



CLIMATE ADAPTATION OPTIONS FOR DROUGHT-VULNERABLE HERITAGE SITES IN EAST OF ENGLAND

LOCATION: Henley Business School Greenlands campus, Henley-on-Thames, UK

ORGANIZERS: Walker Institute, Historic England

DATE: 19-20 May 2022

On the 19th and 20th May 2022, the Walker Institute and its partner, Historic England, co-organized a workshop attended by experts, practitioners, and academics from across the heritage and environment sectors, including national and regional public bodies from across the UK. The purpose of this multi-disciplinary workshop was to bring together relevant experts to pilot the use of new adaptation planning tools and techniques to inform the future management of heritage sites under climate and environmental change.

ACKNOWLEDGEMENTS

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We also gratefully acknowledge the colleagues below towards making the workshop and its outputs a success:

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INTRODUCTION

On the 19th and 20th May 2022, the Walker Institute (WI), in partnership with Historic England (HE), co-led a workshop attended by experts, practitioners, and academics from across the UK heritage and environment sectors, including national and regional public bodies. The purpose of the two-day residential workshop was to engage with critical stakeholders and experts to explore the development of novel and more fit-for-purpose climate adaptation planning tools and techniques to inform the future management of historic sites.

The workshop provided an opportunity to facilitate dialogue among the participants and their complementary expertise and points of views, allowing the research team to gain a deeper understanding of the real issues and demands of the sector and how we can better respond to them, together.

Historic England, and other stakeholders working on the historic environment, are looking for more resilient yet flexible adaptation planning framework that is applicable to a wide range of different sites; this workshop provided the space for an open, informed and collaborative discussion towards earlier, right and proportionate actions in the face of increasing climate risk.

The participatory workshop marked a milestone for the collaborative project between the Walker Institute and Historic England (see Box 1). During the two days, we

Box 1: The collaboration between the Walker Institute and Historic England

With a shared understanding of the value of heritage globally and locally, the Walker Institute partnered with Historic England (a member of the Climate Heritage Network) to address gaps in climate risk assessment and response in the sector. This followed on from a meeting between Prof. Ros Cornforth, Director of the Walker Institute (WI), and Dr. Hannah Fluck, at the time, Head of Environmental Strategy, Historic England (HE) at the UNFCCC 24th Conference of the Parties (COP24) in Katowice in Poland.

Seed funding was obtained from the University of Reading's Interdisciplinary Research Fund in 2021 to further develop a proof of concept study to address the challenges of decision-making facing the Heritage Sector related to deep uncertainties and the cross-scale gaps between scenario-based climate change studies and context-specific resilience building efforts. The proof of concept study stemmed from lessons learned through Walker's research as one of the eight "My Climate Risk" Regional Hubs appointed by the World Climate Research Programme (<https://www.wcrp-climate.org/mcr-hubs>) working together with global south partners in Africa and South Asia on water and food security.

The ultimate goal is to co-develop a new evidence-based and place-based adaptation methodology that meets the demands of ongoing adaptation efforts by the heritage and environment sectors in the UK, and internationally.

explored the viability of a proposed evidence-based and place-based adaptation planning method to help the sector take decisions today, despite the many uncertainties.

The method was adapted from the Dynamic Adaptive Policy Pathways (DAPP) approach pioneered by Haasnoot et al. (2013) for the water management sector in the Netherlands, but never applied to the historic environment context. Tailoring the DAPP to such a setting presents its challenges, including the need for a multi-dimensional and more holistic definition of “success” compared to the water management sector.

To guide the workshop discussion towards practical outcomes, three wetland archaeology sites in the East of England were selected as case studies. These were:

- Wicken Fen near Cambridge,
- Flag Fen near Peterborough, and
- Beccles close to the Suffolk coast by the River Waveney.

These ancient wetlands have revealed internationally important wood, metal, stone, and bone finds including weapons and jewellery, with the expectation that important archaeological artefacts are yet to be uncovered. Yet, changes in water quality, quantity and soil geochemistry exacerbated by climate change, threaten the waterlogged conditions that have protected these sites for millennia.

For the workshop, the participants were allocated to the different sites to work as small, interdisciplinary decision-making teams in charge of drafting hypothetical but realistic adaptation plans with long-term outlooks. The stepwise DAPP process was adapted for this workshop by Prof. Rosalind Cornforth and Elena Saggiaro from Haasnoot et al., 2013, and integrated with other tools such as a collaborative SWOT analysis.

OPENING

Professor Rosalind Cornforth, Director at the Walker Institute and Principal Investigator, delivered the opening remarks. She introduced the ethos and core work of the institute: supporting the development of climate resilient societies through interdisciplinary research. She noted that the collaboration with HE is bringing this work into a new space: from working together with governments, communities and practice-based partners in the Global South to understand *their* climate risk and quantify this contextualised impact of climate change, to transferring those learnings back

home in the UK for innovative place-based adaptation planning.



Figure 1: Dr Hannah Fluck (Historic England) giving her opening remarks on the Adaptation Planning Workshop

Dr Hannah Fluck, then Head of Environmental Strategy at Historic England and archaeologist by training, introduced the partnership with the Walker Institute (Figure 1). She stressed the pressing need to start implementing existing adaptation strategies and the importance of joining forces across disciplines to achieve this. She noted the importance of cultural and historical heritage in a changing climate: connecting us with the history of our places to see our present and future with a deeper purpose.



Figure 2: Extract from Dr Hannah Fluck's presentation of wetland archaeology

PROBLEM FRAMING 1: CLIMATE CHANGE, THE HISTORIC ENVIRONMENT AND WETLAND ARCHAEOLOGY

Dr Hannah Fluck started by introducing Historic England's **Heritage and Climate Change Strategy** (<https://historicengland.org.uk/whats->

[new/features/climate-change/our-strategy/](#)), which states that ‘by 2040, our heritage will have played an important role in the in the global fight to limit climate change and its impact on people and places’, while preserving heritage for future generations. She highlighted the broader international context in which HE’s climate policy must operate and the three strands of the strategy: **Strand 1 - Mitigation**, **Strand 2 – Managing Risks**, and **Strand 3 - Adaptation** – the latter two being the focus of the workshop. Hannah moved on to introduce the importance of wetland archaeology: these sites can preserve unique remains due to the anoxic waterlogged conditions that conserved organic objects, such as wood and leather, for millennia (Figure 2). They also preserve crucial palaeo-environmental information. She presented the three archaeological sites of interest for the workshop - Wicken Fen near Cambridge, Flag Fen near Peterborough, and Beccles close to Suffolk coast – their differences and commonalities.

PROBLEM FRAMING 2: UK CLIMATE CHANGE SCENARIO AND DROUGHT RISK

Elena Saggioro, Interdisciplinary Research Fellow at the Walker Institute, showed the expected changes to the UK climate based on the latest climate modelling by the Met Office (UKCP18;

<https://www.metoffice.gov.uk/research/approach/collaboration/ukcp>) (Figure 3). In a warmer world, the UK will see milder, wetter winters and hotter, drier summers, in combination with more frequent and intense weather extremes and larger seasonal variability. The South and East of England are expected to see a stronger warming and drying in the summer compared to the rest of the country.

Climate change may impact wetlands directly e.g., due to changes to river flows, and groundwater availability and quality, larger seasonal variability, and peat desiccation and erosion, and indirectly e.g., due to competition for available water for agriculture and human consumption. While there is agreement on the increase in drought risk in the South and East of the country, the magnitude and persistence of future droughts remain uncertain.

DECISION-MAKING UNDER DEEP UNCERTAINTY

Professor Rosalind Cornforth discussed the current challenges of adaptation decision making, stressing the scale gap between global climate projections information and local impacts and the weak link



Figure 3 Elena Saggioro (Walker Institute) presenting the UK climate change scenarios

between knowledge production and application. Given these challenges, she argued, we must change course and move towards a decision-centric framework to manage climate risk and adaptation planning. Prof. Cornforth introduced the three-pillar methodological framework in development at Walker: i) Dynamical Adaptive Policy Pathways (DAPP) to visualize adaptation and start planning today despite changing circumstances; ii) Climate storylines to represent uncertainty in few but highly plausible (or high impact) futures; and iii) Causal networks to model socio-economic-nature-climate systems, bringing together climate data, impact modelling and expert knowledge. Applying this framework to historic environments, the aim is to enable robust decisions to be taken despite the deep uncertainty surrounding climate change, including the application of a customised DAPP.

Applying Dynamic Adaptive Policy Pathways (DAPP) to Historic Environments

Elena Saggioro walked the audience through the adapted DAPP (see Introduction) approach, highlighting its strengths: i) a time dimension for decision-making, ii) multiple adaptation pathways to reach the same goal, and iii) identification of ‘no regret’ short term actions, overcoming policy paralysis due to deep uncertainty. A DAPP (Figure 4) looks like a “metro map” with increasing risk/time on the horizontal axis and adaptation options on the vertical axis.

An adaptation pathway is any sequence of options taken in time that achieve the adaptation objective. When the risk becomes too high for an adaptation option to be effective, this is called its Adaptation Tipping Point.

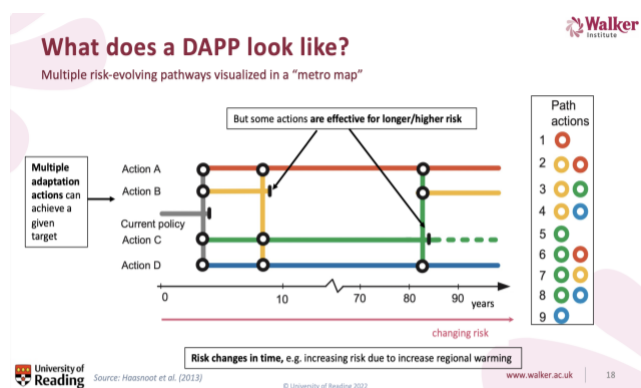


Figure 4 DAPP "metro map" visualization

She illustrated how a DAPP can be developed through the example of its application for the Hutt River Flood Scheme, New Zealand (Lawrence et al., 2019), from which a few basic steps were extrapolated (Figure 5). These constituted the workflow for the rest of the workshop.

Workshop workflow

ANALYSIS OF THE SYSTEM	<ul style="list-style-type: none"> • Background reading material • SWOT analysis of current conditions
STEP 1	<ul style="list-style-type: none"> • Specify adaptation objective
STEP 2	<ul style="list-style-type: none"> • Find adaptation tipping point (ATP) under business-as-usual scenario
STEP 3	<ul style="list-style-type: none"> • Identify adaptation options • Order them by ATPs
STEP 4	<ul style="list-style-type: none"> • 4.a Generate a pathways map • 4.b Assess cost, benefits, co-benefits and trade-offs of each pathway
STEP 5	<ul style="list-style-type: none"> • Design adaptive plan: short-term actions, long-term options, preparatory actions to keep the latter open • Discuss a monitoring plan for signals
STEP 6	<ul style="list-style-type: none"> • Implement the strategy (short-term actions)
STEP 7	<ul style="list-style-type: none"> • Monitor the strategy: look for signals of change, new actions or breaking assumptions • Implement actions if ATP is reached (including corrective/preparatory) • Reassess plan if needed

Figure 5 DAPP workflow used at the workshop

PARTICIPATORY GROUP WORK ON THE DAPP

For the second half of Day One, the participants split into three groups, with a balance of decision makers, researchers, and practitioners in each, to focus on developing a hypothetical but realistic adaptation plan for each of the three wetland sites. The groups worked in parallel, following the workflow outlined in Figure 5.

The work was led by Prof. Ros Cornforth with one member each from the Walker Institute and HE teams, including some facilitators among the National Trust (NT) participants, as Table Facilitators for each group. In each case, the HE and NT team members had experience in the specific site or typology of the site being discussed by the group. At the end of each day, the groups returned to plenary to exchange progress and providing feedback. The lessons learned from these exchanges are included at the end of this report.

Step 0: Analysis of the System

Each group started by considering a statement of significance provided by HE, describing the value of the site and current and future threats including from climate change. Then, focusing on the current management plan and conditions, the groups identified the strengths, weaknesses, opportunities and threats facing their respective sites using a collaborative SWOT methodology (SWOT analysis; Figure 6).



Figure 6 Beccles group working on the SWOT analysis

Step 1: Specification of the Adaptation Objective

Adaptation objective is what "success looks like". In practice for this context it can be defined as, e.g., the ability to preserve archaeology *in situ*, or if it is possible to translate it into soil conditions, e.g., to maintain oxygen and humidity of the soil at a certain level. Discussions across all the groups concluded that it was challenging to define an adaptation goal and translating it into a realistic and quantitative statement for complex systems like these wetlands sites.

Step 2: Analysis of the Current Policy/Management’s Tipping Point

Next the three groups discussed when the current management policy for their site would reach its Tipping Point, i.e., fail to achieve the objective defined in Step 1 (Figure 7). Maps of changes in temperature, precipitation and soil moisture under a range of climate change scenarios were provided to aid their analysis. All groups found that the tipping points for all three sites were likely to be breached soon, although the adaptation timing was hard to assess without relevant monitoring in place and a precise definition of adaptation success.

Step 3: Identification of the Adaptation Options and Tipping Points

After considering the likely tipping point for the current management strategies, a range of adaptation options were discussed by each group. Many of these options related to water and land management practices for the different sites, as well as the possibility of excavations for critical archaeology. Time sequencing of the adaptation tipping points was discussed by considering which action would fail first, second, and so on, assuming the risk increases in time (no mitigation). Pathways including combinations of options, or on-and-off strategies were considered by some groups. In addition, one group decided to further characterize adaptation actions in terms of ‘policy attitudes’ i.e., those actions that focused more on social benefits, or on excavation, or on preservation *in situ*.



Figure 7: Working together at the Beccles table

Step 4a: Generation of Pathways

Given the adaptation options and their tipping points, a “metro map” of the DAPP was drawn up by each group, selecting all the viable sequences (pathways). By way of an example, one of the group’s DAPPs is included in Figure 8.

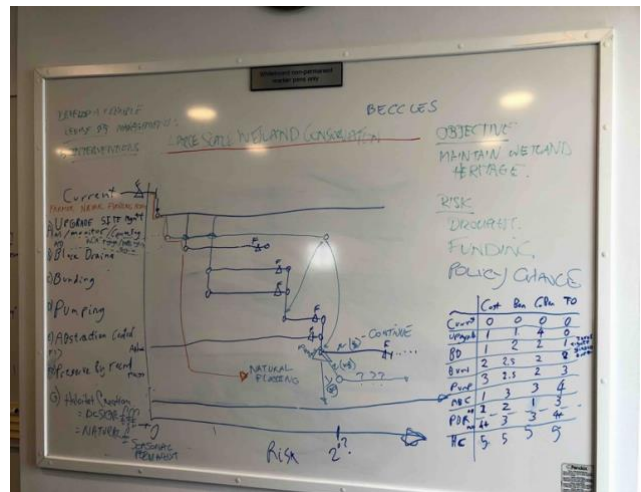


Figure 8: DAPP drawn by the Beccles group

Step 4b: Cost-Benefit Analysis

On Day Two, the groups reconvened to analyse each adaptation pathway drawn the day before, qualitatively assessing the costs and benefits including any co-benefits and trade-offs (see for example, Figure 9). This analysis would then be used to rank the pathways and finalise the adaptation plan. Interestingly, through this analysis some pathways that were initially viewed more favourably were found to be less viable than anticipated.

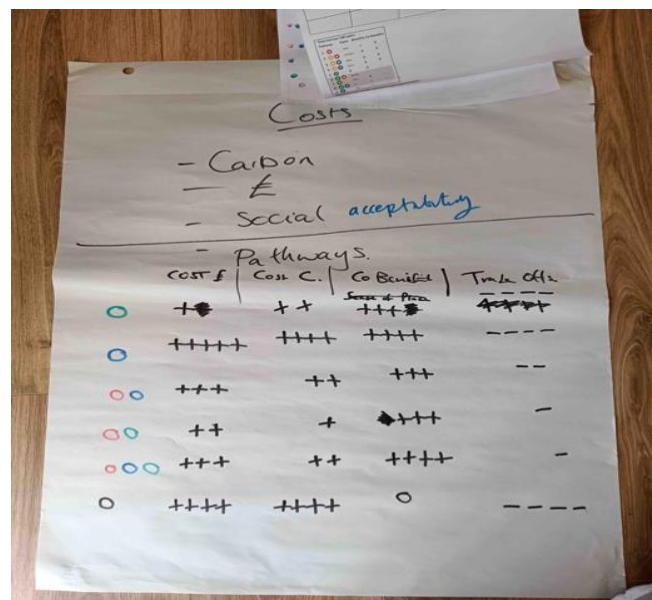


Figure 9: Cost-benefit analysis for Flag Fen

Step 5: Towards the Design of an Adaptation Plan

Finally, each group identified its preferred pathways and drafted key elements of an **adaptation plan** (e.g., Figure 10) including:

- short-term actions
- long-term options, and

- preparatory actions to keep the latter open.



Figure 10: Elements of adaptive plan for Flag Fen

Baseline Knowledge

- Missing baseline information e.g., updated assessment of soil condition and buried archaeology. Without this, planning is less robust and progress hard to evaluate.
- Difficulty in working in sites with great potential for archaeology but where there is no certainty about it.



Figure 11: Discussing on the lessons learned within the Beccles group

REFLECTION ON THE METHODOLOGY

The three groups compared their efforts and reflected on the challenges and the effectiveness of the DAPP process for designing adaptation plans under conditions of deep uncertainty (Figures 11, 12).

For ease, the comments emerged are grouped by themes below.

Multi-Stakeholder Dialogue

- It is a difficult process, but very much needed as many wetland sites are rarely managed only for archaeology but oftentimes also for nature and more.
- More stakeholders needed to be at the table e.g., community representatives, water management companies, farmers, as some of them were missing from this experimental workshop. However, smaller groups make decision-making easier.

Definition of Adaptation Objective / Goal

- Was generally hard to pin down in practical terms.
- A sound definition of the objective would require more time, more stakeholders, and more data.
- As the identification of the objective influences heavily all the analysis that follows, it is critical to understand which perspective(s) it is reflecting.
- It was a useful challenge to understand what success would look like 'on our own terms'.
- Consideration of other stakeholders, even the ones absent, came naturally to many participants.

Adaptation Actions

- Similar adaptation objectives were identified for all sites, despite their physical and archeological differences.
- Common categories of adaptation options across sites were identified (land and water management).
- Yet significant site-specific tensions and constraints remains.



Figure 12 Discussing lessons learned within the Flag Fen group

DAPP as a Tool and as a Process

- Was found to be useful for generating more grounded and practical discussion on adaptation.
- Provides a framework to make the process of adaptation planning more manageable and goal oriented.

- Can be useful and adaptable for broader strategic planning, beyond management of a single site.
- Is an effective way to capture experts' input and have a strong logical discussion with them via a process that focuses minds.
- Teases out some key decision points and disagreements so that they can be debated.
- Helps to identify what additional data requires prioritization.

Data and Modelling Gaps

- A need for targeted modelling to assess tipping points emerged: the wetland environment is very complex and its responses to combinations of stressors are hard to predict without modelling.
- A need to fill the gap in monitoring data emerged. But it was also noted that which data would be more useful depends on the specific adaptation/question being addressed/asked.

Suggestions for Improvement and Questions

- DAPP was presented with having only one dimension of risk contemplated, but two or more may be needed (e.g., biodiversity and archaeology). However, it seemed hard to generalize to multiple risk dimensions.
- The cost-benefit analysis should include the assessment of the "inaction pathway" too.
- The process would benefit from a clearer "policy entry point" to allow easier contribution from such stakeholders
- How can more modelling complexity be included (e.g., landscape view, risk to multiple hazards)?
- How to extend the DAPP to better join up different stakeholders' views? Maybe it could be integrated with other participatory methods?
- How to integrate DAPP with existing strategies?

REFLECTIONS ON THE DAPP PROCESS

Finally, in plenary the three groups reflected on the workshop itself and the process they engaged in during the two days. A synthesis of these reflections follows:

- Two days was a good length for the workshop - providing time to digest the information of Day One and use it to maximum potential on Day two.
- In discussing the benefits of 'social adaptation pathways' for Flag Fen, there was a realization amongst some participants that aspects of the archaeology at that site had been underestimated.
- It was beneficial to think about the full adaptation pathway before focusing on specifics.
- There was some information asymmetry between participants (e.g., with/without pre-existing

knowledge of the site) which prevented some participants from contributing as effectively.

- It was unclear how granular adaptation actions should be to make a DAPP effective.
- Whilst using a new framework felt uncomfortable at times, overall, it led to good and unexpected results in terms of understanding of the risk.
- The iterative process was unfamiliar to some but was considered eventually very useful.
- A suggestion was made to re-run the workshop with single stakeholder groups to help ensure different perspectives could be heard and brought to the table – whilst recognizing that there will be need for their integration at a subsequent stage.
- As a next step, more stakeholders should be brought in, including local communities, to allow for greater ownership through co-production of the adaptation pathways.

CLOSING STATEMENTS

Closing the second and final day of workshop, Professor Cornforth thanked all participants for their energy and willingness to take part in the piloting of the DAPP for use in historic environments. She invited the participants to provide the closing statement of the workshop (Figure 13). Several of the comments made are captured below:



Figure 13: Closing statements

“What really struck me about the DAPP model was its facility in bringing diverse stakeholder perspectives to bear upon a particular issue, be it site management, policy framework, or wider strategic direction, and to allow those perspectives to be couched in the wider context of ‘uncertainty’, in this case climatic change and drought.”

“Having previously explored similar climate adaptation pathway derivations and methodologies, the DAPP method highlighted in particular the need for multi-disciplinary collaboration in order to make the outputs practically applicable in the real world.”

“The workshop highlighted the importance of multi-vocality from a multiple agency perspective and the need for all the key agencies to be involved at each stage in the process. Missing in the case of the workshop were those able to speak from a specifically nature conservation perspective. It emerged the need for much more active dialogue with nature conservation interests so that understanding and appropriate strategies can be developed.”

“Some incorporation of scale would be useful – managing wetland archaeology as climate changes will no doubt require nested approaches of landscape and site-focused actions.”

“There is potential for development of the DAPP approach to be refined so that it could account for power dynamics within groups, with several potential tools that could be augmented to the DAPP approach to open up discussions.”

LOOKING FORWARD

The workshop established an exciting new interdisciplinary community of practice that can work better together toward the design of effective adaptation plans to benefit these fragile wetlands and the people living in the surrounds (Figure 14).



Figure 14: Building new relationships through informal conversations

Two concrete actions steps resulted from the workshop.

Firstly, a journal article is in progress, co-authored by participants of the workshop, to give the DAPP process and related themes of climate adaptation under deep uncertainty greater visibility, and to help bring the climate and historic environment community closer together.

Secondly, an exciting new collaboration has arisen, bringing together Historic England, the National Trust and the Walker Institute to work together on Wicken Fen, a National Trust site. Taking on board the lessons learned from the workshop, this pioneering research and adaptation planning will involve an expert group of stakeholders with deep local knowledge, including the communities and local government, to come together and develop an adaptation plan that can have practical, positive consequences in the current and future management of the site.

A word from Professor Robert Van de Noort, Vice-Chancellor of the University of Reading

Prof. Robert Van de Noort, Vice-Chancellor of the University of Reading and himself an archaeologist, joined part of the second day of workshop. Opening the morning session, he stressed the importance of working across disciplines and with the relevant partners to tackle complex problems, such as the impact of climate change on landscapes and communities that live in them.

“At Reading we believe partnerships are crucial to help address key challenges, including the adverse effects of climate change on cultural heritage. I am delighted to join colleagues from the Walker Institute and experts from government and heritage organisations to initiate the important work of developing adaptation planning tools to protect our local heritage from climate change. Given my previous work on wetland archaeology, I am particularly glad to see sites such as Wicken Fen being at the forefront of research and policy interest.”

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ANNEX A: PARTICIPATING ORGANIZATIONS

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<i>Dr Hannah Fluck</i>	at the time of the event Historic England, now National Trust
<i>Elena Saggioro</i>	Walker Institute, University of Reading

ANNEX B: WORKSHOP PROGRAMME

Venue: Henley Business School Greenlands Campus, Henley-on-Thames, UK

Date: Thursday 19th – Friday 20th May 2022

Time: Day One: 13:00 – 17:00 and Day Two: 09:00 – 13:00

DAY ONE

TIME	SESSION NAME
13.00	Welcome
13.10	Outline of the agenda
13.15	Round of introductions with participants
13.45	Problem framing 1: Archaeological sites
14.00	Problem framing 2: UKCP18 future climate scenario
14.15	Solution framing: Decision making under deep uncertainty and DAPP
14.30	Today's workflow and an example of applying DAPP
14.45	Analysis of the archaeological site
	Reading time on the archaeological sites' statements of significance
15.15	Coffee break
15.45	Specify the adaptation objective (Step 1)
16.00	Current policy tipping point (Step 2)
16.15	Identify adaptation options (Step 3)
16.45	Draw the DAPP pathways (Step 4.a)
17.15	Working group facilitators wrap-up

DAY TWO

TIME	SESSION NAME
9.00	Welcome back
9.15	Review of previous day and outline of the agenda
9.25	Cost-benefit analysis (Step 4.b)
10.00	First steps in designing an adaptive plan (Step 5)
10.30	Coffee break
11.00	Discussion of next steps
11.45	Closing session with feedback from groups



Climate Adaptation options for drought-vulnerable heritage sites in East of England
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