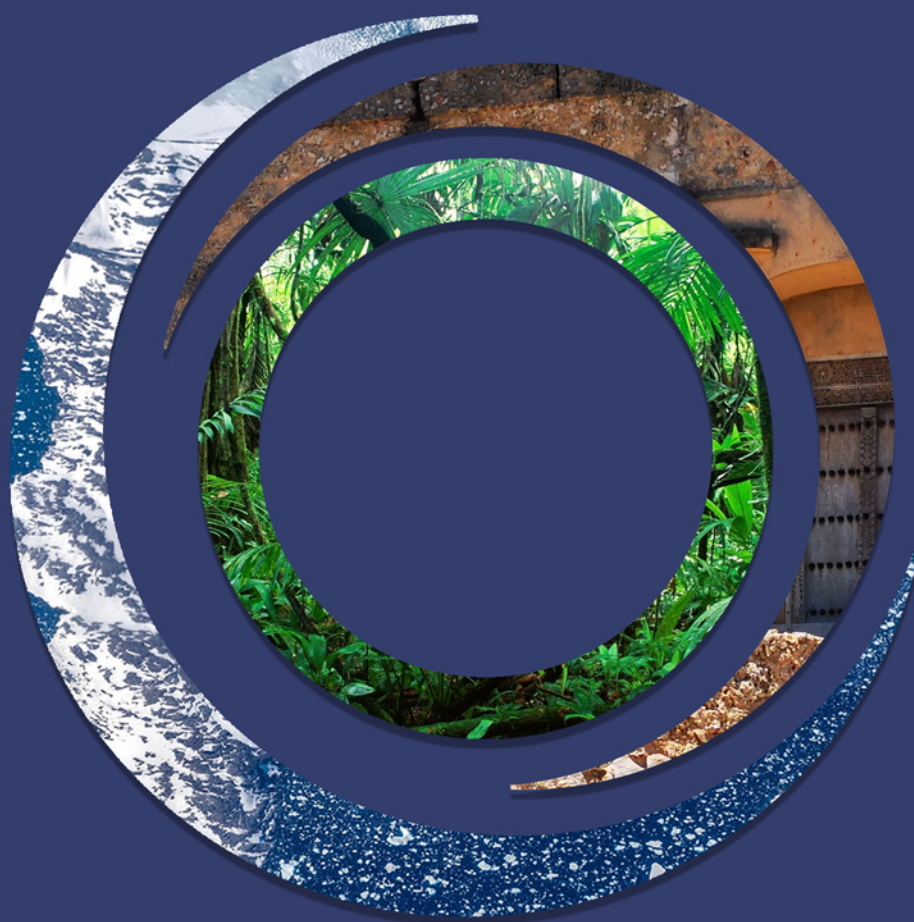# Global Research and Action Agenda on Culture, Heritage, and Climate Change

Scientific Outcome of the International
Co-Sponsored Meeting on Culture, Heritage and Climate Change

INTERNATIONAL CO-SPONSORED MEETING ON
CULTURE, HERITAGE & CLIMATE CHANGE

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List of Case Studies

List of all contributing Case Studies and contributing authors:

Global Research and Action Agenda on Culture, Heritage and Climate Change

Culture and heritage have a key role in understanding the causes and impacts of climate change and in designing responses, including low-carbon, climate- resilient pathways consistent with the aims of the 2015 Paris Agreement and other international agreements relevant to climate change. The design, conception, acceptability, feasibility and effectiveness of mitigation, adaptation and measures to promote resilience measures are dependent on how well culture and heritage are understood and change across communities, regions and nation-states. The role of culture and heritage in addressing climate change is especially important within the context of human and ecosystem (including biodiversity) inter-connectedness; cities and urbanisation; land and water use and management practices; and governance, including climate justice, capacity building, equity and wellbeing. Acknowledging and enhancing work that recognises the contributions of culture and heritage to understanding and responding to climate change is of critical importance to climate action efforts at all levels.

This paper addresses culture as well as heritage. The term 'heritage' is used and should be read to mean both natural and cultural heritage, intangible and tangible. This is to overcome existing methodologies that draw distinctions between heritage; such differentiation is complex if not problematic. Natural heritage here is understood as components of the natural environment, including fauna and flora, ecosystems, natural features, geological and physiographical formations or structures. It includes natural sites of value from the point of view of communities, through scientific, spiritual, historic, aesthetic, or other social significances. Natural heritage supports biodiversity and human systems, and may include natural resources.   .

Cultural heritage is understood as tangible and intangible expressions of ways of living developed by a community or society, inherited from past generations. It is 'in its broadest sense, both a product and a process [of human communities/societies], which provides [them] with a wealth of resources that are inherited from the past, created in the present and bestowed for the benefit of future generations' (UNESCO, 2014). Tangible cultural heritage includes archaeological sites, buildings, structures and monuments, landscapes, museum collections and archives. Intangible cultural heritage includes the practices, representations, expressions, knowledge, skills and ways of knowing – as well as the instruments, objects, artefacts and cultural spaces associated therewith – that communities, groups and, in some cases, individuals recognise as part of their cultural heritage. Examples include performances, ceremonies, music, dance, art, designs, symbols and other artistic and cultural expressions. Intangible cultural heritage is sometimes referred to as 'living heritage', in that it is transmitted yet constantly re-created. Knowledge and skills are considered as dynamic. They are constantly re-created by communities and groups in response to the environment and to interact with the rest of nature and people, past and present. Some elements of heritage have been landmarked, listed or otherwise included in inventories by governmental or professional actors; others are simply recognised as such by associated groups and communities.

Culture and heritage can hold evidence of paleoclimatic change, social evolution and past human responses to environmental change and environmental stress. It can also reflect and embody contemporary knowledge of environments, land and water use and resource stewardship developed over generations from societies, groups and communities. Furthermore, it can reflect patterns and events impacting the development of the peoples of the world, including historical patterns of social and political organisation (including injustices) as well as practices relating to agriculture, production of other goods and services, and the consequences of extractive histories through the extraction of resources. The notion of intergenerational transmission of heritage is key.

As the outcome of the International Co-Sponsored Meeting on Culture, Heritage, and Climate Change, this Global Research and Action Agenda on Culture, Heritage and Climate Change proposes that these heritage and cultural practices act as a bridge between different ways of knowing, embody inherited knowledge accumulated over generations, and serve as entry points for climate action. To do so requires acknowledging, respecting and implementing a plurality of knowledge systems inherent in culture, heritage and creative practices.

In this Agenda, 'those involved in culture and heritage, including understanding the past' includes, but is not limited nor restricted to researchers and scientists (e.g. archaeologists, anthropologists, geographers, geologists, architects, heritage conservationists, paleoclimatologists and other researchers from the social and natural sciences and the humanities), knowledge holders (such as members of Indigenous Peoples and local communities), practitioners, women and youth, as well as those living in informal settlements and other marginalised and/or vulnerable diverse actors. It encompasses members of the culture, heritage, planning, creative and design communities in addition to professionals and academics (e.g. from private and public sector enterprises, international and/or national organisations, professional bodies, networks and site and historic house museum managers, civil society and policy-makers in culture and heritage).

Part I: The International Co-Sponsored Meeting on Culture, Heritage and Climate Change: Background and Summary

The proposal to hold an International Co-Sponsored Meeting on Culture, Heritage and Climate Change was a response to growing calls for international attention to culture, heritage and climate change including by the Intergovernmental Committee -established under the UNESCO 1972 Convention concerning the protection of the World Cultural and Natural Heritage-, which requested, already in 2016, the UNESCO World Heritage Centre and the Advisory Bodies to the World Heritage Committee to work with the Intergovernmental Panel on Climate Change (IPCC) with the objective of including a specific chapter on natural and cultural World Heritage in future IPCC assessment reports. These calls were a recognition that significant gaps exist in understanding the role of culture and heritage in global climate science and climate change responses.

An earlier call was a roundtable held in 2015 at the United Nations Framework Convention on Climate Change (UNFCCC) COP21 in Paris. Here the treatment of cultural heritage in the IPCC's 5th Assessment cycle was discussed. That event was sponsored by the International Council on Monuments and Sites (ICOMOS) and included the Vice Chair of the Intergovernmental Panel on Climate Change (IPCC), Dr Youba Sokona, and representatives of IPCC Working Group II. It was prompted by the statement included in the Fifth Assessment Synthesis Report that 'loss of … cultural heritage and ecosystem services are difficult to value and monetize, and thus they are poorly reflected in estimates of losses'.

The UNESCO World Heritage Convention is one of the world's best recognised cultural heritage instruments. The Convention, whose full title is 'The Convention Concerning the Protection of the World Cultural and Natural Heritage', was adopted by UNESCO in 1972 and with almost 200 countries party to it, is one of the most widely ratified international Conventions. The Convention provides a permanent framework for international co-operation in safeguarding cultural and natural heritage, and introduces the specific notion of 'world heritage', that is, heritage that is of value to humanity across the world beyond its local or national specificity. The Convention is governed by the World Heritage Committee, and the General Assembly of States Parties. Subsequently, the UNESCO Convention for Safeguarding the Intangible Heritage was adopted by UNESCO in 2003.

In 2016, at its 40th session (Istanbul/UNESCO, 2016), the World Heritage Committee recommended that:

'the World Heritage Centre strengthen its relations with other organizations working on Climate Change, particularly with the UNFCCC and the Intergovernmental Panel on Climate Change (IPCC) secretariats, and specifically with regard to the effect of Climate Change on World Heritage properties, and also request[ed] the States Parties, the World Heritage Centre and the Advisory Bodies [IUCN, ICOMOS, ICCROM] to work with IPCC with the objective of including a specific chapter on natural and cultural World Heritage in future IPCC assessment reports.

(Decision 40 COM 7, para 15)

In 2017, ICOMOS and UNESCO submitted a proposal for IPCC co-sponsorship of a meeting on heritage and climate change. This led to the *International Co-Sponsored Meeting on Culture, Heritage and Climate Change* (the Meeting), herein referred to as 'the Meeting'. The proposal, first put forward by the International Council on Monuments and Sites (ICOMOS), was agreed by the Co-Chairs of the Working Groups of the Intergovernmental Panel on Climate Change (IPCC), endorsed by the IPCC Executive Committee in June 2020, and co-sponsorship confirmed by UNESCO in July 2020, following which a collaborative concept note for the meeting was finalized. The Meeting was held virtually over five days from 6–10 December 2021. The Meeting was co-sponsored by IPCC, UNESCO and ICOMOS, in partnership with the International Union for the Conservation of Nature (IUCN) and Local Governments for Sustainability (ICLEI).

The aim of this Meeting was to take stock of the state of knowledge regarding connections of culture and heritage with anthropogenic climate change and to establish gaps in knowledge regarding these connections. Approximately **100 participants** from a wide range of backgrounds attended. Meeting participants represented **40 countries** across all six continents, with 40 per cent of the participants coming from the **Global South** and **61 per cent of the participants being women.** Researchers and practitioners were present, consisting of 13 **Climate Scientists, 78 Culture/Heritage practitioners and seven Natural Science** practitioners. Participants included members and representatives from Indigenous Peoples and Local Communities.

Detailed notes of the participants' contributions and insights have formed the basis of this co-edited Global Research and Action Agenda on Culture, Heritage and Climate Change, herein referred to as 'Climate Heritage Agenda'. The breadth of expertise and information presented at the Meeting highlighted the significant level of knowledge and work achieved, and continued, by Indigenous Peoples, local communities, scientific communities, practitioners and policy communities across the globe. Resources contributing to the Meeting include three White Papers each led by a dedicated international team of experts, which align to the Meeting's overarching scientific questions (see below), and three associated webinars. The Meeting itself consisted of **three public-facing panel discussions, 15 workshop sessions** and corresponding breakout room discussions and **two days of poster discussion sessions,** complemented by online website discussions prior to, during and following the Meeting.
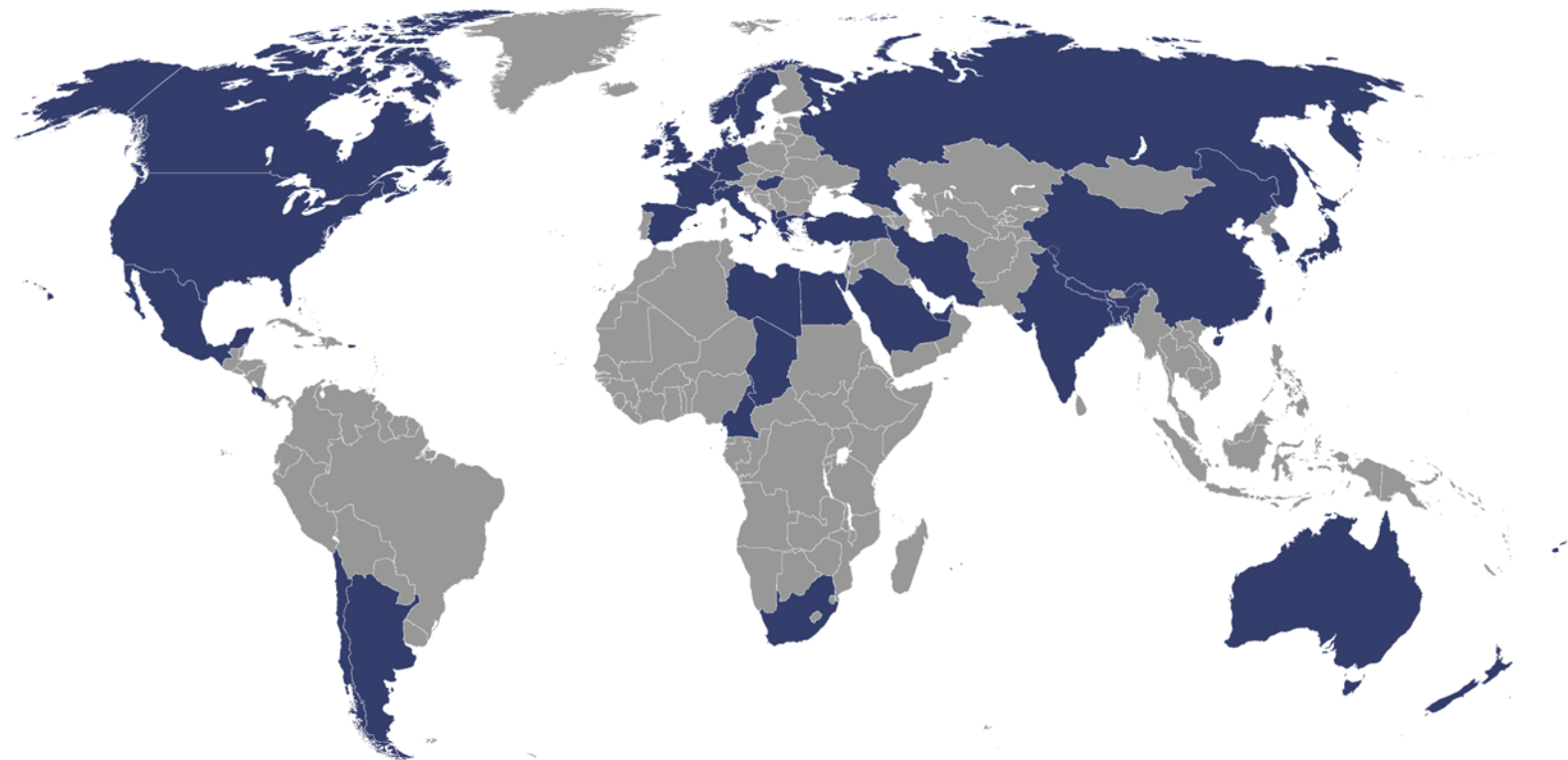
Figure 1: Distribution of participants for the Expert Meeting

Global South 40% 60% **Global North**

Male 39% 61% **Female**

Climate Scientists 13

Cultural Heritage Specialists 78

Natural Heritage Specialists 7
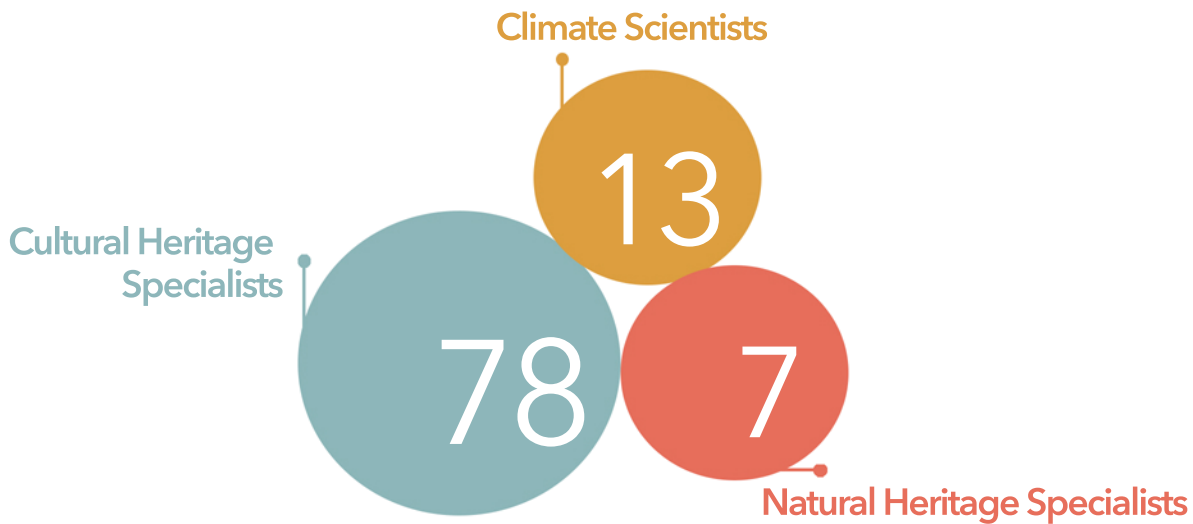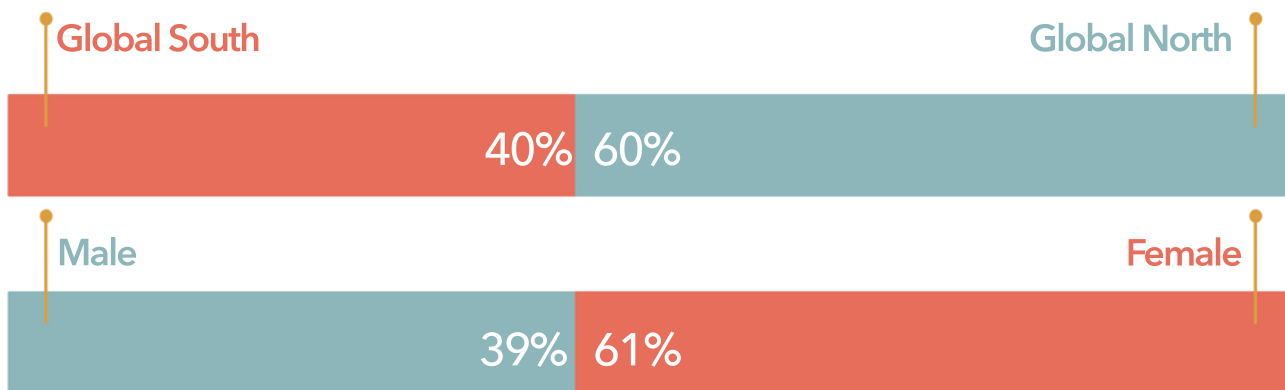
Figure 2: Visualisation of representation present at the Meeting

The **key messages (KMs)** set out in this Climate Heritage Agenda identify knowledge gaps and themes as well as action items designed to help expand global capacity by connecting culture, heritage and climate action. The Agenda has been compiled to serve and support relevant parties in developing blueprints, funding proposals and action plans to catalyse research and collaborations, and also to seed further outputs including peer-reviewed publications and other appropriate literature, training and capacity-building resources and further documentation, including those from Indigenous Peoples and local communities. It encourages co-production that brings together multiple knowledge systems and highlights the importance of other ways of knowing in our response to climate change.

This document is comprised of three parts:

1. A summary of the Meeting themes, schedule and discussions
2. Knowledge gaps and action items by the Meeting
3. Delivering on research and action agendas emerging from the Meeting

All case study boxes and examples presented in the Agenda were discussed in the Meeting and are used here with the consent of the Meeting participants involved in the work. They are included to illustrate key messages and to represent the importance of culture and heritage in understanding and addressing climate change.
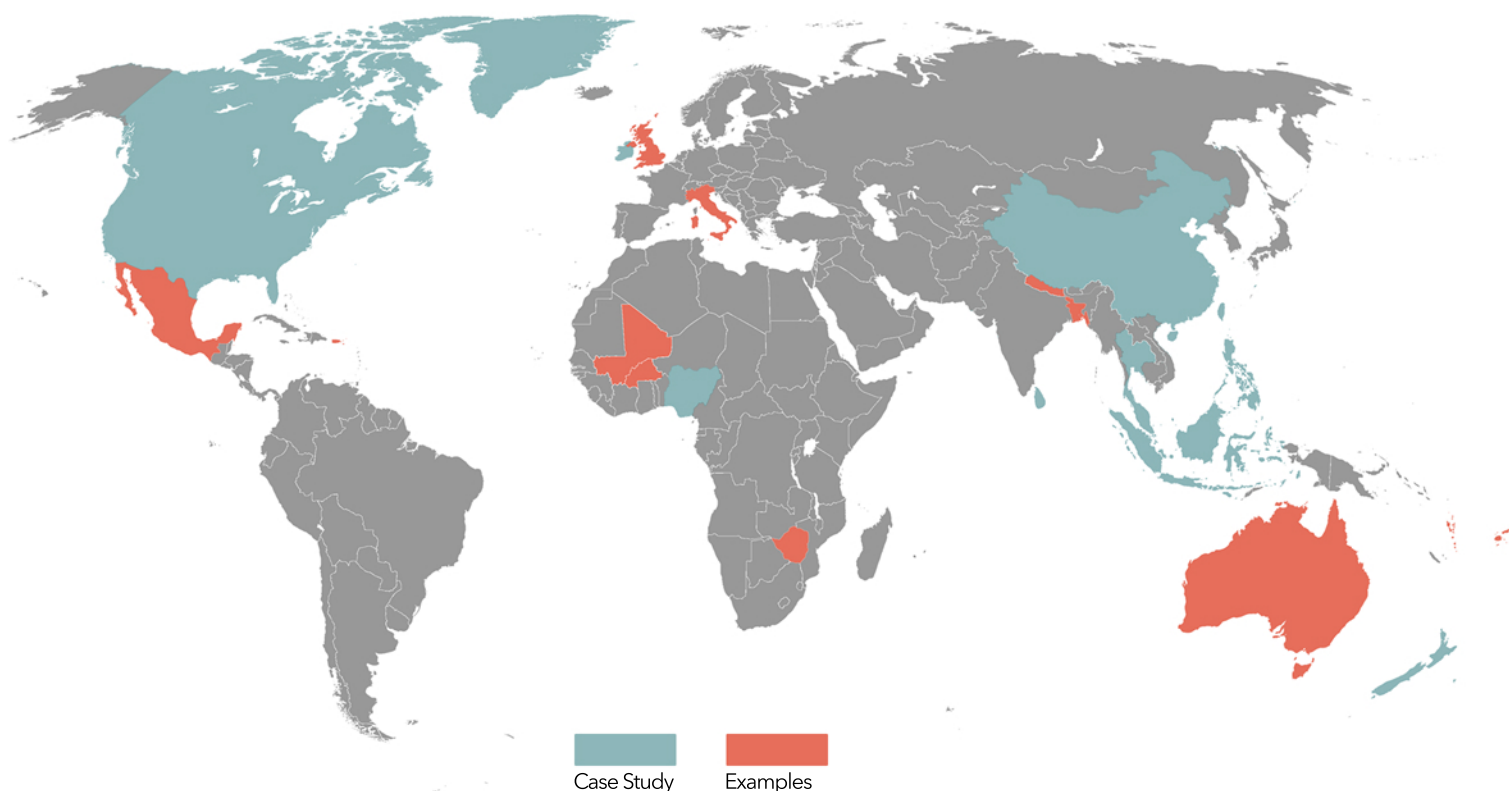
Figure 3: Global distribution of case studies and examples provided in the Agenda

SUMMARY OF SELECTED CASE STUDIES

A total of 13 case studies were selected from a number of countries and regions

Country	Case Study	Theme
Global	**Case Study One:** Building off work from IPCC Co-sponsored Internation Conference on Cities and climate change, presents role of cities in climate action and agenda	③
New Zealand Aotearoa	**Case Study Two:** Integration of Te Ao Māori (Indigenous Knowledge) into large city climate adaptation planning	① ③
Canada Inuit Nunangat	**Case Study Three:** Impact of climate change on Inuit heritage in Inuit Nunangat (Canadian Artic) and collaborations undertaken to address these collective issues	① ② ③
Ireland	**Case Study Four:** Outlines work done by Irish Government in better integrating climate change into the national Built and Archaeological Heritage Plan	②
Japan	**Case Study Five:** Use and retention of traditional ecological knowledge found in the use of stone tidal weirs	① ② ③
United States	**Case Study Six:** Role of traditional fire practices in the conservation of oak forests in South West US	① ② ③
China	**Case Study Seven:** Effective use of local knowledge in the adaptation of large and complex cultural landscapes of Honghe Hani Rice Terraces	① ③
Nepal	**Case Study Eight:** Describes collaborative work between Western institutions and Nepalese communities in addressing impact of natural disasters on Kathmandu	① ② ③
Nigeria	**Case Study Nine:** Impact of climate change on Ogun coastal communities and how local and traditional knowledge is being adapted and utilised to reduce severe impact	① ② ③
Sri Lanka	**Case Study Ten:** How the empowerment of women in climate action has strengthened local knowledge and climate resilience	① ③
Macau China	**Case Study Eleven:** Revitalisation of traditional skills to help counter the impact of climate change and rapid urbanisation on historic urban architecture	① ② ③
Philippines	**Case Study Twelve:** Utilisation of Indigenous stone walling technology in climate adaption and its transference to urban settings	① ③
South East Asia	**Case Study Thirteen:** Maladaptive use of traditional slash and burn farming and the need to better adapt traditional practices with controlled methods	① ② ③

① Knowledge Systems   ② Impacts   ③ Solutions

Figure 4: Breakdown of case studies with a brief summary

Summary of the Meeting Themes, Schedule and Discussions

To work towards this mandate, three overarching scientific questions and two cross-cutting issues were discussed at the Meeting. These were:

1. Systemic connections of culture, heritage and climate change (Knowledge Systems)

- Nature and scope of representation of diverse forms and scales of culture and heritage in climate literature and assessments
- Integration of diverse knowledge systems, including Indigenous knowledge systems, across areas of climate research and response
- The history of climate change and its alignment with the history of all communities; nature and scope of historical, social and cultural contexts of the Anthropocene

2. Loss, damage and adaptation for culture and heritage (Impacts)

- Climate impacts on culture and heritage, including methods of describing vulnerability of culture and heritage to climate impacts
- Adaptive/preservation methods for culture and heritage, including understandings of significance and approaches to prioritisation of/for action
- Understanding of and approaches to loss and change

3. Roles of culture and heritage in transformative change and alternative sustainable futures (Solutions)

- Capacity of historic buildings/landscapes/traditional land use to hold carbon
- Cultural and natural heritage as sources of resilience or refuge in response to disasters
- Heritage as inspiration for art, connection, understanding and action on climate adaption and mitigation

4. Cross-cutting issues: a) Cultural governance; b) The capacity to learn from the past

- Who decides what heritage is?
- How is heritage knowledge managed?
- Intersections of heritage with conflict
- Use of data and knowledge from the past in climate models and policy
- Finding common ground between climate and heritage approaches to research questions

To take stock of the state of knowledge regarding these overarching questions, and to stimulate discussion, three White Papers were commissioned in advance of the Meeting **(Annex B).** White Paper themes aligned with the agreed overarching scientific questions outlined above and were used to develop topics and considerations discussed during the Meeting. These themes are outlined below.

Theme 1: Systemic connections of culture, heritage and climate change
(Knowledge Systems)

As outlined in the Knowledge Systems White Paper, knowledge systems can be 'defined as sets of interacting agents, practices and institutions that organise the production, transfer, and use of knowledge' and as 'complex ensembles of connected values, practices, institutions – as well as beliefs, worldviews, emotions and senses' (Orlove *et. al.* 2022). Opportunities exist to work across different systems of knowledge (e.g., Indigenous knowledge, local knowledge, practitioner, and scientific knowledge) and to support the willingness of individuals and groups coming from different knowledge systems to work together to address the widely acknowledged threat of climate change.

Theme 1 discussions explored these considerations with a focus on the following topics:

1) Knowledge systems, power and interpretation of climate change
2) New conditions, new knowledge
3) The challenges and opportunities of integrating knowledge systems

Theme 2: Loss, Damage and Adaptation for Culture and Heritage
(Impacts)

The Impacts White Paper identified a global imbalance in the understanding of impacts resulting from an incomplete picture of how climate change is impacting culture and heritage around the world. It stressed the importance of losses and damages[1] to climate action and how this imbalance in the understanding of impacts is resulting in unequal and incomplete recognition of non-economic losses. This dynamic is further exacerbated by current literature, which predominantly evaluates exposure in a data-driven or data-informed way; this in turn causes a bias towards listed and protected heritage, and towards areas in which heritage is well documented and well described. Overall, the White Paper noted that the implications of climate change for culture and heritage are diverse and complex. This is due to the variety of global climate and environmental change, compounded with local anthropogenic factors stressing the 'urgent need to promote a collective understanding and use of representations of uncertainty and likelihood, within both IPCC and heritage related fields, in line with the relevant broader communities to foster cross-disciplinary collaboration and impact.' (Simpson *et. al.* 2022).

Theme 2 discussions explored all these considerations with a particular focus on the following topics:

1) Collective understanding of uncertainty
2) Identifying common factors for vulnerability and resilience
3) Impacts, power and interpretations of climate change

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[1]This report utilises the definitions of 'Loss and Damage' and 'losses and damages' used in the Glossary to the 2022 IPCC WGII report, namely, 'Loss and Damage (capitalised letters)' refers to the political debate while 'Lowercase letters (losses and damages) have been taken to refer broadly to harm from (observed) impacts and (projected) risks and can be economic or noneconomic'. See IPCC, 2022: Annex II: Glossary [Möller, V., J.B.R. Matthews, R. van Diemen, C. Méndez, S. Semenov, J.S. Fuglestvedt and A. Reisinger (eds.)]. In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem and B. Rama (eds.)]. Cambridge University Press.

Theme 3: Roles of Culture and Heritage in Transformative Change and Alternative Sustainable Futures *(Solutions)*

The Solutions White Paper suggested that science-based solutions are likely to be socially, economically, politically and culturally interwoven. As such 'mobilising the affective power of heritage becomes a potentially powerful tool in organising for climate action – although this involves emphasising a different version of heritage, less concerned with national pasts and more with collective human endeavour' (Shepherd et. al. 2022)

Prioritising change requires an understanding of the things people value, what they are willing to change and what they are not. Values are often implicit or unstated; explicitly identifying values can improve mitigation and adaptation outcomes. This theme explored how culture and heritage can help people and communities to imagine and realise low carbon, just and climate-resilient futures. The past can be a key resource in these

Theme 3 discussions explored all these considerations with a particular focus on the following topics:

1) Climate justice
2) Impacts and capacity building
3) The power of heritage in climate thinking

Within the Meeting, participants were asked to consider how we might: enhance resilience, adaptation and mitigation action and support; enhance understanding of methodologies, indicators and data, different forms of data and evidence and what type of support is needed in this pursuit; rethink national climate action planning and implementation; and enhance understanding of reporting instruments and communications.

Suggested points of entry included: terrestrial and freshwater systems; cities and settlements; the ocean, coasts and intertidal zones; water heritage and security; food security and agriculture; health and wellbeing; and economies and livelihoods. Particular emphasis was placed on cities and urban areas and their governance due to urban areas' complex culture and heritage and the 'high proportion of global greenhouse gas emissions … generated by urban-based activities' (Revi et al., 2014), and corresponding potential to support transformative change. The IPCC WGIII Summary for Policymakers report stated, 'The global share of emissions that can be attributed to urban areas is increasing' and that the 'drivers of urban GHG emissions are complex and include population size, income, state of urbanisation and urban form'. **Case Study Box one** outlines some synergies and gaps in knowledge about the relationship between culture and heritage and transformative urban climate adaptation, mitigation and climate-resilient sustainable development.
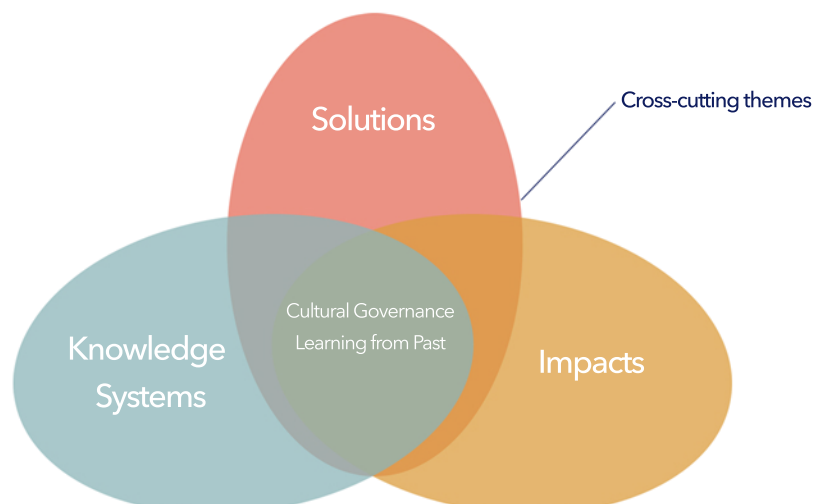
Figure 5: Visualising the relationship between the different sub-themes

Case Study Box 1

Cities as Engines of Transformation for Global Sustainability in the Urban World of the 21st Century

Author: Yunus Arikan, ICLEI /Andrew Potts, Climate Heritage Network

At the **43rd Session in 2016,** the IPCC agreed to prepare a special report on cities as part of the IPCC 7th Assessment Report and to convene a special meeting as part of the preparatory process. The IPCC Co-Sponsored International Conference on Cities and Climate Change was convened in March 2018 and concluded with the Global Research and Action Agenda on Cities and Climate Change. The IPCC took note of this report and the full version was published by the World Climate Research Programme in 2019.

The Global Research and Action Agenda on Cities and Climate Change notes that actions to address climate change through adaptation and mitigation at the city level will make crucial contributions to the national efforts aimed at fulfilling international commitments. It is built on three pillars: cross-cutting issues and knowledge gaps, key topical research areas and suggested implemented approaches. In 2021 'History and Cultural Heritage' was added as a new topical area at the **Innovate4Cities 2021 Conference** and several gaps for future research were listed.

The urban context presents steep challenges as cities are on the frontlines of issues such as inequality and the need for transparent institutions. As socially constructed entities, cities are also arguably one of humanity's greatest inventions for crafting solutions for the future. From the ancient cities of Mesopotamia to the metropolises of today, cities bring creative and productive people together.

With consideration of the evidence base that exists concerning the role of culture and heritage for climate change in urban areas, some of the synergies and gaps noted at the Meeting (2022) include:

- The potential of heritage methodologies and culturally sensitive approaches to achieve more equitable inclusion of diverse individuals and communities in adaptation and mitigation decision-making processes at urban scales.

- The layers of the urban built environment, including archaeology and heritage sites, as sources of insights as to how humans in agglomerated settlements have coped with environmental changes throughout history. Not only do these scientific data need to be better assembled, but the non-use of existing data also suggests the existence of 'implementation gaps'.

- Culture and heritage are keys to understanding: the spatial dimensions of cities and the interplay of this with circular economies; mobility and walkability; local self-sufficiency; gastronomy and healthy living. Better connections are needed between:

a) these cultural dimensions of urban planning and design
b) climate change mitigation and adaptation action

- Research indicates that changes to underlying cultural norms are more difficult to accomplish than transitory behavioural changes. Once established, however, they are likely to be more durable and to support a wider range of low-carbon lifestyles. More knowledge and implementation are needed to show how the cultural and heritage dimensions of urban living – both the physical form and social relations – affect consumption, influence adaptive capacity and intersect with the possibility of climate-resilient development.

Towards COP26, 'circular culture'[2] emerged as an innovative concept and potentially a powerful approach to address climate emergency. Overall, the evidence considered pointed to the need for new partnerships, connections and research supporting a larger role for culture and heritage in climate change science of cities. It will be essential that this larger role be realised in the next phases of implementation of the Paris Agreement with the recognition of multilevel and co-operative action in the Glasgow Climate Pact and in the scoping and delivery of the forthcoming special report on **Cities and Climate Change in 7th Assessment Report (AR7).**

Figure 5: Visualisation of the circular culture that has developed out of Eurocities. The vision of circular culture is based on four pillars: **Harmony with nature, harmony with change, harmony with each other and harmony with the past.**

[2] The concept of "circular culture" was first presented by the Tunç Soyer, Mayor of Izmir Metropolitan Municipality and member of ICLEI Global Executive Committee at the UCLG Culture Summit in Izmir (Soyer, 2021). The concept is further advanced by Izmir Planning Agency (IZPA, 2022) in collaboration with a broad diversity of partners..

Part II: Knowledge Gaps and Action Items identified through the Meeting

1. Cross-Cutting Knowledge Gaps and Actions Items

The Meeting identified a range of cross-cutting issues that need to be addressed in all stages of climate action. These include the recognition and inclusion of the diversity, role, function and value of all knowledge systems; the co-production of research and policy design and its implementation; and evaluation and learning. Diverse ways of knowing and measuring climate change are essential in understanding the scale and scope of climate change impacts, loss and damage, including on culture and heritage, as well as the role that culture and heritage can play in alternative sustainable futures.

a. *Holistic and Inclusive Approaches to Culture, Heritage and Climate*

To explore alternative, sustainable responses to climate change, there is an urgent need to enable holistic and inclusive approaches to culture and heritage that unlock its potential to help people imagine and realise climate-resilient futures. This process can be facilitated through the acknowledgement and recognition of diverse knowledge systems (i.e. ways of knowing, measuring and recording) and of how each of these ways of knowing understands the relationship and inter-connectedness between human and natural systems. Enabling real participation in decision-making and capacity building in ways that promote diversity, inclusion and justice benefits from collaboration between climate scientists, Indigenous Peoples and local communities, governments, private sectors, culture/heritage practitioners, and professionals, and policy makers across human and natural systems. Specifically, real participation addresses the need to avoid silos and to acknowledge plurality and inclusiveness of knowledge systems, removing any need to give precedence to one over another. Those involved in culture and heritage, including understanding the past, can help to address opportunities and barriers within governance frameworks and legal frameworks.
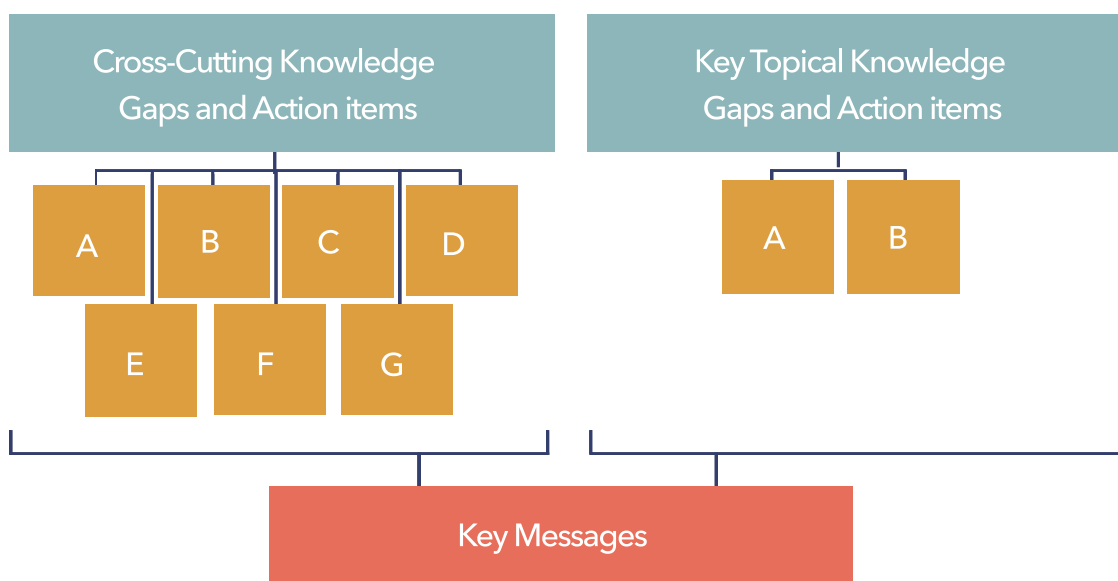
Figure 6: Relationship of the different wider themes and issues that were brought up in the Meeting, and how they were condensed into Key Messages

Key Message (hereafter KM) 1:

Climate and culture collaborations should start with the premise that all voices and knowledge systems are equally valuable in terms of the role, function, distinctiveness and contribution to addressing climate change and emerging problems

Indigenous Peoples and Local Communities have long been undermined in their rights and ability to participate in actions on equal terms and on equal footing with other stakeholders, an imbalance that must be appreciated more fully when planning collective climate action. Protocols for protecting, promoting and collaborating across diverse knowledge systems (including Indigenous Peoples' and Local Communities' ways of knowing and practices) are available and can be advanced through participatory and collaborative approaches. A paradigm shift would involve moving from a model where Indigenous Peoples' knowledge and concerns are objectively presented and reinterpreted to one in which space is made for them to share their knowledge and experience from their own world-views on an equal footing.

New approaches to the design of management and decision-making systems (including calls for tenders and contracts) can reinforce and support diverse knowledge systems e.g. through co-production approaches. This requires the continuous and critical review of existing approaches and how they consider issues (such as free, prior and informed consent; intellectual property rights; tenure rights; recognition of customary law; acknowledgment of Indigenous sovereignty), as well as in what ways they can continue to develop to address emerging issues effectively and inclusively. During the Meeting, Chrissy Grant (Aboriginal Kuku Yalanji from the Jalun-Warra clan and Torres Strait Islander (Mualgal from Kubin on Moa Island Elder) spoke of work in the Great Barrier Reef that prioritises and ensures consent is requested and accepted upfront – **a)** to make sure that Indigenous Peoples are not disadvantaged in any way by giving or having their knowledge used in wayswithout their consent, and **b)** to ensure they benefit from the work and their sharing of knowledge through capacity building and sharing information into their systems as well (pers. comms., Grant 2021).

> *...work in the Great Barrier Reef that prioritises and ensures consent is requested and accepted upfront – a) to make sure that Indigenous Peoples are not disadvantaged in any way by giving or having their knowledge used in ways without their consent, and b) to ensure they benefit from the work and their sharing of knowledge through capacity building and sharing information into their systems as well (pers. comms., Grant 2021)*

KM2:

National, sub-national and local governments' climate policy decision-makers need to work collaboratively with researchers, practitioners and local knowledge holders to proactively to acknowledge, translate and incorporate data on social, cultural, spiritual, and natural dimensions to avoid silo-style understandings and analysis of climate action and practice, and to improve and dvelop holistic, equitable and inclusive evidence-based policy.

Diverse data sources from diverse knowledge systems generate insights on past and present human and 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. National and local government actors in fields

such as climate planning, nature conservation, culture or the environment are often siloed, which obstructs issues from being addressed in an integrated manner, including geographies, social and cultural dimensions, ecological, economic, technical and development factors. This is particularly evident between governing, legal and management structures that artificially separate nature and culture and that further divide culture into tangible and intangible. In Nepal, for example, work done following the 2015 Gorkha earthquake faced challenges due to plural Indigenous knowledge systems being recorded in ways that were incompatible with government and academic systems; this led to great difficulty in the sharing and dissemination of information and project scaling (pers. comms. Coningham, 2021). Intersectoral, integrative and landscape approaches can look more holistically at areas to support climate planning and responses better. These approaches can help develop how effectively to apply successes and effective practices from one locality with its peculiarities to another, as well as how to evaluate the ways in which actions might potentially impact local cultures. **Case Study Box Two** provides an example of how different sectoral plans were considered within heritage planning to facilitate consistency and strategic vision across different sector policies. It is an empowering initiative in which New Zealand's first peoples, Māori (tangata whenua), are working alongside local government to develop adaptation plans with a shared vision.

KM3:

Scientists and researchers in the social and natural sciences need to collaborate proactively with Indigenous Peoples and local communities through co-production approaches and to acknowledge the value of traditional research practices as contributing to an understanding of climate-related heritage issues equal to scientific approaches.

This requires recognising the integrity of knowledge systems as having a wide range of components, including spiritual dimensions, which provide a holistic framework to address climate-related challenges to heritage. Ongoing evidence of inequality and a lack of recognition of local communities and local knowledge is seen across the world. For example, in the Caribbean in Puerto Rico, the knowledge of local communities is often not yet recognised or incorporated in management planning. As such, these voices, experiences and situations are largely ignored or absent – most notably after disasters and emergencies such as devastating hurricanes (pers. comms., Flores Román 2021). On the other hand, an example of how projects can be co-designed with Indigenous groups or local communities is demonstrated through **Case Study Box Three.**
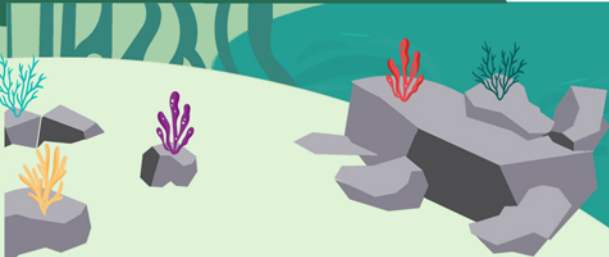
Co-produced Climate Action Planning, Aotearoa/New Zealand

Case Study Region: New Zealand, South Pacific

Authors: Sarah Forgesson, University College London/ Helen McCracken, JSC-ANZCORP

In New Zealand work is continually being done, with various levels of success, to identify and incorporate local iwi (tribes) into adaptation plans. Most notable is that of New Zealand's largest city, Auckland, in which its inhabitants are engaging with a remit of differing understandings but a shared vision. Utilising and adapting the Dynamic Adaptive Pathways Planning (DAPP), first developed in the Netherlands, Auckland Council in collaboration with Tāmaki Makaurau iwi have developed the 'Te Tāruke-ā-Tāwhiri: Auckland's Climate Plan' (Auckland Council 2020).

The Plan acknowledges the importance of Indigenous knowledge and 'mana whenua as the first peoples of Tāmaki Makaurau (Indigenous name for Auckland), and an intimate part of the ecological and cultural fabric of the region'. In response to the Plan, mana whenua have developed a Te Ao Māori wellbeing framework called **Te Ora ō Tāmaki Makaurau, to be used together with Te Tāruke-ā-Tāwhiri.**

Cover Page of Te Tāruke-ā-Tāwhiri: Auckland's Climate Plan © Auckland Coucil

From a Te Ao Māori perspective, we need to consider equity and fairness from the perspective of nature, place and people. Recognising the rights and interests of nature, place and people from a whole living systems perspective is critical.

Excerpt from Plan, pg 12

b.   Governance and Institutional Frameworks

Governance and institutional frameworks are multi-layered in that they span across hierarchical or horizontal levels, involve a range of actors and relate to a variety of issues and aspects. Those involved in culture and heritage, including understanding of the past, can contextualise tensions across governance and frameworks related to legitimacy, ownership and inclusivity issues. This includes investigating historic and ongoing distributions of power, exploring why and how this has been enabled through existing forms of path-dependencies and considering what consequences these inequalities have had – and continue to have – on the capacity for diverse actors to respond to decisions. Governance and institutional frameworks are further complicated by geographical scale (i.e. through how culture and heritage might be recognised internationally, regionally, nationally and locally) and what that might mean in terms of limitations on, for example: agency, jurisdiction and authority; participation in decision-making; access to finance and funding; or representation, due to alternative (and unrecognised) forms of governance structures. Such governance and frameworks can actively marginalise diverse actors through perpetuating power imbalances within processes.
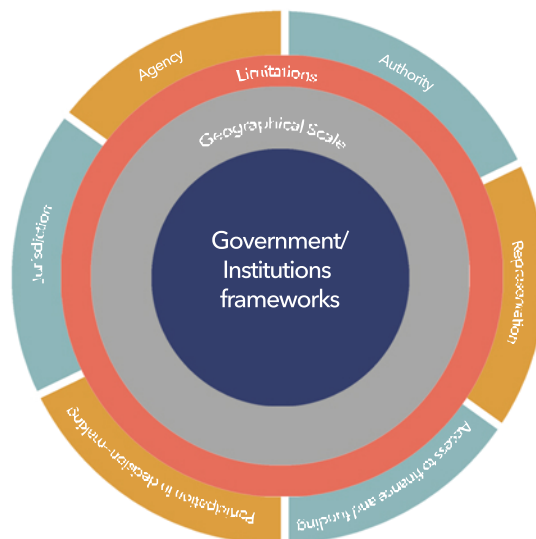
Figure 7: Visual demonstration of how governmental and institutional frameworks are complicated by geographical scale (i.e. through how culture and heritage might be recognised internationally, regionally and locally)

KM4:

Drivers that disempower and deprive some actors, and detach groups and individuals from culture, heritage and climate change planning, must be addressed with a view to enhancing diversity.

Different experiences apply to different actors and groups across different regions, and as such governance and institutional frameworks must respond to this, and require meaningful inclusion of diverse cultures, interests and voices in planning, decision-making, monitoring and revised actions. In the context of heritage, many methodologies for identifying and documenting heritage acknowledge that contested identities and diverse values form an integral part of that process, although practice in some places needs to be improved. Moreover, these practices will need to expand to focus on values that support climate action and to improve support for traditional and associated communities as they prepare for losses and damage, making use of culturally appropriate documentation tools. These tools are used by those involved in culture and heritage, including understanding the past, to help critically address systemic inequality and exclusion, and their causes, in the governance of climate response.

Case Study Box 3

Impact of Climate Change on Inuit heritage

Case Study Region: Canada / Inuit Nunangat (the Canadian Arctic), North America

Author: Max Friesen, University of Toronto

Two separate Indigenous organisations in Inuit Nunangat (Canadian Arctic) and Arctic archaeologist Max Friesen (University of Toronto) have worked in collaboration for over 20 years. The first project, in the Mackenzie Delta, was performed in collaboration with the Inuvialuit Cultural Centre, who co-designed the research and supported the work throughout. The second, in Nunavut, was initiated and led by the active, Elder-run organisation **Pitquhirnikkut Ilihautiniq / Kitikmeot Heritage Society (PI/KHS)** of Cambridge Bay; Max became involved naturally, having worked in collaboration with PI/KHS since 1999.

The Arctic is experiencing high rates of climate warming, causing serious concerns in the day-to-day world of circumpolar Indigenous peoples related to housing (melting permafrost leads to slumping of buildings), erosion (many coastal villages are actively eroding) and travel (winter routes over sea ice are no longer safe). Coupled with these issues is the awareness that northern heritage is also being impacted.

For the first project, in the Mackenzie Delta region, the Inuvialuit Cultural Centre partnered with the University of Toronto to study and address the destruction of ancestral Inuvialuit archaeological sites due to coastal erosion. Over five years they surveyed hundreds of kilometres of coastline and rescue-excavated two large pit houses in danger of imminent destruction.

The second project was organised by the Pitquhirnikkut Ilihautiniq / Kitikmeot Heritage Society (PI/KHS). The PI/KHS first evaluated why working with archaeologists might benefit their activities. Following a meeting to see if personalities and visions aligned, the parties committed to work together. PI/KHS and the University of Toronto have since shared decision-making at all stages, as well as research, to the benefit of both groups.

Today PI/KHS are concerned about the impacts of climate change on ancestral sites. They have initiated a programme to monitor erosion in key regions and have future plans to research the impact of thawing permafrost on archaeological sites. In addition, the organisation is at the forefront of applying Inuit knowledge in solving climate-related problems. They are currently designing and building a prototype net-zero building for Arctic communities. Based on Inuit principles of flexibility and sustainability, the building uses modern materials adapted from traditional architectural forms based on snow, stone, driftwood, and animal skins.

Elders and researchers discuss an ancestral Thule house during its excavation. Aspects of the region's Traditional Knowledge and archaeology are being used to design sustainable buildings in the warming North. Photo ©Max Friesen

Researchers examine the floor of a 400-year-old Inuvialuit sod house slumping down an eroding bluff. Two years later, nothing remained of this house. Photo ©Max Friesen

KM5:

Cultural and social sciences' methods and methodologies involving forms of monitoring, observing and interpreting need to be acknowledged as robust evidence within the scientific fields predominantly used in the study of climate change and in deliberative processes surrounding climate action decision-making.

The social science value of understanding and responding to climate change is rooted in human, social, political and cultural behaviours, dimensions and contexts, which in turn highlight the interconnections between people and ecosystems, and the dependency of people on ecosystems. Yet these behaviours, as well as social and cultural dimensions and contexts are multi-faceted and complex; they cannot be easily quantified, if at all. Awareness across the natural and climate change sciences is needed to recognise that culture and heritage relate to past and present human interventions, land use and management practices, as well as power dynamics and inequalities, consumption and production patterns, and (un)sustainable practices and behaviours. Social sciences focus on the how and why of the what and where, in terms of climate change impact and action. It also facilitates the amplification of diverse voices. Cultural and social sciences' methods and methodologies, involving forms of monitoring, observing and interpreting, need to be acknowledged as robust evidence within the scientific fields predominantly used in the study of climate change and in deliberative processes surrounding climate action decision-making.

c. Integration of Natural and Cultural Heritage

Heritage is often categorised in silos (i.e. natural, cultural, intangible, tangible) for governance purposes, making the implementation of holistic management approaches (that acknowledge the connection, inseparability and importance of multiple dimensions of heritage) challenging. Indigenous Peoples and local communities' roles in designing, managing and implementing positive change are critical drivers for sustainable ecosystem management; many different Indigenous Peoples and local communities are deeply connected with nature and conceive the human nature relationship as equal and interconnected. The relationship between cultural and natural environments has only recently been increasingly recognised by, for example, organisations such as UNESCO, ICOMOS, IUCN and IPBES, who are addressing this in their work.

More crucial is the missed opportunity in addressing the environment holistically alongside other national priorities: culture and heritage should be an element of decision-making on sustainable building and infrastructure priorities and developments; land use management and governance; agriculture and food security resource efficiency and carbon sequestration; ruralisation/urbanisation; Ecosystem-based Adaptation (EbA)[3]. Barriers to recognise cultural and natural heritage as inseparable are due not to scientific uncertainty, but rather to a lack of political understanding. Diverse actors and groups need more self-determination and local autonomy in these processes. Those involved in culture and heritage, including those understanding the past and the role of diverse actors and groups, can better inform the role and function of traditional practices and management for green and blue infrastructure.

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[3] Note that 'Nature Based Solutions' has been challenged as a term during the WGII approval, leading to the following footnote, "Ecosystem based Adaptation (EbA) is recognised internationally under the Convention on Biological Diversity (CBD14/5). A related concept is Nature-based Solutions (NbS), which includes a broader range of approaches with safeguards, including those that contribute to adaptation and mitigation. The term ' Nature-based Solutions' is widely but not universally used in the scientific literature. The term is the subject of ongoing debate, with concerns that it may lead to the misunderstanding that NbS on its own can provide a global solution to climate change."

KM6:

Knowledge is needed on ways to enhance the culture and heritage sectors' current capacity to contribute to climate change planning.

There is a consensus that cultural institutions and public bodies lack human capacity, training, financing and funding, not to mention the organisational flexibility required to participate in climate change programmes and policies and to incorporate climate change planning explicitly into their existing frameworks and work programmes. The methodological, organisational psychology and other root causes of the non-inclusion of culture and heritage bodies in the formal climate planning needs to be understood better so these roadblocks may be dismantled. **Case Study Box Four** provides an example of how heritage, including built heritage and archaeological sites, was robustly included in national, multi-sectoral climate adaptation planning. The issues around integrating attention to cultural dimensions into institutional climate planning finds a parallel in the incorporation of social sciences in climate science. It also provides an example of how different sectoral plans were considered within heritage planning to facilitate consistency and strategic vision across different sector policies.

KM7:

Future climate management and planning need to incorporate approaches that integrate both natural and cultural heritage (tangible and intangible), which must in turn be informed and incorporated by a range of expertise, particularly from Indigenous Peoples and local communities.

Diverse forms of heritage need to be taken account of across climate and disaster response governance levels, including in political discourse and processes. For example, in Vanuatu, many see cyclones as constituents of their culture, rather than as disasters. As such, categorisations of cyclones and consequential disaster response frameworks become decisions that are imposed from a top-down structure. Interesting conversations are taking place between local communities and disaster managers as local communities continue to insist that they are being forced into a disaster response framework in ways that are not necessarily culturally appropriate, making them feel that their own response mechanisms are ignored (pers. comm., Ballard 2021).

KM8:

Existing knowledge and methods for sustainable ecosystem management are embedded in Indigenous Peoples' and local communities' knowledge systems and practices.

Indigenous Peoples and local communities hold knowledge, expertise and evidence of mutual and equal importance to natural science evidence. Indigenous Peoples and local communities, through generations of understanding and observing natural cycles and patterns, practising independent mechanisms and forms of conservation and protecting ecosystems, are well equipped to produce meaningful and effective options and solutions for transformative change, including social-ecological systems thinking and biocultural approaches. For example, in North Canada the caribou co-management board added previously marginalised voices from caribou-hunting communities; it now comprises individuals representing various Indigenous groups (Inuit, Dene, the First Nation) as majority alongside government agencies, scientists and

Case Study Box 4

Ireland's National Climate Adaptation Framework

Case Study Region: Ireland, Europe

Author: Dr Cathy Daly, Carrig Conservation and University of Lincoln

Ireland's National Climate Adaptation Framework (NAF) is composed of nine sectoral plans, all of which were written using a six-step framework stipulated by the Department of Communications, Climate Action and Environment (2019) – the government department charged with coordinating the NAF. The Built and Archaeological Heritage plan was informed by existing research and incorporated expert stakeholder and public consultation. It also closely considered the other sectoral plans to aid consistency within the NAF and to ensure that cross-cutting issues were highlighted. Of the many potential impacts of climate change, those identified as priorities were flooding (inland and coastal), storm damage, coastal erosion, soil movement (landslip or erosion), changing burial preservation conditions, pests and mould, wildfires and maladaptation.

Goals, objectives and an action plan were developed commensurate with the five-year term of the plan, but also initiating a long-term strategic vision. While the focus of the adaptation action plan was on addressing priority impacts, many capacity building measures address a broader range of effects – an advantage given the uncertainty of climate change. A monitoring strategy was developed to monitor progress, identify problems and inform improvements to the adaptation plan as part of an iterative process. The process of writing the NAP illustrated that climate change adaptation may offer the opportunity to initiate a more holistic approach to heritage policy and governance, including options for inter-sectoral policy alignment.

The process of writing the NAP illustrated that climate change adaptation may offer the opportunity to initiate a more holistic approach to heritage policy and governance, including options for inter-sectoral policy alignment

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Input   **Point of interaction**   **Output**

Scientific Knowledge System

Indigenous Knowledge System

Local Knowledge System
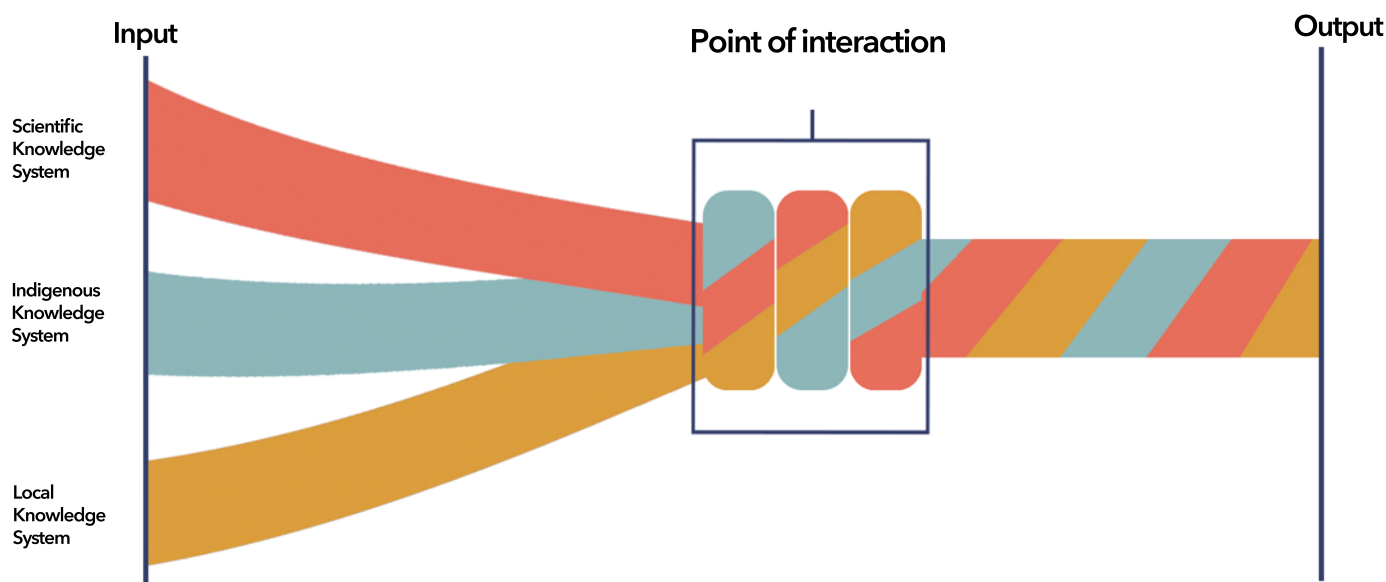
Figure 8: It is important to note that when seeking to utilise the three knowledge systems that the distinctivness of each is recognised, allowing for autonomy of different knowledge systems, rather than integrating them into a single hybrid knowledge system. This will enusre each is considered a complex, integrated whole. This figure represents the concept of 'braided knowledge,' which is commonly used by Indigenous Peoples and local communities, showing how each knowledge system is recognised as a separate entity, but at the same time is interwoven with the other strands to form a stronger whole that would not be possible without each of the strands (Orlove et. al. 2022, Snively and Williams, 2016)

academics. Through knowledge of caribou ecology and behaviours from resource-users with the common goal of safeguarding the caribou population, this co-management model has had successes in the provision of suitable approaches and support to complex systems (pers. comm., Friesen 2021).

KM9:

Advance knowledge of the impact of anthropogenic climate change on oceans and other aquatic environments and its intersection with communities and heritage.

The cultural heritage dimensions of the Ocean, water systems and other aquatic environments are often overlooked. 'The physical, biological and chemical impacts of climate change on cultural heritage located under water and related heritage remain poorly understood, putting heritage (sites) and traditional cultural lifeways (practices) at risk (pers. comm. Underwood, 2021). There is a need for more research into and across water systems, particularly as coastal communities are vulnerable to the impacts of climate change. 'People and communities have long exploited bodies of water such as rivers, lakes, and coasts for access to crucial resources and rich ecosystems, including water', and local knowledge encompasses ways in which existing communities understand their environments and enhance resilience (Morel et al., forthcoming). For example, in the UK, the Coastal and Intertidal Zone Archaeological Network (CITiZAN), CHERISH and SCAPE work with coastal communities across England, Scotland, Wales and Ireland. Working in collaboration, the three projects produced 14 climate heritage short videos to illustrate how understanding coastal communities and environments enhance an understanding of climate change and its impact on coastal and inland communities and settlements – including industries, biodiversity, ecosystems, landscapes and seascapes, building andinfrastructure, food security and more. Case Study Box Five also illustrates how heritage, or fish weirs, provide evidence of sustainable cultural practices and industries, developed through local knowledge of the environment and opportunities.

Indigenous People, Traditional Ecological Knowledge and Climate Change: The Iconic Underwater Cultural Heritage of Stone Tidal Weirs

Case Study Region: Japan, East Asia

Author: Akifumi Iwabuchi – Tokyo University of Marine Science and Technology
[UNESCO UNITWIN Network for Underwater Archaeology]

The underwater cultural heritage of stone tidal weirs is incredibly vulnerable to the impacts of climate change. If the sea level rises more than one metre, these traditional pieces of architecture and a form of knowledge system no longer function as a viable fish trap. Furthermore, once they are damaged by destructive storms or high waves, now more frequent, most coastal communities are unable to mend or reconstruct them, leaving them abandoned. In certain communities, tidal weirs play an important role as eco-friendly fishing gear; they help to sustain marine biodiversity and cultural diversity, and also serve as a tourist attraction which in turn has led to revival movements. For example, Hainan Island used to have many stone tidal weirs. Despite their deterioration, the adaptation and utilisation of traditional ecological knowledge, expressed through traditional songs, illustrates how this heritage is still relevant. The lunar tidal calendar is still used for fishing inside stone tidal weirs, passed down through generations by islanders, and a few communities have taken advantage of the tide cycles which divert stone tidal weirs to fishponds. Such resilience and adaptation in coastal communities has also been observed in the Hawaiian Islands, which have similar stone tidal weirs and fishponds.

Despite their deterioration, the adaptation and utilisation of traditional ecological knowledge, expressed through traditional songs, illustrates how this heritage is still relevant.

Yet, through a combination of environmental changes and modern coastal developments, such weirs are on the verge of disappearing, often without being studied further nor safeguarded by local and central governments.

Stone tidal weirs in the Peng hu Islands © A. Iwabuchi

Local utilising tidal weirs in the Fujian Province © A. Iwabuchi

d.   The Domain of Intellectual Property Rights

There is an ongoing movement to provide better protections under international systems for Intellectual Property Rights (IPR). Rules or provisions relating to IPRs must provide international legal instruments that recognise the rights of Indigenous Peoples and local communities to their knowledge, resources, expressions, creativity and innovation; they empower and enable all diverse actors to have sovereignty of their own intellectual property. Many established research organisations continue to use unethical and inappropriate methods of collaboration with diverse actors, including Indigenous Peoples and local communities. Trade-Related Aspects of Intellectual Property Rights, known as TRIPS, can also have negative impacts on the environment, food security, human health, biodiversity, livelihoods and other rights, and thus require equal and fair representation and deliberation.

KM10:

Effective approaches (e.g. access and benefit-sharing systems) are needed to ensure the recognition, contribution and rights of knowledge and resources, particularly from Indigenous Peoples and local communities, and to ensure that these are not misappropriated, misrepresented or used out of context nor appropriated in ways that they have not allowed (i.e. commercialisation or through private ownership).

It is important that free, prior and informed consent is given for access and use of knowledge systems, and that cultural and traditional intellectual property is properly protected to ensure self-determination, cultural integrity, respect and protection of rights, including cultural rights. This includes gathering, storing, patenting and using literary, performing and artistic works; languages; types of knowledge (including spiritual knowledge); cultural heritage (both tangible and intangible); ancestral remains and genetic material; culturally-relevant or environmental resources; heritage of significance; and other documentation. When in pursuit of collaborative research/work between knowledge systems, it is critical to be clear on data-sharing and benefit-sharing agreements so that IPRs are maintained, consent is transparent and groups (e.g. Indigenous Peoples and local communities) are not disadvantaged in any way by giving or having their knowledge used, misused or abused. Indigenous Peoples and local communities must benefit tangibly from it, including through capacity building/strengthening, development planning and sharing information into their systems. For example, in Australia, integration of knowledge systems for management of the Great Barrier Reef includes key discussions on data-sharing agreements and maintaining IPRs to disclosed knowledge. There is a requirement for meaningful consultation and to be upfront and transparent about consent. As an example of potential outcomes from this, work is being done in Australia to develop a standalone piece of legislation for Indigenous IPRs that is distinct from the general intellectual property (pers. comms. Grant, 2021).

When in pursuit of collaborative research/work between knowledge systems, it is critical to be clear on data-sharing and benefit-sharing agreements so that IPRs are maintained, consent is transparent and groups (e.g. Indigenous Peoples and local communities) are not disadvantaged in any way by giving or having their knowledge used, misused or abused.

KM11:

Mutual respect, synergies and collaboration between diverse actors from different knowledge systems, fields of study, perspectives and approaches are crucial elements of an urgent enabler of effective climate action.

Working across barriers will help to build trust and create a space for reconciliation between diverse actors, many of whom have been historically excluded from decision-making processes despite acting as effective stewards of ecosystems. Historical and institutional biases have limited, and continue to limit, the capacity of local institutions, diverse actors and different sectors, including in the areas of climate response and disaster preparedness. For example, currently in Australia, a collaborative project – Healthy Country Ai – is being undertaken between Aboriginal co-researchers and Indigenous rangers, the global corporation Microsoft, the UNESCO World Heritage site Kakadu Board of Management and Australia's national science agency CSIRO, featuring researchers from the Northern Australia National Environment Science Program (NESP), the University of Western Australia (UWA) and Charles Darwin University (CDU). The goal is to support better decision-making to care for significant species and habitats on Indigenous lands. Large quantities of drone data, collected by Aboriginal land managers, are combined with scientific research and Indigenous ecological knowledge. These data inputs are interpreted by artificial intelligence to provide real time insights for the Indigenous rangers who manage the park (pers. comms. Gorring, 2021).

e.   Advancements in Action-Oriented Climate Heritage Practice and Research

Adaptation and mitigation policies, community development strategies and heritage research itself are better informed by knowledge and practices generated through collaborative interventions that also benefit communities. Those involved in culture and heritage, including understanding the past, are well positioned to help better collate a range of observations, data and approaches that can feed into modelling and responses. They can also help identify, address and overcome research and regional biases and issues of accessibility to data and knowledge, as well as highlighting alternative forms of evidence. Heritage-orientated climate action and research (see Part I) provide necessary forms of participation and collaboration which can open pathways towards new forms of mutual respect and new forms of governance. These changes will ensure that research and data are conducted through co-production rather than extractive and unethical methods.

KM12:

More work is needed to ensure that climate change research takes a broader view of evidence, including the need to acknowledge and integrate diverse methods of research.

This includes evidence of change and adaptability recorded in the deep past, accessible through archaeology and geoarchaeology. Through participatory approaches to research, the potential exists to explore whether existing knowledge systems are suitable and relevant to today's changing and evolving landscapes and seascapes, and how continuously adaptive traditional management systems, rooted in values and experiences, are responding to changing climate. There is a need to understand better how climate change adds to and interacts with a number of previously existing vulnerabilities affecting Indigenous Peoples and local communities, and to recognise Indigenous and local knowledge systems on an equal

footing to science for transformative change. At the same time it should be recognised that heritage science approaches, in recent years, have embraced citizen science and crowdsourcing – and have developed robust, community-led approaches to understanding climate change.

KM13:

To improve pathways towards transformative change, new knowledge is needed on how and why scientific biases and prejudices have existed and continue to exist.

Documenting biases (including of standard methods used and of acknowledging positionality) helps to address legacies of mistrust across disciplinary, social, cultural, political and community-based groups. Biases, for example, are also reflected in how knowledge is cited and acknowledged, and in the use of peer-reviewed expertise versus non-peer-reviewed expertise (e.g. custodians of traditional knowledge). Education, in turn, can also reinforce biases, and thus has a key role in reviewing and reformulating the systems through which such biases are transmitted. These biases obstruct the wider use of humans' adaptation potential and cultural heritage resources in scientific evidence of a changing climate. Non-instrumental, qualitative and quantitative data observed or evidenced by Indigenous and local communities remain underused in understanding and communicating about climate change. **Case Study Box Six** illustrates the highly specialised expertise, knowledge and skills that the Indigenous Peoples of California have in relation to their environment and observed climate changes. The study also reveals how existing methods are used for, in this case, oak preservation.

f.   Inequalities, Marginalisation and Climate Justice

Culture, heritage and climate change are all strongly linked to issues and concerns around justice and equity. Causes of climate change, and human and ecosystem breakdown, are exacerbated by socio-political inequalities and the marginalisation, or exclusion, of diverse actors. Those involved in culture and heritage, including understanding the past, bring essential insights and toolkits to help better explain, explore and address climate change and historic inequalities and injustices. These include injustices caused by differential treatments of diverse cultures, heritage and knowledge systems and the ways in which these intersect with both vulnerability to climate change impacts and adoption of low carbon and/or circular economy-based lifestyles.

KM14:

Co-developed reconciliation efforts and approaches are needed to identify and promote mechanisms and practices to overcome the suppression of voices and rights of diverse groups.

Many extractive economies responsible for environmental degradation continue today, which causes high vulnerability, and are influenced by "historical and ongoing patterns of inequity such as colonialism and capitalism" (IPCC, 2022; 4.3.8). They are oppressive in that they enable processes which actively repress the ability of Indigenous Peoples and local communities to access, practice and nurture their own ways of knowing and being. This has led local communities and others to abandon traditional knowledge and practices that are valuable for mitigation, climate adaptation and for developing resilience, as well as practices for use when adaptation capacities are overwhelmed.

Climate Change and California Indians: Oaks, Fire and Drought

Case Study Region: South West US, North America

Author: William Carmen, Indigenous Knowledge Holder/ Pasqua Yaqui)

Droughts are the most important climatic influence in the Southwest US. Tree ring studies in California indicate that the past century was among the wettest of the last 7,000 years – and, naturally, our current cities, farming, infrastructure and water usage are based upon these most recent 'wet' conditions. Recently we have experienced short periodic droughts, but severe megadroughts in the ninth, twelfth, thirteenth and sixteenth centuries lasted decades. Megadroughts disrupted Native American cultures – some less than others – and provide insight on how we may adapt (or not) to future hotter and drier conditions. Oaks are a keystone of tribal culture and traditions in California; they cover approximately 13 million acres. Indigenous peoples evolved highly specialised traditions for grove stewardship, acorn harvest and storage, and the labour-intensive, multi-step processing required to make them edible. Climate change (warmer temperatures, less water availability, extended extreme droughts) will reduce but not eliminate acorn production, but it will negatively impact oak distribution, recruitment and health (Carmen et al., 1987). There will be an overall loss in oak habitat extent with some species displacing others.

Already threatened by habitat fragmentation, disease and lack of regeneration, traditional fire practices may play a role in oak conservation (Long et al., 2016). Indians learned to live in fire-prone environments and to shape these ecosystems with cultural fire for their benefit; they employed sophisticated practices to ensure availability of food and game, medicinal plants and myriad wildland products such as for basket weaving (Lake, 2021). For example, local Wintu and Pit River people used cultural low-intensity fire to improve acorn production and to enhance deer and elk populations. Recent studies have found that burning stands in January increased the acorn crop compared to unburned areas. The Jemez Pueblo people also used 27 fire practices relative to the domestic, village, agricultural and larger forest landscape (Roos et al., 2021).

Conceptual Map of how Jemez Pueblo peiople are using fire relatice to different social landscapes (Roos et al., 20221, 4)

Government interest in traditional burning has focused most on controlled burns to prevent large, destructive, high-intensity fires, especially in the wildland urban interface. Recent, but small-scale, agreements between the US Forest Service and tribal communities are the first steps in the use of traditional fire knowledge and practice to improve and protect forest ecosystems and infrastructure. However, this is still a difficult process, as people fear fire escaping and do not like the hazardous air quality impacts from smoke; many also have the idea that burning wildlands only increases carbon emissions. However, we must realise that California ecosystems are fire adapted, and so must we be – again. Adaptation will involve reorienting our approach to the environment from one of utilitarian exploitation. A mutualist rather than exploitative relationship with nature is the key.

These pressures, including those from policies, also limit the transmission of languages – Indigenous and others – and so contribute to language loss. This is seen, for example, in certain places where traditional agriculture lacks resources to support it, leading to abandonment of traditional practices due to financial pressures. Both sustainable practices that support climate action by promoting agricultural and cultural diversity, including and traditional practices, that support biodiversity must therefore be incentivised and rewarded in some way. For example, existing mechanisms and practices can be included in frameworks such as agricultural considerations, so that traditional systems in place that promote biodiversity are better supported (pers. comms. Fuller, 2021).

Both sustainable practices that support climate action by promoting agricultural diversity and traditional practices that support biodiversity must therefore be incentivised and rewarded in some way. For example, existing mechanisms and practices can be included in frameworks such as agricultural considerations, so that traditional systems in place that promote biodiversity are better supported (pers. comms. Fuller, 2021).

KM15:

Monitor approaches that involve, empower and partner with diverse actors (Indigenous Peoples and local communities, researchers, practitioners) within government departments to ensure their diverse decision-making processes remain included in climate action planning.

While there is an effort to improve the representation of diverse voices, barriers for inclusion involve strict and rigid structures to participate, inaccessible funding programmes, fixed policy cycles and timeframes and inflexible mechanisms, all of which disable meaningful involvement from diverse actors. The lack of mechanisms and competencies across government departments create barriers so that Indigenous and local knowledge holders are unable to access and communicate with upper levels of government. For example, in countries such as Mexico, the need to rebuild trust between local communities and government or research institutions is vital; local governments currently have little incentive to engage with climate change concerns, making it difficult for local communities to engage and voice the scale and scope of climate change impact (pers. comms. Mora Navarro, 2021). Those involved in culture and heritage, including understanding the past, remain excluded from policies presumed to be separate from culture and heritage issues. However, a consideration of culture and heritage can facilitate the implementation of climate change responses and mechanisms for more appropriate management frameworks i.e. for land use.

KM16:

New knowledge is needed for a nuanced and place-based understanding of cultural loss, economic inequalities and injustice brought about by migration and relocation, whether that constitutes planned retreat, displacement, climate-related disasters, conflicts or emergencies.

The trauma that people experience due to migration, relocation and displacement is long-lasting and has multiple layers, for example separation from territories and loss of cultural heritage, solastalgia and other forms of eco-anxiety related to separation from communities, culture and heritage. However, providing the tools for communities to recreate themselves has clear benefits: 'the physical touchstones of heritage, particularly that of the cultural landscape of "home" can mitigate the long-term effects of migration-related

trauma, as well as the loss of ontological security' (pers. comm, Brabec, 2021). For example, the national government of Fiji published relocation guidelines in 2019, emphasising the importance of community leadership and household participation in the decision-making process. However, relocation is complex. Numerous challenges are evident in balancing the economic impact of climate change with the intangible cultural value that Indigenous Fijians have with the land on which their ancestors have lived for generations. The ability in practice to balance the potential risks and value of cultural heritage has proven to be place-based for each of the four villagesrelocated in Fiji (pers. comm. Forgesson, 2022).
.

Climate Hazards and Stressors   Possible Reponses

Slow onset

Sea level rise or coastal erosion

Water scarcity and lower crop productivity

Migration on long term basis

Stay and Adapt

Slow/Medium onset

Consistent drought and heat stress

Displacement

Sudden onset

Storm surges, floods and other natural disasters

Migrate on cyclical or temporary basis

Heritage Impact

Loss of key natural spaces

Damage to urban centres and historic buildings

Loss of traditional practices and key cultural relationships

Loss of place attachment and cultural and social instability

Figure 9: Breakdown of possible impact of climate stessros and hazards on migration and displacement

g.   The Capacity to Learn from the Past

Past narratives are neither static nor a fixed series of events, but rather involve active and socio-political negotiations with the present. They also relate to historic continuity of knowledge based on interactions with the environment, exercised in the present. Furthermore, the capacity to learn from any example, whether linked to the past or not, is related to a range of variables which can dictate the relevance and appropriateness of using diverse approaches within different contexts. These variables include: diversity of regions; economic, political and cultural histories and conflicts of territories; degree of distinct connections with surrounding nature, natural resources and ecosystems; social, political and economic systems and their capacities and stability; relationship and access to culture, belief systems, knowledge systems, world views and languages; access to traditional knowledge. It is important to explore more critically the use and relevance of past adaptation for today, while recognising that tomorrow will be very different and may exceed adaptation capacity. There are general lessons to be learned, for example, about factors that made past societies more resilient in the face of climate change, although each case may need to be understood in its particular context.

KM17:

New knowledge is needed to increase understanding of the opportunities and challenges in how different knowledge systems have responded, and are responding, to climate change.

All knowledge systems have different means and ways in which they observe, interpret, understand and respond to climate change. It is important to be respectful of these approaches and to increase awareness and understanding of how each view can comprehend and respond to the unprecedented scale, scope and speed of climate change. The past can enhance understanding of how human intervention impacts surroundings and environments, and how built environments, landscapes and seascapes have been managed and manipulated by people of the past. Lessons related to trade-offs, co-benefits and potential adaptation or maladaptation are useful in understanding how different interventions may impact communities and their culture and heritage in different ways. **Case Study Box Seven** below illustrates how the Hani, one of the most marginalised and poorest hill tribe groups in East Asia, maintain traditional practices that enable climate resilience. Such practices are passed down through generations by ancient songs that record knowledge of ethnic migration, skills and worship.

Use of Local Knowledge in the Adaptation of the Cultural Landscape of Honghe Hani Rice Terraces

Case Study Region: Yunnan Province/China, East Asia

Author: Rouran Zhang/Shenzhen University/ICOMOS China

The Cultural Landscape of Honghe Hani Rice Terraces is composed of a traditional 'forest-village-terraces-water' system. It is a combination of agriculture, forestry and water distribution, as well as a 'living' socio-economic and religious system that is unique. In this system, the forest at the top of the mountain is used by local people as a 'sacred forest' to store rainwater. The water is then channelled through an elaborate drainage system to each village, where it flows into the terraces below the village and finally into the river. This system has been developed over 1300 years of agricultural practices and subsequently passed from generation to generation. It consists of a system of ditches managed by only a few villagers called Gangouren 赶沟人, chosen by the entire village.

The core of the system is called 'wood carving and water distribution', meaning that a horizontal wood or stone is placed at the end of the ditch. The Gangouren then cut slots in the wood according to the actual amount of water needed by each terraced field. Because of its unique 'forest-village-terraces-water' system, these agricultural practices have proved to have good water-holding and regulating functions.

...good illustration of how traditional management methods can be most effectively supported as they contribute to climate adaptation and resilience.

Between 2008 and 2012 the Yunnan province suffered from a rare five-year period of drought, but the Hani terraced fields still maintained good production functions. This indicates that the Hani Rice Terraces have the potential to be highly resilient to climate change. It is a good illustration of how traditional management methods can be most effectively supported as they contribute to climate adaptation and resilience. The survival of these systems also comes from traditional beliefs well established in the area. Hani villagers believe that the biodiversity of the forest behind the village is inhabited by the mountain god. The annual sacrifice to the forest is thus an important part of the Hani people's unique landmark festival, 'the Angmatu Festival (昂玛突节)', a manifestation of the Hani people's ancient ecological culture. The villages themselves were also selected and constructed through consultation conducted with 'Hani ancient songs 哈尼古歌'. Such songs record the Hani people's knowledge of ethnic migration, production skills and worship; they are called the 'wordless encyclopaedia' of the Hani people.

Cultural Landscape of Honghe Hani Rice Terraces © R. Zhang

Example of the Gangouren managing the ditches © R. Zhang

KM18:

Further research and practice are needed to understand whether local successes can work on a larger scale or in different localities, and what trade-offs sustainability practices might involve (for national, regional, local, traditional or Indigenous contexts).

The presence of cultural elements raises questions about the transferability/scalability of both adaptation and mitigation measures. For example, the IPCC Working Group III report, Climate Change 2022: Mitigation of Climate Change, contains an example related to how past energy shocks and the experience of the COVID-19 pandemic influenced the cyclability of cities.   Examining historical transitions to cycling across European cities, Oldenziel et al. (2016) found contextual factors including specific configurations of actors to lead to very different outcomes. Kraus and Koch (2021) found a short-term social shock (i.e. the COVID-19 crisis) to lead to differential increases in cycling behaviour, contingent on other enabling conditions. Climate change impacts and cascading impacts also affect different regions in different ways, while also occuring across a range of timescales or periods of time for different regions. For example, rising temperatures or rising sea levels in one region or community may initiate different responses, and so give rise to different experiences, than another region or community facing the same impact. Different communities recognise exposure, risk and impact – or human- and ecosystem-tipping points – in different ways. Impact severity is dependent on location, perspective and approach of individual communities, including their adaptive capacity. That said, historic evidence for the existence of tipping points and frequencies of change in climate systems, social systems and coupled socio-natural systems may help us to identify approaching tipping points in contemporary (local) societies. Analyses of how past societies have responded to or interacted with climate change, in ways that demonstrate relevance to projecting how contemporary societies may respond to or interact with climate change and experience adaptation limits, should be encouraged. Priority should be given to determining how best to accomplish this – for example, through explicit consideration of factors differentiating modern from past societies (such as population size, governance structures, available resources and technology) and through using protocols that include such factors as covariates in analysing databases that encompass both past and present social trajectories.

KM19:

While current anthropogenic climate change appears to be unprecedented, a deeper understanding of observed human and ecological system interactions are valuable to helping address and predict climate-related issues.

The capacity to understand, observe, monitor, tell stories about, name and personify, and/or respond to climate change may be embedded in localities, particularly for Indigenous Peoples and local communities. However, more understanding on what relationships are being observed and used can help us better to understand climate indicators for future predictions. For example, calendrical systems are based on observing and understanding relationships within ecosystems. In Australia, Aboriginals and Torres Strait Islanders develop seasonal calendars based on their unique lands and territories. In particular they rely on a flowering plant to indicate that there is a certain fish available (pers. comms. Grant, 2021) thus recognising connectedness within ecosystems. Similarly in Bangladesh, a Bengali calendar known as 'Fasli San', used by farmers since 1584, helps them to maintain and cultivate their lands properly for crops. These calendars use indicators to understand climate and changes. However, over the last 5 to 10 years these calendars have become no longer accurate; the seasons have changed from six to three, and further adjustments are

required due to accelerated and anthropogenic changes in climate (short winter and prolonged summer and rainy seasons). The 'Fasli San' calendars nonetheless capture the relationship that underpins human and ecological systems (pers. comms. Darain, 2021).

KM20:

We need to explore past emergency preparedness initiatives critically in order to learn from both successful and unsuccessful practices to cope with natural hazards.

This involves critically analysing 1) the response phase after a natural disaster (emergency period and relief period); 2) the recovery phase (including restoration of public services (infrastructure); 3) the structural and non-structural measures adopted in the past disaster prevention phases; 4) the past preparedness phase (e.g. disaster planning, early warning systems that were adopted, logistical planning to rescue movable culture and heritage, emergency drills). In Nepal, for example, extensive work is being done to explore past adaptation of post seismic activities and disasters – a project that has immediate lessons for increasing the challenges brought on by climate change (interdisciplinary research and practice teams, integration of 'scientific' and traditional/ Indigenous knowledge systems). The core issue is how to best share, disseminate and scale the lessons that have been learned from past adaptation methods (pers. comms. Coningham, 2021). This is further explained in **Case Study Box Eight.**

2. Key Topical Knowledge Gaps and Action Items

This section outlines topical research and practice areas where the availability of more evidence-based knowledge would assist actors, operators and decision-makers (e.g. politicians, practitioners, community leaders) to engage more effectively with the cultural and heritage dimensions of climate change and the responses to it. This includes areas in which relevant cultural and heritage knowledge already exists but is not consistently being acted upon, nor included in climate planning. Such areas indicate the existence of 'implementation gaps' which themselves need to be better understood.

Case Study Box 8

Can We Rebuild the Kasthamandap?
Disaster Management in Nepal

Case Study Region: Nepal, South Asia

Author: Robin Coningham, UNESCO Chair, Durham University, UK/ Mr Kai Weise – ICOMOS (Nepal)

Disasters, human or natural, very often overwhelm planned responses, a situation that in turn compromises heritage research and protection agendas. This leads to any planned mitigation practices and interventions being somewhat alienating for local communities and Indigenous practitioners. In such environments, archaeology and heritage science, although infrequently mobilised, are uniquely placed to assist in providing a fuller understanding of the impact of climate change on urban infrastructure in the past; they also facilitate reflection on lessons of adaptation and resilience for modern cities and their inhabitants.

Building on North–South partnerships, an interdisciplinary and collaborative research programme has integrated archaeology, geoarchaeology, 3D visualisation, geotechnical and structural engineering with architects and artisans to co-produce and disseminate novel methodologies to characterise environmental adaptation within Kathmandu's historic urban infrastructure. Through analysing and sequencing soil profiles from monument foundations, and assessing their interlinkages with superstructures, we were able to identify why selected monuments failed and how they could be reconstructed. In so doing we drew on traditional methods to preserve intangible values while minimising risk from future environmental disasters. In particular, our project guided the US$1 million reconstruction of the Kasthamandap in Kathmandu. It involved close collaboration between researchers and artisans to translate findings between 'scientific' and 'Indigenous knowledge' domains. This led to further discussions on improving the status of artisans and the official procedures for them to be involved in contracting and restoration projects – bridging between those domains. In the process we reframed how archaeology and heritage science can play a greater role in future sustainable urban planning – and in the move of practitioners from observation to action.

> ...archaeology and heritage science, although infrequently mobilised, are uniquely placed to assist in providing a fuller understanding of the impact of climate change on urban infrastructure in the past; they also facilitate reflection on lessons of adaptation and resilience for modern cities and their inhabitants.

a. Culture, Heritage and Loss and Damage

The ways in which people perceive, understand and react to the risk of climate impacts are informed and modulated by culture and heritage in complex ways. Intersecting cultural considerations (e.g. attitudes about equality and mobility practices) and "historical and ongoing process of colonialism and capitalism" (IPCC, 2022; 4.3.8) relevant to land and water use and management, can reduce or increase the vulnerability of people and ecosystems to climate change. These considerations inform the recognition, identification, measurement and valuation of the scope and scale of losses and damages across both natural and human systems. In understanding loss and damage, there is a need to explore the scale and availability of relevant data to address climate change impact in both past and contemporary settings, and to work to coordinate the perspectives of the heritage community. The possibility of valuing losses and damages to culture and heritage themselves has important implications for the legal and political Loss and Damage debate. The culture and heritage dimensions of concepts such as risk, vulnerability, losses and damages have important consequences for the design and implementation of corresponding climate response measurers. The experience of losses and damages of cultural resources may intersect not only with the recognition of loss but also with human agency to respond to loss, influencing the measurers adopted to cope and rebuild.

Figure 10: Infrographic of the possible loss and damage to heritage brought about by climate change. Adapted from McNamara et. al. 2021

KM21:

Elaboration of approaches to valuing 'Loss and Damage' to culture and heritage is essential.

Loss can, and does, include cultural practices, traditions, places and traditional knowledge systems, sometimes referred to as 'Non-Economic Loss'. Loss of language can bring with it a corresponding loss of knowledge relative to sustainable practices. There is a need to recognise the absence of agreed and shared concepts of heritage and cultural capital and value, and the ways in which this impacts the development of strategies for addressing Non-Economic Loss. Methodologies for accounting for Loss and Damage to culture need to be addressed, but so do the consequences of conceiving of culture and heritage in economic terms. The absence of agreed and shared concepts and understandings of heritage and cultural capital and value across communities, and how this impacts the safeguarding of culture and heritage, is difficult to value in economic terms. Further exploration is also needed of the accepted degree of change and loss as defined by each local community, as the current parameters of accepted change are often imposed by outside experts. Those involved in culture and heritage, including understanding the past, can help to explore appropriate methodologies, including the consequences of valuing culture and heritage in economic terms. They can also to facilitate the learning from, and valuing the shared experiences of, communities affected by migration, displacement and/or relocation (including from disaster or catastrophe). In so doing they help to provide better understanding of the cultural dimensions involved in recognising loss and damage, and the ways in which these affect the development and prioritisation of responses.

KM22:

In order to reduce risk to culture and heritage, a better understanding of their relation to climate impacts, exposure and vulnerability is needed.

At present, there is no systematic assessment of the range of heritage types (e.g. natural, cultural, tangible, intangible) at risk from climate change, nor of the range and severity of climate impact drivers, nor of losses and damages to heritage from climate change. More work is needed to understand how hazards affect cultural heritage at the site level, including integration of physical, socio-economic and cultural vulnerability and exposure of individual sites (Simpson et al., 2022). Revised or new methods are needed to assess the vulnerability of heritage, including heritage values, to a range of climate scenarios and corresponding severity, distribution and scope of climate change impacts, particularly for Indigenous Peoples and local communities. Climate change responses may also put culture and heritage at more risk, as a result of maladaptation and climate mal-mitigation[4]; the monitoring and evaluation of outcomes is therefore critical. These new methods must address the broader consequences of impacts to heritage on associated communities, as well as how to manage loss and damage and the roles and responsibilities of managers/decision-makers for sites, protected areas or landscapes. Research projects across the world are now beginning to explore how to best to understand, articulate and manage loss. For example, the 'Landscapes Futures' project led by the University of Exeter has developed the idea of 'adaptive release' as a conceptual framework, enabling decisions to accommodate decline or loss of heritage (pers. comms. Fluck, 2021).

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[4] Use and definition of malmitigation is taken from IPCC report: https://www.ipcc.ch/site/assets/uploads/sites/2/2019/02/SR15_Chapter1_Low_Res.pdf. It states that 'Mal-mitigation includes changes that could reduce emissions in the short-term but could lock in technology choices or practices that include significant trade-offs for effectiveness of future adaptation and other forms of mitigation' (Allen et. al. 2018)
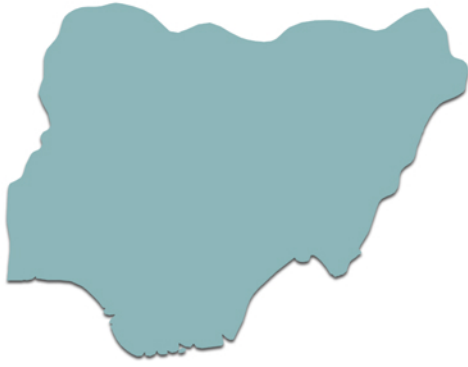
Local and Indigenous Knowledge of Coastal Systems in Ogun, Nigeria

Case Study Region: Nigera, West Africa

Author: Professor Ibidun Adelekan/University of Ibadan, Ibadan, Nigeria

The Ogun coastal stretch in southwest Nigeria is an area that is continuously subject to severe flooding. This is due to heavy rainfall and an increased frequency and intensity of storm surges during the wet season months. Fishing communities have lived along this coastline for over 200 years; at present there are 24 fishing villages which are home to over 30,000 inhabitants. They are currently considered highly marginalised, lacking basic infrastructure and services including all-weather roads, electricity, portable water supply and adequate health facilities.

Due to these increased climatic phenomena, local communities are inundated by floodwater for a greater part of the wet season. For example, the increase in rainfall has caused water bodies (rivers and beel wetlands) in the coastal area to overflow into community settlements and surrounding lands. This has led to socio-economic activities, including the movement of people, fish processing and marketing, being greatly challenged. In the past, dredging of beels around communities to drain flood waters into the sea was undertaken three times at most in a wet season. By 2007 these activities were being performed over five times every two months. However, many communities are still not included within broader governance and development processes, which hampers their access to appropriate facilities and further compounds their isolation with other communities and neighbouring cities.

Example of beels created by locals to drain flood water © I. Adelekan

This, in turn, has jeopardised their ability and platform to bring forward solutions and lessons learned, from skills acquired through a deep understanding of nature-based solutions and the environment around them. Some localised household adaptation strategies have been deployed to cope with increased flooding; these include construction of new dwelling units every three to five years, annual reinforcement of the superstructure of houses and the use of local herbs and homemade remedies for the treatment of climate and flood-related ailments. Other comunity measures adopted include the building of flood bridges within and out of communities to help aid

Impact of flooding on coastal community © I. Adelekan

movement, the channelling of water from beels into the Atlantic Ocean to facilitate draining of floodwaters within communities, sand filling of road tracks and the movement of communities closer to the sea (Adelekan and Fregene 2015).

KM23:

New methods to better understand how diverse actors have different views and perspectives on loss and damage are essential to acknowledge different perceptions of risk, as well as forms of loss and damage.

While climate change puts culture and heritage at risk, there is also potential for culture and heritage to be used as a resource to improve risk assessment and climate response for communities at large. There is also a need to address outcome biases in risk and vulnerability assessments which ignore community-led approaches and fail to take account of world views, values, practices and preferences of diverse actors, including Indigenous Peoples and local communities. Because meaningful inclusion (e.g. through consultations, consent and other means) is often missing from risk and vulnerability assessments, the scale, scope and impact of climate change on Indigenous Peoples and local communities are not properly acknowledged by policy-makers, nor in climate change literature. Those involved in culture and heritage, including understanding the past, can address these gaps through culture and heritage methodologies and processes, and by acknowledging and including a plurality of values in assessments. **Case Study Box Nine** illustrates how this exclusion might impact communities, as demonstrated through the Ogus coastal stretch of Nigeria.

KM24:

A better understanding is needed of how to value and incorporate information about climate impacts embedded in communities into local, national and sectoral climate decision-making processes.

...communities experiencing these impacts are often able to provide relevant knowledge, observations and documentation of change, for instance by using citizen science methods and techniques ranging from oral traditions or photographic evidence to ages of trees or levels of constructions built on top of one another over time.

Many places do not have the resources (e.g. infrastructure, technology, funding, human resources and /or capacity) to monitor or document climate change impacts. However, communities experiencing these impacts are often able to provide relevant knowledge, observations and documentation of change, for instance by using citizen science methods and techniques ranging from oral traditions or photographic evidence to ages of trees or levels of constructions built on top of one another over time. Well-known heritage sites and familiar rituals and traditions can provide valuable baselines for observing change. Community-based schemes of observation can have the added benefit of mobilising residents and enhancing an understanding of urgency. These benefits have been documented, but such schemes have not been incorporated at scale in local, regional and national climate planning. For example, Indigenous Peoples are acutely aware of impacts of climate change, but consider it in the context of a much longer time span and imbued with the memory of past events. For some, adapting to climate changing may not be seen as an issue because they have done it in the past. However, for each circumstance new ways of adapting may be required; these can only be defined by the cultural group itself, since the objective is to preserve their culture. Government programmes may be a) assessing an impact when Indigenous cultures may not see it that way and b) looking at complex

solutions when the preferred option for Indigenous cultures may be a more straightforward one (pers. comms. Rivet, 2021).

KM25:

An integrated approach for how best to involve and include individuals and communities (including diverse actors such as Indigenous Peoples and local communities) as equal stakeholders in climate change risk assessments and climate change response planning is vital for improved resilience.

Traditional knowledge holders, as well as researchers and practitioners that work with communities and their culture and heritage, are equipped with insights and approaches that can help to address diversity, inclusion, exclusion, historical tensions and conflicts, participation and respect for values. Further research on the use of these approaches can help to empower communities, particularly Indigenous Peoples and local communities, thus strengthening their voices, decision-making powers and capacity to respond to risk. Exogenous and non-inclusive approaches to culture and heritage can have the opposite impact, however, and their ongoing use needs to be addressed. For example, in Mali and Burkina Faso the Dogon country stretches across 400,000 hectares of the Mopti Region. It is home to 289 villages of mainly Dogon people who have a close relationship with their environment. The cultural landscape 'Cliff of Bandiagara' (Land of the Dogons) was nominated by the State Party of Mali and inscribed in 1989 as a World Heritage property, but only a few of the 289 villages were proposed within the boundaries of the World Heritage property. This exclusion of all other villages and communities have made already fraught relationships between communities even more conflictual, which disrupts community resilience (pers. comms. Chundu, 2021).

KM26:

A holistic approach to risk and risk management is needed through the involvement of communities where climate change impacts might otherwise be overlooked or ignored due to low occurrences of extreme climate events or lack of cultural indicators to assess impact.

Greater consideration of cultural and heritage dimensions of systemic risk and the interplay of physical hazards and cascading impacts across multiple scales is required. Risk and cascading impacts take different forms and affect communities in different ways. They can occur alongside climate-related hazards or emerge as a consequence of them. They include: economic migration leading to the loss of knowledge holders and/or traditional practices; food insecurity in one region as a consequence of water management decisions in another; increased vulnerability due to cultural gender practices; and so on. These impacts are often not accounted for in assessing climate risk (including risk to heritage sites). Losses and damages to cultural resources in turn affect climate vulnerability in iterative ways that also need to be better understood. For example, loss of iconic heritage places can impact identity and social cohesion. Both climate impacts and response measures, as well as intersecting processes such as 'development', can enable or disrupt knowledge systems and undermine adaptive capacity. In Grand Pré, Nova Scotia, the landscape may be subject to change and engineering solutions may be found to adapt the structural elements. However, this does not account for the potential disappearance of critical cultural and/or heritage elements of the landscape that are directly related to the collective memory of the Acadians (pers. comm. Rivet, 2022). **Case Study Box Ten** highlights how the challenges brought on by water management alongside other climate change responses have empowered women in community decision-making and management.

Case Study Box 10

Empowerment of Women in Rural Sri Lanka

Case Study Region: Sri Lanka, South Asia

Author: Dr Dulma Karunarathna, Centre for Asia Pacific Initiative, University of Victoria, Canada

In rural Sri Lanka, a series of ambitious projects has led to the construction of large- and small-scale tanks and canals, interconnected within a catchment of the dry zone. These developments help to harness both monsoon rains and seasonal rain waters, offering a solution to variations in weather and climate. They have in turn led to thousands of small village tank cascade systems being scattered across the country, built through their collective patronage. These 'village cultures' – developed in and around water – have become inextricably linked to their physical environment. In establishing a bio-cultural environment at the heart of village cultures, they reflect a harmonious connection between culture and nature.

Work done with these communities has also predominantly viewed environmental folklore and traditional knowledge systems as valuable cultural heritage assets for climate change adaptation (AH/V006371/1 CRITICAL project) . Folk songs, folk stories and the cultural memory of villagers were collected as primary data, covering all provinces of Sri Lanka. Focus was also given to the role of women in the response to extreme weather events and climate change. Women contribute towards the livelihood of the villages through a range of gendered socio-economic roles; these include paddy cultivation, harvesting, protecting cultivated land, seed conservation, pest control, animal rearing, food gathering, water fetching and craft activities. Women were also found to be the most impacted by extreme weather events. However, the challenges faced by these women have made them resilient. Climate change issues have enriched and strengthened their knowledge of local ecology, traditional weather forecasting and household management, and they have also become proactive in water-related conditions. The challenges have provided local women with an alternative profile to the domestic sphere, offering them the opportunity to demonstrate strength, capacity, skills and responsibility. The situation has also revealed the futuristic approaches of women towards the wellbeing of their families, society and environment. The role of women as heritage bearers, combined with their Indigenous and local climate knowledge, enables them to contribute effectively towards climate solutions, climate change adaptation strategies and environmental decision-making

Traditional Watch hut on a paddy field, Sendiriyagama, North central Province, Sri Lanka Photo © Dulma Karunarathna 2019

Traditional Paddy song and a dancing by women, Climate memories story telling workshop at Hatamuna oya, a tributary of River Mahaveli, Polonnaruwa District, Northcentral Province, Sri Lanka- Photo © CRITICAL Project -Dulma Karunarathna 2022

KM27:

Better understanding is needed of the relationship between climate change responses (including the capacity to respond) and intersectionality.

Interconnected social categorisations as applied to a given individual or group create interdependent systems of discrimination or disadvantage; these in turn impact on exposure to climate risks, adaptive capacity and response. Such categorisations are often culturally embedded, encompassing attitudes about gender, race, class, sexual orientation, physical ability, nation-state status, education and spirituality. Culture-based strategies to redress these systems need to be more widely understood. In addition, a greater understanding is needed of the role of cultural and heritage 'infrastructure' (e.g. institutions, networks and platforms) in building common causes across social movements and intersectional interests, linking climate justice with gender justice and racial justice. This includes new ways of dealing with conflict and historical trauma, as well as culture-based methods for promoting solidarity with, and resourcing of, marginalised and frontline communities. It is important both to increase channels between how climate change information is communicated across communities and to explore how creative tools, and the arts, can help to convey urgency and options to communities. In places such as New Zealand and other settler nations, social, economic and political repercussions from "historical and ongoing processes of colonialism and capitalism" (IPCC, 2022; 4.3.8), in addition to extractive land and sea use and management practices, remain a reality to be addressed. Many resources are still being used to reconcile the repercussions, including the loss of land and status, thus reducing the resources that can be directed towards climate change.

KM28:

Rapid social, political and economic pressures from processes such as urbanisation or modernisation can enable or disrupt knowledge systems and practices, and may impact the resilience of communities.

Looking into the past to identify similar processes, and what effects these processes might have had on past societies, can inform current decision-making. For example, across Africa water sector climate change adaptation responses, influenced by Indigenous and local knowledge, record higher evidence of risk reduction compared with responses that lack Indigenous and local knowledge. However, case study evidence from Southern Zimbabwe indicates urbanisation generally contributes to the disruption or decay of Indigenous and local knowledge systems that include multiple environmental indicators to predict season quality, onset of rains, droughts, floods, etc. These communities traditionally have people referred to as 'dreamers', who are respected and influence other households' decisions around their response to climate variability. However, this position is exclusively held by men, who often abandon this position and leave the village for urban centres. The process is thus disrupted, as women and youths do not replace them in these roles (pers. comms. Simpson, 2021).

KM29:

There is a need better to understand the role of heritage (built, cultural or natural) and archaeological sites as providers of refuge to communities during climate crises (including disasters and catastrophes) and places that have helped people survive, feeling as though they belong and are connected.

These places of safety are understudied. The role of nature and culture in emplacement, wellbeing and mental health are also important, alongside understanding the factors affecting the persistence of inhabitation (or disoccupation) of particular locations: some places have been occupied for thousands of years, while others have been disoccupied for thousands of years.

Those involved in culture and heritage, including understanding the past, can help to explore appropriate methodologies, including the consequences of valuing culture and heritage in economic terms. They can also to facilitate the learning from, and valuing the shared experiences of, communities affected by migration, displacement and/or relocation (including from disaster or catastrophe).

b.   Response Options: Mitigation

A better understanding of culture, heritage and the past can create opportunities to increase climate mitigation options and efficacy. Researchers and practitioners can encourage co-operation among diverse groups and actors, and provide information, as appropriate, on how culture and heritage can support GHG reduction and help create low carbon futures. Through facilitating continuous and collaborative dialogue and engagement among relevant groups and actors, culture and heritage work can share experiences, insights and knowledge on the impact of "historical and ongoing processes of colonialism and capitalism" (IPCC, 2022; 4.3.8), nationalism and federalism on GHG mitigation; the contribution of extractive, non-circular economies and petrocultures to the ability and capacity to respond to adverse effects of climate change; and the need to address how mitigation measures can be hindered by the disconnect between culture, heritage and climate change.

KM30:

Improve meaningful collaborations, and include those (e.g. researchers, practitioners, knowledge holders) that understand cultural and heritage values, practices and norms, in order to understand better how people and places have been, or are, shaped by circular or carbon-dependent lifestyles and economies.

It is important critically to identify elements of culture and practice (including approaches towards and values inherent in sustainability, growth, consumption and production and progress) which may dictate, or play a powerful role in, how climate change is understood, perpetuated or addressed. Researchers, practitioners, knowledge holders or other actors involved with culture and heritage knowledge production can share useful information. This may include data and case studies incorporating values, practices and perceptions that enable or disable greenhouse gas-intensive practices (e.g. assessments of risk, access to natural resources, availability of energy sources and uses of alternative sustainable forms of energy). New methods on how to contextualise, memorialise and document these practices (past and present) are also needed. These include the need to foreground analyses of past non-petrocultures in ways that help contemporary populations understand both the advantages and disadvantages of our current reliance on fossil fuels. They should also explore ways to preserve and promote both tangible and intangible cultures of petrocultures. For example, in Europe sulphur dioxide (SO2) levels spiked from the 1960s to the 1980s due to the proliferation of diesel engines and their sulphur-heavy exhaust. From the 1970s European policy aimed to lower SO2 emissions and the consumption of (particularly sulphur-high) coal. This long-term policy was based on evidence from EU-funded research on the impact of acid rain on European forests and marble facades, including those of cathedrals such as the Milan Duomo. The policy has since decreased air pollution, primarily SO2 and particulate matter generated by fossil fuel combustion, leading to a significant decline in the main source of aesthetic and material decay affecting the built environment. Evidence-based policies work, and knowledge exchange between fossilfuel dependent nations can improve the resilience of the environment (pers. comm. Bertolin).
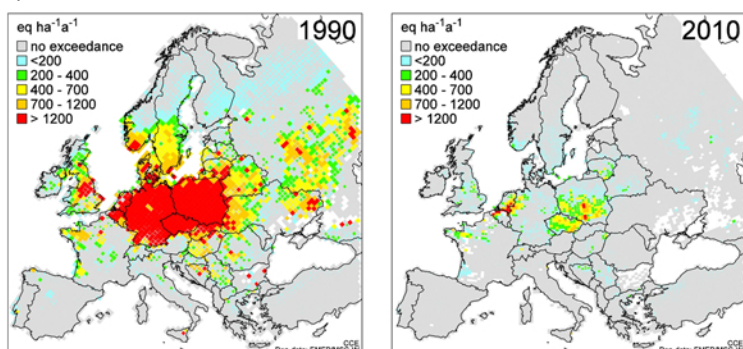

Figure 11: The outcome of emission control of SO2, NOx, and NH3 between 1990 and 2010 presented as maps on exceedance of critical loads of acidity. Such maps have played an important role for illustrating outcomes of future policies as well as of actions taken (from Maas and Grennfelt 2016)

KM31:

Understanding of and support for the role of natural heritage in storing and sequestering carbon is needed, to form part of a broader spectrum of nature-based solutions, as well as of necessary safeguards.

Even with rapid mitigation efforts, research suggests that carbon dioxide removal will likely be required to offset emissions from sectors that cannot easily reduce their emissions to zero, including air travel. Natural heritage can provide carbon sinks, particularly forests, soils, rangelands and coastal aquatic systems (mangroves, seagrass meadows, etc.), as well as natural spaces in cities (Osipova et al., 2014). New methodologies are needed that allow for an effective cost-benefit analysis of varying approaches to carbon dioxide removal, weighing carbon sequestration values and permanence against impacts to social systems, heritage values and governance and just land use. Examples include the impacts of carbon sequestration in forests on Indigenous land tenure and the impacts of afforestation on archaeological sites. More work is also needed on how to utilise traditional ecological knowledge effectively and ethically in the design of appropriate Culture Driven Regeneration projects, including the valorisation of land stewardship by Indigenous Peoples and local communities. In light of the urgent need to implement climate action such research efforts should be accelerated in support of ambitious mitigation – as well as efforts to strengthen biodiversity, especially in carbon-rich ecosystems. In Sri Lanka and India, for example, communities are involved in delineating lands around bodies of water; they are the custodians of those lands. In these communities natural resource management has been ingrained in traditional practices for centuries, but was formerly regarded as being 'vernacular' and actively dissuaded. In this regard there is a need to recognise the intersections between culture, heritage, biodiversity and mitigation more clearly, and to engage more voices in the South East Asia region (pers. comm. Mascarenhas, 2021).

KM32:

Existing models of heritage tourism (cultural and natural) need critical exploration in relation to their role in climate change and its impacts on heritage.

More critical examination is needed of the benefits (e.g. cross-cultural understanding) and harms (e.g. carbon emissions, degradation of local ecosystem and heritage) of cultural and heritage tourism in the context of climate change. Work is needed by those involved in culture and heritage to understand the role of culture and heritage (cultural/natural) tourism actors in empowering tourism-dependent communities to address the risks of both climate change and response measures in the most appropriate way. Better guidance is needed on the ethical dimensions of cultural tourism in the face of climate change, including so-called "last change tourism" aimed at sites on the frontlines of climate change, like the polar regions, which require long-distance travel and concentrate visitors in ways that increase the vulnerability of sites to climate impacts. This could include the ways in which over-tourism exacerbates climate vulnerability, as well as comparisons of so-called 'slow-tourism' initiatives (e.g. cycle-tourism and trekking) versus 'fast-tourism' and global mechanisms). Huge cruise ships that travel in fjords in Norway, as well as other extremely sensitive environments, not only has an impact on the local ecosystem of the fjords (due to the enhancement of wave motion, excavation of channels and therefore erosion), but also in terms of CO2 emission, modification of the landscape views, visual impact on the integrity of heritage sites and a huge potential impact in case of disaster occurrence. Heritage organisations need to re-evaluate their roles in promoting the large-scale travel required to visit sites and critically assess the impact of such designations (e.g. World Heritage status or Ramsar site, for example) on

tourism-related greenhouse gas emissions. Many of these organisations have been working towards promoting sustainable heritage tourism practices and are developing a Cultural Charter that aims to promote moving away from the current destructive growth paradigm and towards a Commons paradigm.

KM33:

A better understanding is needed of the cultural knowledge inherent in the land use and urban planning and design of historic settlements. These relationships between the planning and design of historic settlements to GHG emissions and circular economies also need to be understood better, so that such knowledge (new and existing) can be incorporated more effectively into climate change planning and in the conservation of the historic cities and settlements threatened by the climate impacts in line with the 2011 UNESCO Recommendation on the Historic Urban Landscape.

Urban land use and territorial planning of historic cities and settlements, including approaches to food production and distribution, have been under-represented in mitigation planning. Those involved in culture and heritage, including understanding the past, have extensive expertise and tools for understanding the spatial dimensions of cities and human settlements, and the interplay of these with circular economies and lifestyles; mobility and walkability; creative economies and local self-sufficiency; gastronomy and healthy living in healthy environments. Many historic cities and urban areas have evolved and developed sustainably for millennia. Tools designed to help urban planners understand the impact of different urban design options on emissions and their implications for adaptation to climate change should take clearer account of these cultural dimensions. More research on, and action relative to, these relationships could improve mitigation and adaptation outcomes while driving additional social co-benefits. Cultural factors inform choices about consumption and production. Such cultural dimensions of behaviour can themselves support more durable green transformation policies, creating a need for more research from those involved in culture and heritage, including understanding the past. Culture and cultural production can inform ideas of growth, sustainability and development, and have implications for green transformation. Better understanding of the relationship between the management of land use and ecology in relation to the impacts of the climate change would be valuable also for the conservation of the historic cities and settlements in line with the 2011 UNESCO Recommendation on the Historic Urban Landscape.

KM34:

More work and investment are needed to improve both the evidence base and the understanding of the mitigation benefits and carbon value arising from continued use or adaptive reuse of existing building stock (including historic buildings and traditional buildings).

The mitigation co-benefits of the historic built environment are widely overlooked in climate planning, and yet heritage and the historic built environment are central to urban sustainability. The continued use and adaptive reuse of existing buildings avoids emissions associated with new construction. On a lifecycle analysis (LCA) basis, this is often the best mitigation strategy, especially when coupled with sensitive interventions to improve operational efficiency. However, better tools are needed for quantifying these benefits. In addition, current carbon accounting protocols often disregard energy embodied in buildings (and consumer goods) and materials produced outside city limits (so-called 'Scope 3 Carbon'). There is an urgent need to fill these gaps in order to gain a more accurate picture of building sector emission.

Such innovations have the potential to expose the carbon costs imposed by demolition and other built environment choices. They complement the need to expand the benefit of heritage and historic buildings conservation and maintenance from the scale of individual buildings to a district or even a city scale. Only a few methodological frameworks have been created to enable this transition. Recently Loli and Bertolin (2018) proposed the Zero Emissions Research and Technology (ZERT) framework, which addresses science and engineering knowledge gaps relevant to embodied carbon, to select proper refurbishment interventions in historic buildings at district level – by assessing the building value, extent of decay, type of intervention required (on one square metre of wall) and its related GHG emission. This framework also considers climate change impact and mitigation potential of the intervention. The ZERT framework is still under development to improve further the assessment of historic building significance during refurbishment or energy retrofitting interventions. **Case Study Box Eleven** illustrates work done in Hong Kong to address concerns regarding the continued utilisation and conservation of historic buildings in ways that support urban sustainability. The cultural dimensions of the ways in which buildings are used, and also frame perceptions of comfort, interest with ideas of "sufficiency" (i.e. reducing the demand for materials and energy while delivering a decent living standard for all within planetary boundaries).

KM35:

Those involved in culture and heritage, including understanding the past, have the expertise to develop forms of communication that also seek to increase ambition and promote climate action and longer-term behaviour change, such as environmental education, sustainability education (a high priority for UNESCO) and social marketing, among others.

Heritage interpretation can leverage heritage and cultural lessons and symbolism to inspire action across multiple world-views to mitigation and climate action.

c.   Response Options: Adaptation

A better understanding of culture, heritage and the past can provide opportunities to introduce, develop and enhance adaptation approaches and strategies, thus increasing available options and improving efficacy. Researchers and practitioners can encourage co-operation among diverse groups and actors; they can also provide information, as appropriate, on how culture and heritage can support adaptation, including that of cities, human settlements and built heritage. Through facilitating continuous and collaborative dialogue and engagement among relevant groups and actors, those working in culture and heritage can share experiences, insights and knowledge. In so doing they enhance the ability and capacity of others to respond to the adverse effects of climate change by engaging with diverse knowledge systems, values, practices and ways of life.

Development of Climate Awareness and Strategies for the Historic Urban Centre of Macau

Case Study Region: Macau Special Administrative Region, China

Author: Assistant Professor Kin Hong Ip, Macau University of Science and Technology

General Ye Ting's Former Residence © K. Hong Ip

Traditional slaking and preparation of lime with straw fibres © K. Hong Ip

Vigorous land reclamation and rapid urbanisation have taken a serious toll on the heritage architecture in the once tranquil fishing village of Macau. Recent events such as the increased severity and frequency of summer typhoons, torrential rainfalls and sea water intrusion, all by-products of climate change, have further intensified such impacts. Several adaptive reuse projects have shown unexpected consequences in which salt damage, humidity condensation and biological growth were noticeably worsening.

The original 'passive' buildings have also been mostly decommissioned, substituted instead for more modern designs and materials. As a result, 'living in harmony with nature' has quickly turned to 'altering nature for comfort'. This case study follows a project that investigated the effectiveness of ancient knowledge found in passive building designs for the sustainable future of our living environment.

General Ye Ting's Former Residence is a two-storey building constructed around the 1920s. It was originally located near a local river that has since been filled due to urbanisation. The residence, together with many local heritage buildings, has suffered increased deterioration attributed to several intersecting issues – climate change, vigorous land reclamation and rapid urbanisation, exacerbated by the loss of local knowledge and traditional building skills. This has impacted upon the sustainability of the community's ability to resolve/adapt to climate change. The redundancy of passive building design has also interrupted the natural adaptation system of local buildings to the environment in a way that does not generate harmful greenhouse gases. The restoration of General Ye Ting's Former Residence was a means of involving local experienced craftsmen who have worked and passed on traditional skills to the younger generation. Following work with these craftsmen, previously observed degradation was significantly reduced, following the reinstatement of the traditional permeable materials and original building components such as handmade floor tiles and wooden window shades. The much-needed ventilation was also recreated by reopening the existing lightwell and stopping the use of air-conditioners to counteract the severity of climate change.

KM36:

To understand adaptation and resilience better, more work is needed in understanding the cultural, social, spiritual and political dimensions that are central to a community's capacity and ability to cope with the adverse effects of climate change and biodiversity loss.

Climate change sciences often overlook the human experience and the cultural lens in analysing the causes, impacts and responses to climate change. Those involved in culture and heritage, including understanding the past, are able to share information and expertise about path dependencies and the mapping of events and responses over a timespan extending to millennia to deepen this analysis. Diverse knowledge systems, a multiplicity of social networks and social inclusion play key roles in adaptation and resilience, and more work into how this can be measured and relevant across a range of contexts is essential. Values shape adaptation preferences and culture shapes values (including a sense of what is just and fair, who is responsible, how much change is beneficial) – all which in turn informs adaptation.
the highly technical Indigenous practice of stone walling, practised for hundreds of years, is now being adopted across urban centres and other regions due to the system's climate resilience.

KM37:

Those involved in culture and heritage, including understanding the past, have expertise to help understand better why and how adaptation planning processes can promote inclusivity of particular ethnic/diverse groups and actors while simultaneously overlooking and ignoring other diverse groups.

This includes understanding how local knowledge in informal settlements worldwide can support adaptation, as well as the co-benefits of incorporating local and traditional knowledge holders and local knowledge into adaptation planning – incorporating local ways of knowing and thinking, understanding value systems and local aspirations.

KM38:

A better understanding is needed of how to translate understandings of past events and historic natural and anthropic transformations into contemporary climate adaptation planning.

Cultural landscapes, living heritage, including oral traditions, and tangible heritage, such as archaeological resources, hold evidence of the human responses to past disasters, including changes in vulnerability over centuries. Yet how to interpret and apply this information to adaptation planning and implementation is a challenge. Those involved in culture and heritage routinely work with knowledge from the past (disaster, adaptation intervention, changes in urbanisation), typically consisting of site level information owned by the local community. For example, the impacts of flooding are shown across Europe on mediaeval or early modern stone landmarks and in surviving place names, and topographical features. These data provide valuable information regarding the community's history of hazard response (pers. comm. Bertolin, 2022). Operationalising such data requires more exploration of dynamic, adaptive, policy-planning processes in which diverse actors from different knowledge systems (e.g. historians, architects, cultural professionals, climatologists, urban planners, conservators and experts in risk management) work together.

Case Study Box 12

Stone Walling Practice in the Cordillera Region, Northern Philippines

Case Study Region: Cordillera Region, Philippines/South East Asia

Author: Wilfredo Alangui, University of the Philippines Baguio; Kankana-ey-Igorot and Ilocano

Local construction of Stone Walls using traditional Indigenous practices © W. Alangui

The Indigenous Peoples of the Cordillera in northern Philippines, known collectively as Igorot, have carved out extensive rice terraces on the slopes of mountains and rugged terrains. Rice terraces are also found in Nepal, Vietnam, Indonesia and China. However, the centuries-old Cordillera rice terraces have been described as among 'the most intensive and efficient in the world' (Bodner, 1986). It is an activity that integrates technical and agricultural principles with social and cultural knowledge. It links the Igorot to their ancestors and reflects their worldview. The associated Indigenous practice of stone walling is a vital element of rice terracing agriculture. Stone walling is a soil and water conservation technology for the rice terraces which are built in sloping upland landscapes (Brett, 1985). Stone walls are built to hold the rice paddies, impound water and prevent erosion in general. In many cases they are also used to increase the area of rice paddies. Stone walling is a highly technical form of knowledge. Everything, from stone selection, backfilling and the positioning of individual stone, is carefully considered to build stone walls that last a long time (Alangui, 2010, 2018). It is a gendered knowledge, done mainly by the male members of the community. The highly skilled stonewallers are well regarded members of the community; many of them become respected elders and knowledge holders. As an Indigenous technology developed in upland communities and practised for hundreds of years, the application of stone walls has evolved in varied ways: from holding rice terraces to supporting the houses, irrigation canals, roads and areas that regularly erode due to typhoons (Alangui, 2010, 2018).

Stone walls have long served the purpose of preventing erosions and promoting soil stabilisation in the mountainous areas of the Cordillera region. The technology is currently being adapted in urban centres and many other areas outside of the Cordillera region, now with some modifications. Building stone walls prevents erosion and promotes soil stabilisation in upland communities (both rural and urban), areas that have become increasingly vulnerable to strong typhoons.

Skilled stonewaller working © W. Alangui

Here they recount stories using a history of place, discuss the tangible remains of past hazards (e.g. Monumental Hydrometer, high-water marks and plaques) embedded in historic buildings in the original locations where the disasters occurred, then consider how subsequent communities applied certain changes to build resilience. Such processes help to develop comprehension of how communities have been through difficult times before in order to facilitate adaptation to future change.

KM39:

More knowledge is needed about the role played by cultural approaches and heritage methodologies in ensuring and facilitating the use of local knowledge in adaptation planning, and the ways in which local communities are involved in decision-making processes and policy development.

Integrating local and community knowledge into decision-making processes remains a challenge. Scientific research favours certain types of knowledge to the neglect of others. Governments tend to prefer high-level, top-down solutions while most funders prefer mega-infrastructure in their solutions, investments and responses. However, more support and exploration into multiple micro-infrastructure projects may be a more sustainable option. To understand this, there is a need to grow the evidence base for the cultural dimensions of adaptation and to support the inclusion of cultural dimensions into adaptation planning. Those involved in culture and heritage, including understanding the past, need to work closely across silos to collate lessons learned and linkages made from the experiences of ecosystem-based adaptation practices.

KM40:

A fuller understanding is needed of the role of culture and heritage in human mobility, including migration, displacement and planned relocation as a response to climate change.

Humans have always been on the move, and culture and heritage reflect that mobility. A greater understanding of these phenomena would illuminate climate-related mobility. It is important to avoid the assumption that migration and movement are universally negative (or positive); for example, for some peoples a culture of nomadism is part of their heritage. These are forms of cultural heritage that are often challenged by national borders, privatisation of land tenure, etc.; and in which immobility may also be the result of colonialism and oppression (pers. comms. Sider, 2021). Existing and new research needs to be translated into new cultural heritage methodologies. For example, collaborative community processes are needed to prioritise and document heritage left behind, and to conserve and perpetuate the collective scientific and intangible heritage values of displaced communities undergoing relocation or diaspora. More research is needed on culture- and heritage-based emplacement strategies to help displaced communities, as well as to address the cultural impacts on receiving communities. For example, work on various immigrant populations and receiving communities show that the knowledge systems of both origin and receiving communities can be altered and enhanced overall rather than simply lost. Equally, when people migrate they can alter norms in origin geographies through changing and broadening perceptions (Jíménez, 2017).

d. Culture, Heritage and Capacity for Transformative Change

Culture from arts to heritage can help people imagine low-carbon, just, climate resilient futures. To unlock this potential, the linkages between culture, heritage and transformative climate action, associated co-benefits, trade-offs or limitations remain in need of more analysis. This includes a better understanding of how to maximise all direct or associated benefits and to reduce trade-offs and other disservices that might be better managed or avoided. Culture and heritage dimensions to these decisions are key to identifying opportunities for delivering climate-resilient pathways to benefit diverse actors and communities. Those involved in culture and heritage, including understanding the past, can facilitate and support communities in exploring what climate benefits, associated co-benefits, trade-offs and/or limitations they face. They can also consider what options the communities may have in terms of policy and implementation measures, social cohesion, identifying urgency and other climate-related considerations.

KM41:

Those involved in culture and heritage, including understanding the past, can better inform how knowledge systems include coherent sets of knowledge, practices and values that cannot be separated from each other.

While some attention has focused on how Indigenous and local knowledge and practices have contributed to nature conservation and management, and to climate change adaptation and mitigation, less attention has been given to the cosmovisions and values that underpin knowledge systems. Indigenous Peoples and local communities often understand nature as an interconnected web of life, linking humans and non-humans in a complex relationship. In such conceptualisations, humans are viewed as an integral component of nature and nature is imbued with social, cultural and spiritual values. Moreover, Indigenous Peoples' and local communities' conceptualisations of nature often draw on stewardship ethics based on mutual reciprocity between humans and non-humans, temporary custody for future generations and health of, and attachment to, land. These conceptualisations are the basis for management of landscape and seascape management. They are aligned with the UN Convention of Biological Diversity's 2050 vision of 'Living in harmony with nature' (Orlove et. al., 2022).

KM42:

More insight is needed on climate literacy, and how better understanding of cultural values and norms, deep history and more effective use of local language can improve climate campaigns and Action for Climate Empowerment.

Culture and heritage-based approaches offer additional tools, opportunities and possibilities for advancing climate literacy and empowerment. Facilitating new alliances and coalitions with cultural actors, groups and institutions (such as libraries and museums) can leverage the power of culture and existing cultural infrastructure to advance climate action. Artistic and creative approaches can make the unseen real and provoke re-examination of inherited assumptions in ways that transcend incremental responses and support transformative change. Incorporating climate storytelling and narrative into the interpretation of heritage sites offers powerful symbolism that can inspire action and underscore urgency. Investing and supporting cultural artists and bodies can have co-benefits in terms to being able to communicate more broadly and effectively.

Artistic and creative approaches can make the unseen real and provoke re-examination of inherited assumptions in ways that transcend incremental responses and support transformative change. Incorporating climate storytelling and narrative into the interpretation of heritage sites offers powerful symbolism that can inspire action and underscore urgency.

Currently, however, culture and heritage are often not included in formal climate education strategies, creating an implementation gap that needs to be understood and transcended. The University of Liverpool has been using oral history and archive material to look at flood history of the Lake District World Heritage site. However, in order to encourage engagement with water and the wider landscape, the use of art and, more specifically, poetry has been successful in getting people to reassess some of what they know or understand about those places (pers. comms. Fluck, 2021).

KM43:

The cost and consequences of trade-offs between culture heritage conservation and climate mitigation and adaptation interventions need to be better understood.

Real and perceived tensions exist between climate mitigation and adaptation on the one hand and the safeguarding of culture and heritage conservation on the other. Examples of such tensions include banning the traditional harvesting of peat; the retrofitting of historic buildings for energy efficiency in ways that are perceived to damage heritage values; the insertion of renewable energy infrastructure into cultural landscapes; and the development of carbon mitigation projects that undermine Indigenous Peoples' forest management practices and land tenure. The cost and consequences of trade-offs between climate mitigation (e.g. renewable energy infrastructure and impact on historic/natural environment) and adaptation interventions (e.g. landscape restoration and impact of inaccessibility for local communities) are also not well understood, yet these choices also impact culture and heritage and affect local communities (including Indigenous Peoples) directly. Greater long-term co-operation and multi-sectoral discussions are needed to minimise trade-offs and support co-benefits, especially in the context of transformative 1.5°C pathways. Participatory frameworks are needed for involving culture and heritage advocates, including local communities, in discussions from the concept stage of project development. Meaningful and long-term co-operation and interdisciplinary, multi-sectoral discussions are required to minimise trade-offs and to support benefits through enhancing knowledge towards a more granular, location-specific understanding of the tensions that arise between development policies, heritage conservation and adaptation. Those involved in culture and heritage, including understanding the past, need to be brought into discussions during the very early stages of a project or discussion, in order to contribute to critical thinking about opportunities and challenges to culture and heritage.

Slash and Burn Farming in Southeast Asia

Case Study Region: South East Asia

Author: Gabriel Caballero, ICOMOS Focal Point for the UN Sustainable Development Goals

In Southeast Asia, slash and burn farming is a form of traditional knowledge. For example, the Mountains of the Iglit-Baco National Park has been shaped by the Tau-Buid and Buhid Mangyan communities; here generations of kaingin (slash and burn farming) created a cultural landscape with specially adapted species (Caballero, 2015). However, places such as Indonesia use the technique to such an extent that it increased greenhouse gases and CO2 emissions, affecting neighbouring countries such as Singapore, Malaysia, Thailand, the Philippines and Brunei (Ketterings et al., 1999). Laws to ban fires have been strengthened by the government of Indonesia from 1999, but the practice still exists (Fajrini, 2022). The traditional rotational sequence of cultivation for slash and burn farming includes a fallow period, allowing forests to regrown and nutrients to be replenished. Although some communities celebrate the research that states it can reasonably be effective, this form of farming can also contribute to long-term disruption of nutrient balance and biodiversity loss, requiring other areas to be burned after some time.

A balance between adapting traditional practices and emphasising controlled methods of application, while maintaining social, cultural and environmental knowledge of Indigenous Peoples, is thus required.

One of the potential approaches, therefore, is to provide economically viable alternatives for slash and burn farming that are both socio-culturally sensitive and equitable. Such alternatives include developing other types of agriculture, for example intercropping or productive forests, or creating opportunities for sustainable agro-tourism and ecotourism, which are less harmful to the environment. A balance between adapting traditional practices and emphasising controlled methods of application, while maintaining social, cultural and environmental knowledge of Indigenous Peoples, is thus required. There is also a need to have stronger law enforcement for a ban on large-scale and commercial burning, greater forms of legal protection to Indigenous domains and better discussions between communities and various stakeholders on the global effects of potentially harmful traditional practices.

KM44:

More knowledge about observations and monitoring, as well as evaluations of past or existing communities' or societies' maladaptive responses and unintended lock-ins, are needed to understand better how maladaptation has played out previously and the impact it has had on culture and heritage.

Considering how maladaptation to climate change impacts local culture and heritage can help to improve project design and build more resilient communities. Those involved in culture and heritage, including understanding the past, have expertise in identifying benefits and trade-offs, as well as how or why maladaptive decisions are made. Standards are needed for when climate actions should be deemed maladaptive due to impacts on culture or heritage and other adverse effects. In Ireland, the vernacular architecture of thatched roofs, stones, etc., typical of the Irish landscape, became very unpopular in the post-colonial period; it was associated with a set of historical and cultural associations, including famine, poverty and a peasant lifestyle. Yet such features were intrinsically sustainable, as they drew upon local materials and could be repaired through low-carbon solutions. Today, however, thatch is no longer produced in Ireland; it has to be brought from China, Romania and other countries. This fact, coupled with the low insulation capacity of thatched structures, is making it more difficult for people to live in them. There is a need to take old vernacular structures and make them adaptable to the modern world (pers. comms. Daly, 2021).

KM45:

The role of cultural heritage in 'Just Transition' requires additional research and action.

In order for transformative action to succeed, attention must be paid to the regions, industries and workers who will face the greatest challenges. There is a need to understand better how heritage methodologies and culturally appropriate processes can help to ensure that relevant institutions are acknowledging and integrating local communities' inputs and grievances (e.g. where traditional livelihoods and culture have been adversely affected by climate response measures). Culture/heritage professionals can help to encourage local co-creation of transition planning by supporting community-based prioritisation and documentation of the effects of response measurers, as well as by encouraging activities that recognise the historic contributions of affected regions, workers and industries. Craft, heritage and traditional livelihoods can all feature in contemporary re-skilling and economic diversification.

Part III: Delivering actions to advance collaborative and problem-oriented research on climate change, culture, and heritage

This section focuses on options to support the implementation of this Global Research and Action Agenda on Culture, Heritage and Climate Change. It is supported by the three White Papers (Knowledge Systems, Impacts and Solutions) where complete citations of relevant sources can be found. As illustrated in the previous two sections, many knowledge, research and data gaps still need to be filled in order to understand the culture and heritage dimensions of climate change and unlock the potential of culture and heritage based climate action. The Meeting represented a significant opportunity to bring together knowledge from communities, science, culture, practice and policy, as well as providing a major step forward in understanding knowledge gaps. The Meeting also highlighted the great benefit of working together through diverse perspectives in building evidence based knowledge and expanding global capacity by connecting culture, heritage and climate over the course of, and beyond, the IPCC Seventh Assessment Report cycle. To strengthen these collaborations between different sectors, constituencies, knowledge systems and disciplines, engagement is required at global, national and local levels. This section presents a non exhaustive list of actions that can be taken to enhance such collaboration.

1. Actions for Working Across Knowledge Systems

The co-design, co-production and ethical and respectful sharing of knowledge and information across knowledge systems and by the research, practice and policy communities in a collaborative manner will enhance the value of such knowledge in informing action/initiatives on climate and heritage. A range of actions would enhance such collaborations.

Developing, refining, implementing guidelines for understanding, respecting, recognising and increasing the potential for ethical engagement across diverse knowledge systems, local communities should be prioritised by all actors tackling climate change, but especially by those working to produce, synthesise and disseminate knowledge.

Such guidelines would help organisations – including both climate, culture and heritage public bodies and research organisations – to proceed confidently and avoid problematic approaches, such as those that treat traditional and Indigenous knowledge systems, as well as cultural narratives, as monolithic, static and instrumental, or that divorce such systems from their environmental, cultural and historic contexts. Guidelines could also encourage and guide the inclusion of narration and storytelling as evidence. It is critical that the representatives of Indigenous Peoples and local communities' partner in guideline development. Several examples already exist, such as the Kawerak Recommendations for Co-Production of Knowledge.

New or updated approaches to the management of, and decision-making systems for research organisations (including calls for funding, tenders and contracts) can reinforce and support diverse knowledge systems, for example through co-production approaches. This requires the continuous and critical review of existing approaches and how they consider issues (such as background knowledge, free, prior and informed consent; intellectual property rights; tenure rights; recognition of customary norms and law; acknowledgment of Indigenous sovereignty), as well as continuous development to address emerging issues effectively and inclusively.

A barrier to greater engagement and co-production of knowledge that is consistently expressed is the need to build organisational capacity at community and/or national levels for dealing with Indigenous and local knowledge.

Open lines of communication between Indigenous Peoples and local communities on the one hand and research organisations, public bodies and institutions responsible for climate decision making on the other are essential to supporting co production of knowledge. These linkages should guide the framing and inclusion of cultural information in policy development and research agendas; they should also encourage and assist with the inclusion of narrative and storytelling. However, many climate bodies and institutions currently lack the capacity and expertise to support these outcomes. Indigenous People's organisations and local communities also require greater capacity to support co production activities   for example, to operate collective ways ofdefining what knowledge should be shared. This capacity should be developed and funded as a necessary and desirable element of enhancing understanding of climate change, including climate science and policy functions at all levels. Culture and heritage public bodies (e.g. ministries of culture, heritage offices, culture councils, heritage agencies and funding bodies) can act as platforms (or at least advocates) for this outcome, although that option seems rarely to be pursued. Such bodies are well placed to suggest disconnects which need to be addressed.

> Capacity should be developed and funded as a necessary and desirable element of enhancing understanding of climate change, including climate science and policy functions at all levels.

2.   Actions for Empowering Culture and Heritage Stakeholders to Take Action

At present, many important culture and heritage voices are not being heard in the realms of climate action, planning and policy. Conventional science approaches as well as land, sea and protected area management (and the formal governance of culture and heritage matters) have historically excluded Indigenous Peoples and local communities and their knowledge systems; many continue to do so. Treatments of culture and heritage are often missing from Nationally Determined Contributions, climate planning at all levels and risk and vulnerability assessments. Climate planners often prefer technological and industry-led or market-based solutions, overlooking the less easy to quantify social, economic and cultural aspects and origins of the climate emergency, as well as the more transgressive nature of some cultural and heritage interventions. Traditional scholarly methods for studying culture and heritage tend to be qualitative. It has been argued that data from these methods do not sit comfortably with the approaches prevalent in other social and natural sciences on climate change that foreground measurements and quantification. Some aspects to consider when working to empower people involved in culture and heritage to take climate action can be found below; these can be adapted and developed to suit local contexts.

Attention needs to be given to components of culture and heritage that both enable and disable climate action measures.

Active engagement with and by culture and heritage stakeholders can help tackle activities that contribute to climate change, while advancing those that support sustainability. By working to identify, interpret, contextualise and challenge these 'petrocultures' and related 'carbonscapes', culture and heritage can help

illuminate the origins of anthropogenic climate change and inform response measurers. The absence of attention to these complexities can undermine engagement with, and from, diverse actors. Indigenous knowledge can help understand connections with environmental harm, systemic inequalities and injustices, while cultural institutions/heritage sites managed by trusted organisations with interpretation already framed in place-based, local narratives offer ready spaces for these conversations

Engage with Diverse Partners to Achieve Complex Outcomes.

Inter-disciplinary and multi-disciplinary work has long been encouraged among diverse actor and groups involved with culture and heritage. Leveraging climate action and achievement of other UN Sustainable Development Goals such as reducing inequality and injustice, for example, requires the integration of complex interdependencies across diverse sectors in a systems approach. Empowering culture and heritage actors to achieve such outcomes can require a diverse set of partners. This includes diverse sectors, diverse knowledge systems and diverse types of expertise. Cross-sectoral engagements by culture and heritage actors with climate mitigation initiatives in fields like mobility, agriculture and clean energy are described in the European Cultural Heritage Green Paper. These examples highlight the increasing need for cross-functional teams of practitioners, experts and stakeholders in culture and heritage practice, including climate scientists, practitioners, activists and policy-makers. For government, formally linking climate change planning to the mandates of arts, culture and heritage bodies can help. An example is the 2021 Rome Declaration of G20 Ministers of Culture, which requests that countries consider including culture and heritage in their national Adaptation Communications under Article 7 of the Paris Agreement. The Climate Heritage Network, an informal network launched in 2019 to emphasise the cultural dimensions of the climate conversation, has several initiatives designed to connect cultural voices with climate change policy makers.

More broadly, there is an urgent need to increase the diversity of people at the climate table – promoting in turn a greater involvement (and empowerment) of knowledge bearers, including Indigenous Peoples, local communities and traditional knowledges. For example, the values and cosmologies of Indigenous Peoples and local communities not co-opted by modern take-make-waste approaches can offer counterpoints to "modern" views of progress and development. Such voices should be given the opportunity and the support (including funding) to lead the formulation of sustainable development and climate actions plans, reflecting the proactive rather than reactive substitution of such approaches for models rooted in systems that have proved unsustainable. The development of climate action plans, policies and assessments offers unique opportunities to advance these aims. In the Pacific islands, where the percentage of Indigenous Peoples is high, some national assessments and action plans have begun explicitly to include Indigenous Knowledge. Among other cases, the New Zealand document Arotakenga Huringa Āhuarangi: A Framework for the National Climate Change Risk Assessment for Aotearoa New Zealand (Ministry for the Environment, 2019) promotes the consideration of Mātauranga Māori (Maori knowledge) throughout the assessment process.

Seeking out Synergies; Preparing for Trade-Offs

Multiple lines of evidence reveals that transformative action entails complex and inevitable trade-offs along a continuum of different pathways, highlighting the role of societal values, internal contestations and political dynamics. Yet the linkages between culture and heritage values on the one hand, and climate benefits, associated co-benefits, trade-offs or limitations on the other similarly remains in need of more analysis. Expanding research in these areas will be key to identifying opportunities for delivering better climate-resilient pathways for diverse actors and communities, and for avoiding maladaptation and climate mal-mitigation.

Real-world experiences at the project level show that reconciling trade-offs across sectors and spatial scales is one of the key challenges to the actual integration of adaptation, mitigation and sustainable development. Real and perceived tensions exist between climate mitigation and adaptation on the one hand and the promotion of culture and the conservation of heritage values on the other. Rapid and far-reaching transitions needed to mitigate climate change can arguably be at odds with notions of continuity, conservation, preservation and safeguarding that often lie at the core of cultural and heritage policies. These tensions can problematise climate action by people involved in culture and heritage. To reduce conflicts and promote achievement of win–win outcomes, methodologies for reconciling conflicts in the culture and heritage context should be promoted. In Ireland, for example, people living in peatland communities have cultural and property rights to cut turf for energy – but this traditional practice now clashes with efforts to conserve bog habitats for biodiversity and carbon sequestration. As part of Just Transition efforts, the Community Wetlands Forum is working to address these tensions and encourage solutions.

3.   Actions for Enhancing Meaningful Collaborations among Research, Policy, and Practice

The Meeting revealed the richness and diversity of culture and heritage knowledge and forms of expertise. Indigenous and local world-views and traditional techniques, practices and technologies, skills, oral histories, stories and grey literature contain valuable information on the causes and impacts of climate change and responses to it.

The Meeting also revealed several specific issues, topics and recommendations relevant to the heritage and climate science sectors which would benefit from additional attention. These include projects to explore the use and reconstruction of the past and the use of the archaeological and historic record in climate change reporting (including IPCC reports); similar initiatives consider the roles of culture and society in consumption and production behaviours, as well as the role of culture and heritage in mitigation ambitions and adaptation pathways. Such collaborative initiatives should provide recommendations for policy-makers and align with policy-relevant outputs from organisations such as UNESCO and the IPCC.

Research projects and synthesis studies must look beyond peer reviewed literature to include other forms of knowledge while respecting ethical norms and cultural rights, and so learn from examples elsewhere. One instance of this is the multiple-evidence approach used by IPBES and the CBD, which recognises the incommensurability of diverse knowledge systems and the often-asymmetric power issues that arise when attempting to connect different branches of science with locally-based knowledge systems. Researchers should also support experimentation, including by seeking out and assessing co-produced knowledge and stakeholder-driven research, where questions asked to the local actors focus on what type of information they want to know about things they care about. There is a need to engage with international, government and philanthropic funders of research in order to make their eligibility criteria more inclusive.

There is a need to increase the frequency of dialogue and action among researchers, policy-makers and professional practitioners from climate science and heritage bodies on the topic of Culture, Heritage and Climate Change Science and for concrete actions focusing on undoing marginalisation and exclusion in addressing the impacts of climate change. This might start with a distinction between scales, arenas, forms of action and power relations, ensuring that – starting from a local and community scale – researchers and funders must respect social norms, territorial rights and tenure, recognise formally background knowledge; they also need to apply free, prior and informed consent, and accountability to their methodologies. Inclusivity and openness must also be present at national, regional and international scales, which should encourage and facilitate the representation of Indigenous Peoples and local communities, as well as other marginalised groups, and advance laws and regulation that respect values, territorial rights and customary institutions.

Wherever possible and fair, traditional and Indigenous knowledge bearers should be primary or co-investigators, included as lead and contributing authors on research outputs. Greater involvement of authors with expertise in social science, culture and heritage in established research and synthesis processes should be promoted. Dedicated outreach by key organisations may be necessary to identify and support relevant experts. For example, in 2021 workshops led by the Facilitative Working Group of the Local Communities and Indigenous Peoples Platform (established by the UNFCCC COP24 in Katowice, Poland, in December 2018) explored the area of ethical engagement of Indigenous knowledge in the context of averting, minimising and addressing the adverse impacts of climate change. Actions from these training workshops include the need to support informal and formal networks of Indigenous knowledge holders; enhance financial resources for Indigenous Peoples to organise and schedule local and national workshops, and; support rights to maintain, control, protect and develop knowledge.

4.   Actions for Funding

Existing funding and incentive structures can result in preferential financial support to one community over another. Such a situation leads to academic researchers studying only what they are funded to study, while other local communities and/or Indigenous Peoples have little access to funding sources. These biases, often institutional ones or those reflecting the interests and perspectives of donors or national governments, can lead to unequal allocation of research funds. Regional unbalance in funding (which affects both researchers and other stakeholders) further compounds the lack of attention to collaborative research on climate and heritage, which may result in an unequal geographical distribution of funded research. Research funding agencies should encourage, and in some cases require, partnerships between researchers and local community's or Indigenous Peoples' stakeholders from the onset of proposal development. There is a need to assess and address the extent to which the structure of research funding and their inherent biases have created an imbalance in research.

The knowledge gap, particularly in certain regions of the world, is a direct reflection of inequitable and unequal funding. National and international funding programs should facilitate projects centred, managed and led by people from diverse regions of the world to increase capacities and to collect the best and most relevant data – respecting social norms and land tenure, recognising background knowledge and applying free, prior and informed consent and accountability to their methodologies.

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Annex A

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Annex C

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Annex D

Further material/resources provided by case study authors:

Cities as Engines of Transformation for Global Sustainability in the Urban World of the 21st Century
Contributing author: Yunus Arikan *(Head of Global Policy and Advocacy, ICLEI World Secretariat)* and Andrew Potts *(Coordinator, Climate Heritage Network)*

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Contributing author: Max Friesen *(University of Toronto)*

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Ireland's National Climate Adaptation Framework
Contributing author: Dr Cathy Daly *(Carrig Conservation and University of Lincoln)*

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Indigenous People, Traditional Ecological Knowledge and Climate Change: The Iconic Underwater Cultural Heritage of Stone Tidal Weirs
Contributing author: Akifumi Iwabuchi *(Tokyo University of Marine Science and Technology [UNESCO UNIT-WIN Network for Underwater Archaeology])*

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Can We Rebuild the Kasthamandap? Disaster Management in Nepal
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Empowerment of Women in Rural Sri Lanka
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Development of Climate Awareness and Strategies for the Historic Urban Centre of Macau
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Slash and Burn Farming in Southeast Asia
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