SCEILG MHICHÍL CLIMATE VULNERABILITY ASSESSMENT EXPERTS WORKSHOP

THURSDAY 9TH & FRIDAY 10TH NOVEMBER 2023
BEDFORD HALL, DUBLIN CASTLE, DUBLIN 2

FOOD & REFRESHMENTS WILL BE PROVIDED
RSVP AT kate.dowling@opw.ie

PROGRAMME – 2 HALF DAYS

DAY 1 – 9th NOVEMBER @ 1.30PM

REGISTRATION & LUNCH FROM 12.30PM
WELCOME
INTRODUCTION TO THE PROJECT
PRESENTATIONS
FOCUS GROUPS & DISCUSSIONS

DAY 2 – 10TH NOVEMBER @ 10AM

REFRESHMENTS FROM 9.15AM
RECAP OF DAY 1
FOCUS GROUPS & DISCUSSIONS
CONCLUSION

OPW Oifig na nOibreacha Poiblí Office of Public Works

An Roinn Tithíochta, Rialtais Áitiúil agus Oidhreachta
Department of Housing, Local Government and Heritage

PRESERVING LEGACIES

Sceilg Mhichíl

World Heritage Property

Climate Vulnerability Assessment

Workshop Booklet

INTRODUCTION

Climate change (CC) is the fastest growing global threat to heritage sites, many of which – natural, cultural, and mixed – are already being affected. Due to its location Sceilg Mhichíl has always been subject to climate extremes and the cessation of permanent occupation of the island by monks in the Medieval period has been linked to past CC. The rate and scale of human induced CC however requires a concerted approach to climate risk assessment.

This booklet is designed to support the Climate Vulnerability Assessment[1] (CVA) Workshops. In the workshops participants will be guided through the steps of a climate risk assessment process (see Figure 1). Please also watch the presentations and complete the questionnaire for which links have been provided.

Figure 1. Steps in the climate risk assessment process

STEP 1. DESCRIBE HERITAGE VALUES

The CVA takes a values-based approach to assessing vulnerability. As such **the first step in the analysis is that all participants agree on the values and features of significance which will be considered in the analysis**.

Sceilg Mhichíl is one of two World Heritage Properties in the Republic of Ireland. It is located on a precipitous rock in the Atlantic, 11.6 km from the coast of county Kerry. The sea creates a natural boundary for the World Heritage property and the entire island of Sceilg Mhichíl was inscribed as a World Heritage Property (WHP).

Although not officially designated as a cultural landscape in its WH inscription it is considered by the management plan to be a cultural landscape exhibiting the 'combined works of nature and man … which are of outstanding universal value from the historical [or] aesthetic … point of view' (World Heritage Convention 1972, Article 1). The interaction between the monks of Sceilg Mhichíl and the island's topography and physically harsh environment is what gives the site its outstanding universal value (OUV). The site is also protected for biodiversity, specifically as a breeding colony for a number of birds, some of which are endangered and protected.

The monastic enclosure on Sceilg Mhichíl is built on man-made terraces and consists of dry-stone walls, beehive huts, two boat shaped oratories, a later mortar-built church and a collection of cross-inscribed stone slabs. The monastery is still reached today by one of the three original dry-stone steps that are all largely intact. In addition there is a hermitage on the more inaccessible south peak consisting of a number of small terraces, an oratory and dry stone structures.

[1] The term *Climate Vulnerability Assessment (CVA)* is used to describe the process undertaken here at the request of the OPW. Operationally this CVA is aligned to the Climate Risk Assessment (CRA) process outlined by IPCC i.e. it includes not just an assessment of vulnerability but also of hazards and exposure.

There are also two 19th century lighthouses and associated structures, connected by the lighthouse road, considered to be significant as both local and national heritage and which are intrinsic to the maritime cultural landscape of Sceilg as an island.

In 1996 Sceilg Mhichíl was listed as World Heritage under two of UNESCO's criteria for Outstanding Universal Value (OUV):

Criteria (iii) [As itTo] … bear a unique or at leasts exceptional testimony to a cultural tradition or to a civilisation which is living or which has disappeared [and in providingfor the evidence of Early Christian ascetic monasticism].

Criteria (iv) … to be an As an outstanding example of a type of building, …an architectural or technological ensemble [andor] landscape which illustrates (a) significant stage(s) in human history. for the collection of dry-stone architecture, which is integrated within the island's topography.

The adoption of retrospective Statements of Outstanding Universal Value (OUV) in 2017 expanded further on the criteria (iii) & (iv):

Criterion (iii): Sceilg Mhichíl illustrates, as no other property can, the extremes of a Christian monasticism characterising much of North Africa, the Near East and Europe.

Criterion (iv): Sceilg Mhichíl is an outstanding and in many respects unique example of an early religious settlement deliberately sited on a pyramidal rock in the ocean, preserved because of a remarkable environment.

In addition to the OUV, the lighthouse structures are significant in terms of national heritage value and Sceilg is also a designated Special Protected Area for its avian populations, and is protected under EU and national legislation.

Sceilg Mhichíl – Attributes of Outstanding Universal Value

Attributes convey the Outstanding Universal Value of a World Heritage Property and enable an understanding of that value. These attributes should be the focus of protection and management actions.

Landscape

1. Most spectacularly situated of all early medieval island monasteries in an isolated and dramatic marine setting, deliberately sited on a pyramidal rock in the ocean

2. Dramatic topography and scenery of the island with Christ's Valley 130 m above sea level flanked by the North and South Peaks

3. Integration within the landscape of the principal monastic remains on a sloping shelf on the north-eastern side of the island and of the hermitage on narrow terraces just below the South Peak within the landscape of the island

Archaeological/architectural/structural features/qualities

4. Outstanding example of a perfectly preserved early medieval monastic settlement including landing points, flights of steps, terracing, plots for food production, paved areas, living spaces, buildings for worship

5. Intact indigenous stone architecture of a past millennium, uniquely documenting the evolution of dry-stone masonry techniques

6. Structural-historical integrity

Intangible

7. Symbol of the spread of Christianity and emerging literacy across the world, illustrating the extremes of early Christian monasticism

8. Strong sense of spirituality derived from the long presence of the monks on the island and the retention of the visual-aesthetic integrity of this iconic site

Nature

9. One of Ireland's most important sites for breeding seabirds

PRELIMINARY LIST OF KEY SOCIAL & ECONOMIC ACTIVITIES ASSOCIATED WITH THE PROPERTY[2]

In addition to its built, archaeological and natural heritage significance, Sceilg Mhichíl also has a rich **intangible cultural value**. The island has a unique sense of place, that is celebrated in literature, music and the arts and it retains its value as a place of spiritual pilgrimage. Sceilg Mhichíl is also very important to the local and national population having a high **social value** that is related to the iconic status and fame of the site, fostering a sense of pride, identity and stewardship.

The **Economic value** of the site is well recognised by tourism organisations. Being one of only two World Heritage properties in Ireland it generates tourism revenue from those who visit the island but unlike the other World Heritage Property of Brú na Boinne, Sceilg does not have the capacity to accept large numbers of visitors. Its tourism brand value, however, attracts extensive visitor interest to the Iveragh Peninsula. There is no entrance fee to the World Heritage Property, the transportation fee is set by private boatmen. In 2023 average fee is €140 per person. Success in the tourism sector is proven to bring many socioeconomic and employment benefits and a site like Sceilg Mhichíl can attract visitors who can then be persuaded to dwell longer in the area – with consequent spending. Fáilte Ireland and other local stakeholders developed the *Skellig Coast Visitor Experience Development Plan* (VEDP) in 2016 PowerPoint Presentation (failteireland.ie) and then established the Skellig Coast Tourism Network Company Limited by Guarantee – Kerry PPN.

In general the island opens to the public circa 12th May and closes at the end of September each year.[3] Increasingly extreme weather in September means that extending the season is not practical. OPW access the island at the end of April each year to carry out maintenance works ahead of opening the island to visitors and are finding that access is also being restricted by weather. This is having an impact on their ability to carry out the essential maintenance works ahead of the visitor season i.e. cleaning landing pier, setting up site huts, cleaning and repairing steps carrying out the sweep etc. Approximately 15 boats are currently approved by the OPW to transport passengers to the island during each season. Each boat is licenced to carry 12 persons each to the island, visitor numbers are capped at 180 visitors/day and max 25,000 visitors per season.

[2] These values will be built with community input as part of the community workshop process.

[3] The Sceilg Mhichíl visitor season started on 15th May in 2022 and ended on 29th September. In 2023 the season started on 13th May.

Table 1. Visitor admissions to the site from 2008 to 2023 (source OPW)

Year	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Admissions	10,324	10,642	12,343	9,750	11,577	13,221	15,315	12,560
Year	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Admissions	14,648	16,755	16,792	15,616	0	12,105	13,300	

The values which will be considered during the CVA are listed in Table 2. These include World Heritage values (OUV), those of national and local significance.

Table 2. Sceilg Mhichíl Values & Features of Significance

VALUE	FEATURE	DESCRIPTION	OUV	National	Local	Category
Evidentiary	Monastic structural remains	Dry stone steps, platforms, walls, beehive huts	X	X	X	Cultural
Evidentiary	Landscape	Precipitous rocky island, topography, geology, and location have led to its preservation largely as it was in the Early Christian era.	X	X	X	Natural
Evidentiary	Sub-soil archaeological deposits	Mostly in the monastic enclosure and previously partially excavated		X	X	Cultural
Evidentiary & Functional	Seabirds	One of Ireland's most important sites for breeding seabirds	X	X	X	Natural
Evidentiary & Functional	Lighthouse structures	Lower and Upper lighthouses and associated structures dating from early nineteenth and twentieth centuries		X	X	Cultural
Sensory & Associative	Intangible heritage	Linked to both the landscape and monastic remains, the island has a unique sense of place, celebrated in the arts and as a place of spiritual importance.		X	X	Intangible
Associative	Recognition	Iconic site fostering sense of pride and identity		X	X	Socio-Economic
Functional	Visitor attraction	Generates tourism revenue from visitors who take boat trips, go to the visitor center and stay and spend in local businesses.			X	Socio-Economic

STEP 2. IDENTIFY CLIMATE HAZARDS

Exposure of cultural heritage is the degree to which an identified heritage value is exposed to climatic variations and their related impacts. It is determined by environmental conditions (physical and atmospheric) (Daly 2013).

In this section the data from the two most recent climate change projection studies in Ireland are presented. Both studies use similar models, with the TRANSLATE study adding an extra model to its multi-model ensemble approach. **In general, both studies agree in that the autumn months are to experience the biggest increases in temperature and that the summer and autumn months will likely experience a decrease in precipitation**.

High Resolution Climate Projections for Ireland, EPA

In 2020, the climate change projections for Ireland for the period up to 2060 were published in 'High-resolution Climate Projections for Ireland–A Multi-model Ensemble Approach' (Nolan and Flanagan, 2020). Observed climate for the period 1981-2000 was compared with projections for the mid-century period of 2041-2060 under both low (RCP4.5) and high (RCP8.5) emissions scenarios to produce estimates of future climate change.

Data for the 4Km grid square containing Sceilg Mhichíl was extracted for use in the Sceilg Mhichíl Climate vulnerability assessment by the report author Paul Nolan of ICHEC and is summarised in Table 3.

There is higher confidence in the temperature projections (and derived variables related to temperature) than in the rainfall projections. The range in winter precipitation change provided is due to additional updated results from Ensemble RCM model (suggesting a higher % change).

Table 3. Climate change projections for Sceilg Mhichíl to 2060 (Nolan & Flanagan 2020)

Projections to mid-century (2041-2060)	RCP4.5	RCP8.5	Trend
Mean Temperature Change – Annual	1 °C	1.3 °C	↑
Seasonal Temperature Change – Winter (DJF)	0.9 °C	1.2 °C	↑
Seasonal Temperature Change - Summer (JJA)	1 °C	1.3 °C	↑
Seasonal Temperature Change - Autumn (SON)	1.2 °C	1.6 °C	↑
Seasonal Temperature Change - Spring (MA)	0.8 °C	1 °C	↑
Number of Dry Periods (ppt<1mm) - Annual % change	17%	15%	↑
Number of Dry Periods (ppt<1mm) - Summer % change	16%	22%	↑
Number of Frost Days - Annual change	-89	-91	↓
Precipitation – Winter mean % change	1%-7%	4%-9%	↑
Precipitation – Summer mean % change	-5%	-11%	↓
Precipitation – Autumn mean % change	-8%	-2%	↓

Projections to mid-century (2041-2060)	RCP4.5	RCP8.5	Trend
Precipitation – Spring mean % change	0.6%	0.7%	↑
Precipitation – Annual mean % change	-3%	-1%	↓
Wet Days (>20mm) – Annual mean % change[4]	9%	17%	↑
Very Wet Days (>30mm) - Annual mean % change[5]	27%	28%	↑
Driving Rain – Annual mean % change	-5%	-4%	↓
Driving Rain – Winter % change	-0.4%	-2%	↓
Wind Speed – Winter mean % change	-2%	-2%	↓
Wind Speed – Summer mean % change	-3%	-6%	↓
Wind Speed – Autumn mean % change	-3%	-3%	↓
Wind Speed – Spring mean % change	-1%	-2%	↓

TRANSLATE Results

The TRANSLATE project was established by Met Éireann in 2021 to provide standardized future climate projections for Ireland (O'Brien and Nolan, 2023). This work is an extension and adaptation of the High Resolution Climate Projections for Ireland study carried out in 2020 (Nolan and Flanagan, 2020). The data from this new study that are presented in this report are changes in daily maximum, minimum temperature and daily total precipitation for Global Warming Levels (GWL) 1.5°C, 2°C, 2.5°C, 3°C and 4°C for the period 2070 – 2100 compared to a baseline of the period 1976 – 2005.

The TRANSLATE results were generated as GIS data, the island of Skellig was not included in the analysis, therefore data from the nearest coastal point was selected – Bolus coast.

Temperature

The daily maximum temperature is predicted to increase by between 0.64°C – 1.92°C for the annual average, depending on the GLW (Table 4). The daily minimum temperature is predicted to increase by between 0.75°C – 2.13°C (Table 5). The September-October-November season is expected to see the biggest change of all seasons (**Figure**), with an increase in daily maximum and minimum temperatures between 1°C – 2.65°C and 0.98°C – 2.73°C respectively. The June-July-August season is also predicted to see some of the biggest changes. March-April-May is predicted to have the lowest change of all the seasons.

[4] Observed number of wet days (1981-2000) = 12
[5] Observed number of very wet days (1981-200) = 3

Table 4 The annual and seasonal predicted change in daily maximum temperature (°C) for different Global Warming Levels for the period 2070 – 2100 (TRANSLATE)

	Global Warming Level 2071 - 2100 (°C)				
	1.5	**2**	**2.5**	**3**	**4**
Annual	0.64	1.01	1.32	1.71	1.92
DJF	0.62	0.98	1.32	1.52	1.74
MAM	0.22	0.53	0.69	0.98	1.05
JJA	0.68	1.04	1.46	1.99	2.19
SON	1	1.48	1.81	2.3	2.65

Table 5 The annual and seasonal predicted change in daily minimum temperature (°C) for different Global Warming Levels for the period 2070 – 2100 (TRANSLATE)

	Global Warming Level 2071 - 2100 (°C)				
	1.5	**2**	**2.5**	**3**	**4**
Annual	0.75	1.17	1.5	1.89	2.13
DJF	0.73	1.14	1.46	1.75	1.98
MAM	0.49	0.86	1.11	1.39	1.51
JJA	0.76	1.18	1.56	2.05	2.27
SON	0.98	1.49	1.85	2.36	2.73

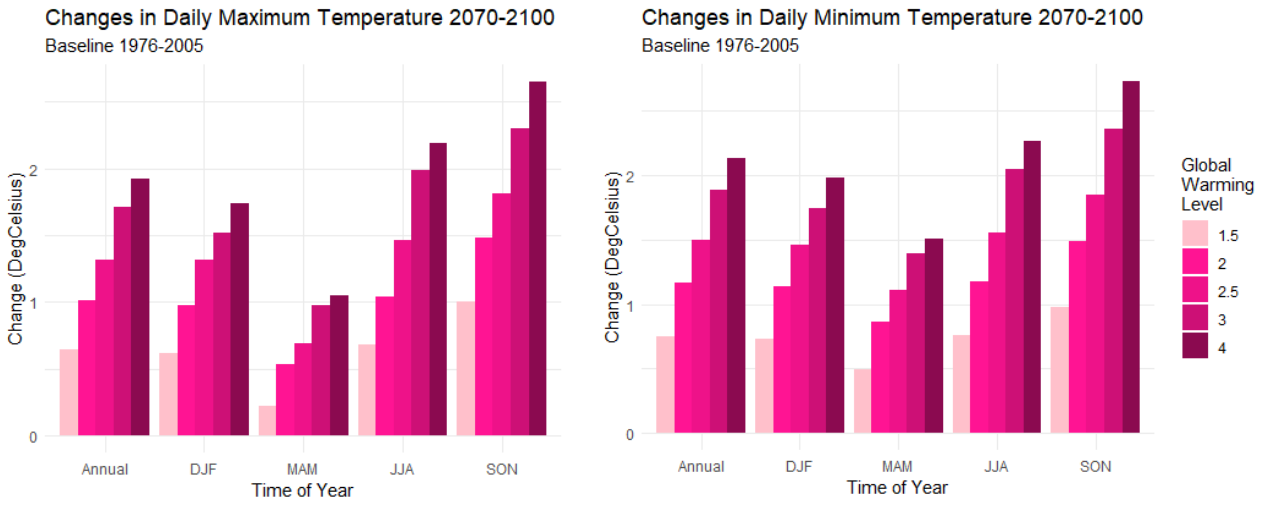

Figure 2. The annual and seasonal predicted changes in daily maximum and minimum temperatures for the different Global Warming Levels for the period 2070 – 2100

Precipitation

The annual average daily total precipitation is expected to increase, by between 3.9mm and 5.64mm (Table 6). However, under all GWL, June-July-August is predicted to see a decrease in daily total precipitation, with September-October-November expected to have a decrease in daily total precipitation for all GWLs apart from the 4°C GWL (Figure 3).

Table 6. The annual and seasonal predicted change in daily total precipitation (mm) for different Global Warming Levels for the period 2070 – 2100

	Global Warming Level 2071 - 2100 (°C)				
	1.5	**2**	**2.5**	**3**	**4**
Annual	3.9	3.32	3.43	3.69	5.64
DJF	9.38	8.19	11.1	12.67	16.87
MAM	10.2	8.96	10.07	9.07	7.93
JJA	-1.79	-1.23	-9.03	-8.55	-10.93
SON	-2.02	-2.29	-0.54	-0.92	3.53

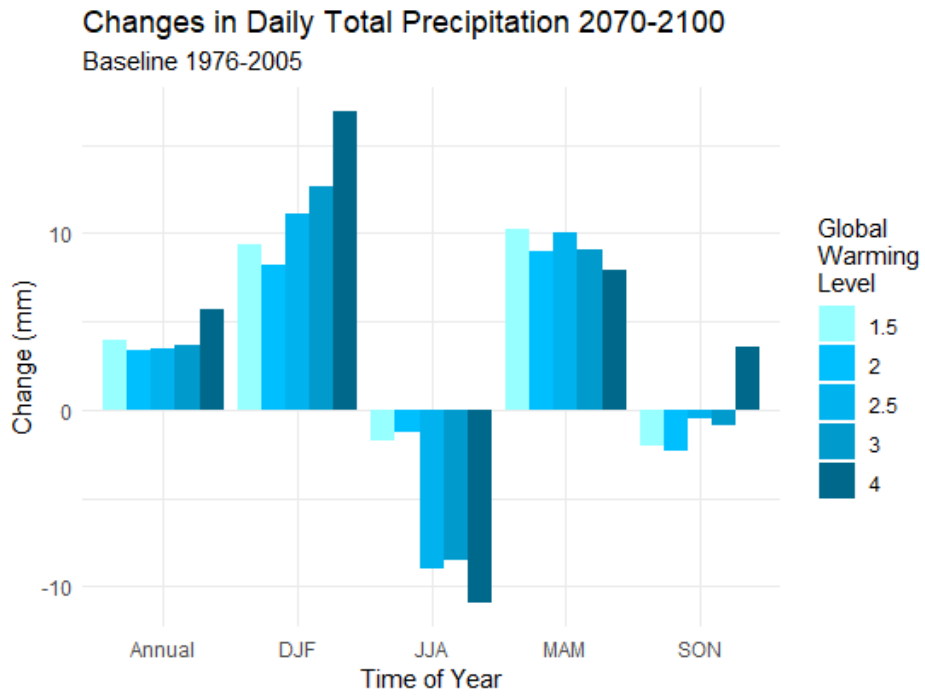

Figure 3. The annual and seasonal predicted changes in daily total precipitation for the different Global Warming Levels for the period 2070 – 2100

POTENTIAL IMPACTS OF PROJECTED CLIMATE CHANGE

The IPCC defines risk as:

> *The potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems. In the context of climate change, risks can arise from potential impacts of climate change as well as human responses to climate change. Relevant adverse consequences include those on lives, livelihoods, health and well-being, economic, social and cultural assets and investments, infrastructure, services (including ecosystem services), ecosystems and species.* (IPCC 2023)

Climate impacts are 'realised climate risks' and can be adverse, neutral or beneficial in their effect (IPCC 2023). The below table (Table 7) has been adapted from the Matrix of Impacts developed by Daly (2014 a & b) and the Potential impacts of climate change on built and archaeological heritage in Ireland from the Climate Change Sectoral Adaptation Plan for Built & Archaeological Heritage (2019; 29)

Climate Drivers & Hazards	Potential Impacts		
	Cultural Landscape	**Built heritage**	**Buried deposits**
HIGHER TEMPERATURES **Hotter summers** **Warmer winters** **Prolonged dry periods** **Longer growing season** **Altered microbiological activity** **Accelerated rate of chemical reactions** **Ocean acidification** ***Controlling parameters: Temperature, Moisture, Radiation***	**DIRECT** Change/loss of habitats & species (flora & fauna) Spread of new species (flora & fauna) Lengthening of growing season Increased microbiological growth / changes in species Increased risk of fires	**DIRECT** Increased biological growth &/or changes in species Reduction in freeze thaw weathering Increased urban pollution effects (summer) Increased thermal weathering Increased risk of fires	**DIRECT** Accelerated micro-biological activity Altered rate of chemical reactions Accelerated deterioration of waterlogged organic deposits Change in vegetation cover Increased risk of fires Exposure of sites
	INDIRECT Changes in land use (agriculture & renewables) Increased recreational use	**INDIRECT** Maladaptation of occupied buildings	**INDIRECT** Changes in land use (agriculture & renewables)
PRECIPITATION **Prolonged heavy rainfall** **Prolonged dry periods** **Increased water flow** **Altered water table** **Change in humidity cycles** **Increase in penetration of water and time of wetness** **Changes in soil chemistry** ***Controlling parameters: Rain intensity & duration, Rain volume, Catchment hydrology***	**DIRECT** Change/loss of habitats & species Vegetation die back Deterioration of peatlands Increased risk of fires Flooding Erosion Deterioration of water quality Silting Landslides, bogslide & rock fall	**DIRECT** Mechanical erosion Chemical erosion (dissolution) Change in humidity cycles (salts) Change in microbiological growth Rising damp Subsidence Changes in surface deposition & washing of pollutants	**DIRECT** Erosion Collapse/subsidence Altered preservation conditions: Microbiological deterioration Desiccation/loss of organics Pollution/contamination
	INDIRECT Changes in agricultural practice Increased recreational use Damaging flood defences	**INDIRECT** Damaging flood defences	**INDIRECT** Plough damage Damaging flood and drainage works
WIND **Storms** **Wind driven rain** **Wind pressure** **Wind driven particulates** **Gusts & changes in wind direction.** ***Controlling parameters: Wind speed, Wind direction, Rain intensity & duration***	**DIRECT** Erosion Rock fall Wind throw (trees) Physical damage, loss & collapse	**DIRECT** Surface erosion & abrasion Increased penetration of water Physical damage & collapse	**DIRECT** Erosion of earthen/stone monuments/soil cover Wind throw Collapse/subsidence

	Additional Coastal Impacts		
INCREASED SEA LEVEL & STORM SURGE **Rising Sea Levels** **Cyclones** **Coastal flooding** **Wind transported salts** **Wind driven sand** **Increased wave heights** **Storm surge** ***Controlling parameters: Temperature, ocean currents, wind speed, wind direction, surface pressure***	**DIRECT** Inundation by sea water Erosion Increase in salt loading and saline intrusion (soils and water table) Sand blasting	**DIRECT** Inundation with sea water Surface erosion and abrasion Physical damage, loss & collapse Rising damp accompanied by salts Increase in salt weathering	**DIRECT** Saline intrusion (soils and water table) Altered preservation conditions Erosion & exposure (sand dunes, underwater and intertidal) Submersion (marine, intertidal) Sedimentation (intertidal, marine)
	INDIRECT Maladaptation (damaging coastal defences) Reduction in water-based recreation Outward migration of people	**INDIRECT** Maladaptation Reputational loss (public confidence)	**INDIRECT** Maladaptation Reputational loss

Table 7. Climate Hazards and Potential Impacts for Ireland

STEP 3. DEFINE AND PRIORITISE RISK

The risk of climate change impacts is determined by a dynamic interaction between climate-related hazards, the exposure and vulnerability of affected human and ecological systems, and the effect of any responses. The concept of vulnerability here includes sensitivity and adaptive capacity of affected human and ecological systems (Ara Begum et al, 2022:146). Undertaking a heritage climate risk assessment therefore requires an in depth understanding of the elements of risk including:

- Potential Hazards and related Impacts
- Exposure and Sensitivity (an aspect of Vulnerability) of defined heritage values/attributes to those impacts and
- Adaptive Capacity of the system i.e. resilience or ability to minimise loss of value (an aspect of Vulnerability).

The results of the assessment are iterative, essentially a snapshot in time and will require revision and updating: *Hazards, exposure and vulnerability may each be subject to uncertainty in terms of magnitude and likelihood of occurrence, and each may change over time and space due to socio-economic changes and human decision-making* (IPCC 2023 AR6 Definition of risk continued).

Figure 4. Simplified version of the IPCC risk propeller (Ara Begum et al, 2022:145)

CURRENT SENSITIVITY TO CLIMATE EFFECTS

Sensitivity of cultural heritage is the degree to which an identified heritage value is affected, either adversely or beneficially, by [climate-related] stimuli. The effect may occur at artefact, assemblage or system level (Daly 2014a).

Past interactions with climate will help our understanding of how sensitive the site will be to future climate change. The below table (Table 8) attempts to summarise these issues. A previous climate change vulnerability assessment was completed for Sceilg Mhichíl 10 years ago (Daly 2014b) and a summary of the results from that study are provided in Table 9.

Table 8. Sensitivity to climate hazards

FEATURE	CLIMATE DRIVERS & IMPACTS	INCIDENCE
Monastic structural remains	**Structural Collapse**: Heavy rain saturates retained material increasing pressure on base of walls. Heavy rain and/or drought combined with animal burrowing also loosens footing of structures. Past conservation interventions may be inhibiting free drainage and contributing to pressure on structures.	The history of the site has been one of subsidence and collapse in places. Since 2018 survey observations have shown an annual shift of 5mm and more in the retaining wall below St Michael's Church.[6]
Monastic structural remains	**Mechanical damage** from water and wind gradually destabilises structures. Rain washes soil into and through dry stone walls, washes mortar out of walls (lighthouse period structures). Wind causes mechanical damage including stone throw (dry stone walls).	In previous years on the South peak the soil in the terraces was washed out causing collapse.
Monastic structural remains	**Access:** Extreme weather could mean altered visitor patterns resulting in change to mechanical damage caused by visitor traffic on the steps and within the monastery. Reduced visitor footfall is likely to result in less mechanical damage.	Experience is of loosening of stones on main visitor routes and in monastery; surface wear on paving in the monastery, erosion of vegetation along visitor routes.
Monastic structural remains	**Vegetation change:** Higher Temp - increased and/or changed plant growth and microbiological growth (including lichens). Rare lichens on Sceilg Mhichíl are important for biodiversity.	Plant growth within walls is an issue that requires constant maintenance, a longer growing season may increase this.
Landscape	**Rock Fall:** The cleavage planes in the bedrock allow weathering and erosion to take place rapidly and results in large cleavage blocks falling on a constant basis this process is exacerbated by climate stimuli: Frost - splits the stone Heavy rain - softens the soil. Dry conditions - loosens stones. Wind - moves stones.	Poses H&S risk to visitors and staff as well as built heritage (lighthouse previously damaged). Rock fall is potentially accelerating with several major events recorded since 2017.
Landscape	**Erosion:** Closely linked with rockfall and implicated in recent events i.e. of fallen cleavage blocks from upper slopes. Heavy rain and wind erodes exposed soil. Puffin and rabbit burrowing undermines soil cover as does visitor traffic. Salt spray and changing vegetation cover increase sensitivity. Together with rock fall poses H&S risk to visitors and staff as well as built heritage.	Predominant sea pink died back to be replaced by sea campion in 1970s. Sea campion died back on SE slopes in the 1990s due to salt dosing.
Sub-soil archaeological deposits	**Disturbance:** Subsoil in the monastery (where main deposits survive) and in areas where outlying features occur (stone steps, cross slabs, structures etc.). Heavy rain or drought - due to saturation pressure and water percolation or loosened footings (particularly by animal burrowing) and erosion.	South peak terraces have been continuously eroded, in most cases the original stratigraphy has been lost as a result.
Seabirds	**Increased sea water temperatures**: Effects availability of food for breeding colonies and if effected several years in a row the population could be impacted.	Anecdotally in some years puffins have been noted coming in with pipe fish as opposed to sea sprats which are harder for chicks to eat.
Seabirds	**Extreme weather:** Increased storminess may impact migration patterns. Changes to vegetation cover,	Detailed surveys of nesting populations have been recently established by NPWS but will

[6] *Skellig Michael Monitoring Survey Report 2022.* Discovery Programme.

FEATURE	CLIMATE DRIVERS & IMPACTS	INCIDENCE
	soil erosion and rock falls may result in loss of habitat and therefore breeding success.	require some repetition to establish accurate data.
Lighthouse structures	**Wave/storm damage:** Extreme storms with large waves can cause mechanical damage. Salt dosing will accelerate deterioration of stone and metal. Structural damage, accelerated deterioration and need for more frequent maintenance, reduction in facilities and/or access for staff. Restricted access/shortening season will affect the ability to carry out maintenance and conservation works. Rockfall impacting lighthouse road.	Waves and storm surge have damaged infrastructure in the past including the pier (2020) and lighthouse ramp. Wave action has removed the mortar from the seaward face of the lighthouse roadway, which is now treated as a dry stone wall to allow for nesting. Rockfall requires additional monitoring, conservation and archaeological works.
Intangible heritage	**Interventions:** Unique sense of place is related to the unspoiled nature of the island, its remoteness and natural and cultural heritage. Management responses to CC could be the most severe for this.	The need to balance H&S with preserving sense of place can be seen in the current crash decks on the lighthouse road.
Social	**Reputational Loss:** Entry onto the list of World Heritage in Danger or loss of World Heritage status is unlikely unless OUV is severely impacted, however both design and communication of management responses have potential to impact social value.	For example, UNESCO sent a reactive monitoring mission in 2007. Unrelated to CC it is mentioned here to demonstrate the risk to social value that can accrue in public perception.
Social	**Access:** A shortened season or closure of parts of the island will impact on how the intangible heritage is engaged with and could result in disengagement with community.	Will be investigated further in Community CVA
Economic	**Access** to the island by staff and visitors is weather dependent. In high winds & storms the boats cannot dock impacting on the livelihood of local boatmen. Evidence of recent years suggests that the tourist season is shortening by 1-2 weeks due to poor weather in September.	The OPW keep records of boat landings, which are weather dependant. For example in 2009 there were 44 days without landings
Economic	Increased maintenance and conservation costs for OPW associated with direct impacts discussed above are likely.	No figures available at present, calculation will need to allow for inflation.

Table 9. Summary of predicted climate change vulnerabilities for Sceilg Mhichíl to 2101 based on previous climate vulnerability assessment (Daly 2014b)

		Buried Deposits	*Structures and features*	*Cultural Landscape*
	Impacts for which Vulnerability is High (priority 1)		• Pressure collapse • Erosion of foundations • Structural damage by wind • Access	• Soil Erosion • Loss of vegetation • Change (loss/gain) of species • Rock fall

		Buried Deposits	*Structures and features*	*Cultural Landscape*
	Impacts for which Vulnerability is Medium (priority 2)	• Subsoil instability	• Changed microbial growth • Mechanical abrasion • Infrastructural changes[7]	• Landslip
	Impacts for which Vulnerability is Low		• Salt crystallisation • Thermoclastic weathering[8]	• Wave damage • Damage by water run-off

CURRENT ADAPTIVE MEASURES

"Adaptive capacity" in cultural heritage management lies mainly in the capacity to reduce sensitivity or exposure to climate change impacts. This involves consideration of all possible actions and management responses ranging from maintenance through minor stabilization, to major interventions or even relocation of features. It also includes capacity building and developing the ability of the existing system to identify, select, and implement appropriate adaptive actions.

We can consider adaptive capacity under the following four themes:

1. *Policies & Programmes* – relevant to the site and its values
2. *Information & Knowledge* – what are the gaps, how is knowledge shared, disseminated, recorded, and passed on.
3. *Implementation* – what is being done already that could help reduce sensitivity and exposure
4. *Monitoring and feedback* – important both for fully understanding and recording the impacts of climatic changes and also for measuring effectiveness of actions taken.

It is also important to consider the capacity of a site at the different scales that can affect it i.e. local and individual as well as national and institutional.

This section will summarise existing management measures that are/could address climate change impacts. Please refer to the Sceilg Mhichíl Management Plan for a more detailed overview of management structures and relevant policies.

Discussion in the workshop will contribute to calculating adaptive capacity as part of the CVA and will also be a starting point for the development of adaptation options going forward.

> *In the context of climate change responses, risks result from the potential for such responses not achieving the intended objective(s), or from potential trade-offs with, or negative side-effects on, other societal objectives, such as the Sustainable Development Goals (SDGs) (see also risk trade-off). Risks can arise, for example, from uncertainty in implementation,*

[7] Added following stakeholder review, relates to concern of stakeholders over the risk of maladaptation due to structural interventions on the island that may be made in response to impacts.

[8] Although overall this is low, the West face of the South peak is extremely vulnerable to this form of weathering (Rourke, pers. comm.)

> *effectiveness or outcomes of climate policy, climate-related investments, technology development or adoption, and system transitions. (*IPCC AR6 Definition of risk cont)

Ownership: Sceilg Mhichíl WHP is owned by the Minister for Housing, Local Government & Heritage on behalf of the Irish people with the exception of the lighthouse area.

The lower lighthouse is owned by Commissioner of Irish Lights (CIL) and operated by them as an aid to navigation. OPW is in negotiation with regard to a long-term lease on the building and is planning future building conservation works.

Statutory Protections: The protection and conservation of Sceilg Mhichíl is controlled by a range of national legislation, local mechanisms and international statutory and non-statutory guidance. These legislative provisions include, amongst others, the National Monuments Acts 1930–2014, the Wildlife Acts 1976 and 2000, EU directives, WH Convention and international charters. Sceilg Mhichíl, along with An Sceilg Bheag and the surrounding sea, has been designated an SPA (S.I. No. 74/2010 – European Communities (Conservation of Wild Birds (Skelligs Special Protection Area 004007)) Regulations 2010) under the EU Birds Directive (2009/147/EC) (Periodic report 2023).

Management structures: The National Monuments Service (NMS) on behalf of the Minister for DHLGH is the state body responsible for implementing the World Heritage Convention and for the development of policy relating to the archaeological, conservation, preservation and management of the built and natural heritage. NMS provides the archaeological advice and oversight for all required conservation works under the Section 14 Ministerial Consent process.

National Parks and Wildlife Service (NPWS) provide the natural heritage advice and oversight for all works to ensure that all known and potential impacts to the Special Protected Area (SPA) under the EU Birds and Habitats Directive are mitigated.

The Office of Public Works manages the island in relation to works and maintenance and in the provision of guides on the island. It is also responsible for all aspects of H&S relating to the monument and the WHP and co-operates with NPWS on issues relating to the avian population. There is coordination between the range of administrative bodies involved in the management of the property, but it could be improved.

Risk management: Safety sweeps are carried out by OPW at the start of each season to identify and reduce rock fall hazards. In recent years the existing canopy on the lower lighthouse road has been expanded and 3 permanent crash decks have been installed on the lower and upper lighthouse roads. Annual rescue exercises are carried out with the Irish Coastguard Mountain Rescue (Periodic Report 2023).

Visitor management: Visitor numbers are capped and only licensed boatmen (n=15) are permitted to land visitors on the island during the season. OPW guides are present on the island during the visitor season (May-September). The mainland interpretive centre in Portmagee is in DHLGH ownership and offers opportunities for visitor management. For example visitor could experience Sceilg when weather does not allow landing, for those who cannot go to the rock and all year around.

Capacity Building: The OPW runs a local depot and employs skilled and trained personnel local to County Kerry. The OPW provides training to its personnel. A publication programme and research framework are currently being drafted.

The DHLGH visitor centre at Portmagee could have a role in community engagement and capacity building, enabling location for the archive, research, social and economic adaptive capacity measures.

Monitoring: The Discovery Programme have undertaken monitoring surveys of the monastic structures since 2018. A LegIT indicator tool for monitoring surface weathering of stone has been in position since 2012.

Natural Heritage: The Management Plan (2020-2030) calls for development of a seabird monitoring programme and the 2021 breeding season saw a dedicated ecological fieldworker spending prolonged periods of time on the island to fulfil two interrelated roles of:

- On site works advisor to the OPW on ecological sensitivities in relation to works on conservation of the island's built heritage.
- Seabird and natural history surveyor developing the ecological survey and monitoring programme.

WORK SHEETS

EXPOSURE: Considering impacts of most concern (min 3, max 5 impacts), please assess the level of exposure. Use table 10 for guidance on ratings:

Impact	Value(s)/ feature(s)	Likelihood (0-4)	Extent (0-4)	Level of Exposure*	Comments

*Add scores for likelihood and extent and divide by 2 to get overall level of exposure

Table 10. Rating and scores for exposure to both rapid onset damage and slow onset deterioration caused by climate change. Exposure for each impact is the mean of Likelihood and Extent scores. (adapted from ANH & CVI)

Score	Likelihood	Extent	Examples of damage and deterioration
0 None	Not likely to occur (annual chance of less than 0.2%)		Damage caused by 1000-year flood [not applicable to deterioration]
1 Insignificant	Very unlikely to occur (annual chance of 0.2% or more) Decreasing/static (deterioration)	Restricted scale (<10% of attribute exposed)	Damage caused by *200-* or *500-year* flood
2 Low	Unlikely to occur Annual chance of 1% or more Slow increase (deterioration)	Localised (11-50% of attribute exposed)	Damage caused by *50-* or *100-year* flood
			Deterioration caused by *occasional* weathering due to wind and rain
3 Medium	Likely to occur Annual chance of 5% or more Moderate increase (deterioration)	Extensive (51-90%)	Damage caused by *10-* or *20-year* flood
			Deterioration caused by *frequent* weathering due to wind and rain
4 High	Very likely to occur Annual chance of 20% or more Rapid increase (deterioration)	Very widespread (91-100%)	Damage caused by *2-* or *5-year* flood
			Deterioration caused by (near) *continuous* weathering due to wind and rain abrasion

SENSITIVITY: Considering impacts of most concern (min 3, max 5 impacts), please complete an assessment of the level of sensitivity. Use table 11 for guidance on ratings.

Impact	Value(s)/ feature(s)	Susceptibility (0-4)	Intensity (0-4)	Level of Sensitivity*	Comments

*Add scores for susceptibility and intensity and divide by 2 to get overall level of sensitivity

Table 11. Rating scores for sensitivity of CH values to climate change impacts. Ranking based on inherent susceptibility and current condition (adapted from ANH & CVI) AND intensity of impact as combination of duration and magnitude (ANH)

Rating	Susceptibility	Intensity
0 Very low	None: Can easily withstand the impact. Condition of property is good/improving	Insignificant: …does not apply to sudden onset damage … only negligible deterioration, even over a period of several decades.
1 Low	Slight: Can mostly withstand the impact, with only minor damage/deterioration. Condition of property is stable.	Minor loss or alteration of value: … minor damage in one day. … minor deterioration in a year.
2 Moderate	Can withstand the impact, with some damage / deterioration. Condition is fair, some alteration or loss is occurring	Some loss or alteration of value … moderate damage in a day or progressively minor damage in a few days. … moderate deterioration caused in a year.
3 High	Can hardly withstand the impact, with major damage / deterioration and/or some collapse / destruction. Condition is poor, significant loss is occurring	Significant loss of value … major damage in a day or progressively minor or moderate damage in a few days. … major deterioration in a year.
4 Very high	Extremely susceptible: Cannot withstand the impact, with collapse / destruction / loss Condition is critical and deteriorating	Major loss of value … extreme damage in a day or progressively moderate or major damage in a few days. …this rating does not apply to deterioration.

ADAPTIVE CAPACITY: Considering the impacts of most concern please complete an assessment of adaptive capacity. Use table 12 for guidance on ratings.

Impact	Management Capacity (1-4)	Technical Capacity (1-4)	Effectiveness (1-4)	Adaptive Capacity*	Comments

*Add scores and divide by 3 to get overall level of adaptive capacity

Table 12. Rating adaptive capacity according to management and technical capacities and effectiveness of current measures (based on CVI assessment method)

Rating	Management Capacities – **Leadership, Finances, Staffing, Learning & Communication, Governance systems**	Technical Capacity - **Information and awareness, Collaboration, Access to technology and scientific knowledge**	Effectiveness of current measures in maintaining or enhancing values
1 Very low	No capacity and/or resources	No technical capacity and/or understanding	Very low/negligible level of effectiveness
2 Low	Low capacity and/or scarcity of resources	Limited technical capacity/ poor scientific knowledge	Low level of effectiveness
3 Moderate	Moderate capacity and/or limits on extra resources	Moderate capacity / some gaps in understanding	Moderately effective, some improvements required
4 High	High capacity and/or highly resourced	High level of capacity/ no gaps in understanding	Highly effective, no improvements required

Considering your top 3 impacts of concern, please describe any adaptation measures that you feel might help reduce these impacts from damaging the site values (feasibility will be established later):

1.

2.

3.

4.

5.

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