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Climate Change Adaptation Planning, a National Scale Methodology

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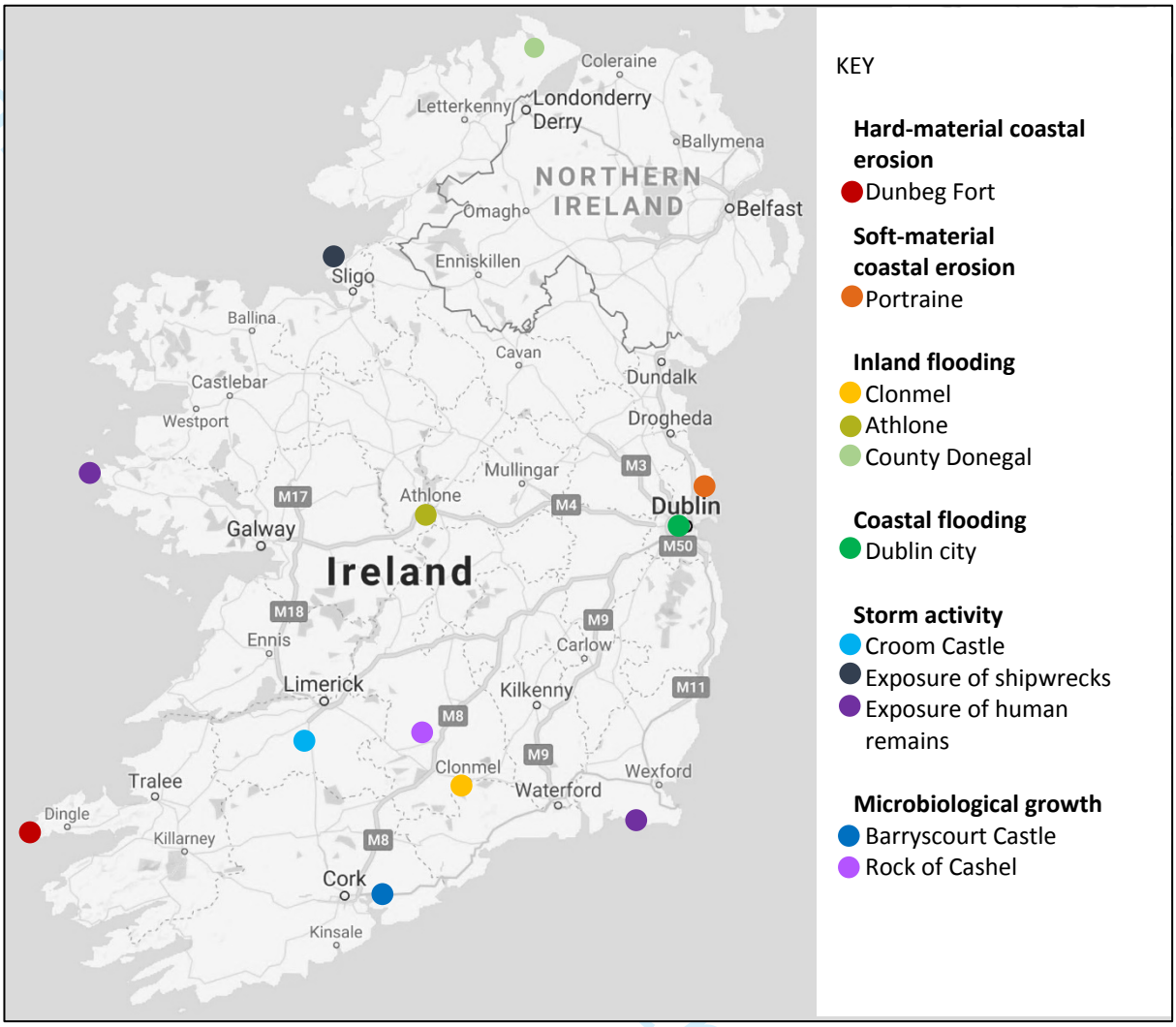
Climate Stimuli & Impact	Sectoral Consequences - Built Heritage		Sectoral Consequences - Archaeology	
Higher temperatures Hotter summers Warmer winters Prolonged dry periods Longer growing season Altered microbiological activity Accelerated rate of chemical reactions Ocean acidification	**DIRECT**			
	Challenges: Increased microbiological growth / changes in species Increased urban pollution effects, chemical processes of deterioration (summer) Increased thermal weathering Increased risk of fires Loss/gain plant species	**Opportunities** Reduction in freeze thaw weathering	**Challenges:** Accelerated deterioration Desiccation of organics Change in vegetation cover Deterioration of peatlands Increased risk of fires	**Opportunities** Discovery of sites (crop marks)
	INDIRECT			
	Challenges: Maladaptation of occupied buildings Changing land use (agriculture & renewables)	**Opportunities:** Increased recreational use	**Challenges:** Changing land use (agriculture & renewables)	**Opportunities:** Increased recreational use
Extreme precipitation & storms Flooding Increased water flow Altered water table Change in humidity cycles Increase in penetration of water and time of wetness Changes in soil chemistry Deterioration of water quality	**DIRECT**			
	Challenges: Surface erosion, abrasion & salt weathering Microbiological growth Rising damp Subsidence / landslip Changes in surface deposition, washing of pollutants, soiling Physical damage, loss & collapse Wind throw		**Challenges:** Landslide, bogslide & rock fall Erosion Silting Pollution/contamination Wind throw Altered preservation conditions Collapse/subsidence	**Opportunities:** Discovery through erosion
	INDIRECT			
	Challenges: Damaging flood defences		**Challenges:** Damaging flood and drainage works	
Sea level rise & storm surge Coastal erosion Coastal flooding Increased wave heights Saline intrusion Wind transported salts Wind driven sand	**DIRECT**			
	Challenges: Mechanical erosion & salt weathering Sand blasting Erosion of foundations Physical damage, loss & collapse Rising damp accompanied by salts		**Challenges** Saline intrusion (soils and water table) Altered preservation conditions Erosion & exposure (sand dunes, underwater and intertidal) Submersion (marine, intertidal) Sedimentation (intertidal, marine)	**Opportunities** Discovery of sites
	INDIRECT			
	Challenges: Maladaptation (damaging coastal defences) Reputational loss (where losses are severe and public confidence in heritage sector is reduced)		**Challenges:** Maladaptation (damaging coastal defences) Reputational loss (where losses are severe and public confidence in the heritage sector is reduced)	

PRIORITY IMPACT	CLIMATIC FACTOR	HERITAGE AFFECTED
Flooding - Inland (fluvial, pluvial & groundwater)	Rainfall	ALL (highest risk for buildings and collections)
Flooding - Coastal	SLR & storm surge	ALL
Storm damage	Wind and rain	ALL (highest risk for buildings and landscapes)
Coastal Erosion	SLR and storm surge	ALL (highest risk for buildings and archaeology)
Soil movement (landslip / erosion)	Intense rainfall, long dry periods, storms	ALL
Changing burial preservation conditions (e.g. desiccation, saline intrusion, acidification)	Long dry periods, SLR, temperature rise	Archaeology
Pests & Mould (mould / invasive species / increase in microbiological activity)	Warmer wetter winters	ALL (highest risk for buildings, collections and landscapes)
Fire (wildfires)	Hotter drier summer periods	Archaeology and Landscapes
Maladaptation (e.g. energy renovation of historic buildings, flood & coastal defences)	Temperature, SLR, rainfall	ALL (highest risk for buildings and archaeology)


Coleraine
Letterkenny
Londonderry
Derry
Ballymena
NORTHERN IRELAND
Omagh
Belfast
Sligo
Enniskillen
Ballina
Cavan
Dundalk
Castlebar
Westport
Drogheda
Mullingar
M3
M17
Athlone
M4
Dublin
Galway
M50
Ireland
M18
M9
Ennis
Carlow
Limerick
Kilkenny
M11
M8
M9
Clonmel
Wexford
Tralee
Waterford
Dingle
Killarney
M8
Cork
Kinsale
KEY
Hard-material coastal erosion
Dunbeg Fort
Soft-material coastal erosion
Portraine
Inland flooding
Clonmel
Athlone
County Donegal
Coastal flooding
Dublin city
Storm activity
Croom Castle
Exposure of shipwrecks
Exposure of human remains
Microbiological growth
Barryscourt Castle
Rock of Cashel

GOAL 1	**Improve understanding of the heritage resource and its vulnerability to climate change impacts**
Objective 1	Establish a baseline for heritage resources from which change can be measured
Objective 2	Conduct risk and vulnerability assessments for climate change impacts on heritage
Objective 3	Undertake monitoring of climate change and its impacts
GOAL 2	**Develop and mainstream sustainable policies and plans for climate change adaptation of built and archaeological heritage**
Objective 1	Integrate heritage issues into relevant national and local inter-sectoral policies & plans
Objective 2	Mainstream climate change adaptation into sectoral policy and conservation planning at all levels
Objective 3	Increase and improve disaster risk management for heritage
GOAL 3	**Conserve Ireland's heritage for future generations**
Objective 1	Increase the resilience of heritage resources under current conditions
Objective 2	Develop management and conservation approaches for changing environments
Objective 3	Find ways to capture value when loss is inevitable
GOAL 4	**Communicate and transfer knowledge**
Objective 1	Create a vision for the sector and demonstrate leadership in the response to climate change challenges
Objective 2	Create guidance and disseminate information
Objective 3	Enable the collection, archiving and sharing of data, experiences and learning related to heritage and climate change
Objective 4	Develop training
GOAL 5	**Exploit the opportunities for built and archaeological heritage to demonstrate value and secure resources**
Objective 1	Explore potential revenue streams and partnerships for the resourcing of goals 1-4
Objective 2	Develop a better understanding of how the historic building stock, and its adaptive re-use, contributes to sustainable communities
Objective 3	Maximise the potential of heritage as an engagement tool for cross-sector research and initiatives, public engagement and education in relation to climate change and adaptation

	ACTION	Lead	Milestones	Delivery	Output	Dissemination	Indicator of Success	Evaluation Schedule	Evaluation Mechanism
GOAL 1: Improve understanding of the heritage resource and its vulnerability to climate change impacts									
Objective 1. Establish a baseline for heritage resources from which change can be measured									
a.	Baseline quantification of numbers, nature and location of heritage assets	DCHG		Y1	Desktop study	Online	Public availability of output	Month 12	WN
b.	Co-ordinate single mapping portal of relevant heritage assets	DCHG		Y1	GIS maps	Online	Public availability of output	Month 12	WN
c.	Condition assessment of a sample of heritage sites/properties in public ownership	DCHG	M1 Selection of sites M2 Field assessment	Y1 Y2	Condition assessments and digital imaging	Internal	Internal digital record (M2)	Month 12 (M1) Month 24 (M2)	WN Report to CCPT
Objective 2. Conduct risk and vulnerability assessments for climate change impacts on heritage									
d.	Hazard & risk assessment - overlaying maps of heritage assets with hazard maps for flooding, coastal erosion and other priority impacts & assessing risk	DCHG	Pre-requisite Goal1.b	Y2	GIS based risk assessment	Online	Public availability of output	Month 24 (M2)	WN
e.	Vulnerability assessment of a number of heritage assets to the prioritised impacts of climate change – focus on high value and/or high risk	DCHG	Pre-requisite Goal1.d	Y3	Site specific vulnerability reports	Internal	Internal publication	Month 36 (M2)	CCPT
f.	Engagement with communities in high risk areas to create evaluations of vulnerability and priorities for response for local heritage	DCHG	M1 Prioritise areas using G1.d M2 Engagement M3 Assessment	Y1 Y2 Y2 & ongoing	Community based adaptation plans for specified areas of high risk	Community based activities	M1 Plans circulated and approved at local level M2 Community engagement M3 Dissemination	Month 24 (M1) Month 30 (M2) Month 36 & 48 (M3)	CCPT WN CCPT
Objective 3. Undertake monitoring of climate change and its impacts									
g.	Monitoring of atmospheric climate at selected heritage properties	DCHG	M1 Select sites in partnership M2 Install equipment	Y1 Y2	Met Éireann stations installed at 2-3 sites	Met Eireann database	M1 MoU with OPW & Met Éireann M2 Equipment installed and operating	Month 12 (M1) Month 24 (M2)	WN WN
h.	Monitoring of ongoing maintenance & repair works undertaken and also of emergency response (including costs)	DCHG	M1 Establish data collection M2 Continued operation	Y1 Y2 & ongoing	Statistics relating to climate impacts and response for heritage in public ownership	Internal database	M1 Database launch M2 Ongoing data entries	Month 12 (M1) Ongoing (M2)	WN WN
i.	Monitoring of the impacts of climate on a representative selection of assets for which condition monitoring has been conducted (see Goal 1.c)	DCHG	M1 Select sites using G1.1.c & G1.3.g M2 Design and implement monitoring	Y2 Y3 & ongoing	Design & establishment of sustainable, tailored impact monitoring regimes at multiple sites	Internal databank of monitoring results	M1 Justified list of properties for monitoring M2 Operational monitoring regime	Month 24 (M1) Month 36 & ongoing (M2)	WN WN
j.	Develop monitoring and response regimes which build on citizen science approaches and utilise new technologies	DCHG	M1 Identify potential areas, activities and communities (Goal 1.f) M2 Support innovative and publicly accessible initiatives	Y3 & ongoing	Established schemes with public engagement	Community based and/or online activities	M1 Outline concept & create outreach M2 Support growth of initiatives at different levels	Month 36 (M1) Month 36 & ongoing (M2)	CCPT CCPT

Climate Change Adaptation Planning, a National Scale Methodology

Abstract

Purpose
Ireland's *Climate Action and Low Carbon Development Act 2015* established the requirement for a National Adaptation Framework (NAF) composed of 9 sectoral plans, of which Built and Archaeological Heritage is one. All the plans were written according to the six step process outlined in *Sectoral Planning Guidelines for Climate Change Adaptation* produced by the Department of Communications, Climate Action and Environment (DCCAE, 2018) which is also the government department charged with coordinating the NAF. This article summarises the application of the methodology to heritage resources in Ireland, the issues encountered and the results achieved.

Approach
The plan was informed by existing research and incorporated expert, stakeholder and public consultation throughout the process. It also closely considered published plans from other sectors in order to aid consistency within the NAF and to ensure cross-cutting issues were highlighted.

Findings
Of the many potential impacts of climate change, those identified as priorities for adaptation planning in Ireland were flooding (inland & coastal), storm damage, coastal erosion, soil movement (landslip or erosion), changing burial preservation conditions, pests and mould, wildfires, and maladaptation. Goals, objectives and an action plan were developed commensurate with the five-year term of the plan, but also initiating a long-term strategic vision. A monitoring strategy was developed to monitor progress, identify problems and inform improvements to the adaptation plan as part of an iterative process.

Value
Much work is being done on the topic of climate change and cultural heritage but it is believed that when Ireland adopted its national adaptation plan for cultural heritage in October 2019 it was the first government to do so.

Keywords
Climate Change, Built heritage, Archaeology, Adaptation, Heritage management, Heritage policy, Planning.

1. Introduction

The United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement 2015 joined all nations into a common cause to combat climate change, establishing a collective goal of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change (Article 7.1). Cultural heritage, embracing historic fabric, buried archaeology, cultural landscapes and traditional ways of life, frequently includes particularly vulnerable places and people. While at-risk heritage needs the attention of adaptation strategists, the sector has much to offer in return. The possible contribution of cultural heritage to climate change adaptation is acknowledged within the Paris Agreement, which states that adaptation action should be based on and guided by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems (Article 7.5). Enhancing adaptive capacity, strengthening resilience and reducing vulnerability of heritage can thus contribute to wider societal adaptation. The global climate has already warmed by between 0.8°C and 1.2°C, and while we must act to reduce carbon emissions and avoid exceeding 1.5°C, some climate change impacts are already inevitable (IPCC, 2018). Ireland's *Climate Action and Low Carbon Development Act 2015* established the requirement for a National Adaptation Framework (NAF). The 2019 NAF was composed of 9 sectoral plans, of which Built and Archaeological Heritage was one. At the time of writing the authors know of no other example of an adaptation plan for cultural heritage which has been adopted by a national government. This article provides a summary of the plan's development, the complete document is available online (https://www.chg.gov.ie/heritage/climate-change/the-built-and-archaeological-heritage-climate-change-sectoral-adaptation-plan/).

Methodology

Adaptation to climate change is defined by the Intergovernmental Panel on Climate Change (IPCC) as *the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities* (IPCC, 2018). This broad definition has led to a variety of interpretations of what adaptation means. In developed economies it tends to be framed mainly as adapting to specific climate risks (hazards based), while in areas where poverty and

climate justice are key concerns a greater emphasis may be placed on social and environmental factors (vulnerability based) that compound climate effects (Dupuis & Biesbroek, 2013). The hazards approach is grounded in climate modelling, takes a long-term, scientifically robust view and is useful for raising awareness. Conversely the vulnerability approach focusses on stakeholder participation, takes a shorter term view and is more helpful in identifying practical actions (Füssel, 2007). In current adaptation practice these have become complementary, as reflected in the incorporation of characteristics of both approaches in the Irish plan (see 2.1 & 2.3).

Adaptation is context dependent and planning can take place at multiple scales, from national to site level. At government level planning for cultural heritage has followed different models dependent on local governance arrangements (Bonazza, 2017, Harkin et al 2020). There are two main options for those approaching adaptation to climate change (Ruhnhaar 2018). The first is mainstreaming, integrating cultural heritage concerns within broader planning, for example the tourism sectoral plan of Egypt's NAF includes one action for archaeology (IDSC, 2011:125). The second is to produce a standalone policy, examples of these have been created by heritage agencies e.g. Historic Environment Wales (2020) and Parks Canada (Nelson et al 2020). Mainstreaming has clear advantages for a small sector such as cultural heritage as it maximises synergies and resource efficiencies, while dedicated plans can falter due to lack of political and financial support. Standalone plans provide greater visibility however, and avoid the risk of policy dilution (Ruhnhaar 2018). The *Climate Change Sectoral Adaptation Plan for Built and Archaeological Heritage in Ireland* (CCSAP), required by the Climate Act of 2015, was written according to the *Sectoral Planning Guidelines for Climate Change Adaptation* produced by Ireland's Department of Communications, Climate Action and Environment (2018). The methodology specifies an individual sectoral plan consistent with and developed in parallel to the eight other sectoral plans, ensuring an emphasis on cross cutting issues and the creation of synergies and resource efficiencies (DCCAE, 2018). The guidelines detail a six-step methodology:

1. Preparing the Ground
2. Climate impact Screening
3. Prioritisation
4. Priority Impact Assessment
5. Develop your plan
6. Implement, Evaluate and Review

These six iterative steps were used as a framework for drafting the CCSAP and are reflected in its structure.

2. Writing the plan

2.1. Step 1. Preparing the Ground

This step entails setting the scope of the plan, defining timescales and assigning roles and responsibilities. Heritage in Ireland ranges from the many modest sites of local and regional importance to those of national and global significance. It includes private homes, national monuments, underwater and buried archaeology, and cultural landscapes. The CCSAP considers not only those structures and sites that have been statutorily listed but all manmade assets which may not be protected but have historical, aesthetic and cultural value. It does not consider natural heritage as this is within the remit of the Biodiversity Adaptation Plan. This somewhat artificial division between natural and cultural heritage (Richards et al 2019) reflects existing governance structures and historic legislative protections in Ireland. By taking a flexible values based approach to 'built and archaeological heritage,' natural, intangible and moveable heritage were nonetheless able to be incorporated in the development of actions. Thus climate change adaptation planning can provide an opportunity to clarify contemporary thought behind preservation decisions (Carroll and Aarrevaara 2018) and it may be that a more holistic approach to managing heritage will develop as a result of this process.

The preparation of each national sectoral adaptation plan was the responsibility of the relevant government department and minister, in the case of cultural heritage, an internal decision was taken to outsource the writing of the strategy. The successful team[1] was appointed in October 2018 and worked in close consultation with the Department of Culture Heritage and the Gaeltacht (DCHG) officials to deliver a final draft in July 2019. The strategy was adopted formally by the Dáil (Irish parliament) in October 2019 and will be reviewed and updated every 3-5 years. The plan was informed by existing research, a commissioned background report,

[1] Carrig Conservation Ltd., University of Lincoln, Irish Green Building Council and consultants.

and climate change projections for Ireland (Nolan, 2015; Daly, 2017). To add robustness and ensure relevance in an Irish context the project incorporated expert, stakeholder and public consultation throughout (DCHG 2019). Published plans from other sectors were also closely considered in order to aid consistency within the NAF and ensure crosscutting issues were highlighted. A short-medium term focus, considering effects up to the middle of the century was taken.

2.2. Step 2. Climate Impact Screening

In this step current understanding of climate risks and impacts are combined with climate change projections in order to produce a first level understanding of possible impacts. Studies of the climate record in Ireland show that the long-term prevailing weather conditions (i.e. the climate) are changing (Dwyer, 2012). The last century was characterised by an upward trend in temperatures resulting in warmer wetter winters and hotter drier summers, accompanied by an increase in extreme events - a pattern that is set to continue (Nolan, 2015; DCCAE, 2018). Projected sea level rise and increasing severity of Atlantic storms are also a major concern for this island nation. The climate projections utilised for the period 2040-2060 (Nolan 2015, 2019) were based on both medium-low and high emission IPCC scenarios. Many of the impacts of climate change on cultural heritage will be process driven and therefore require a fine-tuning of climate modelling data, sometimes described as 'heritage climatology' (Brimblecombe, 2010). For example, the number of wet days where the temperature drops from above to below freezing reveals freeze-thaw action in a way that average winter temperature does not. Similarly, the incidence of relative humidity around certain key threshold values is fundamental for predicting deterioration mechanisms such as salt weathering, mould growth and corrosion. Careful analysis of the scientific data, combined with an awareness of the mechanisms that affect heritage, are therefore essential for informed decision-making.

The direct impacts of climate change on heritage may be immediate or cumulative. Damage from catastrophic events such as floods and storms are likely to increase at the same time as slow onset environmental deterioration mechanisms (table 1). The way these impacts manifest will vary according to the sensitivity of the heritage and its exposure (Murphy, 2013). Exposure will alter with location and aspect, while sensitivity will be determined by the nature of the heritage resource (type, material) and its current condition. There will also be indirect impacts related to societal responses to climate change in terms of both adaptation (e.g. land use changes, flood defenses) and mitigation[2] (e.g. upgrading of historic buildings to reduce energy consumption).

Table 1. Potential impacts of climate change on built and archaeological heritage in Ireland

2.3. Step 3. Prioritisation

Having undertaken a preliminary 'Climate Impact Screening', the third step of the methodology requires identifying which of the potential impacts should be considered as priorities for adaptation planning. A preliminary identification was based on secondary research, the published climate change risk analyses undertaken by heritage agencies in Britain were especially useful in this task given the similarities in climate (Powell, 2012; Croft, 2013; Harkin, Davies & Hyslop, 2018). Expert-stakeholder workshops were subsequently utilised to gather information on how climate impacts were being experienced within the sector and to establish whether the initial prioritisation accurately reflected current concerns (DCHG 2019). Workshop participants were first asked to discuss any impacts on heritage which they believed may be due to climate change. Next they were asked what they saw as the main vulnerabilities of Ireland's built and archaeological heritage to the impacts of future climate change. Lastly, participants highlighted 3-4 key impacts of concern to them, providing some degree of qualitative ranking.

Table 2. Priority Impacts List

This two-phase process led to the development of a final list of priority impacts for the sector (Table 2). In general workshop participants' concerns matched closely with the literature-based list, with two notable exceptions. Firstly, workshop participants did not highlight the impact of increased wildfires. This is possibly because wildfires are currently very uncommon in Ireland and have not so far caused significant damage to built heritage, although gorse fires do regularly have low grade impacts on archaeological heritage. Climate projections suggest

[2] Actions to reduce atmospheric CO_2

that wildfires will increase due to hotter drier summers however, and the current low level of awareness and preparedness for such an event means that this could be highly damaging. For these reasons fire was kept in the final list of priority impacts. Secondly, the impact of maladaptation. This risk was not addressed by the UK studies (which took a hazards approach based in climate science) but was added because it surfaced as a major concern during stakeholder consultations. The term maladaptation is used to describe indirect negative impacts caused by societal responses to climate change that do not consider heritage values. Priorities that emerged will need to be kept under review and updated as a more detailed understanding of climate change risks and impacts evolves over time. This experience illustrates the importance of designing a research and participatory process that includes stakeholders with specific knowledge and skills, ideally a mix of scientists, practitioners, decision makers and analysts (Füssel 2007).

2.4 Step 4. Priority Impact Assessments

Following 'Prioritisation' the next step in the methodology is to undertake a 'Priority Impacts Assessment' with reference to illustrative heritage examples. These case studies need not be exhaustive but should be indicative of how key impacts could manifest on heritage assets. Although the list of priority impacts includes fire, maladaptation, and changes in burial preservation conditions, there was insufficient heritage related data on these issues to build informative case studies. This was mainly due to a lack of monitoring and research, but also the nature of the heritage resources i.e. buried archaeology being essentially invisible. In general where data existed it was made available however ownership and privacy issues can present barriers especially in relation to privately owned heritage. In recognition of this lack of data, recording and research to create a baseline understanding were included as actions in the adaptation plan (Goals 1.h, 1.i, 3.g & 4.g)[3]. The need for further research was also identified in relation to the effects of multiple impacts on a single heritage site e.g. Sea Level Rise (SLR) and storms combining to cause coastal flooding and erosion (Goals 3.b, 4.d, e, & f). The case studies explored both the effects of, and adaptive response to, each impact. When selecting the examples it was important to ensure variety of heritage types and a geographic spread (Figure 1).

Figure 1. Location of sites selected to illustrate the impacts of climate change on built and archaeological heritage in Ireland (Google Maps, 2019).

The case studies considered environmental causes and effects of existing processes, such as coastal erosion, and the impact that future climate projections were likely to have on these e.g. SLR and increased storm activity. This was illustrated with reference to one or more examples. Sectoral consequences such as loss of tourism revenue were outlined. Any adaptation responses were described and where possible the success or failure of these and associated costs were included, as well as recommendations for future action. The elaboration of the case studies created a picture of how different heritage assets may be affected by climate change. They also linked those effects with possible responses, feeding into the formulation of adaptation goals and objectives in step 5. The lack of baseline data on many impacts for heritage was problematic and highlighted the urgent need for data gathering and research in the sector.

2.5. Step 5. Develop Your Plan

According to the methodology step 5 requires establishing goals, sequencing objectives and identifying and prioritising actions that can help in achieving these short- and long-term goals (DCCAE, 2018: 38). The goals and objectives developed for the CCSAP were intended to be commensurate with the five-year term but also outline a long-term strategic vision.

The formulation of the goals and objectives was based on:

1. Steps 2-4 review and prioritisation of climate change impacts
2. Consultation of parallel sectoral plans
3. Literature research
4. Understanding of the determinants of adaptive capacity specific to heritage management (Phillips, 2015; Fatoric & Seekamp, 2017)
5. Consultation with stakeholders, with the DCHG's Climate Change Advisory Group, with relevant organisations and experts, and with the public (DCHG 2019)

Five primary adaptation goals for built and archaeological heritage in Ireland were created and the suggested mechanisms to achieve each goal were outlined in the accompanying objectives (table 3). Heritage resources are by their nature complex and multi-facetted, encompassing possibly conflicting values that have been constructed over time (Graham et al 2000) and, especially in the case of archaeology, are often poorly understood. Goal 1 sought to

[3] Goals and actions (represented by letters a-j) referenced here are detailed in section 5.2.2 of the published plan

address the gaps in baseline information for Ireland's heritage resources (identified in step 4). Cultural heritage is arguably unique in its transversal nature, and wider adaptation strategies which do not consider culture overlook, and perhaps undermine, key values relating to individual identity, community cohesion, and social resilience (Adger et al 2013). Goal 2 addressed the need to include climate change in heritage policy and, conversely, to ensure heritage is included in climate change policies.

The non-renewable nature of built and archaeological heritage means that preservation is a priority, however, the nature of climate change also implies that large scale loss, particularly in coastal areas, is inevitable. New conservation techniques must also be environmentally sustainable. Goal 3 tackled these issues, including the potential adjustment of current practices, and the need to actively plan for loss. Legislative protections, governance systems and concepts such as authenticity and integrity, may act as barriers to adaptive actions (ICOMOS 2019). Recognition of this within the DCHG in the recent past resulted in the autonomous creation of a rapid response procedure for human remains exposed by coastal erosion (Daly 2019). Formulation of the actions therefore needed to closely consider current ways of formalising heritage values and managing their conservation, and where these might require adjustment. Goal 4 sought to overcome these and other sectoral barriers for engagement with climate change adaptation (Phillips, 2015; Fatoric & Seekamp, 2017) through leadership activities, increasing understanding and communicating knowledge.

Adaptation planning should also seek to capitalise on any opportunities that climate change offers. Goal 5 addressed this in terms of promoting and harnessing the value of heritage to society, including climate policy. Adger et al write that in general '*place attachment may inspire citizens to develop or participate in climate adaptation planning processes*' (2013, p114). The hotter drier summers projected for Ireland may result in increased summer tourism, with resulting impacts on visited sites. There is potential for increased revenue however, and goal 5 also sets out activities aimed at encouraging sustainable tourism that benefits the sector.

Once the goals were agreed the next step was to map the goals and objectives onto an Action Plan. The achievement of each objective required a series of separate or sequential actions, over different timescales. Short-term actions are expected to be completed within 1-3 years, medium-term actions are to be completed or nearing completion within 5 years and long-term actions are expected to run beyond the scale of the current 5-year plan. Each action was elaborated in terms of the priority impact(s) it addressed, the expected output by which success should be measured, the stakeholders involved and the timeframe for delivery. There is a large degree of uncertainty both in how climate change will progress in the future and on how its impact will manifest on heritage resources. The approach taken to addressing uncertainty was to select 'low regret' approaches, which will enhance resilience regardless of the degree of future change (Welsh Government, 2013). Considering the five-year timeframe, it was important that the nature and number of actions were realistic and achievable. Adaptation actions can be 'Technological' or engineering solutions (grey), 'Ecological' solutions (green) or 'Policy' solutions (soft). Efforts were made to include actions from each category however, due to the strategic remit of sectoral planning at a national scale, the majority are in fact 'soft' solutions.

It is essential to consider the cross-sectoral nature of climate risks, impacts and planned adaptation responses, including both potential synergies and conflicts with relevant policies (DCCAE, 2018.5). Areas of inter-section between the CCSAP and parallel sectoral plans were identified. This highlighted opportunities for inter-sectoral collaboration and resource sharing as well as possible areas of conflict. For example the draft adaptation plan for Agriculture, Forestry and Seafood identified natural and cultural capital as a cross-sectoral theme and referenced the implementation of measures to preserve monuments or features in these contexts (DAFM, 2018). The transversal nature of heritage meant that intersections were found with every sectoral plan. One subject common to most sectors centered on responsibilities for maintenance and management of historic structures e.g. hospitals, bridges, railway stations, piers and harbours etc. The second common theme was communication and the avenues cultural heritage offers for creatively engaging people with climate-change issues, by connecting with what matters to individuals, such as the sense of place they acquire through understanding their local cultural heritage sites and practices.

Table 3. Adaptation Goals and Objectives for built and archaeological heritage

2.6 Step 6. Implement, Evaluate & Review

This sixth and final step relates to implementation of the plan, beginning from the date of adoption (for a maximum period of 5 years). The design of a monitoring and review process is crucial to improving functionality, and it should require data gathering based on defined indicators, enabling transparent tracking of progress. The results can be utilised to revise and adjust the action plan, the monitoring system itself, and ultimately the adaptation strategy. The evaluation plan is thus best seen as a '*living document for continuous and consistent*

adaptation planning and implementation' (Climate-ADAPT, 2019).

Monitoring and reporting in relation to climate change adaptation occurs at several levels, and it was important that the timing and formulation of monitoring mechanisms proposed were appropriate for all the required scales of evaluation (Irish government, EU and UN). The indicators chosen were designed to meet SMART criteria, i.e. specific, measurable, assignable, realistic and time specific. There are additional challenges in selecting indicators for climate change adaptation given the inherent uncertainties involved and the fact that successful outcomes, i.e. the moderation of harm, may not be determinable for many years (Klosterman et al., 2015). The indicators selected were mostly 'process' and 'output-based', intended to capture the development of governance and the implementation of the adaptation action plan. As the adaptation process matures and baseline information becomes available it will be possible to develop more 'outcome-based' indicators that measure the effectiveness of the strategy in reducing negative impacts for built and archaeological heritage.

Successful implementation of this plan requires active participation of responsible agencies, individuals and communities at all levels and scales across Ireland. Raising awareness and enabling and maintaining engagement is therefore a cornerstone of the implementation process and dissemination is integrated in the review scheme. At a national level, the NAF inter-departmental steering committee continues to meet during the implementation stage and has an overview of progress on all 9 sectoral plans to ensure that cross-cutting issues are addressed and that inter-sectoral planning continues. The proposed monitoring system includes dependent (internal) and independent (external) mechanisms at intervals to reflect the governance reporting requirements. The dependent organisational relationships ensure feedback and reflexive learning throughout the process while independent aspects allow objective assessment of the progress of implementation and dissemination (Klosterman et al., 2015). The final evaluation plan (table 4) includes the following mechanisms:

- *Written Notification* (WN) – Internal reporting on progress and implementation
- *DCHG Climate Change Planning Team* (CCPT) – Continued involvement of stakeholders maintained by the CCPT.
- *External Evaluation* (EE) – Independent evaluation of the implementation and success of the plan. The second evaluation will feed directly into the strategy update (starting at latest in month 60).

Table 4. Extract from the implementation and monitoring plan

3. Discussion & Conclusion

The barriers that have slowed and/or prevented the implementation of adaptive management within the heritage sector have been analysed previously in the literature (Phillips, Fatoric & Seecamp). Unsurprisingly, lack of resources is significant, however a lack of leadership, clear direction, knowledge and understanding (linked to uncertainty) are also key barriers. These are the issues that adaptation policies can address by providing analyses of the climate change risks and opportunities, and developing action and implementation plans for tackling those. The creation of climate change adaptation policies that include cultural heritage (mainstreamed or standalone) is a vital first step in the process.

The development of Ireland's *Climate Change Sectoral Adaptation Plan for Built and Archaeological Heritage* followed a standardised 6-step methodology. The process involved secondary research and stakeholder consultation throughout and was accomplished within a tight timescale. The requirement to develop priority impact case studies revealed the nature and scale of existing impacts on heritage and highlighted significant gaps in knowledge. While the focus of the adaptation action plan was on addressing priority impacts many capacity building measures will speak to a broader range of effects, an advantage given the uncertainty of climate change. The process illustrated that climate change adaptation may offer the opportunity to clarify and perhaps create a new and contemporary vision of heritage policy issues (Casey & Becker 2019), including options for transdisciplinary knowledge and policy alignment.

Adopted by the Dáil in October 2019 the plan has now entered the implementation, monitoring and evaluation phase. As this iterative process evolves adjustments to the action plan may be necessary, this decision-making should be transparent and the learning shared through the evaluation mechanisms. Due to the global COVID 19 pandemic some elements of the implementation (e.g. stakeholder meetings) have been delayed but other activities (e.g. research grant applications) have been proceeding and lessons from the pandemic are being learned. For example anecdotal evidence suggests that restrictions due to COVID-19 have resulted in increased engagement of citizens with their local heritage sites and increased domestic tourism - a sustainable model that could be built on.

The CCSAP was designed to sit alongside a number of other sectoral plans, as part of the Irish NAF. As such it was essential to follow the six steps closely. The methodology proved its usefulness beyond these specific requirements however, and could be utilised in adaptation planning for heritage in other countries and at multiple scales. At the time of writing it is believed that Ireland is the first government to adopt a national plan for climate change adaption of cultural heritage. Thus as the plan navigates the implementation phase in 2020 it will be charting new territory and the lessons learned will be of interest to many.

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