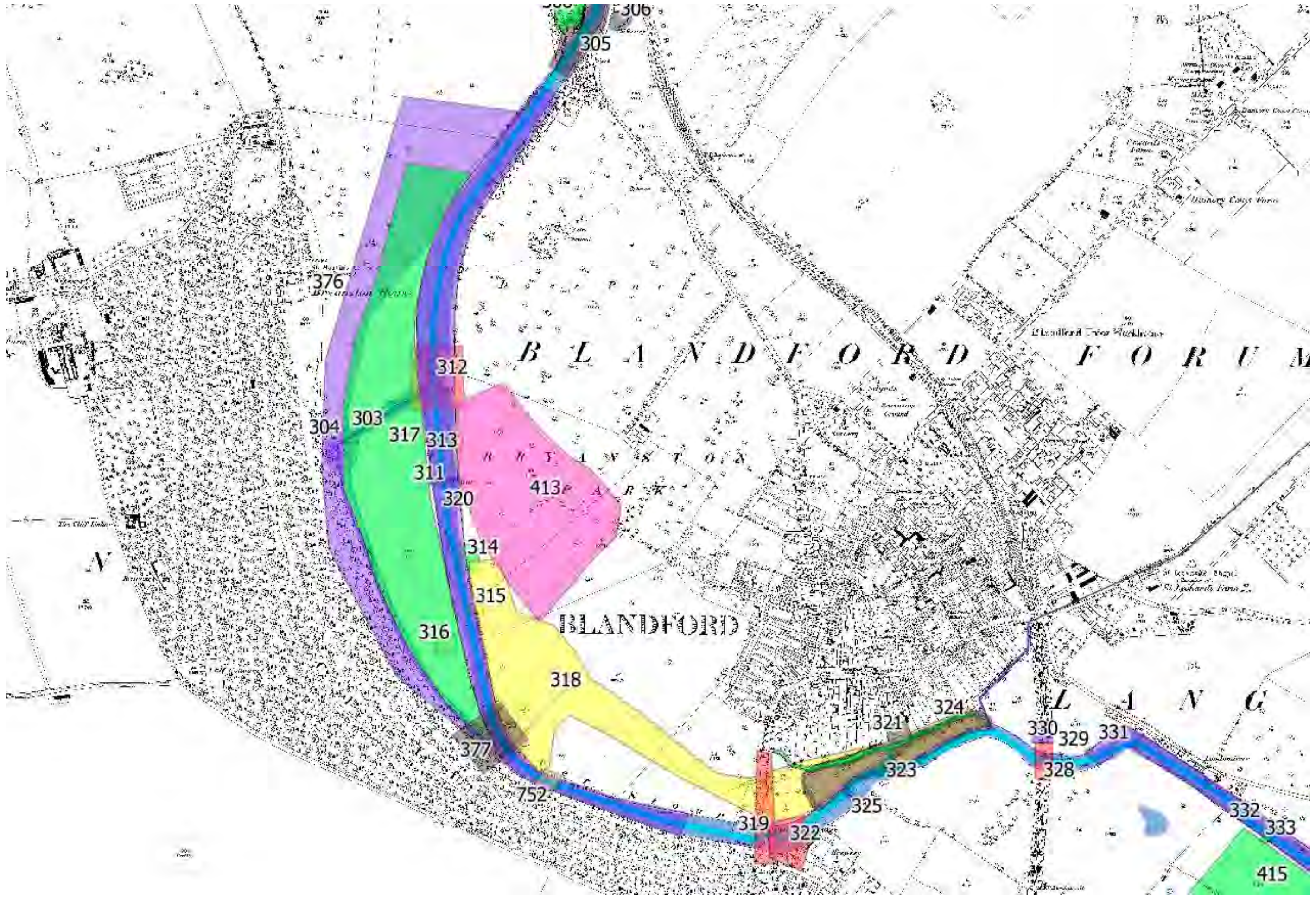
Our mapping and recording of how humans have used and intervened in watercourses is intentionally 'coarse' given the catchment scale it is designed for, resulting in 'Historic Watercourse Polygons' (HWPs) that provide an intermediate level between detailed recording of individual heritage assets within a Historic Environment Record (HER) and the broader brush of Historic Landscape Characterisation (HLC). Each HWP is accompanied by a flat file record (making it easier for managers to incorporate in their own GIS spaces) using controlled terms for type and theme, a description, their association with previously recorded heritage assets, and a signpost to the sources used in their identification and interpretation.

The HWPs highlight the potential for archaeological material that might be impacted by works to alleviate flood risk, for instance. However, they also flag features or former uses of the watercourse that might help explain why a specific place is prone to flooding, and features that might be rejuvenated to help meet objectives relating to climate change or habitat improvement. Looking at the HWPs for a catchment overall helps in gaining a sense of the biography of the river as a whole, at least over recent centuries and often indicating the catchment's human history much further back. This should be a productive basis on which to anticipate or plan changes to watercourses accompanying climate change: more so than approaches that, too often, consider our rivers to be essentially natural or modified only in recent times.

Pilot projects to develop the approach

Two pilot projects on the Dorset Stour and River Culm funded by Historic England have met their primary objectives, resulting in GIS layers – comprising 730 HWPs on the main channel of the Stour and 1233 HWPs across the entire catchment of the Culm – that have been shared with HERs and a range of authorities involved in catchment management. The value of the approach has also resonated elsewhere, however, leading to a series of other projects that underscore the benefit of understanding the human history of rivers to climate action.

On the Stour and the Thames, the Floodplain Meadows Partnership commissioned research that uses this method to understand the historic extent and the potential for restoring meadows which may date back to the Medieval period. Meadows in the floodplain used to be highly valued for the production of hay as fodder and were often managed as commons by each settlement. Surviving floodplain meadows present rich and diverse habitats, provide high levels of carbon capture, and offer attenuation of flooding. But following enclosure and subject to intensive agriculture, the quantity of floodplain meadow habitat is thought to have fallen by more than 90% over the last century. Nonetheless, the form of these former floodplain meadows is often still visible in the landscape, so we have been able to map them out as HWPs indicating their distribution in catchments, their original extent, and locations where they might be restored. >>



Above left: Example of Historic Watercourse Polygons (HWPs) mapped on the Dorset Stour around Blandford. Background: late C19th OS 25-inch mapping, courtesy of Historic England.

Above right: Cut Mill on Dorset Stour, where there has been a mill since before Domesday. © AJ Firth/Fjordr

Above left: River Culm at Collumbjohn adjacent to a sixteenth century mansion site. © AJ Firth/Fjordr

Working with the Connecting the Culm initiative in Devon, our focus has been on using a greater understanding of the historic environment to identify opportunities for Nature-Based Solutions (NBS) for flooding and drought. For example, long-lost historic features such as mill leats and catchworks (hillside watermeadows) offer scope for increasing connectivity with the floodplain and providing temporary storage. The HWPs are helping to inform discussions about the historic character of watercourses in priority areas, and also contributing to detailed considerations for individual NBS demonstration projects. The history of the River Culm is also playing a major part in public engagement through webinars and online workshops.

The impact of our work in Devon has supported a Green Recovery Challenge Fund project led by the National Trust at Killerton in the lower reaches of the Culm. Here a deeper understanding of the history of the river is informing the vision for richer habitats and a more resilient floodplain. The historic watercourses approach has directly contributed to the design and consenting process, including a programme of palaeo-environmental sampling and a watching brief during groundworks.

On the River Eden in Cumbria, mapping the historic character of the river is integral to a UK Research and Innovation (UKRI) Climate Resilience Programme ‘Clandage’ project led by the University of Liverpool (see Macdonald and Fluck, this issue) to develop toolkits for increasing community resilience through greater awareness of cultural and landscape responses to long-term changes. Our mapping of historic aspects of the catchment is complementing research into individual and institutional archives in a truly interdisciplinary fashion.

Back in Dorset, plans are underway for the historic watercourses approach to generate key themes that will underpin the Strategy and Business Plan for Stour Valley Park, led by Bournemouth Christchurch and Poole (BCP) Council as part of the Future Parks Accelerator. The intention is that people using Stour Valley Park will appreciate and engage with the historic environment, centred on the heritage of the river that forms the Park’s core. As well as adding to current enjoyment and wellbeing, increasing awareness of how people have lived with the river through history will help underpin the resilience and sustainability of communities served by the Park.

The historic watercourses approach developed with Historic England’s support is a great example of how understanding the historic character of rivers and floodplains creates tangible benefits as we anticipate the effects of climate change on our water environment. The fact that these benefits are being recognised and pursued by partners from different sectors underlines the potential of this innovative approach ■

Above right: River Culm with Collumbjohn Chapel in background. © AJ Firth/Fjordr

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Emma started her archaeological career in land-based fieldwork before developing specialisms in finds and archiving and in archaeological computing. Emma joined Fjordr full time in July 2017, applying her expertise in GIS, data processing and interpretation, including visualisation of LIDAR and bathymetry data.

Further information

Firth, Antony, and Emma Firth. 2020. ‘Historic Watercourses: Dorset Stour Pilot’. Fjordr ref: 16391, HE 7244. http://www.fjordr.com/uploads/3/4/3/0/34300844/historic_watercourses_dorset_stour_report_280220_web.pdf

Mapping the Historic Character of the Culm: webinar via https://connectingtheculm.com/mapping-the-historic-character-of-the-culm/

Floodplain Meadows Partnership: https://www.floodplainmeadows.org.uk/

Connecting the Culm: https://connectingtheculm.com/

National Trust Killerton: https://www.nationaltrust.org.uk/killerton/features/green-recovery-at-killerton

Clandage: https://www.ukclimateresilience.org/projects/clandage-building-climate-resilience-through-community-landscapes-and-cultural-heritage/

Stour Valley Park: https://www.stourvalleypark.uk/

The Kassandra approach is being applied to Ironbridge Gorge World Heritage Site. © Historic England Archive. Photographer Chris Redgrave, DP177958

Kassandra – an Integrated Decision Support System (IDSS) to manage climate change in historic environments

A metabolic approach to heritage.

All organisms and their inorganic surroundings on Earth are closely integrated to form a single and self-regulating complex system. As humans, we have an inherited need to connect to nature and other biotic forms due to our evolutionary dependence on it, whether for survival, shelter, or personal fulfilment. The built environment is not separate from nature. >>

The challenge of architecture is primarily a fusion of context, function, and materiality. But it's also embedded in human aspiration, cultural aesthetics, and a desire to demonstrate much more than durability and worthiness.

Architecture is a **quest** through time. William Morris said: *"All continuity of history means is, after all, perpetual change, and it is not hard to see that we have changed with a vengeance and thereby established our claim to be continuers of history."* But that doesn't mean architects have carte blanche. Change requires judgment. And we forget history at our peril.

We can certainly reinfuse historic environments with life through thoughtful interventions. But we also know that this new life will have a social and functional content that may be rather different to the architecture's original intent. To intervene therefore is to tread carefully - even when the task might seem straightforward. We need to remember that it's audacious to tamper with architecture that may already be a heroic demonstration of audacity.

We need to remember that it's audacious to tamper with architecture that may already be a heroic demonstration of audacity.

Above: Cava d'Ispica, one of the largest natural-archaeological sites in Sicily. © Kassandra

Historic cities are complex systems and the multiple threats posed by climate change - such as flooding, increased temperatures, extreme weather events, or biological threats – require complex, carefully weighted decisions, based on the analysis of accurate and multi-dimensional data. This complexity needs to be managed, and ultimately embraced. But complex does not necessarily mean complicated. Data from different fields can be brought together and visualized in an Integrated Decision Support System to provide a powerful predictive management tool. Data, or better, the relationship between data, is key.

The questions are therefore: how do we rapidly analyse complex multi-layered data that may influence the impact of climate change? How do we prepare for what appears to be an inevitable future? How do we harness the power of this change to adapt and create a new sustainable partnership with nature? How do we couple this with the enhancement of natural and built heritage?

What is Kassandra?

Kassandra – named after Priam's daughter in Greek Mythology who was cursed to utter true prophecies never to be believed – is the first IDSS that facilitates the creation, development, and management of a truly resilient city.

With Kassandra it is possible to improve planning and resource management, with the aim of enhancing the natural and built historic environments and the quality of life within them.

Our experience working with transformative projects within historic environments has meant that the required mélange of strategic understanding and detail knowledge has become a very familiar challenge. The methodology that Kassandra proposes is also invariably rooted in the consideration of the influence of layers of time and context.

Our analysis is tempered by an alternative vision of architecture: one that focuses not on how to fix the built environment we have, but better on how to resume thinking about it in a metabolic way, assuming that it is possible to conceive the existence of an architecture that is intrinsically ecological and that cities and buildings are not static entities but are ever-changing forms with their own metabolic processes.

Currently, Kassandra is the only multidisciplinary and fully comprehensive IDSS that reaches high levels of geographical accuracy, essential in heritage contexts, and is the only system directly linked to internationally accepted Quality-of-Life indexes.

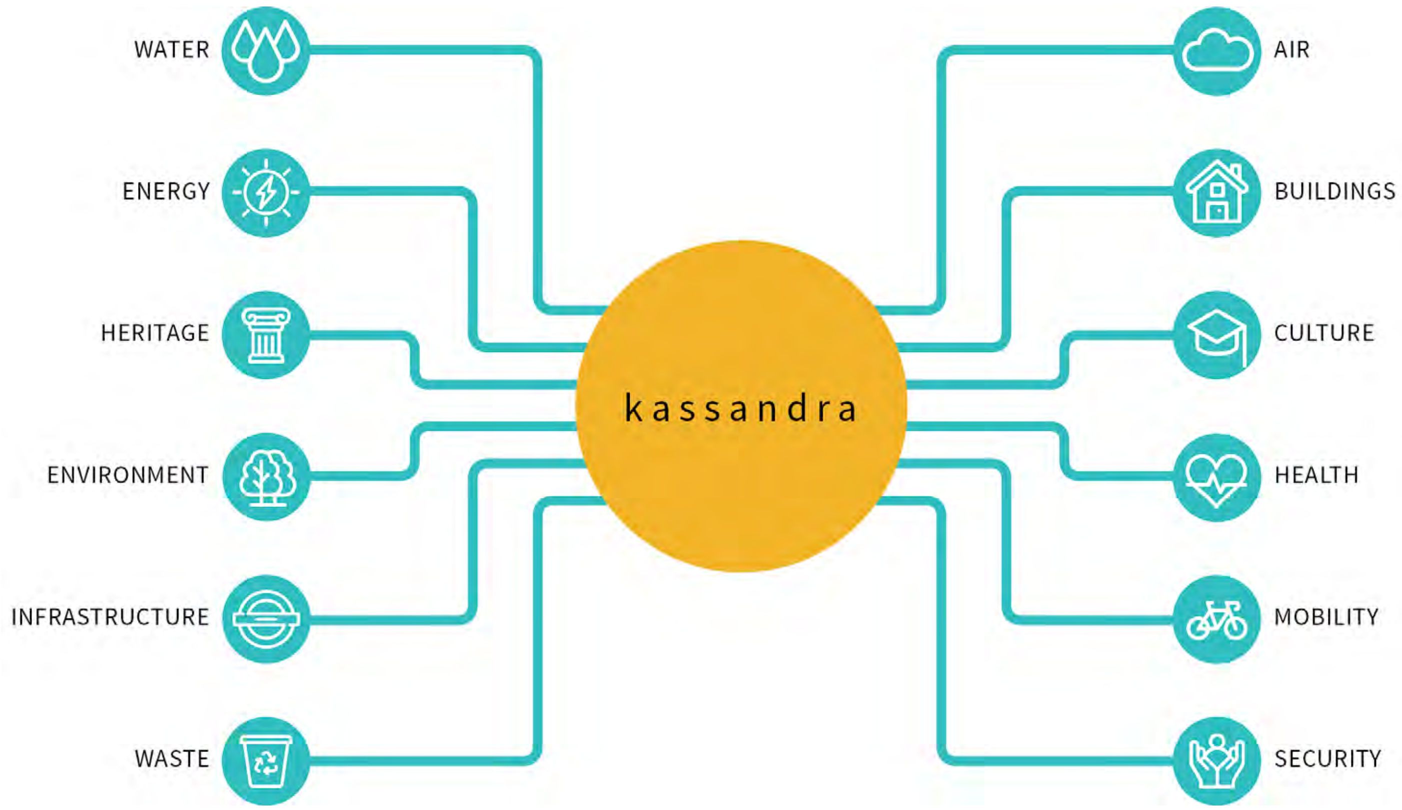
It is also the only system that allows for the prioritization of economic investments in areas where they will have the greatest impact on resilience and that includes the ability of measuring and visualizing positive actions by an individual and at the same time of an entire community.

The term 'Resilience', as defined by the United Nations, is *"the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner"*. It is very different from 'Resistance', the ability by a system not to be affected by something, especially adversely. >>

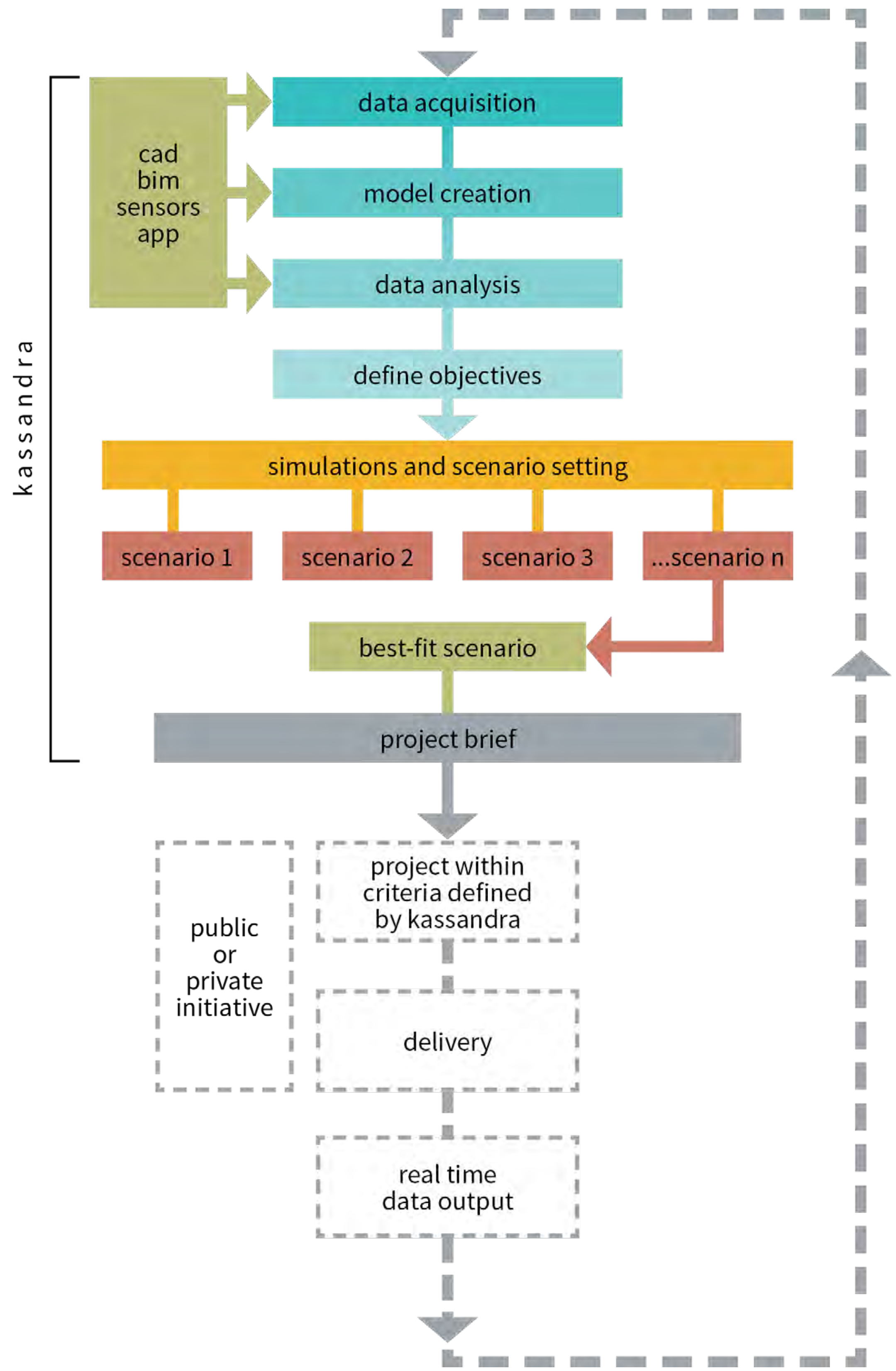
How does Kassandra work?
Kassandra creates a virtual twin of the area or asset to be analysed – based on Building Information Modelling technology – and uses analysis and simulation tools that take a long-term and whole-system view of a historic urban environment. Building Information Modelling or BIM is a process supported by various tools, technologies and contracts involving the generation and management of digital representations of physical and functional characteristics of places.

The analysis of Kassandra is based on twelve main parameters, hundreds of sub-parameters, and, most importantly, the relationship between them.

Following the analysis of the existing condition, using an iterative process, Kassandra creates various scenarios until an optimum solution - in terms of resilience and cost/benefit – can be identified and the foundations of a truly smart, sustainable, and resilient historic environment can be laid, thriving in balance with nature. In its most sophisticated version, Kassandra can also use sensors and actuators – devices that turn data input into actions- as well as artificial intelligence. >>



Above left: Diagram of the main parameters considered by Kassandra. © Kassandra



Above right: The Kassandra process. © Kassandra

The use of management software, applications, and widespread and interconnected sensors can also make individual citizens, local authorities, governments and designers responsible for the fight against climate change in a highly democratic and participatory process. Ultimately, Kassandra can become an invaluable tool for all those decision makers in public authorities and organizations that aim at improving the resilience of the built or natural environment they have stewardship of.

Applying the approach in the UK and beyond

Kassandra is a tool that is inherently scalable and versatile. It is being used for projects to improve resilience in historic cities in Italy; to provide guidelines for reconstruction in the nations of Dominica and Grenada in the Caribbean; to increase readiness to the effects of climate change for a motorway operator in Northern Italy; and, most recently, for the National Trust in Northern Ireland and for the Ironbridge World Heritage Site for Historic England. For Ironbridge, Kassandra is analysing an area of over twenty square kilometres, which include the entire World Heritage Site and more than 2500 buildings. >>

Kassandra is a tool that is inherently scalable and versatile.

Above: Illustration of Kassandra's digital twin of Coulibistrie, Dominica. © Kassandra

Conclusion

Architecture, new or old, must face the inevitability of change – sometimes perhaps even audacious change. Significant architecture must, when equipped with meaningful data, interpret meaningful change. And the challenge posed by climate change can itself become an opportunity to engender a new sustainable design and conservation approach.

Historic cities can continue their dialogue with time, purpose, and aspiration. They are marks of life and place. And they can still have great possibilities ■

Historic cities can continue their dialogue with time, purpose, and aspiration. They are marks of life and place. And they can still have great possibilities.

Above: Illustration of Kassandra's digital twin of Modica, Sicily. © Kassandra

The author

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Mark, a Conservation Architect, established Kassandra with Antonio Stornello in 2019. Mark founded his architectural practice in 2013 in New Zealand and opened the Italian office in Sicily in 2015. He previously worked for several design and Conservation practices in the UK, where he was responsible for the delivery of a large number of projects that often involved careful interventions in historic contexts, such as London's King's Cross Station and the De La Warr Pavilion – one of Britain's most important Modernist buildings. His focus is combining Sustainability and Heritage.

Further information

The Kassandra website https://www.kassandraproject.org/

Progress for peatlands

Understanding and protecting England's peatlands helps both heritage and mitigating climate change.

Peatlands are important for their rich cultural history and their significant environmental and habitat value.

As places where the historic and natural environments are intertwined, caring for and managing peatlands requires close collaboration between the heritage and natural environment sectors.

This article introduces the many facets of peatlands and the issues they face. It then summarises the current developments in national policy aimed at restoring and protecting them. >>

Left: The Grade II Listed Holme Fen post, Holme Fen National Nature Reserve, Cambridgeshire. © Zoë Hazell

Above left: Excavating the Neolithic timber Lindholme trackway, Hatfield Moor, South Yorkshire, 2004–2006. A drainage ditch cuts across the trackway itself. © Henry Chapman

Above right: Peat cuttings (likely post-medieval) in the foreground, on the upland hills at Exe Plain, Exmoor, Somerset. © Historic England Archive. Photographer Damian Grady, 27413_002

What are peatlands?

Peatlands are a type of wetland comprising the preserved remains of the plants that once grew. These organic remains are only partly decomposed because the wet conditions slow down decay processes. Peat accumulates upwards, forming layers of deposits that can be up to 10 metres deep and date back 10,000 years. Peatlands can be found both in upland locations such as Dartmoor and the Peak District and in lowland settings like The Fens and the Somerset Levels. However, not all peat deposits are still functioning wetlands: this is particularly the case in lowland peatlands that have been extensively drained for agriculture.

Why are they important?

Peatland heritage

Peatlands are important for a range of historic environment and cultural reasons, both tangible and intangible. For millennia people have lived on and used peatlands, which therefore preserve evidence not only of past human activities but also of the changing past environments of these cultural landscapes. Most visible are the features at the surface, for example, prehistoric stone circles, hollows left from historical peat cuttings, ruins of industrial and military buildings, to name just a few.

Healthy, functioning peatlands store water and release it slowly helping mitigate flood risk.

For the rest, we need to 'dig deeper' both physically and figuratively. Peat is composed of the remains of plants and other organisms (e.g. pollen and spores, seeds, and insects) which are evidence of past environments and the environmental impact of past human activities (such as farming and burning). The wetness of the peat is also perfect for the preservation of organic artefacts, meaning that peatlands offer unrivalled insights into past lives (e.g. food, tools, clothing and structures) and the people themselves (i.e. bog bodies). Other cultural connections to peatlands are intangible – perceptions of and interactions with peatlands both today and in the past (e.g. the language of peat and peatlands, the uses of peat and *Sphagnum* moss, and the peat harvesting tools), and how peatlands are represented in art and literature.

Peatland environment

Peatlands account for 11% of England's land surface (Natural England 2010, 2). When peatlands are in good condition, they capture carbon from the atmosphere and store it. Conversely, degraded peatland releases carbon: it is estimated that about 10 million tonnes of carbon dioxide are released every year (UK Government 2021, 8). Degradation also threatens the biodiversity of modern peatland habitats, putting the special – sometimes scarce – plants and animals that make up these habitats at risk. Water quality and flood mitigation are also dependent on healthy, functioning peatlands. Peatlands are the source of a significant amount of drinking water, but where degraded the water is often discoloured and this requires costly treatment to remedy. Healthy, functioning peatlands store water and release it slowly helping mitigate flood risk. >>

Above left: Grade II listed remains of the late 18th to early 19th century Old Gang Peat Store, North Yorkshire List Entry Number 1131503. The peat was used as fuel to smelt locally-mined lead. © Historic England Archive. Photographer David MacLeod, 28813_046

Above right: An example of the prehistoric rock art (probably late Neolithic) exposed after the 2003 fire on Fylingdales moor, North Yorkshire. © Jonathan Last, Historic England

What threatens peatlands?

Peatlands require specific hydrological conditions to form, develop, and maintain their special environment. They are particularly at risk of loss from drying out and burning events (whether natural or anthropogenic). Once the stability and integrity of peat deposits are compromised, they become extremely vulnerable to erosion. Many activities, such as tree planting, agriculture and drainage, can directly result in this. All these activities/interventions are set in the wider context of a changing climate and the projected increase in the incidence of extreme weather events. Active measures for peatlands that are vulnerable and degrading are known as 'peat restoration' works, and can include re-profiling (levelling) peat surfaces or blocking grips (ditches) and gullies to help prevent dewatering and erosion. Whilst such active interventions are necessary and welcome, they have a potential impact on archaeological remains (which needs to be considered throughout); some deposits and remains might be disturbed, but others will ultimately benefit from the restoration process.

What is being done to protect peatlands?

In 2018 the *25 Year Environment Plan* (UK Government 2018) committed to both restoring vulnerable peatlands and phasing out the use of peat for horticultural purposes by 2030. Following on from this, in May 2021 the Department for Environment, Food and Rural Affairs (Defra) launched the eagerly-anticipated *England Peat Action Plan* (UK Government 2021) (previously referred to as the England Peat Strategy). Specifically, this initially sets out a peat restoration target of 35,000 hectares by 2025.

It is supported by the Nature for Climate Peatland Grant Scheme (NCPGS), part of the wider £750 million Defra-funded *Nature for Climate* grant scheme. The NCPGS has over £50 million to provide as grants to undertake peatland works, either as Restoration grants or Discovery grants. The scheme, administrated by Natural England, is currently funded until 2025.

How is the historic environment covered within this?

Since 2019, as part of the England Peat Action Plan's formulation, Historic England has worked with Natural England and Defra to articulate and promote the importance of the historic environment of peatlands. The England Peat Action Plan is a landmark moment for heritage – ensuring that the historic environment is fully considered within conservation-led peat management approaches, particularly restoration projects. This is ensured as part of the NCPGS where the grant guidance states that "Peatland restoration schemes must deliver long-term protection of historic environment features and palaeoenvironmental remains" in order to secure funding.

As part of this work Historic England is producing documents on peatland heritage. The first of these two on Peatlands and the Historic Environment, in the Historic England Advice and Guidance series, explains their cultural and heritage value. Its publication earlier this year was timed to coincide with the launch of the England Peat Action Plan. The second – a 'how to' document setting out consideration of the historic environment when investigating and carrying out projects on peatlands – will follow. >>

The England Peat Action Plan is a landmark moment for heritage – ensuring that the historic environment is fully considered within conservation-led peat management approaches, particularly restoration projects.

This integrated approach – embedding the historic environment into peatland restoration at the outset and realising its potential opportunities – is key. It has also contributed to raising awareness of the cultural value of peatlands and their importance as a historic environment resource. The COP26 (Conference of the Parties) held in November 2021 will see the Global Peatlands Initiative (GPI)'s 'Peatland Pavilion' (in partnership with other organisations) include an event to promote better understanding of the heritage value of peatlands and will feature the recent collaborative work of Natural England and Historic England as an important step in greater global recognition of the varied significance of peatlands.

> *"Protect the historic environment of peatlands so the important evidence of our past can be preserved for the future, and ensure that restoration projects deliver cultural heritage, education and enjoyment, alongside other public goods."*
>
> England Peat Action Plan
> (UK Government 2021, 5) ■

Below: View eastwards over Five Barrows Hill, Exmoor National Park, Devon. © Historic England Archive. Photographer Damian Grady, 33021_024

Left: A carnivorous sundew on Dartmoor, Devon. Photo © Derek Harper and licensed for reuse under creativecommons.org/licenses/by-sa/2.0

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Louise's varied archaeological career includes research excavations in the North Atlantic, training and teaching, community archaeology, and delivering multi-disciplinary benefits to landscapes through her work on two NLHF-funded (National Lottery Heritage Fund) Landscape Partnership Schemes in Nidderdale and the South Pennines. Louise is also an Honorary Visiting Research Fellow at the University of Bradford.

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Zoë has a Geography background (Quaternary Science), with research experience in the reconstruction of past environments and landscapes. Her multidisciplinary interests mean that she has worked on diverse projects, from the use of peatlands to reconstruct past climatic conditions, to the study of wood use through the identification of archaeological wood/charcoal remains.

Further information

England Peat Action Plan (UK Government 2021) https://www.gov.uk/government/publications/england-peat-action-plan

A Green Future: Our 25 Year Plan to Improve the Environment (UK Government 2018) https://www.gov.uk/government/publications/25-year-environment-plan

Nature for Climate Peatland Grant Scheme https://www.gov.uk/guidance/nature-for-climate-peatland-grant-scheme

Advice on the historical, archaeological and natural significance of peatlands https://historicengland.org.uk/advice/technical-advice/peatlands/

England's peatlands: carbon storage and greenhouse gases (NE257) (Natural England 2010) http://publications.naturalengland.org.uk/publication/30021

United Nations Framework Convention on Climate Change (UNFCCC) COP26 https://ukcop26.org/

Peatland Pavilion https://youtu.be/cj_PrOIpbzs https://www.iucn-uk-peatlandprogramme.org/news/peatland-pavilion-proposal-cop26-programme

Articulating loss; understanding and communicating the loss of coastal heritage

Historic England has teamed up with the University of Exeter to support a collaborative PhD project researching methods of communicating the physical and emotional impacts of coastal heritage loss.

Above: Set atop cliffs, Geevor tin mine is a fascinating part of Cornwall's coastal heritage. © Historic England Archive. Photographer Damian Grady

Climate change is already affecting a wide range of heritage assets all around the coast. Some of these will be lost as the coastline changes. As heritage professionals, how we understand, process and communicate this loss to the wider public is of paramount importance; if we cannot save these important sites how instead do we lose them better?

The threat to coastal heritage

All over the world past societies have left their mark on the landscape. From where I'm writing this in Cornwall I frequently come across the remains of crumbling chimney stacks and old engine houses. They line the roads and perch on the edge of cliffs, remnants of an industrial past. A past that has been recognised as a World Heritage site since 2006. The legacy of these heritage assets can be seen not only in the cultural landscape but also, and much more insidiously, on the climate record itself. In the UK climate change will mean warmer wetter winters and warmer drier summers, and this is already causing stresses to a range of heritage assets "from built to buried" (Croft, 2013; Heathcote *et al*, 2017).

As the impacts of a changing climate begin to be felt more acutely, not least in threatening the longevity of the very built heritage that contributed to its acceleration, policy within Historic England has changed from one of fighting against change to trying to adapt to it (Fluck, 2016). Part of this policy specifically addresses how to manage sites that will inevitably be changed or lost, while also contributing meaningfully towards wider conversations on the important role that heritage has to play in conversations surrounding climate change (Fluck, 2016; Heathcote *et al*, 2017). This article is based on a framework created as part of an ongoing collaborative PhD project between Historic England and the University of Exeter. The framework looks at the loss of heritage assets through the lens of four distinct themes described below, with the aim of better understanding and communicating the loss of coastal heritage. >>

Above left: Bude Storm Tower, Cornwall – adaptation due to coastal erosion. The relocation of a Grade II listed coastal look-out and eye catcher is planned, due to coastal erosion and associated threat of collapse into the sea. © Historic England Archive. Photographer James O Davies, DP276200

Loss and the heritage sector

The heritage sector has a long and complicated relationship with loss. On one hand the need to protect has led to a fear of losing which underlies the current UK legislation for heritage protection (Schofield *et al*, 2011). On the other hand, loss occurring through destructive techniques such as excavation is welcomed even celebrated for its ability to unlock knowledge of the past and increase our understanding (Fluck and Wiggins, 2017). Indeed, avoiding all aspects of loss is neither achievable nor, arguably, desirable. Loss can help to continue collections, create value and even renew interest in history (Holtorf and Kristensen, 2015; Fluck and Wiggins, 2017; Morgan and Macdonald, 2018). Though the majority of the literature on climate change and heritage still focuses on methods of managing and conserving heritage assets to prevent or mitigate against loss, more recently there has been an increased focus on exploring the more transformational aspects of heritage loss and on the potential for value to emerge through accommodation of these natural processes (DeSilvey, 2017; Fatorić and Seekamp, 2017; Harrison *et al*., 2020).

Above right: A First World War emplacement eroded onto a beach at Kilnsea, East Yorkshire. © Historic England Archive. Photographer Alun Bull, DP169750

Loss can help to continue collections, create value and even renew interest in history.

Yet even with these new perspectives there is still an uncomfortable relationship between the acceptance of loss and heritage professionals especially as heritage sites are seen as a finite resource (Holtorf, 2015). These new ways of thinking still have to move from the more academic space to practical operational heritage management. When faced with the potential loss of heritage assets there seems to be an overwhelming professional anxiety based in fears of perception of mismanagement. This concern is exacerbated by uncertainty about the rate and scale of change acting on heritage sites. This isn't to say that loss should be blindly accepted without consequence. Instead, when faced with the transformation of coastal sites that can't be stopped to instead try and allow places to decay in a thoughtful and controlled manor intended to alleviate professional anxieties which can cause a breakdown of communication with them and the wider public. >>

The language of loss

Currently practitioners don't have the language needed to talk about and explain the physical, emotional and mental challenges associated with the loss of heritage. Nor has there developed a dialogue exploring the opportunities presented by its depletion. This is why the project's framework was developed; to give loss a language by creating a method of describing the physical and emotional aspects linked to four discrete themes of loss that may be encountered within the historic environment.

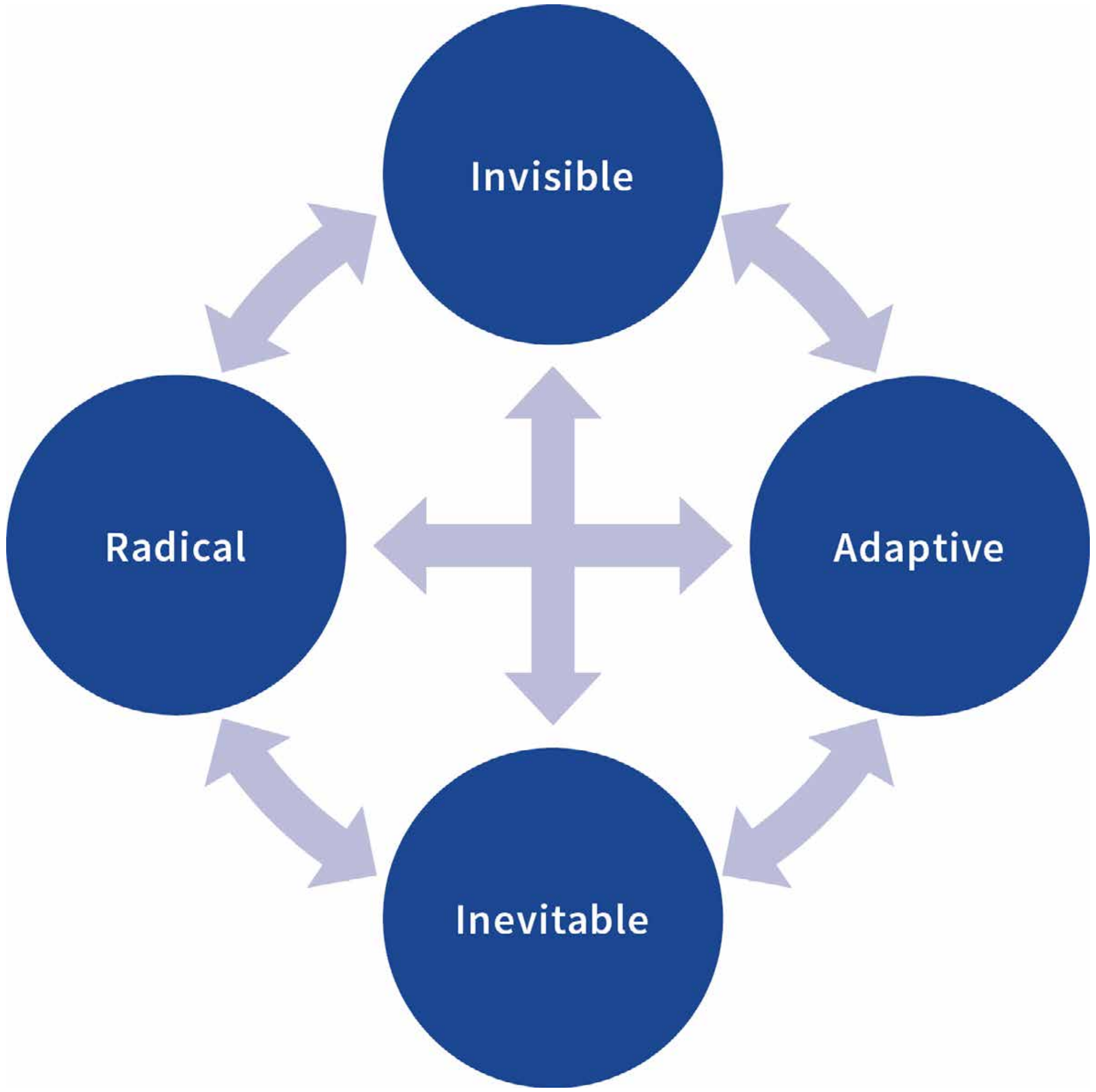
1. **Invisible loss**, which engages with heritage yet to be uncovered or assets that have gone unnoticed or overlooked. This theme concentrates on the potential release of value through the process of discovery and recognition;

2. **Adaptive loss**, which recognises the transformational nature of a place, and allows for continued evolution of form and function;

3. **Inevitable loss**, which involves the loss of heritage over an extended but unpredictable time period and provides opportunities for renegotiation of cultural and social relationships;

4. **Radical loss**, which requires the consideration of future histories, the histories we leave behind for future generations, which are associated with landscape scale change. Importantly this these incorporates the loss of both heritage and non-heritage assets.

(Venture *et al*., 2021)



Above: The Articulating Loss framework themes. © Tanya Venture

By breaking loss down into these four themes the framework is designed to help understand and compartmentalise this otherwise overwhelming issue. But, these themes are not meant to be overly prescriptive. This isn't an exercise with a correct answer. The type of loss that you assign to a site might be different to how I would assign it, and neither approach is wrong. The important aspect is deciding what narrative to follow; what conversation to facilitate while keeping people that make up the various stakeholders at the heart of the discussion.

Loss is messy and this framework actively encourages that messiness, in the different narratives that maybe encountered even within the same site. These themes are designed to be flexible, flowing in and out of one another. As funding or interest fluctuates a site may transition from adaptive to inevitable back to adaptive. This allows for sometimes contradictory perspectives to emerge though open ended conversations which encourage the flexibility and collaboration needed to tackle the challenges head on.

Heritage professionals are in a unique position to use their intimate knowledge of cultural landscapes to help broad audiences understand historic and prepare them for future change (Dawson, Hambly and Graham, 2017; Harkin, 2018). Groups like the Climate Heritage Network formed in 2019 bring together a diverse group of heritage professionals, business owners, government officials and cultural practitioners to help connect the issues of cultural and climate change and to take action (CHN). Communicating about difficult subjects in thoughtful and emotionally-intelligent ways is of paramount importance in gaining acceptance and trust and in establishing the cooperation needed to face the challenges presented by climate in the future (Cumming and Norwood, 2012; Olson, 2015; D'Ancona, 2017).

As the climate changes so too will our way of life and relationship to the past. Heritage can be a great tool for preparing people for that change and that will include accepting some form of loss (Smith, 2006). But, loss is not the end of the story, in many cases it is just the beginning. The themes explored in this framework aim to help guide the conversations providing heritage professions with the tools to confidently address the challenges and take advantage of opportunities of a changing coast.

These themes, briefly described above, are not meant to be overly prescriptive. This isn't an exercise in assigning heritage assets to one of these neat, fixed boxes but instead the aim is to facilitate conversation. Through breaking loss down into these four themes the framework is designed to help understand and compartmentalise this otherwise overwhelming issue, making it more manageable and providing the confidence needed to address challenges and take advantage of opportunities, whilst leaving room for reaction when unexpected things occur ■

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Further information

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