UNESCO Climate Action and Sustainability Framework

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Compiled for the United Kingdom National Commission for UNESCO by Bureau for the Contemporary and Historic with the Research & Innovation Group

ButCH/*
Bureau for the Contemporary and Historic

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Suite 98, 3 Whitehall Court
London SW1A 2EL
United Kingdon

info@unesco.org.uk

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UNESCO Climate Action and Sustainability Research Agenda

Team (in alphabetical order by organisation)
ButCH: Lara Band, Nadia Bartolini, Sarah May, Sefryn Penrose, and Angela Piccini
UKNC: Dave Chapman, Aisling Parrish and Matt Rabagliati
Research & Innovation Group: see page 38

Cover photo: Crow Point Beach, North Devon Biosphere Reserve, UK. Photo: Helen Hotson

About the United Kingdom National Commission for UNESCO

The UK National Commission for UNESCO (UKNC) supports the UK's contribution to UNESCO and brings the benefits of UNESCO to the UK. We are the central hub for all UNESCO-related matters within the UK. We are an independent not-for-profit organisation, supported by grant funding from the UK government.

Our core functions are: To provide expert, individual policy advice to the UK and devolved governments on UNESCO related issues, to support the UK government's agenda to help UNESCO achieve its core goals, to advise and assist individuals and institutions in the UK and its' Overseas Territories and Crown Dependencies, with accessing UNESCO accreditation and prizes. We also support and enhance the value of the UK's UNESCO sites and projects. For more information see: **www.unesco.org.uk**

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Foreword

Climate change remains one of the most urgent issues worldwide. Its effects are intricate and interrelated, exacerbating current sustainability challenges and impacting our natural, cultural, and social environments. In response, organisations such as the **United Nations** and the **Intergovernmental Panel on Climate Change** are promoting research and practices that are localised, inclusive, interdisciplinary, and focused on action – often utilising participatory and nexus frameworks. These integrated approaches are now broadly acknowledged as crucial for tackling the challenges of our time.

In this context, UNESCO sites such as **Biosphere Reserves, Global Geoparks** and **World Heritage Sites** serve purposes beyond mere symbolic recognition.

The UNESCO Climate Action and Sustainability Framework views them as practical, dynamic laboratories for deploying, testing, and expanding integrated sustainability approaches. This approach positions these sites at the forefront of future innovation, resilience, and adaptive strategies.

Anchored in local communities and landscapes, they foster connections among people, organisations, knowledge systems, culture, heritage, and the environment in meaningful, vibrant ways. These sites allow us to examine not only what is threatened but also how to respond collectively, practically, and ethically.

This Framework builds on that potential. It has been developed through, and in collaboration with, the **UK National Commission for UNESCO**'s extensive research and knowledge in this area, utilising the expertise gained from our **Climate Change and UNESCO Heritage** (CCUH) and **Local to Global** (L2G) projects. The Framework was guided by the **Bureau for the Contemporary and Historic** (ButCH), working with a UNESCO Research and Innovation Group, which brought together an exceptional team of researchers, site managers, practitioners, and policy experts.

At its core, this Framework is grounded in a commitment to nexus and systems thinking approaches that recognise the interdependence of environmental, social, and governance systems. It encourages a move beyond isolated inquiry toward integrative, place-based research shaped by diverse voices and designed to drive transformative change. The Framework provides the conceptual scaffolding for the accompanying **Research Agenda** which outlines clear objectives, essential criteria, and guiding principles for future work, addressing themes such as adaptation, governance, community resilience, and research infrastructure.

Crucially, this is not a static roadmap but a living framework. It invites continued contributions, iteration, and collaboration across geographies, disciplines, sectors, and between the Global North and South. It asks us to harness the power of UNESCO designation not merely as a mark of prestige, but as a platform for experimentation, learning, and transformation.

As the Framework is implemented, we hope it will inspire researchers, funders, site managers, and policymakers alike, and help strengthen the role of culture and heritage in shaping a just, sustainable, and climate-resilient future.

Matt Rabagliati
Head of Policy, Research and Communications
UK National Commission for UNESCO

Executive Summary

This document presents a UNESCO Climate Action and Sustainability Framework developed through the UK National Commission for UNESCO (UKNC) commissioned Climate Change and UNESCO Heritage (CCUH) project, funded by HM Treasury's Shared Outcomes Fund. It has been led by ButCH and advised by an R&I Group composed of leading academics and practitioners. It aims to establish UNESCO-designated sites – Biosphere Reserves, Global Geoparks and World Heritage Sites – as laboratories for research into climate action and sustainable development through integrated, place-based, and transdisciplinary approaches.

The Framework identifies three interlinked priorities:

- **Leveraging climate action and adaptation** as a pathway to sustainable development
- **Applying nexus approaches** across sectors and systems
- **Harnessing the distinct properties of UNESCO-designated sites** including their governance structures, networks, and embedded stakeholders, for experimentation and innovation.

Nexus approaches are especially suited to these sites, as they integrate ecological, social, and economic dimensions, as well as multiple stakeholders and the potential for transferable, scalable solutions. UNESCO-designated sites are well-positioned for such work due to:

- Strong networks at both local and international levels
- Pre-existing data and research foundations
- Participatory governance and long-standing stakeholder engagement
- Designation-driven legitimacy, which enhances visibility and access to funding.

However, several challenges remain, as outlined here, ranging from issues with management structures to data interoperability. This document highlights the importance of intentional, inclusive research design and infrastructure that fosters long-term, transferable learning.

The Framework concludes by outlining recommendations for the development of a Research Agenda, which it underpins, for the next 5-10 years, focused on:

- **Participatory and inclusive planning**
- **Treating sites as 'living laboratories' for resilience strategies**
- **Supporting multi-scalar and cross-disciplinary research**
- **Enhancing data capacity and integration.**

Introduction

This UNESCO Climate Action and Sustainability Framework (hereafter referred to as the Framework) provides the theoretical and strategic foundation for utilising UNESCO-designated sites as places to research, trial, and evaluate responses to interconnected challenges, including climate change, biodiversity loss, and social and economic sustainability.

Commissioned by the UK National Commission for UNESCO (UKNC), this document is a key output of the Climate Change and UNESCO Heritage (CCUH) pilot project. Funded through the HM Treasury's Shared Outcomes Fund and delivered in partnership with the UK Department for Culture, Media and Sport (DCMS), the pilot collaborated with stakeholders across three UK UNESCO-designated sites to co-design models for improved joint working, develop new tools for climate and heritage data analysis, and explore approaches for community-led resilience.

> Starting with its Programme and Budget in 2016 and continuing in the Programme and Budget for 2020-21 UNESCO and its Member States began to present a vision of UNESCO designated sites as "learning sites for inclusive and comprehensive approaches to environmental, economic and social aspects of sustainable development.

Canadian Commission for UNESCO & United Kingdom National Commission for UNESCO. *Sites for Sustainable Development: Realizing the Potential of UNESCO Designated Sites to Advance Agenda 2030*. 2022, 17.

The Framework builds on the findings of the **Sites for Sustainable Development Report** (Canadian Commission for UNESCO & United Kingdom National Commission UNESCO 2022), which demonstrated the value of UNESCO-designated sites – Biosphere Reserves, Global Geoparks and World Heritage Sites (hereafter referred to as UNESCO sites) – as living laboratories for advancing **Agenda 2030**. While the pilot tested approaches tailored to specific sites in the UK, it is envisioned that findings will be relevant, adaptable, and (re)usable, with value to places more widely, both in the UK and internationally. This work also aligns with and builds upon key publications and strategic reviews, including **Heritage and Our Sustainable Future (Changing the Story)**, the **British Council Strategic Literature Review on Climate Change Impacts on Cultural Heritage, the Future Observatory** Cultural Policy Report (DSDHA/AHRC) and the **Cultural Heritage and Climate Change: New Challenges and Perspectives for Research** (JPI Cultural Heritage and JPI Climate). It complements the **Alliance for Research on Cultural Heritage in Europe SRIA** (Strategic Research and Innovation Agenda), providing a practical contribution to the growing knowledge base.

To guide this work, the UKNC established a cross-sectoral **Research and Innovation Group (R&I Group)** comprising academic experts from eight UK universities and UNESCO Chairs, practitioners from cultural and environmental agencies (e.g., English Heritage, National Trust), and representatives from designated sites and UNESCO itself (see Research and Innovation Group section, p.38). The Framework has been led by Bureau for the Contemporary and Historic (ButCH), drawing on contributions from the R&I Group.

The purpose of the Framework

This framework has two primary purposes:

1. To position UNESCO sites as critical infrastructure for research on climate action and sustainability, through integrated or 'nexus' approaches. The relationship between climate change and its effects on natural and cultural heritage is an increasingly important subject of policy, research and practice. Over the last decade, several strategies and research agendas have addressed the issue, including the Climate Change Response Strategy from the US National Park Service (2016, updated in 2023; see also Morel et al. 2022). Simultaneously, there has been increased recognition that natural and cultural heritage can play a greater part in supporting sustainable development (e.g. Giliberto and Labadi 2022; Labadi et al. 2021; Brennert et al. 2023; Gunma Declaration 2025), and that heritage sites are fertile areas for researching climate impact as well as sustainable development (e.g. Morel and oud Ammerveld 2021; Hansson and Öhman 2022). This Framework therefore demonstrates how UNESCO sites offer distinctive opportunities for grounded, collaborative, and locally relevant research in this space.
2. To underpin the **UNESCO Climate Action and Sustainability Research Agenda** by outlining its theoretical foundations and distinct contributions to the wider research landscape (Figure 1).

In particular, the Framework emphasises:

- The opportunities afforded by climate action towards addressing and unlocking new pathways to sustainable development
- The use of nexus approaches to address interlinked social, environmental, and cultural challenges
- The role of UNESCO sites in enabling and demonstrating these approaches.

Figure 1. Visualisation of the UNESCO Climate Action and Sustainability Research Agenda's position within the research agenda landscape.

The Framework addresses **three research questions**:

1. What are the roles of UNESCO sites, both in the UK and internationally, in effectively localising climate action and sustainable development challenges, and supporting/trialling new and interconnected/nexus approaches to addressing them?
2. What current factors enable or restrain UNESCO sites to effectively test new approaches and demonstrate their wider relevance and utility?
3. What are the opportunities and limitations of data (including data science advancements) in underpinning approaches to climate action and sustainability in UNESCO sites?

The structure of the Framework

This Framework is structured into three general sections – Introduction, Methodology, and Conclusion (Implications for a Research Agenda) – and three core sections, each addressing the main research questions set out above.

The document also features text boxes that describe the UNESCO designations referred to in the CCUH project (Biosphere Reserves, Global Geoparks, and World Heritage Sites), and case studies that provide examples of sites demonstrating the use of nexus approaches in interdisciplinary climate action and sustainability research. These case studies are interspersed throughout the document to help illustrate the breadth and applicability of UNESCO sites as laboratories.

> We share knowledge and ideas to inspire innovation and drive transformation, and ensure that everyone—including young people, thought leaders and national delegates—have a seat at the table.

https://www.unesco.org/en/laboratory-ideas

CCUH pilot site visit to Braunton Burrows, within the North Devon Biosphere Reserve. Photo: Matt Rabagliati.

Biosphere Reserves

UNESCO Biosphere Reserves are 'learning places for sustainable development'. They are sites for testing interdisciplinary approaches to understanding and managing changes and interactions between social and ecological systems, including conflict prevention and biodiversity management. They are places that provide local solutions to global challenges. Biosphere Reserves include terrestrial, marine and coastal ecosystems. Each site promotes solutions reconciling the conservation of biodiversity with its sustainable use. Those in the UK are listed here. Biosphere Reserves are nominated by national governments and remain under the sovereign jurisdiction of the states where they are located. They are designated under the intergovernmental MAB Programme by the Director-General of UNESCO following the decisions of the MAB International Coordinating Council. Member States can submit sites through the designation process.

Source: **https://www.unesco.org/en/mab/wnbr/about**

Southern Marsh Orchid aka Dactylorhiza praetermissa, at Braunton Burrows. Photo: Mushy.

Global Geoparks

UNESCO Global Geoparks are single, unified geographical areas where sites and landscapes of international geological significance are managed with a holistic concept of protection, education and sustainable development. Their bottom-up approach, which combines conservation with sustainable development and involves local communities, is becoming increasingly popular. Currently, there are well over 200 UNESCO Global Geoparks located in 50 countries. Those in the UK are listed **here**.

UNESCO Global Geoparks are given this designation for a period of four years, after which the functioning and quality of each UNESCO Global Geopark is thoroughly re-examined during a revalidation process. As part of this process, the UNESCO Global Geopark under review prepares a progress report, and a field mission is undertaken by two evaluators to assess the quality of the UNESCO Global Geopark.

- If the area continues to fulfil the criteria, the area will continue as a UNESCO Global Geopark for a further four-year period (so-called 'green card')
- If the area no longer fulfils the criteria, the management body will be informed to take appropriate steps within a two-year period (so-called 'yellow card)
- If the area does not fulfil the criteria within two years after receiving a "yellow card", the area will lose its status as a UNESCO Global Geopark (so-called red card).

Source: **https://www.unesco.org/en/iggp/geoparks/**

Waterfall Country in Bannau Brycheiniog National Park and Fforest Fawr Geopark, the Vale of Neath. South Wales. Photo: Salarko.

World Heritage Sites

UNESCO World Heritage Sites belong to everyone, and it is everyone's duty to protect them for future generations. These sites are designated under the 1972 UNESCO World Heritage Convention, which commits all signatory countries to safeguard heritage of outstanding universal value. Those in the UK are listed **here**.

World Heritage Sites represent the diversity of our planet and the people who have lived on it. They show the development of human history over thousands of years and celebrate the best of who we are – through art, architecture, religion, industry and much more They are ours to share, to cherish and to respect. Their disappearance would be an irreparable loss to humanity. There are over 1,200 sites on the World Heritage list globally, categorised into three types: cultural (such as a temple), natural (like a rainforest), and mixed (where both cultural and natural elements coexist at the same location).

Source: **whc.unesco.org/en/**

Hadrian's Wall, Northumberland, England, UK.
Photo: Colin Ward.

Methodology

To answer the three questions set out in the Introduction, ButCH carried out a review and analysis of existing and ongoing research, adding insights from face-to-face discussions held both with members of the R&I Group, and participants of the UKNC's CCUH and L2G projects.

A literature search was conducted to build the broadest possible picture of international research on sustainable development in relation to UNESCO sites. A bibliography was compiled of approximately 300 documents in a library using Zotero software, and a limited sample of these papers was chosen for further analysis.

What was included:

- Google Scholar was used to gather a broad range of practical insights and non-academic outputs from project and funder websites, blogs, and consultancy or industry reports. A systematic keyword-based search captured both scholarly and technical outputs. Keywords were derived from the **17 United Nations Sustainability Development Goals (SDGs)** to guide each search. Focusing on literature reviews, data-led studies, and practice-based research with clearly stated outcomes, 231 entries were added to the Zotero library.
- A Web of Science search was conducted, based on the same keywords, which validated patterns identified in the Google Scholar search results.
- R&I Group members recommended works of significant interest to their field. These were supplemented with papers authored by members of the R&I Group, resulting in an additional 72 papers added to the Zotero library.
- A selection of papers for thematic analysis were selected according to the following criteria
  - Published within the last five years
  - Practice-based with clear details of the method and outcomes
  - Clear links to UNESCO sites.
- In addition to the literature review, preliminary reports and webpages were examined from the UKNC's two programmes, CCUH and L2G. ButCH also held one-to-one discussions and interviews with members of the R&I Group and representatives of the research programmes (See Appendix 1).

What was not included:

UNESCO web pages were excluded from the overall internet search of completed research. A test indicated that this would return an excessive number of results with descriptive content about designated sites rather than foreground the practice-based analytical content required to approach the three research questions.

Limitations

The original focus of the framework centred on the inclusion of the 17 SDGs within research work untertaken in UNESCO sites. The initial literature search was therefore undertaken with this focus. The switch of focus to sustainable development more broadly construed occurred after the literature search but prior to sample selection. Due to the breadth of the initial search it was possible to adapt the bibliography to suit the new focus.

Case Study 1: Biosphere Reserves

CULTIVATE: Co-creating cultural narratives for sustainable rural development

Locations: Scotland, Norway, Estonia, Czech Republic

Stakeholders: site managers, local stakeholders, communities

Themes: governance, heritage-in-the-making, transdisciplinarity, learning frameworks

Funder: JPI on Cultural Heritage, Identities & Perspectives: Responding to Changing Societies (JPICH), administered through national providers

Key takeaways: UNESCO sites serve as powerful testbeds for transdisciplinary, place-based approaches to sustainable development. Understanding and co-creating cultural heritage narratives with local stakeholders can support sustainability transitions that are sensitive to local identity, knowledge, and ecological context across diverse sites, using scalable frameworks.

Further reading: Bohnet, I.C., Bryce, R., et al. (2025). **Co-creating cultural narratives for sustainable rural development: a transdisciplinary learning framework for guiding place-based social-ecological research.** Current Opinion in Environmental Sustainability 73:101506.

This research advances a bold transdisciplinary model for addressing sustainability and identity in rural Europe by positioning culture and heritage as active components in shaping social-ecological futures. Using a network of Biosphere Reserves – Wester Ross in Scotland, Nordhordland in Norway, West Estonian Archipelago in Estonia, and Trebon Basin in the Czech Republic – the **CULTIVATE** project developed and tested a four-step learning framework designed to co-create cultural narratives that support sustainable rural development. The four-step process is iterative, developing continuous dialogue, learning, and collaboration through:

1. Understanding cultural heritage in its local and embedded forms
2. Exploring diverse cultural narratives across communities and knowledge systems
3. Co-creating cultural heritage narratives aligned with sustainability goals for sustainable rural development
4. Supporting heritage-in-the-making through long-term engagement and shared learning.

The steps are ‘generic enough’ to allow for comparative research in and analysis of diverse social-ecological systems and ‘specific enough’ for higher-level findings. This approach requires deep investment from participants as well as long-term robust data infrastructure, both of which are challenging in the current funding landscape.

Svet Lake, one of 500 ponds and lakes in the Třeboň Basin Biosphere Reserve, Czech Republic. Photo: Jan Mach.

Case Study 2: Global Geoparks

Assessment of forest fires' impacts on geoheritage: A study in the Estrela UNESCO Global Geopark

Locations: Portugal

Stakeholders: caretakers, conservationists, researchers. Local communities, businesses

Themes: environmental, assessment, wildfires, transferable methods, geosite vulnerability

Funder: FCT (Foundation for Science and Technology; Erasmus Mundus program PANGEA)

Key takeaways: UNESCO sites enable testing of various techniques that harness nexus approaches and assist in the evaluation of risk and broader socio-cultural impacts.

This study uses the Estrela Global Geopark in Portugal as a research, development and testing site for an impact assessment methodology of wildfires on geoheritage that is transferable, systematic, and practical. The occurrence, severity, and duration of forest fires are increasing globally. The risk that wildfires pose to geodiversity is poorly understood. This study integrated measures of vulnerability (quantified using geosite value and educational/ touristic use) with hazard factors to calculate an overall degradation risk. While it found that the potential for scientific loss was relatively low, the assessment identified significant impacts on cultural, aesthetic, and ecological values, as well as on educational and tourism uses. The study highlights methodological advances to address current limitations and the need to further develop this assessment framework to support the conservation and management of geosites in understanding wildfire risks.

Estrela Global Geopark with large granite rocks worn by erosion in the village of Travancinha, municipality of Seia, Portugal. Photo: Luis Fonseca.

Further reading: Gonçalves, J., de Castro, E., Loureiro, F., and Pereira, P. (2024). **Assessment of forest fires' impacts on geoheritage: A study in the Estrela UNESCO Global Geopark, Portugal.** International Journal of Geoheritage and Parks 12(4): 580–605.

Case Study 3: World Heritage Sites

Climate vulnerability assessment of the rice terraces of the Philippine Cordilleras

Locations: Phillipines

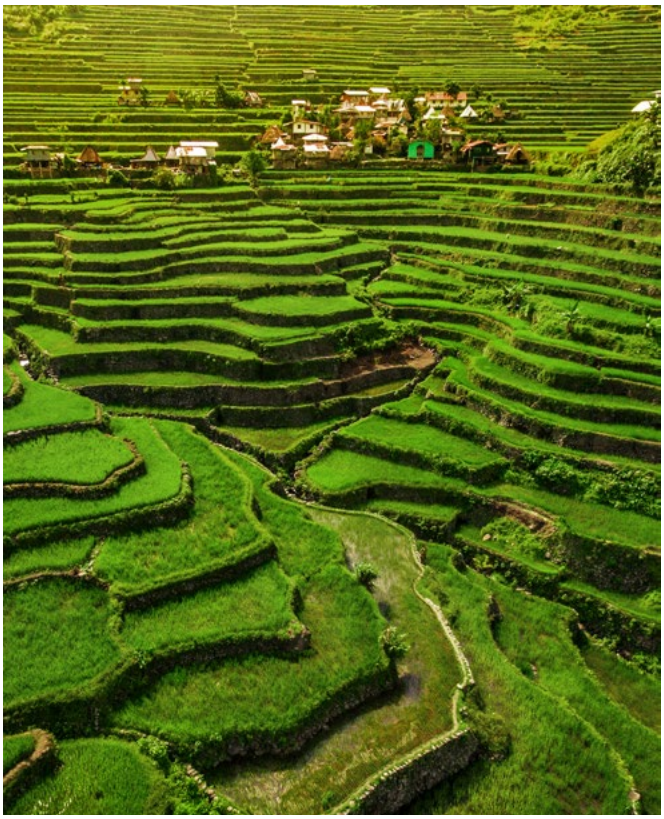
Stakeholders: Indigenous communities, local and regional government, National Commission on Indigenous Peoples, local stakeholders, national agencies

Themes: social, embedding local values, climate change resilience

Funder: Preserving Legacies (National Geographic Society global climate adaptation initiative), ICOMOS, the Climate Heritage Network and Manulife

Key takeaways: Traditional knowledge can contribute to and be embedded within climate action.

This project, based in the Rice Terraces of the Philippine Cordillera World Heritage Site, home to the Ifugao group of Indigenous peoples, investigated how traditional local values and those related to the site's Outstanding Universal Value criteria are affected by climate change. Focus groups and workshops employed a values-based approach, exploring the terraces through various lenses (tangible/intangible, natural/cultural), and included resilience strategies as a fundamental aspect of heritage conservation strategies. The combination of traditional values with scientific practices has resulted in more meaningful pathways for local communities, connecting climate action with intergenerational responsibility and community spirit, while acknowledging limitations such as inequality, governance, and technology. The process was participatory, inclusive and holistic, incorporating Indigenous knowledge systems that are culturally relevant to local communities to develop adaptive strategies that are scientifically sound.



Ancient Ifugao rice terraces at Batad in northern Luzon, Philippines. Photo: R.M. Nunes.

Further reading: Martin, M., Jamero, L., Paterno, M.C., Megarry , W. and Hermann, V. (2024). **Climate vulnerability assessment of the rice terraces of the Philippine Cordilleras.** Project Report. ICOMOS Philippines, Manila, Philippines, 82.

Question 1: UNESCO Sites in Climate Action Research

What are the roles of UNESCO sites, both in the UK and internationally, in effectively localising climate action and sustainable development challenges, and supporting and trialling new and interconnected nexus approaches to addressing them?

UNESCO oversees several international programmes that designate sites of outstanding cultural, natural or scientific significance. Each programme is governed by its own treaties and/or regulatory framework, focusing on different dimensions of heritage, including natural landscapes, cultural traditions, and areas of scientific importance. The CCUH project centres on three types of UNESCO designation: Biosphere Reserves, Global Geoparks (see text boxes for further information), and World Heritage Sites. Other designations, such as Creative Cities, are excluded from the specificities of this project, but there are commonalities, and concepts outlined in this document will have some application to other designation types.

UNESCO's role in promoting peace and international collaboration through education, science, culture and communication has been its core mission since its founding in 1945. As new global challenges have emerged and gained momentum in the 21st century, particularly climate change and the need for sustainable development, UNESCO has increasingly expanded its research and policy agenda in response:

> "Nexus approaches... remind researchers and policymakers of the strong linkages amongsectors, scales and regions and the potential need to be aware of trade-offs and to seek synergies when solving major problems."
>
> Liu, J., et al. (2018). Nexus approaches to global sustainable development. Nature Sustainability 1: 474.

What are nexus approaches and why are they suitable for this Framework?

UNESCO sites provide the conditions upon which to explore these environmental and socio-economic impacts. As living laboratories, they enable these pressures and drivers to be grounded and examined in real-world settings through nexus approaches.

These approaches, presented conceptually by the daisy model discussed below, enable integrated exploration across sectors such as culture, environment, governance and community. The insights and processes developed on-site contribute to positive, sustainable development outcomes.

Importantly, the aim is to identify which elements are transferable, so that these processes and outcomes can be replicated between and beyond UNESCO sites.

Nexus approaches are a set of planning and research tools that "simultaneously examine interactions among multiple sectors" (Liu et al. 2018: 466). Within the context of this Framework, nexus approaches leverage the social, environmental and economic networks that UNESCO sites are both embedded within and actively help to foster. As explored below, through shared governance structures, management plans and integrated ways of working, these sites not only participate in, but also shape, cross-sectoral approaches. This embedded and generative role enhances their capacity to support impactful and interdisciplinary research compared to sites that work in isolation.

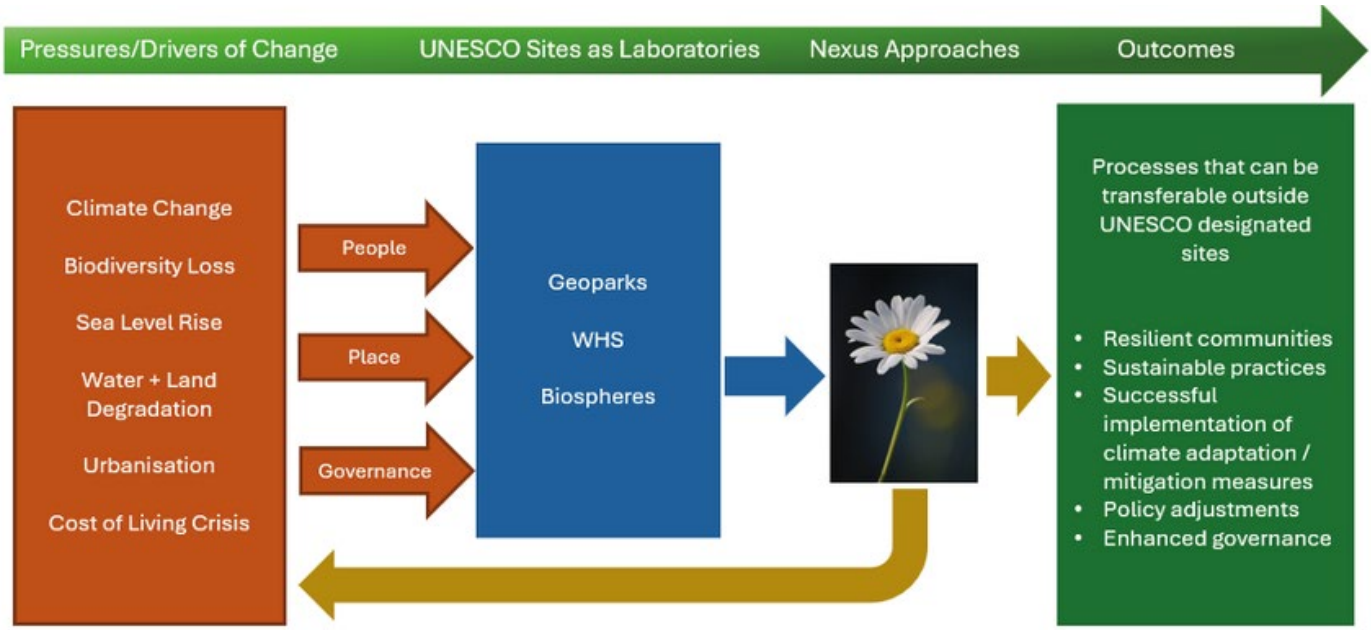


Figure 2. Process diagram showing the relationship between change, UNESCO designation sites and nexus approaches. The daisy is explained below in Figure 3. The feedback loop indicates how research changes our understanding of the pressures/drivers of change.

Innovation within sustainability frameworks is increasingly recognised as needing to be cross-sectoral and relational. This aligns with the growing emphasis on applying nexus approaches to connect sectors that were previously being siloed in policy and management (de Coninck et al. 2018).

Rather than viewing innovation as isolated or sector-specific, there is a shift toward understanding it as embedded within complex systems of interdependence. For example, Dabard and Mann (2023: 1085) argue that "sustainability innovations develop as bundles of interdependent, entangled novelties, due to their disruptive character". Their proposed four-dimensional analytical framework, combining context, actors, process, and outcomes, is a valuable tool for examining innovation within such systems. While developed in the context of Biosphere Reserves, it is applicable to other UNESCO sites. Bohnet et al. (2022: 104492) offer a complementary framework by identifying three highly interdependent preconditions for supporting cultural heritage within sustainable landscape development: "(1) embracing landscape multifunctionality, (2) taking a multi-level collaborative landscape governance approach, and (3) encouraging adaptive landscape planning and management". Together, they show how UNESCO sites, through integrated management structures, not only reflect but also actively cultivate these interconnections, positioning them as ideal laboratories for relational sustainability innovation.

Nexus approaches thrive on partnerships. Not only do these kinds of partnerships produce more impactful and context-sensitive research but they also strengthen the resilience of sites by supporting staff through peer-to-peer connections. Nexus approaches also expand the notion of transdisciplinarity, ensuring that problems are addressed holistically. As Olazabal et al. (2025) argue in relation to transdisciplinary research, nexus approaches are particularly powerful for climate adaptation because they:

- Require researchers to negotiate power dynamics
- Expand the solution space by increasing the types of knowledge and values from early stages
- Deliver agreed upon goals and outcomes
- Boost reflexivity.

The stakeholder mapping conducted through the CCUH project shows how work carried out within a UNESCO site can, through nexus approaches, extend its impact far beyond site boundaries by activating broader networks and partnerships. One such initiative involves the UKNC working with Natural England and the National Trust to explore how the Trust – one of the largest landowners in England and Wales – can strengthen its engagement with UNESCO sites where it holds land. There, a broad-based partnership approach has demonstrated how coordinated action can address interconnected environmental, cultural, and social challenges across the wider landscape.

UNESCO sites are uniquely positioned to support nexus approaches because they bring together many different concerns, factors and sectors/stakeholders in ways that enable integrated and coordinated action. These UNESCO sites do more than bring together different sectors: they are also embedded within multiscalar networks that connect local initiatives to national and global agendas.

Crucially, they act as long-term repositories of knowledge, drawing on historical, cultural and ecological insights over time. With a focus on cultural and natural heritage at their core, UNESCO sites offer a distinctive foundation for envisioning alternative futures, grounding innovation and resilience across places, and in shared memory and identity.

Figure 3 illustrates how diverse elements can converge at UNESCO sites through a nexus approach: each petal represents a distinct character, priority, guiding principle, factor, or stakeholder:

- These elements are individually important, yet form part of a cohesive whole
- Some petals overlap, while intersecting without having to tessellate precisely
- The petals are connected through the UNESCO sites, and therefore locating the nexus, which is represented by the disc in the centre.

In this visualisation, some of the daisy's petals give a sense of the kinds of integration that are expected. However, each designated site and each research project will identify its own unique combination of aspects to bring together. Some elements, such as the governing frameworks that define designated sites and the networks they are part of, are spatially integrative. Others, like the involvement of diverse stakeholders, are socially integrative. Still others, such as data and governance, are longitudinal.

This visual model, while deliberately simple, is grounded in the growing recognition of relational ontologies, recognising that meaning, identity, and actions emerge through relationships rather than isolated entities (as noted above). In this space, other visual models were considered to describe the complex relationships brought together in a nexus. For instance, the 'web of interactions' that combines people, place and the more-than-human, as mentioned by one interviewee, aligns with the interrelations and entanglements of Tim Ingold's 'meshwork' (Ingold 2013). Another example of a model is work from Science and Technologies Studies that focuses on a set of relations that 'follow' particular actors or agents affecting networks (Callon 1984; Mol and Law 1994; Latour 2005). Another relevant model features rhizomatic thinking which led Gilles Deleuze and Felix Guattari (1987, see also DeLanda 2016) and Anna Tsing (2015) to consider mycelium and lichen as metaphors for understanding human and more-than-human worlds of interconnected and nonlinear research.

Figure 3. The daisy as a metaphor for nexus approaches at UNESCO sites.

Some of this work, of course, also builds on Indigenous and Global South worldviews (e.g. Matuk et al. 2020). The daisy has been selected for three reasons. First, it is organic, and it illustrates the nexus approaches at UNESCO sites through a more-than-human living organism. Second, it simplifies the complexity of networked structures, allowing them to be more easily identified, linked, and acted upon. Third, the daisy is a pollinating flower that attracts other living beings towards it and offers pollen, which is illustrative of Kathy Allen's (2018) reflections on the importance of cross-pollination in innovation and development.

While the term 'nexus approaches' was developed in the context of planning for sustainable development (Liu et al. 2018), we find this conceptualisation useful for describing integrative research practice. Figure 4 illustrates how nexus approaches integrate different sectors, such as the public and private sectors, transport, tourism, and energy. While the petals on our daisy deal with more granular matters, a single daisy grows in a field of daisies, so it serves to support the wider nexus.

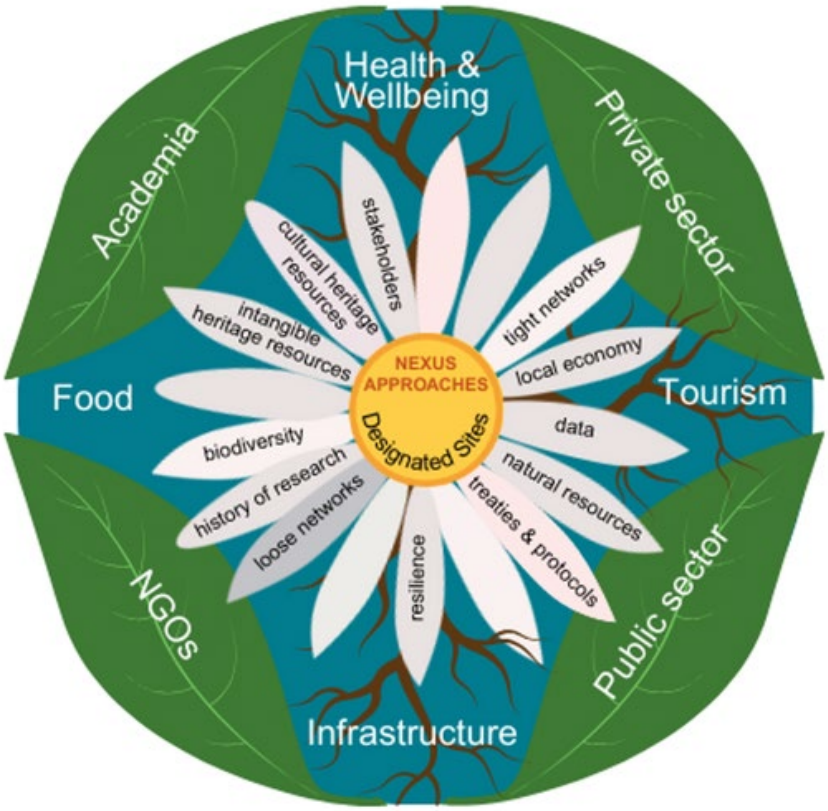


Figure 4. The nexus captures more granular matters (the petals) and wider considerations (the field).

Case Study 4: Global Geoparks

Partnership between three UNESCO Global Geoparks: A window of opportunity for geoheritage enhancement and geoscience education

Locations: Finland, Italy, France

Stakeholders: educators, students, local stakeholders

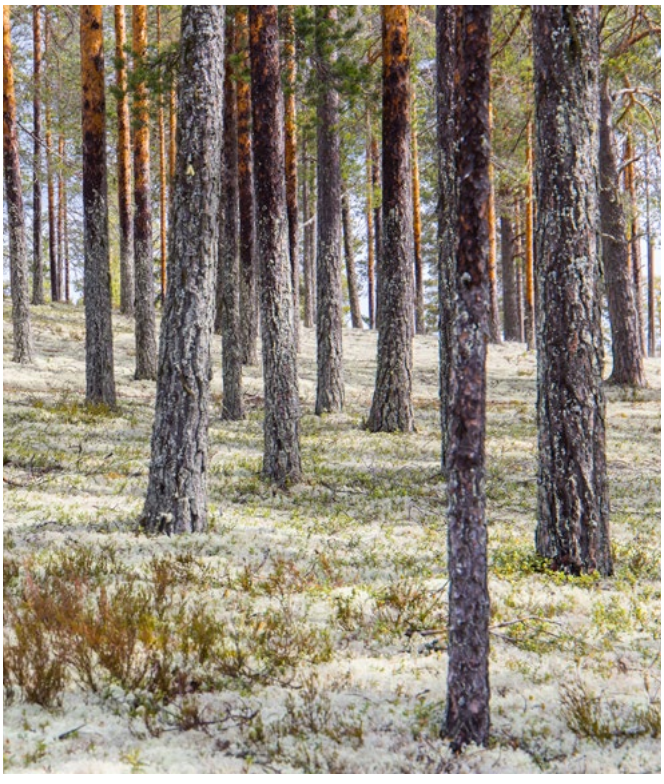
Themes: social, environmental, education and communication, comparative and longitudinal study, climate change

Funder: Erasmus+

Key takeaways: UNESCO sites can be laboratories for studying and monitoring long-term change with comparative potential, and provide learning sites for multiple stakeholders.

Further reading: Giardino, M., Justice, S., Olsbo, R., Balzarini, P., Magagna, A., Viani, C., Selvaggio, I., Kiuttu, M., Kauhanen, J., Laukkanen, M., & Perotti, L. (2022). **ERASMUS+ strategic partnerships between UNESCO Global Geoparks, schools, and research institutions: A window of opportunity for geoheritage enhancement and geoscience education.** Heritage 5(2): 677-701.

Three Global Geoparks – Rokua, Finland; Chablais, France; and Sesia Val Grande, Italy – in collaboration enabled students to learn about the effects of climate change and its impact on local culture. Fieldwork activities enhanced geoheritage knowledge, moving from global to local perspectives, and enabled cross-border data collection, sharing, and the implementation of research methods and teaching practices aligned with national curricula. Climate change effects were analysed through impacts and risks, as well as resources and opportunities, which included learning from past climate variations. Sustainable development was examined through interventions in the natural environment, as well as farming, food production, and urban design measures in nearby villages. This case study demonstrates how Global Geoparks can be "natural laborator[ies] for the investigation of long- and short-term climate change and also for a discussion around the effects of climate change on nature and culture". It also points to how education and dissemination of climate change effects raises awareness and promotes capacity building.



Forest in Rokua Global Geopark, Finland. Photo: Photofex.

Case Study 5: World Heritage Sites

Integration of Climate Action and the Sustainable Development Goals in World Heritage Sites

Locations: India, USA

Stakeholders: non-professional stakeholders, local managers

Themes: sustainability, governance, holistic management

Funder: ICOMOS

Key takeaways: Multiple sites provide ideal comparative case studies and produce transferable findings.

This study compares two World Heritage Sites – the Taj Mahal (India), and Monticello and the University of Virginia in Charlottesville (USA) – as testing places to explore the relationship between policies, stakeholders, governance, and sustainability. It found that the growing recognition of intangible cultural heritage offers a more holistic pathway to sustainability than traditional methods employing monumental or aesthetic frameworks alone. By leveraging the consistent reporting standards and transparency required of World Heritage Sites, the researchers were able to formulate a comparative question across diverse contexts, allowing for a truly global perspective on sustainability to emerge. The active participation networks fostered by World Heritage status enabled interviews with a wide range of professional and non-professional stakeholders. These perspectives helped deepen the analysis of what was driving change, and how management strategies were actually being put into practice, going beyond what could be learned from official reports. While grounded in two specific sites, the findings offer broader relevance, encouraging more integrated and holistic heritage management in approaches worldwide.

Taj Mahal, Agra, India. Photo: Sean Hsu.

Monticello, Charlottesville, Virginia, USA. Photo: Eurobanks.

Further reading: Saha, S., Caballero, G.V., and Loopesko, L. (2022). **Integration of climate action and the Sustainable Development Goals in World Heritage Sites: Case – Taj Mahal and the University of Virginia and Monticello.** Monographie. ICOMOS Sustainable Development Goals Working Group, September.

Question 2: Enabling & Restraining Factors

What current factors enable or restrain UNESCO sites to effectively test new approaches and demonstrate their wider relevance and utility?

UNESCO sites offer uniquely supported and networked loci for testing innovation and fostering research. They are also, less uniquely, subject to several restraints. This section examines the potential for UNESCO sites as laboratories for climate and sustainability research, as well as the enabling and restraining factors that influence this potential.

UNESCO sites offer fertile ground for nexus approaches. Their position within a global network facilitates the exchange of knowledge, tools, and outcomes for sustainability experiments, making them powerful spaces for both local innovation and international learning. The UNESCO designation itself brings added legitimacy and visibility, often helping to attract funding, technical expertise, and strategic partnerships. Moreover, the international profile comes with the advantage of established governance frameworks: many sites already have multi-stakeholder management committees that are well placed to coordinate across sectors and respond flexibly to emerging challenges.

> If we are to leverage the power of place-based learning for sustainability to meet global challenges, 'individual sites' are not sufficient: regional and global networks are needed, to develop middle-range theories which account for context specificities but are generalizable.

Barraclough, A.D., et al. (2023). Global knowledge–action networks at the frontlines of sustainability: Insights from five decades of science for action in UNESCO's World Network of biosphere reserves. People and Nature 5.

UNESCO sites as testing sites

UNESCO sites have also been extensively used as sites for research and innovation projects, though the research histories of each designation differ considerably. Findings from the literature review indicate that designated Biosphere Reserves (BR) have generated more research outputs relating to climate and sustainability, despite there being significantly more World Heritage Sites (WHS). This can be partially attributed to the deliberate conceptualisation of BRs as sites for research and innovation in these fields, as learning places for sustainable development and as sites for testing interdisciplinary methods. The shift in emphasis from conservation and safeguarding to sustainability and innovation that opened up BRs as sites of research occurred in 1995 (Barraclough et al. 2023). The integration of sustainable development into the World Heritage agenda did not, however, occur until 2015 (Bonn Declaration 2015), and for more ambitious climate change action, until 2023 with the Updated Policy Document on Climate Action for World Heritage (UNESCO 2023). Research into WHS has tended to address the heritage and values for which sites have been designated, or heritage management more broadly. Global Geoparks (GG), as a relatively new designation, have received far less scholarly attention overall and in relation to climate action, but, like BRs, are more amenable as testing sites. The explicit link to sustainable development (Quiroz-Fabra et al., 2023) enables an ostensibly geology-focused designation to adopt broad, people-oriented approaches.

UNESCO sites are diverse in their characteristics, yet this diversity may not be well appreciated by researchers, communities, or policymakers at a national or regional level. All types of designation offer opportunities for nexus approaches, but each type has different affordances. The bottom-up governance structure of GGs, and the four-year cycle of re-validation means local stakeholders are more actively connected.

The Outstanding Universal Value (OUV) of WHS lends itself to international profile, soft diplomacy, and conservationism (though the 2023 UNESCO Updated Policy Document on Climate Action for World Heritage is effective in building climate change consideration and action into OUV and opening WHS as testing spaces). BRs have been more actively engaged in research on climate action and sustainable development (Barraclough et al. 2023; Leibenath et al. 2024). However, the recent foregrounding of the possibilities of other designations, including those by CCUH and L2G, suggests a fuller exploration of how their properties might yield results. This imbalance in existing research presents a challenge: it is often easier to build upon existing research, especially within the enabling frameworks and strategies in which it operates. However, nexus approaches could facilitate the experience of BRs in supporting the development of research in other designations, trans-designation-based research, and exploring the transferability and implementation of research methodologies across different designations. During the preparation of this Framework, the R&I Group have identified several opportunities for nexus approaches to be used within WHS contexts.

While the transdisciplinary research required by nexus approaches is powerful, it can be challenging. Each designation appeals to particular disciplinary fields, which can encompass both practitioner and academic research fields. Bridging disciplines requires dedication and longer-term collaboration, as well as consideration of the practical and policy backgrounds of the different stakeholders.

Enabling factors

1. Networked sites

- UNESCO sites are networked and interconnected with other sites, enabling potential scaling of projects, comparative research, and partnerships that cross-cut regions, challenges and opportunities.
- Networks of stakeholders exist for each site, from diverse locally-based stakeholders to national policy-makers.

2. Designation criteria

- Site designation criteria can support research work by providing existing focus areas such as values, boundaries, specific interests, safeguarding methods, and more. BRs are intended as 'learning places for sustainable development', meant to serve as sites for innovation and research, with potential also at other designations.

3. Existing data, research and evaluation

- Designated sites are often well-researched and understood, with significant baseline research contributing to their designation. While this work is not always connected or coordinated, and may not relate to sustainability directly, it provides a springboard for developing nexus approaches, and potential for analysing change over time/ differing factors across contexts.

4. Special regulation

- Some designated sites may have attached special regulations allowing for nexus approaches to be developed for specific innovations.

5. Designated sites as a resource

- Sites and their constitutive elements receive high levels of care and oversight, and by definition, represent valued landscapes or key elements.
- Resource can come in the form of research (see above).
- Resource can also come in the form of stakeholders, many of whom possess long-term knowledge and are already networked into the sites.

6. Funding access

- Designated sites and site managers can access funding pathways that may not be available for undesignated sites.

7. Participatory approaches

- UNESCO sites have been embedding participatory approaches for decades and these relationships and practices are strong.

8. Scalability

- Large projects can be easily designed with stakeholders for scalability.
- Localised projects also have the potential to be scalable, with localised innovation and development holding promise and offering valuable insights into effective change processes.

9. Underutilised academic and UNESCO Chair infrastructure

- Many designated sites are located near or within the reach of local universities, research centres, and field institutes. These offer site-specific expertise, studentship potential, and long-term research continuity.
- The UK's network of UNESCO Chairs remains an underused asset (with many in the R&I Group). These globally connected scholars can bridge practice and policy, bring methodological rigour, and align local site-based innovation with global agendas.

10. Normative foundation and policy alignment

- UNESCO/UN frameworks – such as the SDGs, the Sendai Framework, Education for Sustainable Development, and Culture for Sustainable Futures – provide sites with a normative foundation that lines up with global agendas. This enables site-based work to be easily aligned with international policy and funding frameworks.

11. Symbolic and diplomatic capital

- UNESCO designation carries symbolic weight and legitimacy. The status can garner media attention, political interest, and diplomatic value, all of which can help convene cross-sector actors and foster new partnerships.

Restraining factors

Many of these factors are not unique to UNESCO sites, but rather reflect more generic difficulties faced in developing research and innovation projects within larger, immutable, or rapidly changing regulatory landscapes.

1. Long-term funding and infrastructural support

- Complex funding packages may be needed for projects and organisations that require broad and ongoing partnership activities. Funding applications put costly pressure on resources, and some funders may constrain the ability to experiment in research.
- Funding regimes are not secure and in some cases, do not always consider legacy planning or offer long-term opportunities for longitudinal studies and evaluation.

2. Challenges of nexus approaches

- There is a need for innovative monitoring and evaluation approaches across inter- and transdisciplinary projects.
- Participatory approaches are desirable (see above) but can also be restraining when participation is limited and participants are excluded from decision-making. This is particularly problematic if there has been an expectation of inclusion. Jang and Mennis (2021: 10) observe "a continued mismatch between the practical reality and the administrative ideal" with regard to WHS.

3. Bureaucratic inertia

- Complex governance can slow down decision-making and innovation.
- The desire to implement innovation can be strangled by regulatory difficulty. Such regulatory impediments are not uniform from site to site, especially internationally, which further hampers the implementation of comparative or scaled research projects.

4. Friction across disciplinary approaches

- An approach that fails to assess the holistic impact of actions in a given landscape can conflict with different disciplinary aims.
- Aims to incorporate or meet local worldviews can clash with more orthodox disciplinary approaches.
- Meeting a funder's requirements or institutional outputs may not align perfectly with the needs of sites and their stakeholders. Many approaches are siloed within reporting or research regimes, limiting capacity and resolve for truly innovative and meaningful nexus approaches.

5. Political, economic or environmental sensitivity

- Sites in contested or politically volatile areas may be cautious about risk-taking or may be excluded from global networks due to political sensitivities. Moreover, priorities for sites can be disrupted by economic and environmental instability at various scales.

6. Accessibility

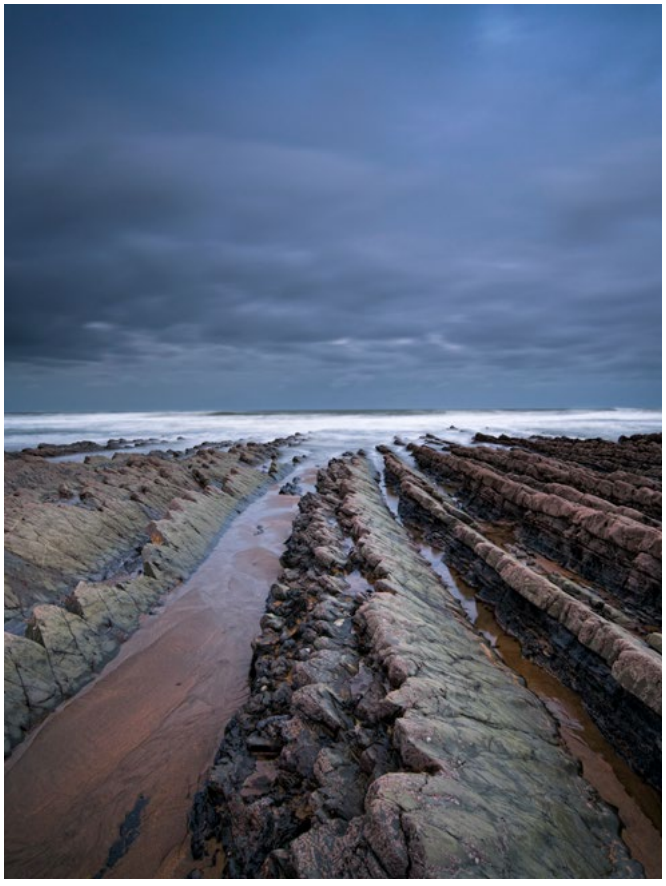
- From disciplinary framing to public transportation, designated sites can be inaccessible to many would-be stakeholders, limiting their input and, therefore, the range of voices and perspectives heard. Effective co-production requires that all voices be heard, with ripple effects of reduced participation on the ability to conduct effective research into perceptions and change towards sustainable development (Tippett and How 2020).

7. Data, research and evaluation

- There is no systemised approach to logging and storing research and data, nor standardisation practices for data collection, or for undertaking and cascading learning from evaluation. This presents a challenge for project initiatives and local stakeholders, who often have limited capacity to effectively store and share data and lessons learned, due to the short-term nature of project work and funding cycles. See further details on data in Question 3 below.

8. Designation sensitivity

- Designated sites can be subject to over-tourism.
- Designated sites can be subject to considerable extractive research activity.
- As different designations may have different reporting timelines, working across UNESCO sites can create overlapping pressures and increase the administrative burden.
- Balancing conservation and development can be seen to jeopardise either site integrity or sustainability, and can sometimes make managers risk averse.



Welcombe Bay, within the North Devon Biosphere Reserve, UK. Photo: Edward Nurse.

9. Local /global friction and bias

- Projects that address local-level or localised concerns may not accord with national or international aims. Opposition from local or regional stakeholders to innovation is not uncommon.
- National policy siloes can also create misalignment with local authority interpretations and community values and practices. Moreover, tensions and complexities may arise in circumstances when UNESCO sites cross regional administrative borders.
- Available case studies, theoretical approaches, and funding and institutional access mechanisms may reflect bias towards particular groups and research regimes. This can be especially poignant when projects seek to work with or utilise Indigenous communities and worldviews, yet are unable to sufficiently incorporate them into conflicting reporting regimes.

10. Prevailing mindsets

- Conservation frameworks, particularly those rooted in established heritage practice, may prioritise the protection of built heritage, form, and authenticity over a growing need to look at adaptive reuse (and loss), experimentation, or transformative responses to climate and sustainability challenges.
- Some heritage bodies often operate within preservation paradigms that can unintentionally limit innovation. While important, it is crucial that UNESCO sites are viewed within the wider debates surrounding these paradigms on managing change and loss, which are increasing in the context of growing climate change impacts.

Case Study 6: Biosphere Reserves

Building institutional capacity for environmental governance through social entrepreneurship: Lessons learned from Canadian biosphere reserves

Locations: Canada

Stakeholders: site boards of directors, site managers

Themes: governance, hybrid management, directorship, social entrepreneurship

Funder: Social Sciences and Humanities Research Council of Canada

Key takeaways: The diversity of management models at UNESCO sites offer fertile ground for examining what works and for developing transferable models.

Further reading: George, C., and Reed, M.G. (2016). **Building institutional capacity for environmental governance through social entrepreneurship: Lessons from Canadian Biosphere Reserves.** Ecology and Society 21(1): 18.

This research compared the governance models of four Biosphere Reserves in eastern Canada: Southwest Nova, Fundy, Manicouagan-Uapishka, and Bras d'Or Lakes. While each BR had a multi-stakeholder board of directors to ensure diversity of participation, each also had a hybrid governance structure and was varied in the level of social entrepreneurship involved. The study combined a review of documentation with in-depth interviews to understand how these different governance models supported the sustainability goals of the BRs. The researchers found that Manicouagan-Uapishka, which had the highest level of social entrepreneurship, had the strongest connection to surrounding communities and the greatest flexibility in pursuing sustainability goals. Relying solely on multi-stakeholder boards, especially during times of reduced funding, led to decreased participation and a focus on project-based work rather than relationship-building over time. Integrating social entrepreneurship could enhance nexus approaches in research.

Hopewell Cape, Bay of Fundy, New Brunswick, Canada. Photo: Brian.

Case Study 5: World Heritage Sites

Building resilience through participation in traditional viticultural practice

Locations: Italy

Stakeholders: youth, local communities, health services

Themes: social, mental health, resilience, traditional practices

Funder: Association "The Vineyard Landscape of Piedmont: Langhe, Roero and Monferrato", UNESCO World Heritage Site (Alba, CN)

Key takeaways: The nexus approach of this place-based intervention shows how sites can bring benefits to wider communities, developing resilience and supporting reciprocal care and sustainability.

This case study from the Vineyard Landscape of Piedmont: Langhe, Roero and Monferrato World Heritage Site, shows how the dynamics of place have "a preeminent role in recovery-oriented practice." The study brought young people experiencing mental health problems to work alongside professional viticulturists on the grape harvest. The study leveraged the site's designation criteria – cultural landscape and winegrowing expertise – to understand the therapeutic benefits of landscapes defined by attentive care and support for biodiverse ecosystems. The "lived experience of caring for the vines" allowed the young people to embed themselves in a landscape for which they assumed care themselves: an 'enabling place' defined by a diverse web of associations.

Vineyard in the Vineyard Landscape of Piedmont World Heritage Site. Photo: Denis.

Further reading: Barbieri, E.R. (2024). **"It is like post-traumatic stress disorder, but in a positive sense!": New territories of the self as inner therapeutic landscapes for youth experiencing mental ill-health.** Health & Place 85: 103157.

Question 3: Opportunities & Limitations of Data

What are the opportunities and limitations of data (including data science advancements) in underpinning approaches to climate action and sustainability in UNESCO sites?

UNESCO sites, and the organisations, communities and individuals that they embrace, are a complex network of data creators, processors and consumers, with relevance and value ranging from place-specific to regional, national and international. This data-rich ecosystem presents both a challenge and an opportunity: robust data governance and management practices must be ensured, while the potential of data to support and inform research, decision-making, and inquiry is leveraged. Data often exists in different siloes and formats, and at varying levels of accessibility, making effective data sharing difficult to achieve.

While recognising the necessity to restrict access to data in certain cases (e.g., data sensitivity; identifiability), a general shift to more accessible, interoperable and reproducible data practice would support better knowledge sharing, particularly when attempting to address interconnected challenges across disciplines and sectors. The definition of data is also an important determinant in what is perceived as valuable and worthy of inclusion: if responses to systemic issues such as climate change are to be genuinely inclusive and representative of place, 'data' must include diverse and distributed knowledge and perspectives from local communities and groups as part of sustainable collaboration.

> Diverse data sources from diverse knowledge systems generate insights on past and present humanand natural systems regarding the implications of actions, such as synergies and trade-offs, as well as the role that culture and heritage actors can have towards these outcomes.

Morel H. et al. Global Research and Action Agenda on Culture, Heritage and Climate Change. (2022). Global research and action agenda on culture, heritage and climate change, 14.

Data availability, use and gaps in UNESCO sites

The main source of information exploring the role of data within UNESCO sites' emerging role as living laboratories is research undertaken during the Sites for Sustainable Development Report (Canadian Commission for UNESCO and UKNC UNESCO 2022), and a comprehensive data landscape audit undertaken by NIAXO Ltd, the CCUH programme's appointed data consultant.

NIAXO's audit aimed to map how data is currently used – and where it is lacking, across both national and local stakeholders, to monitor, measure and adapt to climate change impacts on heritage sites. The audit also aimed to plot the data landscape across different organisations and partners to understand potential data blind spots and opportunities for greater data awareness, visibility, and improved access; this sought to address the often-fragmented nature of data and information, a recognised barrier to effective working, especially within environments with multiple organisational and/ or sectoral partners.

NIAXO interviewed a range of national stakeholders identified by the UKNC, such as DCMS, Natural England and Historic Environment Scotland.Additional stakeholders, including the Met Office, NHS Trusts, the RSPB, will be consulted in future should opportunity arise. In parallel, NIAXO also surveyed the three CCUH pilot sites (Fforest Fawr GG; Hadrian's Wall WHS; North Devon BR) to identify local data needs, barriers and opportunities for improved data integration. The audit also reviewed relevant international and national data initiatives, including the ONS Integrated Data Service, Julie's Bicycle, Coastal Connections, and Case Study 11.

A **further piece of research** with Creative Policy and Evidence Centre (Newcastle University/RSA) commissioned under the L2G project will measure the financial and non-financial value of multi-stakeholder partnerships in UK's UNESCO sites (expected completion July 2026).

NIAXO's initial findings were relayed in a preliminary report dated November 2024; this preliminary report has been used in the preparation of this Framework. An updated report will be available in autumn 2025. Additional and complementary information was provided by Anna Louise Spencer's Liveable Futures report (June 2025), which features an assessment of national and local stakeholders related to the three pilot sites of the CCUH programme.

In this section we attempt to simplify the findings into clear headings. It is important to note, however, that preliminary findings on data seem to suggest binary relationships: for every opportunity there is a limitation, and vice versa.

Opportunities

1. The range of stakeholders that produce and collect data

There are a variety of stakeholders who own, produce, and/or coordinate data related to climate action. National stakeholder mapping from NIAXO identifies how data generated by the National Trust, DEFRA, the Met Office, and Historic England feeds into DCMS, which then coordinates data and provides insights and policy guidance (NIAXO 2024). The UNESCO pilot sites involved in the CCUH project collect and produce data to varying extents (e.g., visitor data; environmental impacts and weather patterns) and also gather data from other organisations (e.g., satellite imagery; census data) (NIAXO 2024). This diversity in data collection and generation presents an opportunity, as it showcases different methods of data gathering and the willingness of organisations to collect data. UNESCO pilot sites share data with stakeholders – usually in analysed rather than raw form. This data can be utilised to identify trends and support decision-making at UNESCO sites. Additionally, citizen science initiatives can empower communities and enable locals to contribute data through mobile applications.

2. UNESCO site managers are willing to try new technologies

UNESCO site managers are willing to try to use new technological tools. Managers expressed a desire to expand the use of GIS for predictive modelling or spatial analysis. Opportunities also exist in unlocking the potential use of tools driven by AI to support data query and analysis, as well as to enhance data processing workflows (NIAXO 2024).

3. Linking data is the key to understanding climate change effects

Numerous datasets related to climate change exist. Data integration facilitates nexus-based planning and management. There is also an opportunity to connect data linked to broader government topics more coherently, especially alongside climate change data. One UNESCO site respondent mentioned the need for “a golden thread” between climate change and government priorities to consider climate change and its effects as catalysts – drivers that stimulate change in the socio-economic fabric (NIAXO 2024: 78). Data could then be used to investigate social issues, for example, through collaboration with UCL academics, where data collection by Fforest Fawr GG is utilised to study the pandemic's impact on social housing (NIAXO 2024: 67).

4. Considering data as a product

One of NIAXO’s findings is that “most of the [UNESCO pilot] sites indicated that their datasets aren’t being used by external parties to create products and services” (NIAXO 2024: 68). While some site respondents acknowledged that some of their collected data is being used, “they were unaware of any current commercial use” (ibid). There is an opportunity for UNESCO sites to consider any data they collect as a product and service to other partners and seek to obtain a return on their investment. This would need careful consideration of possible unintended consequences, such as closing off the sharing of data and learning.

Limitations

1. Accessing data

The variety of stakeholders involved in data collection through collaboration presents both an opportunity and a challenge: stakeholders range from national bodies and academic institutions to charities, trusts, private businesses, and other third-party organisations. This makes accessing data complicated and time-consuming, especially since many stakeholders "have a vested interest in the collection, sharing, and exploitation of data" (NIAXO 2024: 51). Additionally, in some cases, policy guidelines are hard to navigate. More data has become accessible to the public, but tooling remains a barrier: some organisations feel they need other stakeholders to provide the tools they require, or they rely on tools that do not meet their needs.

UNESCO site stakeholders mentioned that the lack of centralisation of data (or centrally searchable data) is a limitation. Some highlighted "the lack of a fit for purpose way to request information regarding public climate data that isn't in the public domain" (Spencer 2025: 48). Data can therefore be difficult to find. Furthermore, enhanced access restrictions make access challenging, as in the case of "data hosted by DEFRA" (NIAXO 2024: 75). Often, personal contacts are relied upon to obtain and access data.

2. Quality control and data integration

Poor standardisation of data, and the lack of harmonisation and/or comparability between different datasets were issues identified by site stakeholders. With the range of data collected by various stakeholders, it is often difficult to integrate data, due to institutional and/or technical obstacles.

Integrating data from various sources and formats to obtain a clear picture can be challenging, particularly when multiple datasets are required to support a story (e.g., a link between climate change and social need) or when new areas of research connectivity are being explored. Data quality cannot always be ensured across stakeholders and UNESCO sites. Quality control is often hindered by time and resource (human, technical, financial) constraints, and the auditing of data is rarely undertaken.

On the data itself, some commented that the "spatial granularity can be too coarse", and some national datasets "do not have good local accuracy" (NIAXO 2024: 76). The lack of granularity for some of the threats and opportunities collected data was also identified as a limitation during the L2G regional workshops.

3. Capacity

Site managers and related stakeholders must be well-acquainted with software to make the best use of it (such as in the case of advances in **Earth Observation** and real-time monitoring, which allow accurate tracking of changes). Many stakeholders lack the capacity to interpret and utilise complex data effectively; therefore, capacity development activities would be encouraged as part of the research.

4. Sharing Data

Ownership and ethical issues were identified as concerns by various stakeholders (Spencer 2025). Challenges raised by stakeholders include licensing restrictions, data access agreements, and adherence to legal and privacy agreements, as well as the protection of sensitive and commercially valuable information.

Some informal discussions during the L2G regional workshops highlighted the need for greater data sharing between UNESCO sites. Some tools exist, such as the UNESCO Sites Navigator, which provides an opportunity to share data across WHS, BRs and GGs (NIAXO 2024). Such tools are currently being extended and augmented, and will contain monitoring and data-sharing capabilities (see Case Study 11). Yet such a site would need to be expanded to better share and query data, in addition to enabling other designations to participate to inform one another of site synergies.

Sharing data may be problematic for Indigenous communities in cultural or mixed sites. Moreover, an over-reliance on technology can marginalise traditional knowledge systems that are crucial for sustainability.

5. Data capture

Some data, such as intangible cultural heritage (ICH), is difficult to digitise. This challenge arises from several factors, as outlined by the British Council, including the various methods of digitisation for ICH, the necessary structures, and limited access to digital tools (NIAXO 2024). Data stewardship also plays a crucial role: the voice of those with digital access might not accurately reflect the heritage that needs preservation, and there is a risk of misappropriation. The British Council considers that achieving a unified global voice on ICH is challenging.

The Climate Connection was mentioned as a potential way to document intangible heritage and practices through climate change considerations (NIAXO 2024). Participatory processes and visioning workshops conducted within UNESCO sites can generate valuable datasets, yet capturing detailed perspectives and viewpoints from these workshops is rarely systematic or digitised. These insights emphasise the need for open-source tools but also highlight the inherent difficulties faced by a single organisation in overseeing, managing, and sharing data for preservation.

Some general issues were identified throughout ongoing programme reporting, specifically, a lack of budget, staff, time and clear processes and protocols. Some possible solutions proposed were upskilling staff, particularly in data literacy, and including the possible uses of AI (NIAXO 2024). Storage also remains a preoccupation for national and local stakeholders who need to evidence and monitor change through time.

Case Study 8: Global Geoparks

Across the Atlantic

Locations: Scotland, Canada

Stakeholders: site managers and stakeholders; Education Scotland

Themes: social, emigration, settler colonialism, refugees, clearances, Ghaidhlig/Gaelic, denuded human ecology

Funder: UNESCO Chair for Refugee Integration through Education Languages and Arts, University of Glasgow

Key takeaways: Working with experiences of historical forced migration and historical settler colonialism can trouble settled narratives around loss and new life. These narratives can also facilitate the development of relationships with more recently arrived populations and with visitors. Cultural mediators are necessary.

Further reading: Phipps, A, Fisher D., Aldegheri, E. (2023). **The New Scots Refugee Integration Strategy: A report on the local and international dimensions of integrating refugees in Scotland** https://www.gla.ac.uk/media/ Media_900243_smxx.pdf

Short film:
https://sitesunseen.gla.ac.uk/film-clearances/

Podcast:
https://sitesunseen.gla.ac.uk/ podcast-mikmaki/

In this project, a relationship between the cleared landscapes of the North West Highlands Global Geopark, Scotland, was developed with the Cliffs of Fundy Global Geopark, Canada: the landscape that received many of those forced to leave. The project sought to introduce an educational focus in the non-formal sector through arts-based interventions that can be used to develop learning materials for schools and visitors to sites. The complex narratives around the Scottish Clearances and the displacements and settler colonial experiences of the Mi'kma'ki were explored and learning packs created, which were distributed at both sites. The educational materials developed a perspective through co-creative and partnership working, which offered a decolonial and forced migratory lens on the two WHS. It was imperative that this work was undertaken with cultural safety in mind and expert educational design. It was developed multilingually in both contexts, to enable the depth and nuance necessary for understanding what were seen as 'emptied' or 'settled' landscapes. A cultural consultant was vital. Creative methods were also used to develop a film and podcasts as part of the learning materials for groups.

Loch Stack, North West Highlands, Scotland. Photo: David.

Case Study 9: World Heritage Sites

Preserving the built environment from floods in a World Heritage Site

Locations: Poland

Stakeholders: local communities, local authorities, local businesses and land owners/managers, national agencies

Themes: social, embedding local values, climate change resilience

Funder: Preserving Legacies (National Geographic Society global climate adaptation initiative), ICOMOS, the Climate Heritage Network and Manulife

Key takeaways: Nexus approaches could enable improved understanding of environmental resilience. New tools and datasets are not necessarily required to improve resilience.

This study explores the complex challenge of protecting the Historic Centre of Kraków's World Heritage Site from flood risks. The researchers' reviewed existing planning, mapping, and policy documents to create a holistic picture of flood resilience. A key part of the researchers' methodology was to view the historic built environment from a systemic perspective; in other words, cultural heritage was seen as a "living element of the city's tissue" rather than as a separate entity. The findings show that existing planning documents do not account for flood protection of built heritage. The study recommends that flood protection should consider the environmental, economic, and social aspects of heritage. It also suggests using both qualitative and quantitative data in the development of flood protection strategies. This case study highlights how cultural heritage should be incorporated within a holistic framework, at the intersection of nexus approaches, and how the historic fabric within the WHS should be included in the city's core planning and climate adaptation strategies. Through review and analysis of existing data, new approaches can be developed inepensively.

St Mary's Basilica, Kraków, Poland. Photo: Piotr.

Further reading: Porębska, A.; Godyń, I.; Radzicki, K.; Nachlik, E.; Rizzi, P. (2019). **Built heritage, sustainable development, and natural hazards: Flood protection and UNESCO World Heritage Site protection strategies in Krakow, Poland.** Sustainability 11: 4886.

Implications for a Research Agenda

UNESCO sites are well-positioned to act as laboratories for research on climate action and sustainability. Their characteristics enable nexus approaches to thrive and achieve outcomes that are scalable and transferable, thereby contributing to addressing wider societal challenges.

The development of a Research Agenda for the next 5-10 years should focus on the following elements:

Areas of research interest

- Research into participation processes, co-production, and partnership building, especially in a rapidly changing context (climate, socio-economic, and geopolitical).
- Opportunities for utilising UNESCO sites as living laboratories for various climate adaptation, mitigation, and resilience strategies.
- Opportunities for using UNESCO sites as laboratories to investigate how climate action can promote sustainable development for communities both within and beyond the boundaries of designated sites.
- Understanding the role that cultural and natural heritage can play in sustainability and adaptation transitions through the nexus or living labs approaches within UNESCO sites.
- How smaller scale, targeted, disciplinary research can contribute to network building and data collection.
- The integration of qualitative data and research on perceptions alongside quantifiable, measurable data (bio-geophysical, health, and socio-economic).
- The importance of conducting multi-scalar research, which links local contexts to larger scales and considers factors that influence the transferability of outcomes.

Characteristics of the research benefitting from nexus approaches

- Holistic, transdisciplinary and inclusive research where parties are committed to the process and social learning is embedded in the foundational stages of research.
- Research using designated sites as laboratories should have impacts that benefit communities outside UNESCO sites. Learnings from the L2G programme suggest that projects benefit from buy-in from local communities whilst also generating impact on wider demographic flows (such as tourism, regional economy).
- There are research synergies and complementary advances that can be made by working alongside similar designations or working across UNESCO and non-UNESCO sites, both in the UK and internationally.
- Data, including project evaluation data, forms the temporal structure of nexus approaches, maintaining the connections through time between research projects and their outcomes. The Research Agenda should include strands for further research on data, as well as guidance and support for the creation, management, storage, and sharing of data generated through research.

Recommendations

- To develop a **UNESCO Climate Action and Sustainability Research Agenda**.
- To support the continuations of the R&I Group to offer advice and feedback to researchers and explore potential synergies and ways to maximise the benefits of research for further learning and action taking place in the next 5-10 years.

Case Study 10: World Heritage Sites

Linguistic diversity and conservation opportunities in Africa

Locations: across Africa

Stakeholders: national/local governance committees/authorities, Indigenous communities

Themes: governance, social, environmental, language diversity and biodiversity

Funder: study supported by Eleanor R. Stuckeman Chairship in Design, Penn State University

Key takeaways: Data from UNESCO sites can yield greater understandings that can lead to developments in governance and management that are inclusive and that reduce barriers between natural and cultural approaches.

This study surveyed 48 Natural World Heritage Sites in Africa and nearby islands to assess the co-occurrence of Indigenous languages and biodiversity. It found that nearly all the sites are contiguous with zones in which Indigenous languages are spoken. The health and number of Indigenous languages serve as indicators of cultural diversity, while species health and diversity reflect strong biodiversity. The study examined four taxa and freshwater species in relation to areas with Indigenous languages to understand the correlation. The high correlation discovered provides evidence that blurs the boundaries between natural and cultural diversity approaches and supports shared governance, where species diversity coexists with cultural diversity and may even depend on existing cultural practices. The project noted that where species and languages are endangered, co-occurrence decreases, further indicating that the health of both is interconnected. Governance of WHS sites often focuses on preserving biodiversity; the study highlights the strong link between biological and cultural diversity and advocates for new approaches involving greater participation of Indigenous communities in governance, as they may have a deeper understanding of the interconnectedness of site diversity.

Katam or Baramer Lake, within the Lakes of Ounianga World Heritage Site, Chad. Photo: Homocosmicos.

Further reading: Gorenflo, L.J. and Romaine, S. (2021). **Linguistic diversity and conservation opportunities at UNESCO World Heritage Sites in Africa.** Conservation Biology 35: 1426-1436.

Case Study 11: World Heritage Sites Biosphere Reserves Global Geoparks

Development and expansion of UNESCO Sites Navigator (formerly, World Heritage Online Map Platform, WHOMP)

Locations: Global

Stakeholders: site managers, States Parties to relevant Conventions, heritage stakeholders and practitioners, conservationists, researchers, private sector

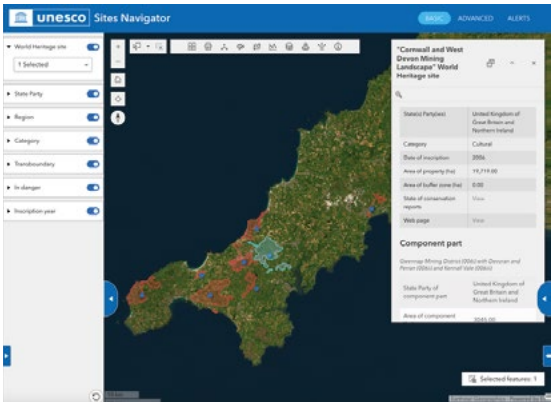
Themes: governance, Geospatial mapping, georeferenced databases, site monitoring, satellite data

Funder: Government of Flanders (Belgium)

Key takeaways: Data tools can cross innumerable boundaries to provide stakeholders with cross-comparable multiuse perspectives.

Further reading:
https://whc.unesco.org/en/wh-gis/
https://whc.unesco.org/en/news/2785/

The **UNESCO Sites Navigator** is a GIS monitoring tool developed by the UNESCO World Heritage Centre, launched in 2023 and expanded in 2025 to include Biosphere Reserves and Global Geoparks. It responds to the need for authoritative, up-to-date spatial data on UNESCO designations, especially for identifying Multi-Internationally Designated Areas (MIDAs). The Navigator offers georeferenced polygons with global coverage, supporting UNESCO's monitoring and conservation roles. Integrated with peer-reviewed, open-access datasets, some near-real-time and satellite-derived, it helps assess recurring threats to Outstanding Universal Value, including those related to climate change, based on data from the **State of Conservation knowledge system**, floods, droughts, and risk maps. An automated alert system provides daily screening of hazards, including fire, flood, tsunami, coral bleaching, and vegetation disturbance, to support rapid situational assessment and action. The Navigator integrates real-time satellite and scientific data to support monitoring and alerts for UNESCO-designated sites at the global level. It enables spatial analysis of recurring threats to OUV and identification of MIDAs using verified boundaries of UNESCO designated sites, Ramsar sites and Key Biodiversity Areas (KBAs). The platform supports cross-sectoral risk awareness, with applications in conservation, communication, and capacity-building, as well as transparent access to information. It is a critical tool for informed decision-making, early warning, and communications across UNESCO sectors. Its positioning within UNESCO will change to reflect its coverage of other kinds of sites.



UNESCO Sites Navigator interface.

The Research & Innovation Group

The Research & Innovation Group comprises the following members. Their contribution to this project has made it possible.

Fernando Avakian
Project Officer, UNESCO World Heritage Centre

Lara Band
Research Analyst, ButCH

Nadia Bartolini
Research Director, ButCH

Rosalind Bryce
Director, Centre for Mountain Studies, University of the Highlands and Islands

Dave Chapman
Project lead, Climate Change & UNESCO Heritage UK National Commission for UNESCO

Dina D'Ayala
UNESCO Chair on Disaster Risk Reduction and Resilience Engineering, University College London

David Drewry
Vice Chair, Non-Executive Director for Natural Sciences UK National Commission for UNESCO

Francesca Giliberto
Senior Research Fellow, University of Leeds

Kate Guest
Senior Policy Advisor (Climate Change), Historic England

David Hannah
UNESCO Chair in Water Science, University of Birmingham

Keith Jones
National Specialist Climate Change, National Trust

Stefan Krause
UNITWIN Network on Ecohydrological Interfaces Under Change, University of Birmingham

Qiuhua Liang
UNESCO Chair on Informatics and Multi-hazard Risk Reduction, Loughborough University

Sarah May
Co-Director, ButCH; R&I Secretariat

Marc Metzger
Professor of Environment and Society, University of Edinburgh; Chair of the UK National Committee for UNESCO's Man and the Biosphere Programme

Aisling Parrish
Project Administrator, Climate Change and UNESCO Heritage UK National Commission for UNESCO

Sefryn Penrose
Co-Director, ButCH; R&I Chair

Angela Piccini
Project Director, ButCH

Matt Rabagliati
Head of Policy, Research and Communications UK National Commission for UNESCO

Claire Thirlwall
Director, Thirlwall Associates

Ian Thomas
Head of Evidence, Arts, British Council

Juliet Thondhlana
UNESCO Chair in International Education and Development, University of Nottingham

Joanne Tippett
Senior Lecturer in Spatial Planning, University of Manchester

Imogen Wood
Senior National Consultant for Heritage & Climate, National Trust

Rob Woodside
Conservation & Estates Director, English Heritage

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Appendix 1:

Documentation reviewed and interviews conducted on UKNC's ongoing programming:

Climate Change & UNESCO Heritage (CCUH) Programme

- Anna Louise Spencer/Lateral North, including:
  - Liveable Futures – exploring the strategic and systemic role of heritage in the context of climate change in the UK (June 2025)
  - Appendix to Strategic mapping report
  - Fieldguide draft document (Autumn 2024) – a creative approach that brings together insights from first stages of mapping, site visits, research and design
- Raw data files, including:
  - Pilot_survey_Sept24_v4
  - Climate Change & UNESCO Heritage: National Stakeholders Survey (Responses), Oct 2024
  - Climate Change & UNESCO Heritage: Pilot Site Stakeholders Survey 1 (Responses), Oct 2024
  - CCUH_baseline_survey_analyses_Oct24_v4_final_draft
  - UNESCO_FutureScapes_Workshops_RawData_CONFIDENTIAL (Dec 2024)
  - Prototype mapping spreadsheets listing the range of stakeholders at 3 pilot sites consulted
- NIAXO Data Audit Report (Nov 2024)
- Exchanges, informal chats and some follow-up interviews conducted with representatives from the three CCUH pilot sites.

Local to Global (L2G) Programme

- L2G website: **https://unesco.org.uk/projects/local-to-global-programme**
- Phase 1 Toolkits:
  - Fundraising Toolkit 1: How to prioritise projects to align with your strategy
  - Fundraising Toolkit 2: How to write a fundraising case for support
  - Fundraising Toolkit 3: Developing a pipeline of fundraisers
  - Fundraising Toolkit 4: Tips for writing successful bids to funders
- Audience Development and Mapping Toolkit
- Digital Toolkit for UNESCO designated Sites in the UK
- Local to Global Phase 1 Completion Report to NLHF (Jan 2025)
- Local to Global Phase 1 Final Evaluation Report (David Waterfall, Jan 2025)
- Discover the UK's UNESCO Sites map 2023 Summer campaign, Evaluation Report (undated)
- Local to Global Phase 2 untitled and undated document (possibly submission to NLHF)
- Local to Global Phase 2 Community Grants Application Form and Guidance (undated)
- Regional Workshop Trello boards from the activity inspired by the Seeds of a Good Anthropocene approach

The L2G Phase 2 programme incorporated a series of six in-person regional workshops to 'scope synergies, share learning, and broker partnerships locally and globally that identify new audiences and potential funding streams' (L2G Phase 2 website). Nadia Bartolini from ButCH attended the Canterbury workshop and her notes were incorporated in the overall review. ButCH also arranged one-to-one meetings with R&I Group members and colleagues who attended the other five regional workshops in Perth, Bath, Saltaire, GeoMon/Anglesey and Giant's Causeway. Online meetings were recorded, and transcripts were used to identify key elements that have been incorporated in the review.

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National Commission
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Bureau for the Contemporary and Historic