2010-2

World Heritage in a Changing Climate; the Potential for a Global Laboratory

Caithleen Daly
Technological University Dublin, cathydaly@hotmail.com

Recommended Citation

Daly, Caithleen. (2010). World heritage in a changing climate; the potential for a global laboratory. Proceedings of the Japanese-German Colloquium World Heritage for Tomorrow: What, How and For Whom? BTU Cottbus, Germany, 17-20 February. doi:10.21427/8ev3-vj63

Funder: DAAD Germany

World Heritage in a Changing Climate;
The potential for a global laboratory

Paper presented at the Japanese-German Colloquium; *World Heritage for Tomorrow: What, How and For Whom* (17-20th February 2010 BTU Cottbus)

Ms Cathy Daly MA
Dublin Institute of Technology & ICOMOS Ireland

Figure 1. Clonmacnoise, Co. Offaly. (C. Daly 2009)

1. Introduction

There is currently a broad International consensus that we are entering a phase of Global Climate Change and that this is due, at least in part, to manmade greenhouse gases (IPCC, 2007). As the term suggests, this is a phenomenon that will impact on the entire planet, and as such it can be seen as the defining International issue of the 21st century. What this paper seeks to demonstrate is how World Heritage could play an important role in International efforts to understand and combat climate change in the future.

The aim of the colloquium *World Heritage for Tomorrow*, at which this paper was delivered, was to address the future of the World Heritage Convention. It took inspiration partly from a UNESCO Workshop on Future Directions that had previously highlighted the perceived weaknesses of the Convention. These include an unsustainable focus on inscriptions, a lack of awareness of World Heritage conservation objectives, poor conservation and monitoring at many sites that devalues World Heritage and the threat to heritage values from climate change (UNESCO, 2009). This paper outlines a project that addresses these weaknesses, through climate change research and demonstrates the potential for repositioning World Heritage at the cutting edge of conservation.

Figure 2. Cultural Landscape at Brú na Bóinne, Co Meath (C. Daly 2008)

The strengths of the World Heritage Convention for Global Climate Change research are the internationally recognized Brand *World Heritage* (UNESCO, 2009), the fact that UNESCO combines culture with education and science in its roles, and the global network of World Heritage sites through which it would be possible to engage in consensus building. World Heritage sites are thus in a strong position to emerge as leaders and centers of excellence in the International field of climate change impact research, and this would be to the overall benefit of the Convention.

2. Background

Policy and research relating to climate change and World Heritage is in its infancy. Global climate change was first considered as a threat to Outstanding Universal Value (OUV) by the World Heritage Committee in 2005. Following on from this, the 2007 Committee meeting in Christchurch endorsed a *Policy Document on the Impacts of Climate Change on World Heritage* which was ratified by the 16th General Assembly of State Parties (UNESCO, 2007).

Figure 3. Location of Brú na Bóinne (▲) & Clonmacnoise (▲) (Daly et al 2010)

In 2008 the ICOMOS Ireland climate change sub-committee was asked by the Department of Environment, Heritage and Local Government to draw up a proposal for the monitoring of climate change impacts at two heritage sites. The sites chosen were Brú na Bóinne (World Heritage) and Clonmacnoise (proposed World Heritage). This paper briefly outlines the project undertaken by ICOMOS Ireland which forms part of the author's PhD research at Dublin Institute of Technology. The complete report (Daly et al 2010) is available from ICOMOS Ireland and is published online at www.icomosireland.ie/climate_change/.

Brú na Bóinne is located in the Boyne river valley on the East coast of Ireland, 9km from the sea. Brú na Bóinne was added to the World Heritage list in 1993 under criteria (i), (ii) and (iv) for the Megalithic tombs, the rock art collection, and the continuous settlement evidence which is part of its rich cultural landscape (ICOMOS, 1993). The Monastic City of Clonmacnoise Co. Offaly and its Cultural Landscape is on the Ireland's tentative list for World Heritage nominations. Clonmacnoise is located on the banks of the river Shannon in the Western midlands. The 2009 draft Management Plan proposes the site be put forward for World Heritage listing under criteria (iv) and (v) for the architectural ensemble and the cultural landscape (Department of Environment Heritage and Local Government and Office of Public Works, 2009).

Figure 4. Shattered kerb stone at Knowth Brú na Bóinne (C. Daly 2009)

3. Methodology

Ireland has a temperate oceanic climate, with small variations between the seasons. Climate change predictions for the coming century suggest we will experience warmer, wetter winters and warmer, drier summers (Sweeney et al., 2003). There will be some regional variations however, and these will be observable at the case study sites (Table 1).

Figure 5. Knowth and the flooding Boyne at Bru na Boinne (DoEHLG)

Understanding how the changing climate will affect individual heritage values is complicated by the many interacting variables involved (Figure 4). To predict how climate change would impact on the case-study sites a vulnerability assessment was carried out using the model shown in Table 2. Following research and stakeholder interviews values were assigned for sensitivity, exposure and adaptive capacity on a sliding scale of 1-3 (Schroeter et al., 2005).

Table 1. Summary of climatic changes predicted by 2099 using ICARUS ensemble data (Fealy and Sweeney, 2007) for Dublin Airport & Birr using A2 emissions scenario (Daly et al, 2010)

	Average Temperature	**Average Summer Rainfall (July)**	**Average Winter Rainfall (December)**	**Intensity of Rainfall**	**Wind Gusts (frequency and intensity)**
Clonmacnoise	↑ 2ºC	↓ 24% (12mm)	↑ 19% (15mm)	↑ 23% (days >5mm)	↑ (not modelled)
Brú na Bóinne	↑ 2ºC	↓ 30% (14mm)	↑ 24% (19.5mm)	↑ 15% (days >5mm)	↑ (not modelled)

Table 2. Vulnerability Model (Daly, 2008)

Climatic Factor	**Sector or W. H. Value**	**Impact**	**Indicator**	**Sensitivity**	**Exposure**	**Adaptive Capacity**	**Measure of Vulnerability**
Increased rainfall (winter)	Cultural Landscape	Flooding	XY[1]	1 - 3	1 - 3	1 - 3	Calculated as per below equation

This was done in the case of each heritage value to every predicted climate change impact of relevance. The measure of vulnerability was then calculated using the formula:

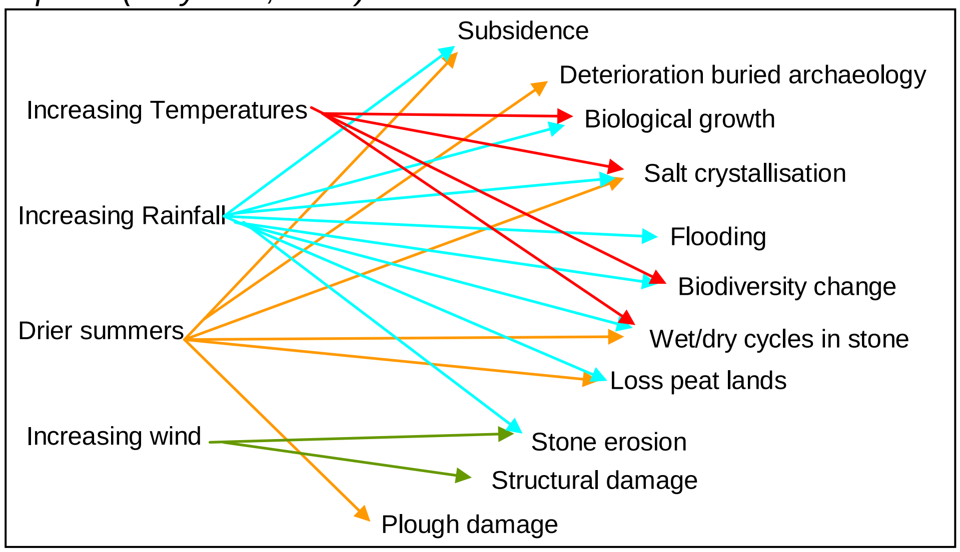
Vulnerability = (Sensitivity + Exposure) – Adaptive Capacity

Using the results from the model it was possible to rank the impacts in order of concern. It is important to emphasise that this

[1] XY represents any indicator i.e. any quantifiable variable that can be used as proxy for assessing sensitivity, exposure or adaptive capacity (Schroeter, Polsky & Patt 2005).

is a preliminary assessment and one that is 'expert-driven' and therefore prone to subjectivity. It should be kept under regular review, not least because climate change science itself is constantly developing better predictive modeling techniques. Despite these stated limitations the model is believed to offer a good indication of where to focus the monitoring programmes.

Figure 6. Multiple Interactions: Climate change factors and impacts (Daly et al, 2010)



4. Proposed Monitoring

The ICOMOS Ireland Climate Change Sub-committee report made recommendations for two sets of monitors to be placed at each site. The first of these would be a set of climate monitors to record detailed information about local weather conditions. The second, and more complex, suite of site specific impact monitors would record the effects of climate change as manifested on individual heritage values. Relating the two sets of data from these systems would (at some future point) enable quantification of the actual impact of climate change on individual heritage values. As climate change is commonly measured in periods of 30 years or more, results of significance will take a generation to accrue. The monitoring scheme is therefore envisioned as a long-term project or a 'legacy for the future'.

Figure 7. Weather station, archaeological site, Malta (K. Blackwood 2009)

The climate parameters which are to be measured are basic; rainfall, wind (speed & direction), temperature, relative humidity and solar radiation. The key point is that the level of accuracy should correlate with World Meteorological Organisation standards so that data collected is comparable both nationally and internationally. For the impact monitors a multi-facetted strategy was developed:

Fig 8. *Biological growth on stone wall at Clonmacnoise (C. Daly 2009)*

1. Utilise existing data & research e.g. River levels monitored by Office of Public Works.

2. Create partnerships with relevant institutions e.g. National Biodiversity Centre for moth traps.

3. Where monitors are to embedded choose simple, robust techniques for regular implementation by staff & volunteers.

4. Seek the funding to engage consultant expertise where necessary.

The monitors include traditional recording, embedded mechanical monitors and high-tech expert driven techniques. Once the monitoring regime is established immediate dissemination of the data retrieved is proposed. This can be done through the visitor centre displays, through guided tours and through the creation of a live streaming web site. The monitoring programme could thus offer an ‘added value’ for visitors and an opportunity both to showcase conservation and to raise public awareness of climate change impacts.

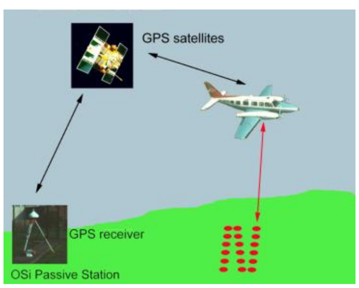


Figure 9. LIDAR mapping methodology (http://www.arch.cam.ac.uk)

5. Conclusion

In addition to informing climate change adaptation systems the monitoring programme would aid the development of sustainable management and conservation systems for both sites. The scheme also presents an opportunity for public communication of messages on climate change through the medium of World Heritage conservation. Finally, it is hoped that the scheme would provide a contribution to knowledge & a legacy for the future, in keeping with the spirit of the World Heritage Convention, and would thus benefit many other heritage sites.

In 2006 the then UNESCO Director General Koichiro Matsuura said:

> *The global network of the World Heritage sites is ideally suited to build public and political support through improved information dissemination and effective communication on the subject [of climate change], given the high profile nature of these sites*. (Matsuura, 2006)

The establishment of monitoring schemes across the International network of World Heritage sites would be a valuable addition to the study of climate change as well as contributing significantly to the maintenance and conservation of individual heritage values. Through dissemination of the data collected World Heritage can locate itself at the cutting edge of public awareness over conservation issues. Projects such as the one proposed in Ireland demonstrate the potential value of the World Heritage Convention and can ensure it remains relevant into the next century.

Table 3. Impact Specific Monitors recommended (Daly et al, 2010)

Monitor	**Frequency**	**Impact at Brú na Bóinne**	**Impact at Clonmacnoise**
Specialist 'buy in' Monitoring			
Field survey / Lidar mapping	5-10 year intervals	Plough damage, subsidence, erosion.	Subsidence, erosion.
Laser scan	As above	Wet/dry, salts, biological growth, mechanical erosion.	Salts, biological growth, mechanical erosion.
Structural survey	As above	Subsidence, collapse.	Subsidence, collapse, wind damage.
Species survey	As above	Biodiversity, biological growth.	Biodiversity, biological growth & sphagnum moss.
Stone testing	Once	Salts, wet/dry, chemical & mechanical erosion.	Salts, wet/dry, chemical & mechanical erosion.
Embedded Monitoring			
Condition reporting & photo survey	Annual	All observable changes	All observable changes
Soil moisture	Daily (automatic) or monthly (manual)	Archaeological preservation.	Peat lands, archaeological preservation.

Monitor	Frequency	Impact at Brú na Bóinne	Impact at Clonmacnoise
Moisture in stone & walls	Annual	Salts & wet/dry cycles.	Salts & wind driven rain.
Water table	Monthly	Flooding, subsidence.	Peat lands, flooding, subsidence.
Flood level markers	Event led	River flood	River flood
Moth traps	Daily (manual)	Biodiversity	Biodiversity

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