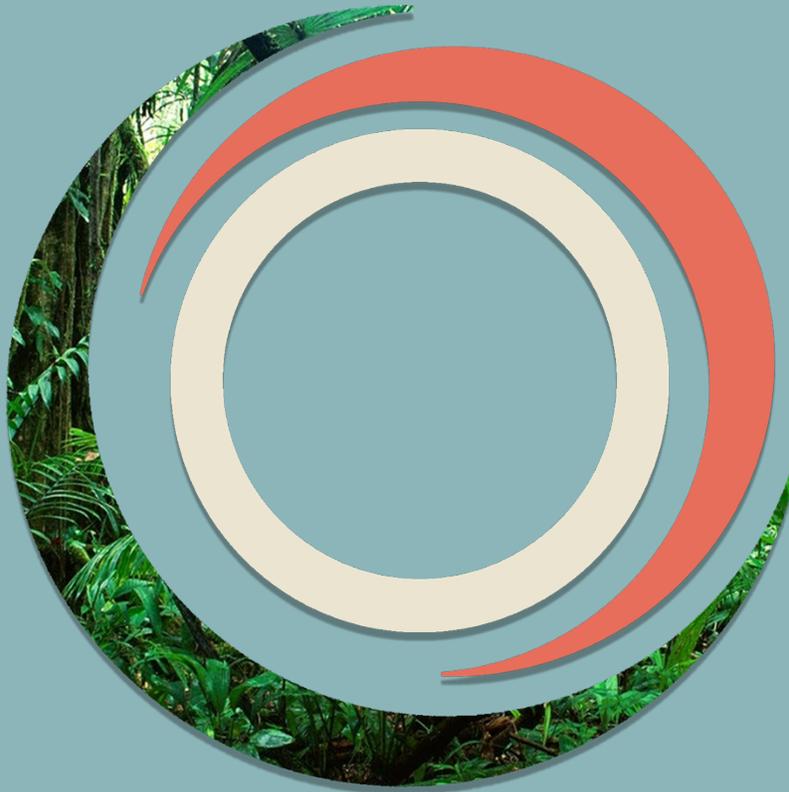
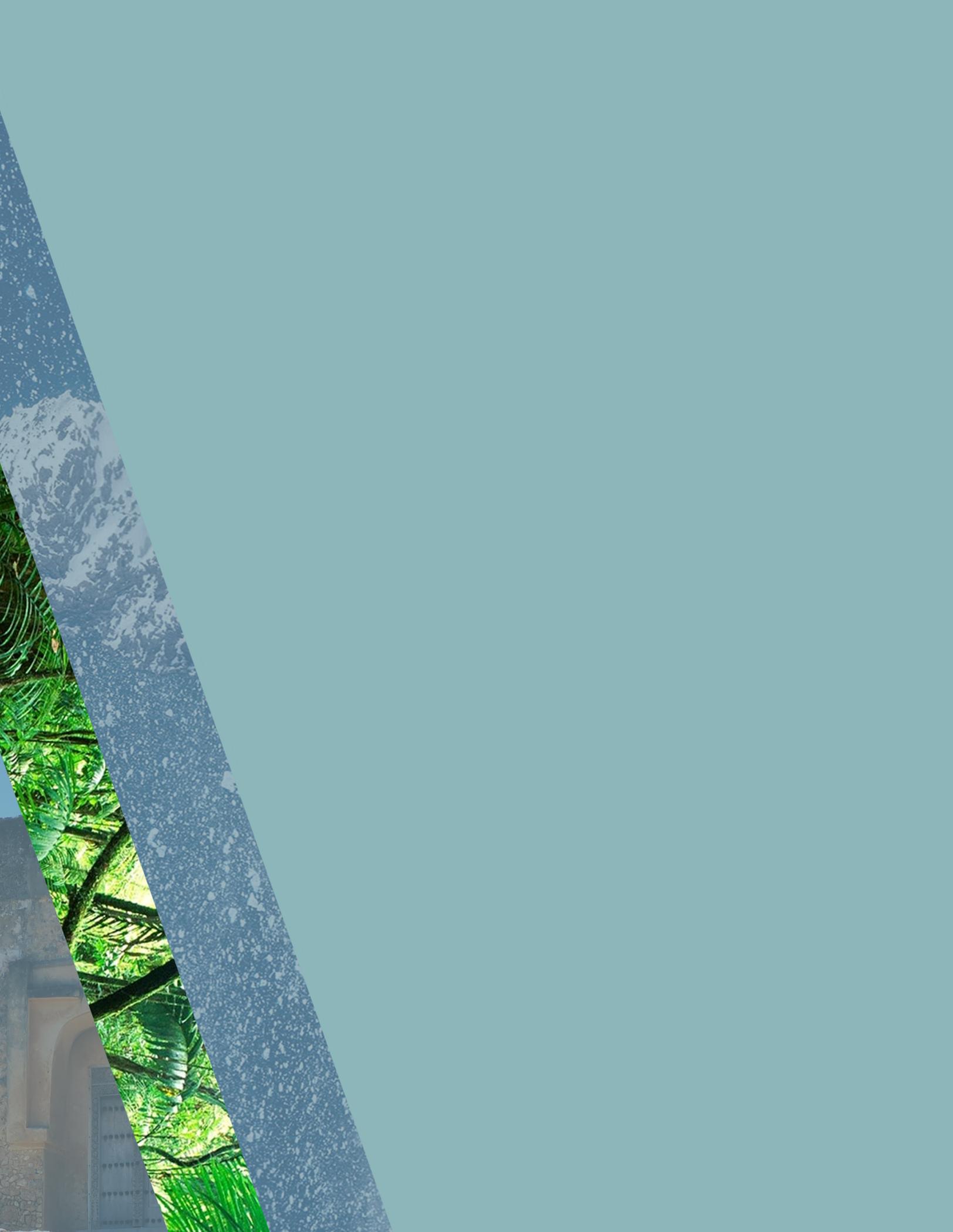


# Intangible Cultural Heritage, Diverse Knowledge Systems, and Climate Change



A White Paper commissioned for the International Co-Sponsored  
Meeting on Culture, Heritage and Climate Change



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## Foreword

As co-chairs of the Scientific Steering Committee of the International Co-Sponsored Meeting on Culture, Heritage, and Climate Change (ICSM CHC) we are delighted to write this foreword for this important publication, and to congratulate the authors on their valuable exploration of **the systemic connections of culture, heritage, and climate change**. This publication is one of three commissioned by the ICSM CHC in early 2022 as a provocateur for attendees.

The proposal for the ICSM CHC 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 there exist significant gaps in understanding of the many connections between culture and the human past and the modern phenomena of climate change, as well as a need to advance the contributions of culture and heritage to climate change mitigation and adaptation.

The proposal, first proposed 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 the United Nations Educational, Scientific and Cultural Organization (UNESCO) in July 2020 with which a collaborative concept note for the meeting was finalized by the Co-Chairs of the Scientific Steering Committee. The ICSM CHC was held virtually over five days from 6 - 10 December 2021 bringing together approximately 100 participants from a wide range of backgrounds. The meeting participants represented 40 countries across all six continents. 40% of the participants were from the Global South and 61% of the participants were women. The participants included Climate Scientists, Culture and cultural and natural heritage experts and practitioners, Natural Science experts and practitioners and representatives from indigenous peoples and local communities.

During the ICSM CHC, participants discussed a wide range of topics including the systemic connections of culture, heritage, and climate change, the roles of culture and heritage in transformative change and alternative sustainable futures and, aided by this paper, systemic connections of culture, heritage, and climate change. Themes within this topic included **knowledge systems, power, and interpretation of climate change, new conditions, new knowledge, and the challenges and opportunities of integrating knowledge systems**.

A draft of this paper was prepared by a diverse group of scholars and heritage practitioners from around the world. This draft was shared with the ICSM CHC meeting participants and then revised by the group following inputs from the meeting. As a provocation piece written to promote conversation and debate, its contents intentionally reflect the views and opinions of the authors and do not necessarily represent

the view of the co-sponsors of the meeting. Attention to culture is an indispensable enabling condition to transformative climate action and climate resilient sustainable development. It is increasingly recognized that the lack of attention to culture can lead to poor adaptation and inadequate mitigation outcomes. As the urgent need for effective, equitable climate action becomes ever clearer, we hope this paper gains a wide audience and it makes an important contribution to a topic that requires greater attention.

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## Table of Contents

Foreword	i
Table of Contents	1
List of Figures	3
List of Boxes	3
Executive Summary	5
<b>1. Introduction: The Nexus of Climate Change, Knowledge Systems, Culture, and Heritage</b>	<b>9</b>
<b>2. Defining and Describing Different Knowledge Systems</b>	<b>13</b>
2.1. Attributes of knowledge systems in general	13
2.2. Scientific knowledge	19
2.3. Indigenous knowledge	20
2.4. Local knowledge	23
<b>3. The Importance of a Historical Perspective on Climate Change, Knowledge Systems, and Cultural Heritage</b>	<b>27</b>
3.1. The importance of a historical perspective on climate change and cultural heritage	27
3.2. The history of colonialism, science, and local and indigenous knowledge of climate	28
3.3. Indigenous responses to climate change from a historical perspective	31
<b>4. Plural Knowledge Systems in The Era of Climate Change: Framework and Work to Date</b>	<b>33</b>
4.1. Consensus on the need for climate change action	33
4.2. The need for collaborations between plural knowledge systems to address climate change	34
4.3. Treating knowledge systems as wholes	37
4.3.1. Components of knowledge systems	37
4.3.2. Overviews of components of knowledge systems	39
4.4. Justice and plural knowledge systems	40
4.4.1. Key conditions: recognition and respect	42
4.4.2. Procedures and mechanisms to support productive collaboration	45
4.4.3. Recent steps towards full, just collaboration: COP26 Glasgow 2022	50
<b>5.1. International and national organisations</b>	<b>55</b>
5.1.1 UNESCO	55
5.1.2 IPCC	56
5.1.3. Other international bodies	59
5.1.3.1. UNFCCC	59

5.1.3.2. IPBES	60
5.1.3.3. IPCC-IPBES joint activities	60
5.1.3.4. The Convention on Biological Diversity (CBD)	61
5.1.3.5. FAO	62
5.1.4. The treatment of different knowledge systems in national assessments and plans	62
5.2. Sources documenting Indigenous knowledge and local knowledge	63
5.2.1 Sources led by Indigenous organizations	64
5.2.2 Sources led by international organizations	64
<b>References</b>	<b>69</b>

## List of Figures

Figure 1: Shared Socio-economic Pathways (SSPs) and the nature-culture duality.	14
Figure 2: Interaction of Indigenous knowledge and local knowledge with scientific knowledge.	36
Figure 3: Heritage and knowledge systems	44
Figure 4: Fullness and justice dimensions of collaboration between knowledge systems	49

## List of Case Studies

Case Study 1: Customary Meetings, Heritage Buildings and Coastal Village Relocation (Fiji)	8
Case Study 2: Mapuche Spirituality and its Contribution to Climate Change Mitigation (Chile)	11
Case Study 3: Local Knowledge of Water Management and Cultural Landscape (Spain)	25
Case Study 4: Restoring Indigenous Fire Management Practices for Forest Conservation (Bolivia)	32
Case Study 5: Indigenous peoples Traditional Governance Systems for Conservation and Sustainable Management of Natural Resources (Nepal)	53
Case Study 6: Stone Walling Practice in the Cordillera Region (Northern Philippines)	54
Case Study 7: Local Knowledge and Flood Risk Management in Urban Informal Settlements (Sierra Leone)	66
Case Study 8: Indigenous Knowledge in Urban Settings (United States)	67

## List of Boxes

Box 1: Scoping questions provided by UNESCO, ICOMOS and IPCC	10
Box 2: Dualities	17
Box 3: Some misconceptions of knowledge systems	24
Box 4: Decisions and outputs from COP26	51



# Intangible Cultural Heritage, Diverse Knowledge Systems, and Climate Change

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## Executive Summary

**Many sources acknowledge the importance of drawing on different ways of knowing to address complex global problems, such as climate change.** Recent research on plural knowledge systems to address climate change has focused primarily on three categories of knowledge: Indigenous knowledge, local knowledge, and scientific knowledge. These knowledge systems are widely represented in peer-reviewed research on climate change and in reports and documents by Indigenous organizations and NGOs. The importance of drawing on plural knowledge systems has been discussed in reports by UNESCO, the IPCC, IPBES and other organizations, with a notable increase of attention in recent years. “Knowledge system” is the most commonly used related term in these reports, but other terms—particularly, “ways of knowing”—have also been used. A number of sources have called for a transformational shift to full recognition and the inclusion—based on mutual recognition and respect—of plural knowledges in international assessments and policy frameworks, though gaps remain for putting this into practice. {3.1, 3.2, 3.3, 3.4, 5.3, 5.4}

**Recent research has emphasized diversity within Indigenous, local, and scientific knowledge, as well as the differences between these knowledge systems.** Though their histories have at many points been separate, there are prior encounters and engagements that can illuminate current relationships between these knowledge systems. These earlier connections vary from efforts by colonial powers to eradicate Indigenous knowledge and the often unstated appropriation of Indigenous knowledge and local knowledge to more productive collaborations, sometimes to advance Indigenous peoples and local communities. {3.1, 4.1, 4.2}

**The acknowledgment of Indigenous knowledge systems in particular has been growing rapidly in peer-reviewed literature and reports by Indigenous organizations, international agencies, NGOs, and other bodies.** This work provides coverage of Indigenous knowledge in all regions of the world. The literature on local knowledge, though also growing, is not as extensive. Some work points to the overlaps between Indigenous knowledge and local knowledge, and the difficulties, in some cases, of distinguishing between them. {1.1, 5.1, 5.2, 6.1, 6.2}

**Indigenous, local, and scientific knowledge systems include both intangible elements (such as languages, concepts, beliefs, values, worldviews, and spirituality) and tangible elements (including objects, structures, landscapes, and organisms). This combination of intangible and tangible can support an engagement with the broad fields of culture (often, but not exclusively, associated with the intangible) and of heritage (where tangible elements have a more prominent role).** Relatedly, recent research has emphasized a variety of forms of action as essential elements of knowledge systems; in this view, ways of knowing are also ways of being, ways of doing and making, and ways of relating and caring. A number of sources challenge the dichotomies that make a distinction between tangible and intangible or knowledge and action, proposing instead models in which these elements are seen as mutually constitutive. These sources note that in many cases, tangible and intangible elements are deeply interconnected, so that erecting a distinction between them can be arbitrary, or a misreading. {3.1, Box 2, Figure 1}

**Indigenous, local, and scientific knowledge systems are keenly aware of the importance of actions to address climate change at present and in the future, though these systems differ in their diagnosis of causes, as well as the pathways that should be taken in order to address these causes. The legacy of colonialism and persistent inequality also block efforts to draw on plural knowledge systems to understand and address climate change from different perspectives.** Many Indigenous Peoples and local communities continue to suffer social, political, and economic discrimination (often including violence and displacement from their territories) and are most affected by environmental and climate change. {4.1, 4.2, 4.3, 5.1, 5.2}

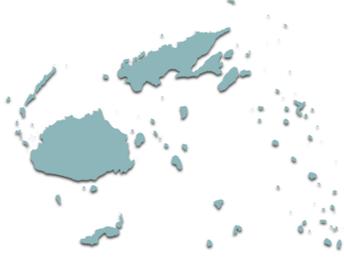
**The collaboration of Indigenous, local, and scientific knowledge systems is widely recognized to enhance the effectiveness of climate action.** Such collaboration is compatible with maintaining the autonomy and distinctiveness of each knowledge system, and the careful design of governance mechanisms can assure the autonomy of each system while promoting their joint efficacy. Such collaborations are different from integration, the latter being a process whereby these knowledge systems are merged or hybridized into a new form. Terms such as “braiding” and “weaving” may express an interrelationship that preserves distinctiveness. {5.1, 5.2, 5.3, 5.4, 6.2}

**The two key dimensions which support the viability and success of collaborations between knowledge systems are fullness and justice.** Fullness refers to the epistemic dimension. For example, are all components of knowledge systems (observations, worldviews, practices, values) included in the collaboration? Justice refers to the ethical dimension. For example, do all holders of knowledge systems participate equitably and fairly in the processes of establishing collaborations? Do they share equitably and fairly the positive and negative outcomes of the collaborations? Are they fully recognized within the collaborations? Finally, are the necessary conditions for their engagement (full rights to their territories and languages) present? These dimensions are not separate and additive, but rather reciprocal; each is necessary for the other. {5.3, 5.4}

**Mutual recognition and respect are also key factors for successful collaborations.** A number of specific tools have been developed to protect different knowledge systems, such as Free, Prior, Informed Consent (FPIC) for Indigenous knowledge and local knowledge, intellectual property rights for all knowledge systems, Indigenous data sovereignty, and other legal mechanisms, such as customary law. Formal recognition by state agencies is an important precondition to full recognition, though in some cases its effects are limited or even negative (for example, leading to surveillance and paternalistic or authoritarian control). {5.4.1}

**In recent years, some studies have begun to specify the forms and nature of successful collaborations between knowledge systems, noting in particular their diversity.** Studies from several regions have shown that effective collaborations often develop over a number of years or even generations, rather than on the shorter time-frame of individual projects. Some studies emphasize the value of drawing on plural knowledge systems to identify problems and possible approaches to construct solutions. Studies also indicate the need to incorporate mechanisms that guarantee fullness and justice. {5.4.2}

**COP26 in Glasgow represents an advance, marking stronger recognition of Indigenous Peoples and local communities within international climate negotiations and support for collaboration between knowledge systems, though much remains to be done.** The parties at COP26 agreed on a number of points which specify significant details about the need for and form of such collaborations. Nonetheless, Indigenous scholars and organizations remain marginal to key negotiations and full intercultural recognition has not been achieved. Addressing these gaps can promote the transformational change that many have called for. {5.4.3}



## Case study 1:

### Customary Meetings, Heritage Buildings and Coastal Village Relocation (Fiji)

[keywords: tangible heritage, intangible heritage, governance, impacts, solutions]

In Fiji, Indigenous knowledge, including knowledge of aspects of weather, climate, soils, agriculture, and forestry, has contributed to climate change responses. This knowledge is often shared through discussions structured by customary cultural forms, such as *talanoa* (storytelling, sharing stories) and *tukutuku* (testimony, formal statements). These are often formalised with the consumption of *yaqona* or kava, a plant with mild sedative properties, prepared and distributed in ritualised ways. *Talanoa* is used in other areas of the Pacific to refer to similar speech forms, particularly the nearby states of Tonga and Samoa (Tomlinson, 2020).

These discussions take place in culturally appropriate structures, often village meeting halls, the residences of village chiefs, and religious centres. The use of space in these structures is formalised, e.g., with senior men seated at the 'upper' half of the space, above the kava bowl. Though traditional materials (local wood for beams, leaves for thatch) have been replaced in some cases by modern technologies (cinder block, metal roofs), this customary use of space continues, and traditional cultural items, such as locally made mats on which participants sit, continue to be used. The cultural norms which govern the discussions, though hierarchical (favouring senior men) are inclusive, allowing representation of a wide range of views from the community (Tomlinson, 2007; Toren, 1999). Climate change has threatened these buildings and objects, particularly with the increasing intensity of typhoons, which cause extensive material damage. To date, however, the plant species that are used to construct traditional buildings and mats are not threatened. Houses called 'bure' in the village of Navala, which has retained high levels of use of traditional materials, serve as a resilient solution in a post-disaster reconstruction period (Aquino et al., 2021).

Tangible heritage (buildings) and intangible heritage (social and cultural forms) show that Indigenous knowledge is impacted by climate change and supports solutions to address climate change. Livelihoods in Fiji have been negatively impacted by storm damage from typhoons and erosion and salinisation of soils from sea-level rise. Villagers have undertaken extensive discussions and, carrying out plans made during these discussions, relocated their villages inland. These decisions entail complex considerations; for example, inland sites may have undamaged soils but lie further from fishing areas. Cultural factors, such as maintaining access to grounds where deceased relatives are interred, are also taken into account. In this sense, the tangible heritage of meeting halls, mats and *yaqona*, and the intangible heritage of *talanoa* support the mobilisation of Indigenous knowledge.

In some cases, the relocation is carried out autonomously; in others, relocation involves consultation with government agencies or NGOs, sometimes involving national or international investment in new building technologies. Moreover, this *talanoa* process has gained wide recognition as a form of discussion which facilitates climate change adaptation and other actions (Tomlinson, 2020). This came to the fore when Fiji served as host of COP23 in 2017. Prime Minister Frank Bainimarama emphasised the value of *talanoa* as a 'new way to drive the implementation of the Paris Agreement on climate change' and indicated that it promotes inclusivity, participation, and transparency (Bolatiki, 2018).

## 1. Introduction: The Nexus of Climate Change, Knowledge Systems, Culture, and Heritage

Human cultural diversity is reflected in many different ways of knowing, being, and doing, each with specific histories, positionalities, and connections to ecosystems, landscapes, and the world. Such diversity results in plural knowledge systems. This white paper describes the characteristics and complexity of knowledge systems in the context of climate change. It notes the deficiencies of action to date on climate change, which has largely rested on scientific knowledge, and discusses the importance of drawing on other knowledge systems, particularly Indigenous knowledge and local knowledge. This paper synthesises evidence highlighting that Indigenous knowledge systems and local knowledge systems are dynamic, contemporary, and actively applied worldwide. Although Indigenous knowledge and local knowledge systems continue to be politically marginalised, the recognition of their role in climate governance is essential. We consider plural knowledge systems and the interactions and potential collaborations between them, with a goal of informing how they can most constructively, equitably, and inclusively be conceptualised and addressed when discussing and generating knowledge about and responses to climate change.

In this white paper, the concept of knowledge systems is used as the overarching framework. This concept of knowledge systems is becoming increasingly applied to research and policy processes about the environment and development, including climate change (Tengö et al., 2017; Thaman, 2013). Literature and initiatives based on concepts such as tangible and intangible cultural heritage are drawn on throughout the paper as valuable resources highlighting different types of values and practices, and their relationship to places, objects, and nature (see Box 2, 'Dualities'). However, the concept of knowledge systems encompasses and goes beyond such work by fostering a holistic, interrelated approach to social, cultural, economic, environmental and political domains (Cornell et al., 2013; Nakashima et al., 2012). A focus on knowledge systems also emphasises diversity among those systems, including different ways of relating to nature and responding to environmental change. Attention to plural knowledge systems additionally supports inquiry into past and present interactions between system types. This inquiry facilitates constructive insights into whose values and knowledge have gained recognition and shaped policies, and into the extent to which political processes and governance structures are inclusive. Ultimately, the focus on plural knowledge systems provides the analytical framework to constructively address the question of how climate governance may become more just and effective.

## Box 1: Scoping questions provided by UNESCO, ICOMOS, and the IPCC

*This white paper focuses on the relationships of intangible cultural heritage and diverse knowledge systems to climate change. In particular, it addresses four questions:*

**Question 1:** What is the range of definitions and interrelationships of concepts of diverse knowledge systems, tangible and intangible cultural heritage, and natural heritage with respect to climate change?

**Question 2:** How have diverse knowledge systems and cultural practices been incorporated into recent IPCC reports (particularly special reports 1.5C, Special Report on Climate Change and Land (SRCCL), Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC))? What has changed/been added over the course of these reports? What gaps are evident and remain to be addressed?

**Question 3:** In knowledge external to IPCC reports, what is the state of understanding regarding the complexity and diversity of knowledge systems and cultural practices, as well as their dynamic and evolving nature in light of climate impacts and adaptation? Where is this understanding held and how?

**Question 4:** With respect to climate change literature (IPCC reports and other sources), what is the state of bringing together local knowledge, Indigenous peoples' ways of knowing and scientific knowledge for the benefit of communities while preserving the distinctiveness of each? Are there good examples of such integration (and if so, from where and regarding what topics)? What gaps and challenges are yet to be addressed?

*This paper contributes to two conversations, one about the need for global climate science and climate governance to better address culture and heritage and a second about the need to advance the contributions of culture and heritage to climate change adaptation and mitigation.*

In advance of the IPCC's seventh assessment cycle, this paper contributes most directly to the following overarching questions about cultural governance and our capacity to learn from the past:

### *Cultural governance*

- Where have major definitions of heritage been made and how do these intersect with attention to (or lack of) with climate impacts and response?
- Are there instances in which cultural heritage has improved security or reduced stress in the face of climate change? What are situations in which cultural heritage has been or may be used as a source or focus of stress?
- What are the range and outcomes of case studies that have productively and effectively linked nature and culture approaches? Where have these worked well and where is more work needed?

### *Capacity to learn from the past*

- What is the status of data-based connections between past environments and environmental change and temporal, causal, and other interconnections with past human activity? What is the balance of current and needed methods for translating insights from centuries or millennia of human-environment experience into meaningful approaches to contemporary climate science and response?
- How well do the questions that climate adaptation and mitigation scientific communities have about the nature of human past, behaviour, and society align with previous questions that researchers have asked about these topics?



## Case study 2:

### Mapuche spirituality and its Contribution to Climate Change Mitigation (Chile)

[Keywords: intangible heritage, governance, solutions]

According to the Mapuche people of Chile and Argentina, three interrelated dimensions form the Mapu, or the surrounding Earth: the Wenumapu (upper space), the Nagmapu (where the earthly life occurs), and the Minchemapu (lower space). The Wenumapu and the Minchemapu are two opposite dimensions, positive and negative energies, that keep the balance in the Nagmapu. This order is protected by the Az Mapu, the guidelines that norm how the Che—the Mapuche person—relate to each other and the Ixofillmogen (biological and spiritual diversity) (Melin et al., 2019).



*The Mapuche community of Liempi Colipi, Curacautín (background: Lonquimay volcano).*

This ontology and its related knowledge system have been disregarded and silenced by Chilean and Argentinian states to open the road for settler/colonial ontologies of land and property rights. This logic has caused an incremental detriment loss of Mapuche ontological knowledge and has led to overexploitation of forest ecosystems, one of the main causes of climate change (Achard et al., 2004). The Chilean forestry sector is based on Mapuche ancestral territories assigned during the Chilean military dictatorship (1973-1989) (Torres-Salinas et al., 2016). The native forest associated with these lands has been subjected to selective harvests, forest fires, and the introduction of industrial timber plantations. Furthermore, these interventions have contributed to Ixofillmogen depletion and destroyed sacred spaces, leading to the disappearance of their spirit protectors, the

Nngen. Once the Nngen are gone, the Az Mapu loses the ability to maintain the balance, provoking the disconnection of the Che (the people) with the spiritual dimension of the Mapu.



*Plantations of Pinus radiata and crops on ancestral territory, Liempi Colipi Community.*

In their quest to recover the connection to the Mapu, Mapuche people engage in reciprocal restoration (Kimmerer, 2011) of their sacred places. Reciprocal restoration involves two aspects. First, it involves strengthening spiritual practices to bring back the Nngen to rule sacred spaces, restoring the Az Mapu, and therefore reconnecting the Che to the Mapu. Additionally, it involves reclaiming and regaining ancestral Lof (territories) and conserving what remains of natural forests. This also involves restoring what has been destroyed, using a process of natural regeneration and replanting that combines traditional techniques and collaboration with the state. By doing this, Mapuche are reducing carbon emissions from deforestation and forest degradation and creating new carbon sinks. However, the different ontological perspectives between the Mapuche and the Chilean state regarding the land result in a lack of appropriate policies to facilitate the contribution of Mapuche people to climate change mitigation (Carmona, 2022).



*Drinking water supply in the Benancio Huenchupan Community, Curacautín.*

**Source:** Arias-Bustamante and Innes, 2020; photos by: José Arias Bustamante

## 2. Defining and Describing Different Knowledge Systems

### 2.1. Attributes of knowledge systems in general

This section describes key characteristics of knowledge systems, with important implications for the types of approaches required to understand them and the ways in which different knowledge systems interact. In brief, this section establishes that knowledge systems are highly complex, rooted in differing worldviews and values, but comprising interrelated domains of social practice. One widely-cited discussion of knowledge systems defines them as sets of interacting 'agents, practices and institutions that organise the production, transfer and use of knowledge' (Cornell et al., 2013). As they are socially constructed and continue to evolve and be negotiated in response to various changes occurring across scales and through interactions with other knowledge systems, they are also dynamic, contemporary, and can be highly resilient. The section concludes by distinguishing three key types of knowledge systems: Indigenous, local, and scientific, which the following sections explore in detail.

Knowledge systems can be characterised as complex. Discussions of knowledge systems provide different lists of their components. However, there is a general consensus that they are inherently holistic, composed of many interacting constituent parts that may span or be embedded within different interrelated aspects of social practice, including economic, social, environmental, political, cultural, and spiritual dimensions (Berkes, 2009; Levac et al., 2018). This means they cannot be easily understood through separation into individual practices, instances of knowledge, or objects (Jovchelovitch, 2007). For example, knowledge systems relate to and connect both material components or tangible heritage (e.g., humans, animals/plants, landscapes, built structures, and objects, including tools), and non-material components or intangible heritage (e.g., languages, ideas, values, beliefs, epistemologies and worldviews). At the same time, knowledge systems reflect how these components interconnect with each other, blurring the boundaries between what is defined as tangible and intangible (see Box 2 for more discussion of these dualities, and Figure 1 for different scenarios relating to the nature-culture duality). For example, Case Study 1 in Fiji illustrates the relevance of tangible heritage, particularly the context of traditional meeting halls, for the exercise of intangible heritage, including social practices and decision-making processes, to support adaptation to sea-level rise. In a similar vein, Barrera-Bassols and Toledo (2005) describe the Yucatec-Maya farmers' knowledge system as related not simply to food production or subsistence, but as being embedded within their holistic understanding of health, landscapes, nature, and spirituality.

An important element of this white paper is the recognition of plural knowledge systems, or the idea that a diverse range of knowledge systems can be identified as distinct and autonomous from each other. Knowledge systems are fundamentally shaped by different worldviews, cosmologies, and ontologies, and by the diverse languages which express them. In other words, because different knowledge systems are rooted in plural ways of thinking, speaking and being, they result in different collective understandings and behaviours, and even produce different cultural worlds. Though there are profound differences between knowledge systems, communication between them is possible. These knowledge systems all draw on shared human capabilities for perception, cognition, and language, and they all link

to the Earth that is our common (if contested) home. Moreover, history—from early times, through the great colonial expansion in recent centuries, to the present—has often brought holders of different knowledge systems into contact, communication, and relationships with each other, as discussed in chapter 3.

As seen below, many observers now divide this pluralism in ways of knowing, learning, being, and doing into categories which share many characteristics: these are often pooled into three types: ‘scientific knowledge,’ ‘Indigenous knowledge,’ and ‘local knowledge.’ Though other types exist as well, such as ‘practitioner knowledge,’ ‘travelling knowledge,’ or ‘lay knowledge,’ this white paper draws primarily on the first three, recognising both the commonalities and the diversity within each type. We note that Indigenous knowledge and local knowledge are sometimes grouped as ‘traditional knowledge.’

Knowledge systems extend from values and beliefs to practices and institutions, therefore including not only cognition and thought, or understandings of the world, but also many forms of action, or engagement with, and relation to the world, including care for the world (Brondízio et al., 2021; Dasgupta et al., 2021; Van Huynh et al., 2020). As a brief illustrative example of how different types of values can produce different understandings and forms of action, Petitpas and Bonacic (2019) describe variations in the understanding of the guanaco (Lama guanicoe) between different groups in South America. Some groups have lived with and sustainably used this species of mammal for centuries, and the guanaco is part of their place-based cultural identity and relational values about nature. Others seek to reduce human influence by implementing forms of protection for the guanaco based on its scientifically-ascribed conservation value.

		Shifts of the current nature-culture dualism reflected in shared socio-economic pathways						
		Large decrease	Medium decrease	Small decrease	No change	Small increase	Medium increase	Large increase
<b>SSP1</b>	Sustainability			X	X			
<b>SSP2</b>	Middle of the Road				X	X		
<b>SSP3</b>	Regional Rivalry						X	X
<b>SSP4</b>	Inequality						X	X
<b>SSP5</b>	Fossil-fuel development						X	X

**Figure 1: Shared Socio-economic Pathways (SSPs) and the nature-culture duality.** This figure depicts the potential of different SSPs to alter current conceptualization of the nature-culture duality, as broadly reflected in global climate action. A transformation from the current state of the duality to a lesser degree of dualism, is deemed by many as a key step to addressing the climate crisis. Criteria for evaluating the potential contribution of SSPs include: (1) Respecting both nature and culture, (2) Recognizing the interrelations of nature and culture, (3) Adopting long-term perspectives, (4) Moving beyond exclusively economic valuation, and (5) Reducing destructive activities.

Knowledge systems are dynamic, and continue to evolve in the contemporary world. People across all cultures engage in everyday communication about collectively held values, through a multitude of practices and a variety of institutions. As such, the many constituent parts of knowledge systems evolve continuously in response to social, environmental, technological and other forms of change that occur from local to global scales. Thus, knowledge systems are not static or only relevant to past conditions, even if they can be considered old and rooted in ancestral knowledge that has passed through many generations. To clearly highlight the contemporary relevance of Indigenous knowledge systems, at least 370 million people identifying as Indigenous manage over a quarter of the Earth's land surface across 87 countries, applying cultural practices and customary institutions based on their Indigenous knowledge systems (Garnett et al., 2018). Moreover, those Indigenous forms of stewardship are increasingly proven to conserve biodiversity more effectively than interventions designed and implemented by states and international conservation organisations (Dawson et al., 2021; Fa et al., 2020). Detailed individual cases of the relevance of Indigenous knowledge systems are provided in Case Study 4, which describes the imperative to revive Indigenous fire management practices in Bolivia's forests to counter increasing threats from forest fires induced by climate change. Furthermore, numerous studies trace the emergence of new knowledge and practices within Indigenous knowledge systems and local knowledge systems (Petzold et al., 2020). Some studies locate areas of dynamism in changing forms of tangible culture, as exemplified among the Inuit artists from Nunavut, Canada, for whom the practice of making of artwork embeds local knowledge, practice and belief into art objects and can make valuable and unique contributions to nurturing knowledge and bridging knowledge across generations, and can even enable monitoring of social-ecological change (Rathwell and Armitage, 2016).

The potential dynamism of knowledge systems also means they adapt and can exhibit great resilience. Though some researchers claim that urbanisation inevitably leads to a loss of Indigenous knowledge, reflecting the difficulty of engaging youth (Bouba, 2020), the absence of historical and sacred Indigenous sites (Hari, 2020) and the pressures from non-Indigenous governance systems and technology (Sirayi et al., 2021) other research shows that this erosion is not universal. For example, in the city of Santiago de Chile, urban Mapuche organisations have undertaken a process of cultural reactivation that has led to the construction of *rukas* - prehispanic Mapuche houses - that fulfil relevant functions, including the administration of traditional medicine and the revitalisation of Indigenous agro-ecological practices, thus transferring the heritage of the southern part of the country to the centre (Carmona, 2015; 2017). Salami et al. (2020) show the vitality of Indigenous knowledge in an urban setting in Nigeria, where it contributes to land management, urban agriculture, food security and livelihoods. And Case Study 8 in the United States shows how different Indigenous groups revitalise their traditional heritage in urban contexts that may have previously represented colonisation and state-sponsored efforts at cultural annihilation, providing new possibilities for adaptation today. And although local knowledge has most often been examined in rural settings, often linked to resource-based livelihoods such as agriculture, pastoralism, fisheries, and forest resource use, some new research documents the creativity of local knowledge in urban settings (See Case Study 7 in Sierra Leone, which illustrates the relevance of local knowledge in risk management in an urban context).

There are discussions of whether Indigenous knowledge systems and local knowledge systems share qualities often attributed only to scientific knowledge. Indigenous knowledge systems, being based in

careful observation, participation, experimentation, trial and error, and transmission of knowledge, share characteristics of Western science, and have been characterised as ‘science,’ by both Indigenous (Whyte et al., 2016) and non-Indigenous (Alessa et al., 2016) scholars. These scholars have noted that some cases of scientific knowledge possess characteristics sometimes assumed to be distinctive of Indigenous knowledge, such as Keller's account of McClintock's genetics, which emphasises the full connection of the researcher to the phenomenon (Keller, 1983), Myers’ discussion on the role of experimenters' full sensorium in molecular biology (Myers, 2015), and O'Reilly's account of the intimacy that links physical scientists with ice-filled landscapes in Antarctica (O'Reilly, 2016).

However, other scholars have emphasised the differences between Indigenous knowledge systems and scientific knowledge systems, pointing to several characteristics of Indigenous knowledge absent from scientific knowledge:

- 1)** it does not exclusively rely on the rational mind but includes what Cajete (2000) calls the ‘metaphoric mind’—including elements such as imagination, art, creativity, dreaming;
- 2)** it does not base its knowing on being separate from the phenomenon being observed but is based on an intimate participation in the process;
- 3)** it is rooted in an ethical respect and obligation to ensure the well-being and abundance of the natural process or ecosystem being studied, for example by practicing the ‘honorable harvest’ (Kimmerer, 2013), and understanding one lives in a ‘moral landscape’ (Martinez et al., 2008);
- 4)** it is not a colonial or hegemonic way of knowing, so that a Seneca farmer may have a very different ‘science’ of farming from a Mandan farmer and that knowledge plurality is expected and positive as it is placed in a different landscape and with a different people.

In the context of this white paper, we follow the distinction in IPCC documents (Hurlbert et al., 2019), which treats Indigenous knowledge, local knowledge, and scientific knowledge as separate systems.

Although this paper focuses on plural, collective knowledge systems, it is important to note that, within a specific knowledge system, knowledge is unevenly distributed among knowledge holders. Diversity of knowledge partly arises from specialisation related to social identities. For example, in the case of Indigenous knowledge systems, shamans, herbalists, and midwives may hold different bodies of medicinal knowledge, which also differs from common knowledge (Singh et al., 2020; Turner and Clifton, 2009). Additionally, certain clans, family lineages, and societies might keep specific knowledge for specific purposes and not openly share such knowledge. Differences in the knowledge held by women and men, or gendered knowledge, are considered one of the most significant sources of intracultural knowledge variation (Fulton, 2004; Pfeiffer and Butz, 2005); which is also related to the intersection of gender with other racial, ethnic, caste, and class divisions (Banerjee and Bell, 2007). In parallel fashion, researchers have shown that scientific knowledge is often characterised by ‘distributed cognition,’ in which individuals and groups hold knowledge of different components of specific entities or systems, so that the full knowledge is composed of these separate elements, often drawing on local knowledge as well as scientific knowledge (Mukerji, 2009).

## Box 2: Dualities

A set of dualities, or oppositions, underlie the approaches and perspectives that different institutions and bodies of scholarship use to understand both culture and heritage as well as knowledge systems.

In the broadest sense, these dualities rest on the distinction (contested or rejected, in some settings) between humans and the natural world. In particular, they draw on the human capacities for thought and creativity which in turn enable culture, a key feature of all human societies and generally understood to be unique to humans (though with some analogues in other species). Knowledge is more broadly distributed: though humans possess a distinctively rich capacity for knowledge, it is also found in other animal species as well—and, in many cultural systems, in other non-human entities such as landscapes and spirits.

Within the heritage domain, there are two well-defined dualities:

**Duality 1:** *The distinction between natural and cultural heritage.* Natural heritage consists: 'of natural features, geological and physiographical formations and delineated areas that constitute the habitat of threatened species of animals and plants and natural sites of value from the point of view of science, conservation or natural beauty' (UNESCO, 1972). In other words, natural heritage describes entities which existed before the appearance of humans in the world, and are often conceived as separate from humans. Cultural heritage, the product of human societies, is 'in its broadest sense, both a product and a process, which provides societies 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). Though particular sites may contain both forms of heritage, these two can be distinguished in such sites (UNESCO, 2020). Some researchers, noting the many connections between cultural diversity and biodiversity, have developed the idea of a unitary 'biocultural heritage' (Maffi, 2018).

**Duality 2:** *The distinction, within cultural heritage, between intangible and tangible heritage.* Tangible heritage consists of monuments, buildings and sites, and sometimes includes 'movable heritage' or objects; though made by humans, these have a physical reality separate from humans. Landscapes can be included as tangible cultural heritage when they contain visible signs of transformation by humans through 'landscape design' or 'land use' (UNESCO, 2019). Intangible heritage consists of mental, cultural, and expressive forms tied directly to living humans, including rituals and festive events associated with religious and spiritual traditions. Intangible heritage has been defined as 'the practices, representations, expressions, knowledge, skills—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. This intangible cultural heritage, transmitted from generation to generation, is constantly recreated by communities and groups in response to their environment, their interaction with nature and their history, and provides them with a sense of identity and continuity, thus promoting respect for cultural diversity and human creativity' (UNESCO, 2020). UNESCO has also noted that 'Although intangible cultural heritage often has tangible objects, artefacts or places associated with it, it is also something different from tangible heritage, as for example the 'properties forming part of the cultural and natural heritage' that are listed on the World Heritage List' (UNESCO, 2020).

The domain of culture is broad; a number of the different formulations distinguish material culture from other cultural domains. Culture has been defined as 'the set of distinctive spiritual, material, intellectual and emotional features of society or a social group, and that it encompasses, in addition to art and literature, lifestyles, ways of living together, value systems, traditions and beliefs' (UNESCO, 2001).

As mentioned above, it is often paired with and distinguished from nature. Other discussions suggest another duality:

**Duality 3:** *The distinction between material culture and other elements.* Material culture can include physical objects produced by people within their cultural systems and other elements can broadly include concepts, beliefs, values, worldviews (Preston, 2013; C. Tilley et al., 2006; Woodward, 2007). This distinction overlaps with the distinction between intangible and tangible heritage.

Within the domain of knowledge systems, many (but not all) accounts posit:

**Duality 4:** *A duality between subjects (the entities which know) and objects (the entities which the knowledge describes and comprehends).* This duality overlaps with the duality between culture and nature, and also (because of the location of thought within the mind) with the one between intangible and tangible elements. There is a wide range of accounts of the types of knowing subjects, the types of known objects and the relations between them. In many of these accounts, knowing subjects include not only humans and animals, but also other entities generally deemed in western cultures to be inanimate, such as landscape features, and immaterial or spirit beings; these knowing subjects generally are understood to possess some sort of mental phenomena (e.g., mind, consciousness, sentience, volition). Known objects also vary in different accounts, including entities in the material world, such as objects, buildings, organisms and landscapes, and often immaterial elements in a spirit realm. In some accounts, the relations between subject and object within knowledge systems are understood to rest principally on cognitive activities—perception, description, comprehension, analysis and the like; in other accounts, other activities—handling and using; inhabiting; caring—are also constitutive elements of knowledge systems (Bonnemann, 2017).

**Duality 5:** *The relation between culture and knowledge is a complex one* (Norton, 2020). As seen above, in some definitions, knowledge is simply one of many components of intangible cultural heritage (UNESCO, 2001). We note as well that some accounts suggest that scientific knowledge is culture-free, either lacking origins in specific cultures or having transcended any elements characteristic of those cultures to become universal, though others see the links of science to capitalism, colonialism, patriarchy, and other historically contingent processes (Chakrabarty, 2000). See sections 2.2 and 3.2 for further discussion.

Many cultures have specific accounts of knowledge systems, resting on their worldviews, ontologies and values; they can include a variety of types of knowing subjects, known objects, and the relations between them (Berque, 2017). Of particular importance for our discussion below, many cultures including many Indigenous Peoples, *do not rest on some or all of the dualities listed above* (Held, 2020; Neilson, 2020). They may understand nature and culture to be one, with humans located with the world along with other entities, rather than separated from the others by the unique qualities of the human mind (Kohn, 2013; Latour, 2007; Watts, 2013; Whyte, 2013).

The questions of these relations between knowledge and culture, of significance in a number of contexts, have acquired greater urgency in the context of the climate crisis (Whyte, 2017). This urgency stems from the keen awareness of the costs of delayed action (Wilson and Orlove, 2021), and also from the challenges to locating climate and climate change within knowledge systems. Do we think of climate as natural or cultural, when the point is precisely that humans have remade it? Is climate tangible or intangible, when it is material and yet never directly perceived? And, in conducting the immense task of reshaping our human societies to forestall greater damage, how can we draw lessons from the wide range of cultures and knowledge systems, which offer diverse models of the links between humans and the world?

## 2.2. Scientific knowledge

Science is often defined as a knowledge system characterised by a hypothetico-deductive method. However, modern scientific disciplines rely on a variety of forms of reasoning and scientific research is far messier in practice than textbook accounts suggest. This is a strength, not a weakness: natural phenomena are too multifarious to be studied according to a single method, and the incorporation of multiple perspectives strengthens the knowledge produced. Modern scientific disciplines are eclectic assemblages of practices that have accreted over time. To observe that scientific knowledge is historically contingent does not discredit it or diminish its contributions, but it does invite the consideration of other ways of knowing. We note here that we distinguish scientific knowledge from scientism, the view that natural science forms a universal and unitary way of knowing and serves as an agent of economic and moral improvement (Bonnett 2013).

As discussed more fully in sections 3.1 and 3.2, modern scientific disciplines over the course of their histories have borrowed heavily from local, vernacular, and Indigenous ways of knowing. Demarcations between 'western science' and other categories of knowledge are therefore heuristic. These distinctions are important, however, for a variety of reasons. They are necessary, for instance, to ensure that Indigenous knowledge and local knowledge systems are not merely addressed through an extractive approach and reduced to a 'resource' or just another form of data, for international scientific organisations. Abstracting Indigenous knowledge and local knowledge from the ways of life with which they are associated is a form of cultural violence. Distinctions between 'science' and 'other' ways of knowing are also vital because they remind us that there is no universal set of criteria with which to evaluate all forms of knowledge. The value of knowledge can only be judged relative to a given context and purpose. Indeed, the positivist and instrumentalist criteria typically employed by review bodies like the IPCC may be insufficient for addressing an ethical dilemma such as climate change.

To date, much of the evidence acknowledged by policymakers about anthropogenic climate change and its impacts has come from research on the natural sciences, which has mostly relied on large-scale records of weather and climate (as measured by remote sensing platforms and ground-based weather stations), and the use of modelling techniques to describe climate change in data-deficient regions, and to make projections for the future. This knowledge is trustworthy because the infrastructure that generates it has proven robust and because the data is subject to ongoing reevaluation (Edwards, 2010). Still, most researchers now acknowledge that the dependence of climate research on a few quantitative metrics is too coarse to detect the disparate and insidious impacts of climate change, particularly at local scale and for periods when instrumental observations are scanty or missing; other researchers note additional deficiencies as well (see section 2.3, 3.3).

In a related vein, natural scientists have addressed social phenomena, calling for integration of other fields into their understanding of climate change. In that sense, in line with scientific positivism, the integration of social sciences into the understandings of climate change has been often interpreted as the inclusion of social, demographic and economic data in models dominated by natural components. Integration of social science approaches has also been proposed through the dissemination of scientific results to policymakers or the public (Leichenko and O'Brien, 2019).

Beyond these approaches, social scientists argue that a better understanding of the impacts of climate change requires to couple our understanding of ecological and social dynamics, for which climate change research needs to fully take into consideration impacts on local socioeconomic systems (Reyes-García et al., 2019). Social scientists argue that communities are differently affected by climate change, not only because climate change impacts are highly place-specific, but also because climate change affects communities through specific pathways largely mediated by local cultures and livelihoods. For example, while sea-level rise is a climate-related phenomenon with potential effects on the hundreds of millions of people living close to coasts, specific biophysical conditions (e.g., magnitude of tidal influences, geologic subsidence, overall island size and relief) and socioeconomic conditions (e.g., resources to cope with sea-level rise, livelihood strategy) mediate how they perceive such changes and the extent to which they feel affected by it. Further, Indigenous knowledge systems and local knowledge systems shape their understandings and enable their courses of action (see Case Studies 1 and 7). Both natural and social scientists are limited both by the scarcity of grounded data and by the lack of inclusion of values, subjectivities, worldviews, and relational paradigms (relational epistemologies, ontologies, and ethics) in their quest to understand local climate change impacts. In other words, scientific research on its own cannot even *define* the problem of climate change, let alone solve it. Understanding the problem requires other ways of knowing.

### 2.3. Indigenous knowledge

No single definition of *Indigenous peoples* or *Indigenous knowledge systems* is internationally accepted (Petzold et al., 2020), although many have noted that Indigenous knowledge systems are integral to cultural complexes, which also encompass language, systems of classification, resource use practices, social interactions, values, ritual, and spirituality. Although there are large cultural and linguistic differences among Indigenous knowledge systems, Tewa scholar Cajete states that ‘there are underlying similarities in their approach to the nature of the interrelationship and development of individuals in the context of the community’ (2016, p. 370). According to Blackfoot scholar Little Bear (2020), Indigenous knowledge systems on Turtle Island, North America, are holistic, cyclical, generalist, process-oriented, and place-based. In this line, the Inuit Circumpolar Council (2021) states: ‘Indigenous knowledge is a systematic way of thinking applied to phenomena across biological, physical, cultural and spiritual systems. It includes insights based on evidence acquired through direct and long-term experiences and extensive and multigenerational observations, lessons and skills. It has developed over millennia and is still developing in a living process, including knowledge acquired today and in the future, and it is passed on from generation to generation.’

While there is a vast diversity among Indigenous knowledge systems and local knowledge systems, a commonality across these systems is how knowledge, cultural expressions, cultural values, customary laws, biological resources, and landscapes are inextricably linked and required to maintain the integrity of these systems. Strong relationships exist between material (humans, landscapes, animals, objects, and built structures) and non-material elements of the Earth. In that sense, in many Indigenous knowledge systems and local knowledge systems the tangible and intangible components cannot be separated. As a consequence, Indigenous and local knowledge systems pay attention to fostering responsible,

reciprocal, and positive relationships between the tangible and intangible components of their environment. These relationships are based upon experiences, cultures, religion, spiritual inclinations, and Indigenous and local governance (Fernández-Llamazares et al., 2021).

It is generally agreed that Indigenous knowledge systems are rooted in careful observation of natural cycles and ecological processes, from large-scale celestial and terrestrial observations to small-scale, local, place-based observations of the life cycles of local plants and animals. For instance, phenology and natural indicators are widely used by Indigenous people to predict the weather. In Tanzania, Hehe and Nyakyusa peoples observe animals' behaviour and flowering to predict rainfall (Chang'a et al., 2010). In Brazil, communities from Barroca, Bom Sucesso, and Cachoeira observe vocalisation, nesting, and reproduction of birds (Farias et al., 2005). In the Andes, Quechua and Aymara communities note the form of the Pleiades star cluster in the pre-dawn sky in late June, drawing on it to anticipate the start of the rains in October or November and to plan their field preparation and planting activities accordingly (Orlove et al., 2000). These observations are encoded in oral tradition and embodied cultural practices which also convey pragmatic knowledge about the environment, as shown in research on the role of traditional songs for the transmission of environmental knowledge (Reyes-García et al., 2019). They also often contain ethical knowledge about when and how to observe and participate in these processes for community health and well-being. For example, this is observed in the way the Yurok and Hupa peoples honour the salmon cycle and harvest them through the First Salmon ceremonies (Martinez, 2018; Swezey and Heizer, 1977).

Sources of knowledge vary for different Indigenous knowledge systems. Scholars have focused on the ability of the social mechanism to transmit knowledge within a society. Some research has emphasised that knowledge follows kinship and friendship lines (Salpeteur et al., 2015), and that social transmission of knowledge follows a multi-stage model including horizontal, vertical, and oblique transmission (Reyes-García, Gallios et al., 2016, p.). Other researchers have found that participation in community life—including livelihood activities, walks through landscapes, and rituals—supports the acquisition of knowledge (Orlove, 2002), while still others have examined the apprentice relationships between novices and specialists (Singh et al., 2020; Turner and Clifton, 2009).

Indigenous scholars offer contributions which complement and deepen these views. According to Māori scholars Ruwhiu and Cathro, Indigenous paradigms are based on the principle of interconnectedness; knowledge is experiential and influenced by subjective and invisible constructs, such as intuition, feelings, spirituality, and energy (Ruwhiu and Cathro, 2014). However, knowledge is also derived from living beings and landscapes, through spiritual beliefs and rituals, e.g., from sacred plants, forests, or mountains, and together they represent the product or embodiment of knowledge of past and current generations of knowledge holders. For instance, Case Study 2 illustrates how nature conveys to Mapuche People the messages needed to establish a sustainable relationship with the land. Because Indigenous communities are often strongly spiritually engaged, their understanding of and responses to environmental changes are framed within spiritual beliefs, understandings, and elements of longer-standing cultural resilience. For example, Mongolian nomads believe that landscape features such as mountains and rivers are endowed with spiritual value and are considered physical manifestations of different deities and spirits. They celebrate connections with the landscape through a spiritual ritual called

the Ovoo Offering ritual (Huang, 2019; Tugjamba et al., 2021). The ritualisation of connectedness with nature then supports broader sets of common values, such as respect for the cultural and biological diversity of the planet, care for the community, and ethical care for sustainability and planetary future (Zylstra, 2019).

According to Opaskwayak Cree scholar Shawn Wilson (2001), knowledge is a relational process. In many Indigenous worldviews and paradigms, the territory plays an active role in creating the world, and the relation between the mind, the body and the earth is the origin of life, promoting language and knowledge (Suchet-Pearson et al., 2013; Watts, 2013). So, in many Indigenous knowledge systems, relationality and connection between humans, other species, and the earth are essential and evolve through dynamic intergenerational transmission based on oral and embodied knowledge practices (Gram-Hanssen et al., 2021). For example, for the Ndau, in Zimbabwe's Chimanimani district, human ailments such as asthma, back pain, heart and lung diseases guide weather predictions (Risiro et al., 2012), so the body is a source of environmental knowledge. The Baganda in Uganda understand the sense of sight to have two different components (Orlove and Kabugo, 2005), one of which is the principal source of knowledge about the timing of rains (Orlove et al., 2010). Similarly, for rice farmers of Kenyah Badeng in Sarawak, the senses of the body, such as sight, hearing, and touch provide information about present and future weather (Garay-Barayazarra and Puri, 2011). Many Indigenous peoples assert that even their languages come from the lands, as linguist Keith Basso outlined in his book *Wisdom Sits in Places* (Basso, 1996). Spiritual values and beliefs are closely interlinked with, or expressed in, customary laws which govern the way knowledge is acquired and shared, the rights and responsibilities attached to possessing knowledge. These values and beliefs have a strong spiritual character, as the Mapuche law of *Az Mapu* (see Case Study 2) and the non-violence principle of Shagya for the people from Tumba of Gorkha in Nepal (see Case Study 5) illustrate.

Most Indigenous knowledge systems comprise values that inform decision making about fundamental aspects of life, from day-to-day activities to long-term actions and governance, and from the pragmatic to the cosmological. In many cases the customary institutions associated with a particular Indigenous knowledge system relating to resource tenure and access, social inclusion, knowledge transfer, decision-making, and authority, represent governance and management practices through which Indigenous territories and nature within them are conserved or sustainably used (Gadgil et al., 1993; Reyes-García et al., 2021). This can be seen, for example, in the regulation of livestock and land use promoted by various customary institutions and laws in Nepal (see Case Study 5), or in the regularisation of hunting time and location among the Inuit: as extreme weather conditions limit communities' hunting and travel (Gearheard et al., 2010), they have developed community-based hunting and sharing programmes to ensure access to natural resources (Ford et al., 2006; Furgal and Seguin, 2006). Cultural and spiritual institutions also play an important role in regularising practices and shaping natural resource management (Kronik and Verner, 2010; World Bank, 2002; 2006). In Ghana, traditional taboos protect water bodies by the establishment of days when nobody can go to the river, so that the river spirit can have a day of rest (Gyampoh et al., 2009). In Chile, the Mapuche see land care and restoration as the main mechanism for the revitalisation of spiritual life (see Case Study 2).

## 2.4. Local knowledge

Local knowledge systems are commonly distinguished from Indigenous knowledge systems through their relation to the cultures and practices of non-Indigenous communities, both urban and rural (FAO, 2018). Local knowledge systems have often been combined or treated as overlapping with Indigenous knowledge systems, particularly through the use of concepts such as 'traditional ecological knowledge' or 'traditional environmental knowledge' (Berkes et al., 1995; Nakashima et al., 2012). As with Indigenous knowledge systems, local knowledge systems encompass personal and collective experience as well as indirect experience and oral history to continuously generate collective, intergenerational, place-based knowledge. In addition to being forged by the territory, local knowledge systems are also shaped by historical and social processes, whether by resisting imposed practices (Escobar, 1998), or by assimilating them. For instance, Case Study 3 in Spain illustrates how the relationship of local communities with the territory through water management promotes local knowledge systems that shape both the landscape and the social organisation of communities, and how these have been simultaneously affected by broader socio-political processes. However, while local knowledge systems can also inform decision making about fundamental aspects of life, they are not necessarily based on a single specific culture or embedded in a wider system, as Indigenous knowledge systems generally are. For example, diverse and dynamic local communities in Bangalore came together to negotiate values to establish shared visions and new institutions to provide stewardship for urban wetlands (Murphy et al., 2019).

Though the differences between Indigenous knowledge systems and local knowledge systems can be clear in many contexts, these systems sometimes do not have defined boundaries. In some cases, the differentiation between Indigenous knowledge and local knowledge may only be a political practice of world-making (Klenk et al., 2017). For instance, communities who may self-identify and be defined under national laws as Indigenous in one place or region may be excluded in other contexts (Buenavista et al., 2018). For example, in Laos, there are many rural communities spanning multiple distinct ethno-linguistic groups within the three main categories of Lao-Tai, mon-Khmer, and Hmong Mien who have over many generations developed place-based spiritual and cultural values, practices, and institutions for territorial governance, yet none are politically recognised as Indigenous (Baird, 2015).

As for other knowledge systems, there is a high diversity in local knowledge systems, from the knowledge found in new settlements developed by migrants from different places, to the knowledge of local populations with long-term historical continuity of engagement with the environment (Aikenhead and Ogawa, 2007). For instance, Case Study 7 illustrates how local knowledge construction processes are currently produced from flood risk reduction in informal urban settlements in Sierra Leone.

Local knowledge systems have also proved of value in understanding climate change impacts. For example, in Sierra Nevada, Spain, proverbs encode local climatological knowledge, denoting indicators of local weather and climate variability, but research shows that in modern times many proverbs have lost their pertinence or predictive accuracy (Garteizgogeoasca et al., 2020). Community members note this loss as a signal of a disruption of the natural order, leaving them frustrated and uncertain about how to respond and more ready to accept proposed technological innovations proposed.

### Box 3: Some Misconceptions of Knowledge Systems

We summarise here certain misconceptions about Indigenous knowledge and local knowledge. These inaccurate views still persist in some contexts, even though these knowledge systems have received increased attention within scientific and international policy settings, and even though widely articulated principles of equity challenge them. These misconceptions continue to shape the treatment of Indigenous knowledge systems and local knowledge systems. This political marginalisation in many settings operates to the detriment of constructive collaboration in global climate governance and the realisation of rights. Therefore, these assumptions need to be articulated so that they can be challenged and overcome.

**Misconception 1:** Indigenous knowledge and local knowledge are old, static and declining. As documented in each of the case studies, Indigenous knowledge and local knowledge have continuously adapted to environmental changes and today provide new responses to impacts of climate change.

**Misconception 2:** Indigenous knowledge and local knowledge are centred on visual and performative arts, rituals and spirituality, and hence do not engage significantly with natural environments, livelihoods and resources.

**Misconception 3:** The populations that hold Indigenous knowledge and local knowledge are few in number, concentrated in remote areas, and shrinking overall. The populations of the world's Indigenous peoples exceeds 400 million, largely living in balance with natural environments. Local populations are several times larger and also represent many sustainable lifeways. Indigenous peoples are found on every inhabited continent, as are local communities.

**Misconception 4:** Indigenous knowledge, local knowledge and scientific knowledge are so radically different that they are incommensurable, making translation and comprehension between them impossible.

**Misconception 5:** Scientific knowledge is the only basis of climate action. The contributions of scientific knowledge for climate mitigation and adaptation are widely recognised; however, these contributions have not fully addressed the challenges of climate change. Collaborations with Indigenous knowledge and local knowledge offer important new forms of action.



### Case Study 3:

## Local Knowledge of Water Management and Cultural Landscape (Spain)

[Keywords: tangible heritage, impacts, solutions]

The Sierra Nevada, the highest mountain region in the southeast of the Iberian Peninsula and one of the most important biodiversity hotspots of Europe and the Mediterranean basin, is characterised by the historical co-evolution of local communities and ecosystems, resulting in a complex 'cultural landscape.' For centuries, human interventions have modified the Sierra Nevada through the development of diverse water infrastructures like *acequias de careo*, *partidores*, *aliviaderos*, and *cimbras*, *minas* or *qanats*, to channel, guide, and harvest water running down the slopes of the mountain (Compilation 1). This complex water management system has sculpted unique landscape structures that have contributed to the Sierra Nevada's singular biodiversity and made possible the permanent occupation of the territory (Martos-Rosillo et al., 2019). The network of traditional water infrastructure favours aquifer recharge, reduces soil erosion, and helps distribute melting waters through the slopes of the mountain, generating ecological corridors and a great variety of microhabitats in the middle of a Mediterranean arid region, allowing, at the same time, the development of agriculture and livestock (Jódar et al., 2017; Martos-Rosillo et al., 2018). The Sierra Nevada water management system also shapes local identity and cultural heritage (Fernald et al., 2015).

Water in the Sierra Nevada is managed by irrigation communities, formed by the owners of irrigated lands with centuries of family history in common (Espinar Moreno, 1989). Irrigation communities rely on biophysical (e.g., water evapotranspiration at different seasons, soil characteristics at different locations) and social criteria (e.g., watering order, crops in the plot) to assign water to different users (Guzmán Álvarez, 1989). Irrigation communities are the basis of the social fabric as they organise collective action, including cleaning, maintaining, and restoring water channels. In other words, in Sierra Nevada, water infrastructures and the social fabric are intimately linked, forming parts of a holistic system.

During the 20<sup>th</sup> century, the Sierra Nevada faced many changes, including a rural exodus, land use change, agricultural modernisation, and the establishment of strict conservation areas. For example, market pressures and agricultural extension agencies encouraged the 'modernisation' of agriculture through the adoption of simplified agricultural systems -mostly in plain areas-, the adoption of drip irrigation, and mechanisation. Together, these changes threaten the maintenance of traditional water management systems and therefore the ecological (Zamora et al., 2017) and social stability (Iniesta-Arandia et al., 2014) of the area. Climate change, locally manifested in temperature increase and rain and snowfall reduction, further impacts ecosystems and livelihoods in direct ways, but also through synergies with other drivers of change (Zamora et al., 2017). Global environmental change threatens the stability of the biophysical system. At the same time, the reduction of local capacity for collective action that comes with the loss of norms and local institutions for self-governance, such as the formation of irrigation communities, diminishes local capacity of response against global challenges (García-del-Amo et al., 2022).

Within this context, the managers of Sierra Nevada Natural and National Park, are conducting a new project (LIFE Adaptamed, n.d.) aiming at the development of adaptation measures for climate change impacts. In contrast to previous experiences, this project recognises the ecological value of historical irrigation systems and associated local knowledge, and includes local irrigation communities, ranchers and shepherds in workshops and meetings

for decision making. While being a step forward and probably contributing to revitalising local knowledge in the area, the project lacks the institutional setting that would allow dialogue between knowledge systems, the vision to integrate components of local knowledge, and the depth to frame climate change impacts as an additional contributor to the vulnerabilities of the population. Working in these three directions would result in a more just collaboration.

### Compilation 1: Water Images



A) Acequia de careo without water to carry out repair works. B) Members of Bérchules' irrigation community clearing an acequia de careo. C) Aliviadero on the side. D) Aliviadero overflow and flow limiter. E) Partidor of acequia de careo of the Poqueira ravine. F) Water catchment for an acequia de careo. G) Acequia de careo of Bérchules.

**Source:** (García-del-Amo et al., 2022)

### 3. The Importance of a Historical Perspective on Climate Change, Knowledge Systems, and Cultural Heritage

Climate justice depends on recognising climate change as part of a long and complex history of extractive capitalism, colonial violence, globalisation, and the expropriation of knowledge and land from Indigenous peoples and local communities. Developing just collaborations demands a reparative approach to this continuing history of physical and epistemic violence and exploitation.

#### 3.1. The importance of a historical perspective on climate change and cultural heritage

Although the evidence is clear that rising concentrations of greenhouse gases are driving global warming and extreme weather events, there remains much discussion of the deeper roots of climate change, for which these concentrations are merely a symptom rather than the fundamental cause. For the scientific community, the cause is an increase in human activity, characterised by burning of fossil fuels and the increase in greenhouse gases emission. But placing human beings at the centre of this discussion raises two inevitable questions. The first is whether we are all responsible for this situation. Some authors question whether responsibility is even and point out that the term Anthropocene is incorrect since by positioning us all as responsible, it dehistoricises and depoliticises capitalist power relations (Malm, 2015; Malm and Hornborg, 2014; Moore, 2017) and homogenises cultural perspectives and local knowledge systems (Ulloa, 2017). The Anthropocene concept is based on a European worldview that is blind to the ways Indigenous Peoples and local communities modify and manage landscapes. It perpetuates the idea that all human activity, for example, in conservation landscapes is negative. Some ‘wilderness’ landscapes, such as the Amazon, forests of Southeast Asia and the western deserts of Australia, are actually the product of long-term management and maintenance by Indigenous Peoples and local communities (Fletcher et al., 2021).

By contrast, other views see climate change and the Anthropocene more generally as symptoms of a larger problem. Western philosophies have promoted the exploitation of nature by an ideal of objectivity that separates the knower from the known and arbitrarily differentiates between the material and immaterial world (Loy, 2020). Similarly, various Indigenous peoples of Latin America emphasise that the climate crisis is a product of the loss of respect for nature, which is reflected in poor treatment of the non-human, including the spirits (Arias-Bustamante and Innes, 2020; Ulloa, 2008). A historical perspective is necessary to fully appreciate these deeper roots of climate change and to devise ‘solutions’ that avoid replicating the injustices of the past and that uproot ongoing injustices in the present.

All knowledge is born local—that is, it depends for its meaning and efficacy on a particular place (Watts, 2013). Some knowledge systems are deeply rooted in single, continuous territories; others are linked to discontinuous territories, with movement between them. Some knowledge systems are linked to specific roles in a community, such as that of hunter, shaman, priestess, or midwife. It may be vital to a culture that these systems remain secret.

Nonetheless, though all knowledge is born local, much knowledge moves, some of it widely. The globalisation of knowledge is not a phenomenon of the past century alone, but rather has a long, contingent, and complex history (Park and Ragab, forthcoming; Renn, 2020; Smith, 2019). For this reason, it can be misleading to speak of the sciences and Indigenous or local knowledge as entirely separate systems. For instance, the value placed on empiricism in the sciences today is often assumed to be an invention of seventeenth-century European elites during the so-called Scientific Revolution. Yet historians have shown that manual labourers and enslaved people of that era were central not only to making empirical knowledge but also to articulating its value (Gómez, 2017; Smith, 2004; Zinsel, 2000). The historical knowledge of subaltern and enslaved peoples can be studied through attention to alternative spaces and geographies, such as the plantation, the slave ship, the Middle Passage, and the prison (McKittrick, 2021).

Today's climate science is 'global' by virtue of a historically contingent process of globalisation, a process that has foregrounded some points of view and ways of knowing at the expense of others. The modern science of climate has simultaneously appropriated and undermined vernacular, traditional, and Indigenous forms of climate knowledge, along with the knowledge of disciplines that it relegated to the academic periphery, such as geography, botany, medical topography, and horticulture. Although epistemic (Spivak, 1994), this violence has had tremendous material repercussions: violation of rights and autonomy, generation of dependencies and clientelism, loss of social capital, among others (Chakrabarty, 2000). A historical perspective on modern climate science in particular reveals its entanglements with imperialism, racism, and extractive capitalism (Carey, 2011; Coen, 2018; Howe, 2014; Mahony and Endfield, 2018; Morgan, 2018). Today, capitalism continues to structure knowledge-making about climate, and knowledge of climate change has been severely distorted by market incentives (Oreskes and Conway, 2011; Proctor and Schiebinger, 2008).

The invisibilisation of different knowledge systems has increased tensions and conflicts (Lander, 2000). Colonialism and its legacies have translated for many as the imposition of precarity and exploitation, especially for Indigenous peoples and rural communities, who are conceived as a 'peasant subculture' (Quijano, 2000). Local and Indigenous knowledge-makers resist these forces and defend living traditions, based on collective experience, that are relegated by 'science' to the category of 'custom.' The norms of modernity operate so rigidly that much critical debate on these subjects has been silenced (Lander, 2000).

### **3.2. The history of colonialism, science, and local and indigenous knowledge of climate**

From the eighteenth century into the twentieth, European colonisation was often justified by appeals to 'science' as a supposedly universal way of knowing and an agent of economic and moral improvement. As a tool of colonialism, this scientistic ideology (which we term 'scientism,' as opposed to science) has constructed non-European territories and societies as passive objects of knowledge and as an inexhaustible source of resources (Vidal, 2021), legitimating the violation of local and Indigenous populations' rights (Ulloa, 2012) that is continues in the present in many territories of Indigenous Peoples and local communities. It propagated an ideal of objectivity that drove a wedge between the knower and the known, human and non-human, mind and body, and it propagated an ideal of 'value-free'

knowledge that shielded instrumental goals from ethical deliberation (Alimonda, 2011; Proctor, 1991). Colonisation forced the separation of land and the Indigenous population to transform them into marketable objects. Land became a natural resource and the Indigenous population was transformed into a labour force. Territories were subordinated to European markets through the export of raw materials, which, together with the commodification of the labour force, favoured the expansion of the capitalist model (Quijano, 2000). This Eurocentric lens of conceiving the territory and the population installed a domination pattern that ranked societies based on the naturalisation of imposed cultural values, establishing ethnic, gender and class hierarchies. Furthermore, the colonial system enforced the hegemony of Eurocentric knowledge systems as the only basis for valid knowledge (Quijano, 2000). Every difference was considered inferior and therefore incapable of producing meaning about the world. Other ways of knowing were reduced to mere customs, along with associated laws, political organisations, worldviews and ways of inhabiting, understanding, and relating to the world. Ontologies and epistemologies were reduced to 'popular culture,' a culture on the margins of history (De Certeau, 1999).

The irony of the ideology of scientism has become apparent in retrospect, thanks to historical research that demonstrates how European scientists appropriated the climatic knowledge of local and Indigenous peoples. Indeed, Europeans would not have managed to survive in many parts of the colonial world without the aid of local guides and their ecological knowledge (Safier, 2008; Stuhl, 2016). Even in Europe, the founders of modern atmospheric science borrowed the knowledge of farmers, sailors, and fishers, particularly their ability to foretell atmospheric change from the appearance of clouds (Daston, 2016; Friedman, 1989). In Africa and South America, celebrated scientists ignored local knowledge and thereby sowed longstanding misconceptions about regional climates that cast blame on locals for mismanaging their land (Cushman, 2011; Davis, 2007; Fairhead and Leach, 1999). Given that Indigenous knowledge has so often been distorted or exploited as a 'resource' for Eurocentric and extractive sciences, sometimes preserving a knowledge system means *not* sharing it (Liboiron, 2021).

Colonial education systems pressured the colonised to conform to the ideology of scientism, but many colonised peoples nonetheless managed to question, critique, and disrupt it in creative ways (Prakash, 1999). Historians have shown, for instance, the role of colonised and Indigenous peoples in casting doubt on colonial schemes of land reclamation (Tilley, 2011) and alerting colonists to signs of the approach of seasonal climatic fluctuations (Cushman, 2011). Some colonised peoples identified 'European science' with local traditions of natural knowledge, challenging Europeans' exclusive claim to rationality (Elshakry, 2016). Others interwove local traditions with 'modern' science, creating new, 'braided' systems of thought, such as nineteenth-century Ayurveda or twentieth-century traditional Chinese medicine (Lei, 2014; Mukharji, 2016).

The alliance between scientism and the weapons of colonialism was a major factor in the expansion of capitalism and steam-powered industry and thus in the onset of greenhouse warming (Ghosh, 2021; Malm, 2016; Quijano, 2000). Potawatomi scholar Whyte (2017; 2020) describes climate change historically as a problem of relationality, meaning a progressive weakening or violation of kin relationships based on consent, trust, accountability, and reciprocity—between humans and between humans and the non-human world.

This pattern structured the construction of the new countries that emerged from the breakup of European empires, first in Latin America and then elsewhere. It also influenced the related processes of decolonisation of states, and continues to reproduce itself (Quijano, 2000), mainly under the paradigm of development (Escobar, 1999). Development, based on the notion of progress, sets a yardstick to which countries should aspire. This aspiration has had repercussions on all subjectivities collectively, constituting a new intersubjectivity (Quijano, 2000) which is reflected in the organisation of countries under the United Nations Framework Convention on Climate Change (i.e., Annex I and non-Annex I countries). The development paradigm and practices have shaped climate change policies (Eriksen et al., 2021), which, by appealing to a sense of urgency, prioritise technological management (O'Brien and Sygna, 2013) and reproduce the colonial model and often underestimate local knowledge and exclude local and Indigenous communities (Whyte, 2021). Regarding local and Indigenous knowledge, paternalistic dynamics have been established under the pretext of protecting or safeguarding them (Ulloa, 2012). This scenario has negatively impacted communities that could become even more vulnerable (Carmona, 2021; Ramos-Castillo et al., 2017), as in the case of the creation of protected areas and national parks by taking land from Indigenous peoples and evicting them (e.g., Environmental Protected Areas in the Philippines). However, Indigenous Peoples and local communities are on the front lines of environmental protection (FAO, 2021; Garnett et al., 2018). However, their opposition to the concept of development has cost them their lives (Global Witness, 2020). Global Witness reported that around 40% of the 200 people murdered in 2017 for defending their lands or resources from international business were Indigenous (Vidal, 2021). This difficult and continuing history of violence against Indigenous Peoples and local communities and knowledge holders has to be acknowledged in order to build mutual trust and respect and to move forward in the co-production of knowledge and alternative ways in responding to climate change. In many settings, Indigenous knowledge and local knowledge are criminalised, with governments repressing traditional practices and governance.

Even when national and other institutions become aware of Indigenous knowledge and undertake efforts to preserve it, the results are often negative. An example is the loss of ethnobotanical knowledge of the Tsimane' in Bolivia. Following the arrival of missionaries and the introduction of formal education, there were negative implications for their health and nutrition (Fernández-Llamazares et al., 2021). And the frequent attempts to preserve Indigenous knowledge on paper and material objects may not always be successful. In some cases, these efforts undermine the Indigenous place-based practices in which knowledge is maintained and transformed through ongoing presence in ecosystems (Gadamus and Raymond-Yakoubian, 2015; Orlove and Kabugo, 2005). In other cases, such forms of preservation may be damaged or destroyed by climate hazards, fire, water and other risks. At times, the national programmes to support Quechua language instruction in Peru have developed original approaches well-suited to specific contexts, drawing on the collaboration of Indigenous scholars and activists (Hornberger, 2014; Linares, 2017; Ocampo Yahuarcani et al., 2019). At other times, they have relied on materials that show little understanding of Indigenous language practices (Limerick and Hornberger, 2021).

### 3.3. Indigenous responses to climate change from a historical perspective

For Indigenous peoples and local communities over the past generation, climate change has manifested not only in the dropping or rising of temperatures but also in the disappearance or diminishment of native plants and animals that were once abundant (Secaira, 2021). Such observations are available to Indigenous peoples and local communities who have lived their entire lives in their territories, drawing on information that has been passed down across generations by elders (Reyes-García et al., 2016). Among the fisherfolk in Senegal, for example, in the past 10 years or so, climate change has manifested in the changes in wind direction, sea-level rises, reduced quantities and qualities of fish, and coastal erosion—changes that have been confirmed in scientific studies (Diouf et al., 2020). Climate change also has intangible impacts. For instance, it affects the way members can access traditional foods or practice longstanding cultural traditions, such as rituals. When communities are displaced from their territories due to the impacts of climate change—or when their territories are transformed even when they remain in place—they may experience social and cultural crises, and they may face obstacles to making their homes in a new environment or in a profoundly altered one. Shasta Gaughen of the Pala Band of Mission Indians in southern California argues the inability to perform such rituals affects people's identity and sense of belonging (Secaira, 2021). These consequences have been largely ignored by the way the impacts of climate change have been documented by the international scientific community. This perspective has hidden how climate change challenges human subjective understandings of self and society, particularly in connection to place, and the perceptions of the sacred (Allison, 2015). As Simon Schama has noted: 'Landscapes are culture before they are nature; constructs of the imagination projected onto wood, water, and rock' (Schama, 1996). The culturally and spiritually significant landscapes are often at the interface between nature and culture, tangible and intangible values, biological and cultural diversity.

Landscapes bridge nature and culture and people's identity (Salick and Byg, 2007). The elimination of specific landscapes as a result of the environmental crisis—or even as a consequence of climate change mitigation policies—is accompanied by the fading of local people's sense of place and the disappearance of diverse cultures (Adger et al., 2013). For example, glacier recession caused by rising temperature has prompted changes in the rituals of Quechua communities in southern Peru. Villagers still make a pilgrimage up to shrines on the mountain and climb to the glacier, but they no longer collect its ice, which they view as promoting good health and land fertility; this change is deeply troubling to them (Allison, 2015). In other words, because changes in climate are inextricably linked to the social context, climate change impacts on the landscape also threaten the local community's way of knowing and being.

## Case Study 4:

### Restoring Indigenous Fire Management Practices for Forest Conservation (Bolivia)



*[Keywords: intangible heritage, impacts, solutions, learning from the past]*

In 2019, Bolivia experienced an environmental crisis caused by forest fires. The territory of Lomerío in the eastern lowlands of Santa Cruz was heavily affected (Rodríguez and Inturias, 2020a). The fires were partly caused by extreme drought and severe frost conditions, which occur more frequently and acutely due to climate change. Studies also show a strong connection between the extent and damage of the fires and recent government policies and projects encouraging agricultural expansion (Devisscher et al., 2016). For example, the production of biofuels through soybean plantations and the expansion of livestock grazing for export fostered speculative clearing of new lands through the use of fire, both on private land (especially agro-industrial properties) and in adjacent areas on the agricultural frontier (Romero-Muñoz et al., 2019). In addition, since 2013, the government has sanctioned several regulations which allowed the burning and logging of forest areas up to 20 hectares. The result was an acceleration of land grabbing and logging in the lowlands, evidenced by the majority of fires being concentrated in protected areas and titled Indigenous territories, affecting the Monkox People of Lomerío among other groups (Rodríguez and Inturias, 2020b).

As a result, the Bolivian Forest Management Agency issued a resolution prohibiting the authorisation of burning for agricultural use in the Chaco Region. The total prohibition of the use of fire in Indigenous territories threatens the cultural and physical survival of its inhabitants. In order to ensure their food sovereignty, it is essential that Indigenous peoples who depend on forests for their subsistence activities, such as agriculture, hunting and fishing, are able to appropriately use fire as a way to manage their territories (Inturias and Rodríguez Fernández, 2019; McDaniel et al., 2005). In 2020, the Centre of Indigenous Communities of Lomerío (CICOL) initiated a series of activities to ensure good control and management of fire use to aid their adaptation to the increased risk of climate induced fires in their territory. This included the establishment of community forest firefighters, the drafting of a burning protocol, and participatory research conducted by Indigenous researchers to recover ancestral knowledge about the use of fire. The research seeks to recover local knowledge about the cultural significance of fire for the Monkox, its different uses, standards for the appropriate use of fire in agriculture and their current application, perceptions of the impact of the 2019 fires, and visions of appropriate fire use in the territory. The intention is for the Monkox to reach a stronger position to dialogue with national authorities on appropriate regulations for the use of fire in their territory based on their Indigenous knowledge systems and to agree on appropriate protocols together.

Indigenous fire management is a well-established form of land use in other regions, such as Australia and California, where the use of fire also faces obstacles from national governments (Petty et al., 2015).

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## 4. Plural Knowledge Systems in The Era of Climate Change: Framework and Work to Date

### 4.1. Consensus on the need for climate change action

Humanity is at a critical moment. Increasing evidence, drawing on scientific knowledge systems, of the rapid degradation of nature coupled with the growing impacts of climate change have created a sense of urgency to take action (IPCC, 2021; Pörtner et al., 2019). Drawing on other observations and understandings, as detailed in sections 2.3, 2.4, 3.2 and 3.3, holders of Indigenous knowledge and local knowledge also note destruction and devastation, and call for responses. Our current actions will determine the future of human societies, other species, and the Earth (de Coninck et al., 2018; Steffen et al., 2015).

However, the hegemonic approaches proposed so far are inadequate and failing to achieve results (Höhne et al., 2020). By focusing on the biophysical processes described by the natural sciences and approaching the problem as a primarily technical issue, current global policy to tackle climate change has overlooked the social drivers of climate change, the associated historical processes, and the diversity of knowledge systems, values, worldviews, and beliefs that characterise human societies and that could contribute to alternative responses (O'Brien, 2021). Nevertheless, climate change may be perceived differently across communities, including its manifestations, impacts, and causes (Hochachka, 2019). Moreover, the sense of urgency has reinforced top-down approaches that often reproduce the colonial and inequitable dynamics that had made certain groups vulnerable to climate change (Townsend et al., 2020; Whyte, 2021).

In the call for climate action, Indigenous Peoples have been emphatic: we will not solve the problem using the same way of thinking that has caused it (Whyte, 2021). The anthropogenic origins of climate change led to the collapse of the old humanist distinction between natural history and human history. Climate change calls us to think simultaneously about the chronology of the environmental crisis and our history as a species, conceiving ourselves as a biological, even geological, agent that shapes a larger system (Crutzen and Stoermer, 2017; Vitousek et al., 1997). However, attributing climate change to the entire human species is problematic, as not all societies have equally contributed to the problem. For Potawatomi scholar Whyte, (2017) anthropogenic climate change is the intensification of the environmental change inflicted on Indigenous societies during the processes of colonisation; Whyte speaks of climate change as a future to which we are coming back. Furthermore, the construction of the problem as global and urgent has promoted responses that suspend ethical considerations in order to act quickly and in a globally efficient manner (Callison, 2017; Whyte, 2021). In the face of 'epistemologies of crisis'—which guide primary responses to the Anthropocene—Whyte (2021) calls for 'epistemologies of collaboration,' which, while facilitating critical analysis of the power relations and historical causes that have shaped the multiple crises we face, promote ethical and compassionate action. By emphasising the principle of interconnectedness, these epistemologies promote respect for the human and the non-human.

## 4.2. The need for collaborations between plural knowledge systems to address climate change

There is no single knowledge system that is capable of addressing the complexity of the climate change problem (Vogel and O'Brien, 2021). Responses to climate change informed exclusively by scientific knowledge systems have not achieved success, nor have they addressed the problem at the speed that is required to prevent irreversible catastrophic damage to humanity and to ecosystems (O'Brien and Sygna, 2013). These gaps have prompted calls for transformational responses that can transcend prevailing modes of action and generate paradigm shifts in the relations between society and nature (Vogel and O'Brien, 2021). They have also led to proposals to build and expand collaborative approaches among knowledge systems (O'Brien and Sygna, 2013; Vogel and O'Brien, 2021). The inclusion of multiple and diverse knowledge systems—also termed plural knowledge systems—has been recognised as a key element in robust decision-making for informing policy, science, and social action (Hurlbert et al., 2019).

Similarly, there is no single form of collaboration that will address each aspect of climate change in the wide ranges of cultures and landscapes around the world. We emphasise a pluralism of collaborations as well as a pluralism of knowledge systems (see Figure 4). In some cases, individual knowledge systems can address particular problems: scientific knowledge can make predictions of the future of the Antarctic ice sheets under different levels of warming, Indigenous knowledge can guide livelihoods and land care in many settings (Orlove et al., 2020; Petzold et al., 2020), and local knowledge offers responses to resource management and natural hazards (IPBES, 2017).

We discuss below the importance of guaranteeing that such collaborations are full and just. We use the word 'full' to indicate that collaborations are most effective when they recognise the wide range of components within knowledge systems, rather than plucking single elements. We use the word 'just' to refer to equity, fairness, and shared power, rather than the forms of appropriation, exploitation and devaluation that have often characterised interactions of knowledge systems. We note that these two characteristics, fullness and justice, are not simply additive, but rather reciprocal; each requires the other, since justice cannot proceed without full recognition, and full recognition leads to justice, since it addresses the ethical elements within knowledge systems.

In this effort, we build on earlier work from Indigenous scholars and scholars of science and technology studies. Among the former, the Mi'kmaw concept of two-eyed seeing has resonated widely: this refers to 'learning to see from one eye with the strengths of Indigenous knowledges, and from the other eye with the strengths of Western [scientific] knowledges, and to use both together, for the benefit of all' (Bartlett et al., 2012). Other terms, such as 'braided knowledge,' also capture the idea that the distinctiveness of each can and should be preserved, while allowing for fuller understanding and supporting significant interactions (Bartlett et al., 2012). The concept of braid articulates that 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 (Snively and Williams, 2016). A recent article draws on interviews with Indigenous researchers who articulate the concept of 'weaving' to speak of such engagements between Indigenous and scientific knowledge systems, in which each system remains intact but enters into exchanges, remaining cognizant of their mutual tensions or even

contradictions (Sidik, 2022). 'Seeing with two eyes' and 'braiding' refer to ongoing processes; these collaborations unfold over time, and require steady attentiveness to assure just relations.

Within Science and Technology Studies, a number of terms describe collaborations, often between disciplines or domains of research and action; these terms can readily be extended to the knowledge systems under consideration here. 'Boundary work' refers to processes of exchange across disciplinary or cultural divides, processes that nonetheless serve to maintain those divides (Gieryn, 1983). A 'trading zone' denotes a social space that facilitates such exchanges, where common language can be developed (Galison, 1997). 'Brokered knowledge' refers to learning that is mediated by 'go-betweens' who translate between cultures and between local environments and larger-scale knowledge systems (Schaffer, 2009). 'Para'-knowledge refers to a body of knowledge that has been defined or redefined historically in relation to a dominant scientific framework, such as contemporary Rasayana, Ayurveda, or Traditional Chinese Medicine (Mukharji, 2016).

A key distinction in this discussion of plural knowledge systems is the one between integration and collaboration. A number of groups have called for the integration of Indigenous knowledge into climate action (IIPFCC, 2017). We join here with others who have called for maintaining the autonomy of different knowledge systems, rather than integrating them into a single hybrid knowledge system (Mustonen et al., 2021; Tengö et al., 2017; Ulloa, 2017). We advocate a collaboration between different knowledge systems in order to address the climate crisis, but do not propose the development of new hybrid knowledge systems; such collaboration consists of drawing on these knowledge systems to create just forms of climate action, but does not propose the development of a new hybrid knowledge system.

	Interactions of Indigenous or local peoples/communities with scientific knowledge and agencies					Scale of interaction				Phase of interaction within action			Governance and safeguards
	Generally Negative	Somewhat Negative	Neutral or none	Somewhat positive	Generally positive	Local	Regional	National	Global	One or some	All	Extensive, ongoing	
1. Fiji Meetings					<b>X</b>			<b>X</b>				<b>X</b>	National government recognizes customary law
2. Mapuche forests		<b>X</b>					<b>X</b>					<b>X</b>	Longstanding conflicts and violence. Some recent changes
3. Water management in Sierra Nevada, Spain		<b>X</b>				<b>X</b>	<b>X</b>			<b>X</b>			Some government recognition of local institutions, but pressure to modernize agriculture
4. Fire Management in Lomerio, Bolivia	<b>X</b>					<b>X</b>				<b>X</b>			Government generally does not recognize local knowledge or management
5. Forest Governance in Nepal					<b>X</b>		<b>X</b>					<b>X</b>	Government recognizes customary law
6. Stonewalling in Philippines				<b>X</b>				<b>X</b>		<b>X</b>			National government recognizes Indigenous techniques and has adopted them in some settings
7. Informal urban settings in Sierra Leone				<b>X</b>		<b>X</b>				<b>X</b>			Government involves local knowledge-holders to participate in data collection and project design
8. Urban Native Americans in Southwest US		<b>X</b>				<b>X</b>					<b>X</b>		Some spaces for Indigenous agency and influence

**Figure 2:** Interaction of Indigenous knowledge and local knowledge with scientific knowledge in specific forms of actions, including the interactions of key organisations and institutions.

### 4.3. Treating knowledge systems as wholes

Most previous calls for collaboration between knowledge systems do not consider knowledge systems as complex integrated wholes. Rather, they rest on using different **components** of knowledge systems, partially or entirely overlooking their holistic nature. In fact, there might be a tendency to cherry-pick components of Indigenous knowledge systems and local knowledge systems only when they are convenient to 'integrate' and able to be corroborated by 'accepted' or 'standard' scientific methodologies and evidence (as per quality and outcome measures); this tendency can reproduce a fallacy of incomplete evidence. This has resulted in a 'justice gap' whereby the types of social objectives, impacts, processes and solutions that gain attention in global climate governance are a poor reflection of Indigenous Peoples' and local communities' knowledge systems and their justice concerns (Okereke and Dooley, 2010; Suiseeya, 2017). The approach creates the risk of losing the original meaning created by and within the structures of these knowledge systems, potentially leading not only to a loss of meaning, but also to the delegitimisation of other ways of knowing, jeopardising the opportunities of being able to work together.

Since this tendency to fragment Indigenous knowledge systems and local knowledge systems is widespread, we offer here a review of its use within the literature on collaboration. We show that it can be characterised as containing specific approaches, each focusing on a specific component. In this section, we emphasise the importance of full, rather than partial or fragmentary collaboration, in anticipation of the emphasis on just, rather than unequal or unfair, collaboration in the next section.

#### 4.3.1. Components of knowledge systems

We note here four approaches, which we term observational, epistemological, stewardship, and justice approaches.

The first emphasises the value of the forms of **observation** of the natural world and of society contained within these knowledge systems. This approach offers recognition of the close attention to the natural (and social) world in other knowledge systems, but which reduces these systems to sources of data and information.

Because Indigenous knowledge systems and local knowledge systems are commonly place-based, relational and dynamic, there is scope for them to generate a more plural understanding of possible climate change impacts. They may also encompass effective, alternative governance systems that present existing opportunities for potentially transformative change in response to climate change (Lam et al., 2020). Specifically, diversifying sources of knowledge systems could contribute to understanding and addressing responses to climate change impacts through: the meaningful definition of problems and prioritization of issues; the collection of more responsive and representative data; the reduction of selection, source and scale-dependent biases; the development of multi-scale policy and long-term planning. Indigenous knowledge and local knowledge can support resilience through the potential to anticipate disasters (Hiwasaki et al., 2014; Karki et al., 2017). For example, researchers have documented many instances in which Indigenous Peoples and local communities with a long history of interaction with

their environment have developed complex knowledge systems that allow them to detect changes in local weather and climatic variability as well as the impacts of such changes in the physical and the biological systems on which they depend (Fernández-Llamazares et al., 2015; Orlove et al., 2000; Reyes-García et al., 2016). For example, in the Arctic, Inuit reports of changes in weather predictability (based on linkages among winds, animal behaviour, and ice conditions) led scientists to examine the particularities of the local climatic system, finding evidence of a strong drop in temperature on spring afternoons, somewhat at odds with changes on a larger scale (Weatherhead et al., 2010). In the same line, research among the Tsimane', an Amazonian hunter-horticultural society, shows that Tsimane' observations of climatic variability, although at odds with predictions from global models, were congruent with predictions from local meteorological stations (Fernández-Llamazares et al., 2017). This suggests complementarities of knowledge systems in regions for which climate station data are meagre, at best.

A second approach, which we term an epistemological approach, emphasises other components of knowledge systems, particularly **values and worldviews** (O'Brien and Sygna, 2013; Vogel and O'Brien, 2021). This view draws on the idea that nature is experienced and produced differently according to different groups, historical periods and social positions (Escobar, 1999b) and that knowledge shapes environments even as changing environments shape knowledge (Cruikshank, 2005; Nash, 2006; Renn, 2020). This approach notes that Indigenous knowledge and local knowledge systems posit a different relationship between humanity and nature than scientific knowledge tends to, and that this relationship is based on the principle of interconnectedness. Due to its holistic nature, strengthening Indigenous knowledge can contribute to mitigating climate change as well as to providing locally-meaningful adaptation options. For example, traditional ceremonies, sacred sites, and ritual practices played an important role in forest management and biodiversity conservation on Mount Cameroon and present biodiversity loss is believed to be linked to weakening of local knowledge (Ntoko and Schmidt, 2021). Also, Case Study 2 shows how the revitalisation of Mapuche spirituality leads to land repair and climate change mitigation.

A third perspective, which we term a stewardship approach, highlights the role of **practices** embedded in different knowledge systems and that are the basis for environmental stewardship in many places around the world. The success of environmental management practices based on local and Indigenous knowledges is gaining increasing recognition by the international community (Garnett et al., 2018; Wenz, 1996). Representing around 5% of the world's population, Indigenous peoples currently safeguard 80% of the world's biodiversity. Thus, local and Indigenous knowledges are considered critical for the design of mitigation and adaptation strategies (Vogel and Bullock, 2021) and nature-based solutions (Townsend et al., 2020). For example, the Hausa of northern Nigeria have developed a system of intercropping with nitrogen fixing legumes, intensive manure application, soil conservation works, and polycultural production of different cereals that helps them cope with variable soil moisture regimes and support wet and dry season production (Shoko and Shoko, 2013; UNEP, 2002). And in Rajasthan, India, local knowledge has promoted eco-friendly shelters that are resistant to flooding (Pareek and Trivedi, 2011). Case Study 6 in the Philippines illustrates how survival-oriented practices aim not only at reproducing livelihoods, but also at conserving the ecosystems that sustain them. Moreover, the loss of traditional practices can seriously impact ecosystems. When the Aboriginal peoples were removed in the 1960s

from their ancestral homes—the central deserts of Australia, which they have actively managed for tens of thousands of years—the impact was catastrophic to the people and the area: uncontrolled wildfires, biodiversity loss, and significant health impacts (Fletcher et al., 2021). When the Aborigines eventually came back to manage the land, the region not only experienced a reduction in wildfires and increase in biodiversity, but also improved health and well-being of the people. Under this perspective, practices are seen as dynamic and resilient. For example, many Indigenous and local architectural knowledge and practices, a form of tangible heritage, have the ability to adapt to new shocks and disasters, as shown in Case Study 1. The potential of adoption of resilient design principles from traditional architectural heritage can support new urban adaptive strategies (Ejiga et al., 2012; Özel et al., 2014).

A fourth view, which we term a justice approach, underscores the **ethical and political arguments** for such collaborations. The calls for inclusion of Indigenous knowledge and local knowledge in decision-making processes is linked to a growing recognition of the rights of Indigenous peoples and local communities and of the need to bring justice issues to climate discussions (Reyes-García et al., 2021). These calls are aligned and sometimes framed as ‘cognitive justice’ (Burman, 2017), both for Indigenous knowledge (e.g., Monkoxi fire practices and land care in Bolivia, Case Study 4) and local knowledge—for example, French peasant farmers’ knowledge of agriculture (Coolsaet, 2016). The underestimation of local and Indigenous knowledge goes hand in hand with the construction of inequality (Palermo, 2010; Quijano, 2000), as power dynamics have often silenced the knowledges of groups that contribute the least to climate change (Reyes-García et al., 2019) but who are at the same time most affected by it, as it is the case of Indigenous peoples (Figueroa, 2011).

#### *4.3.2. Overviews of components of knowledge systems*

These four approaches mentioned above—what we call observational, epistemological, stewardship, and justice approaches—are not always fully separated. They are sometimes wrapped together in a **pragmatic** overview, focusing on the usability of different knowledge systems (Coen, 2021) and the effectiveness of such collaborations. Some have argued that Indigenous knowledge systems and local knowledge systems encompass different ways of knowing and relating to nature than those considered in conventional science, and hence should form part climate change responses, especially in regard to Indigenous peoples and local communities (Aikenhead and Ogawa, 2007; Brondízio et al., 2021). Others have noted that Indigenous peoples have been adapting to environmental changes for thousands of years (Schlingmann et al., 2021). Key to their capacity to adapt to these changes are their Indigenous knowledge systems and practices that allow them to make critical adjustments in their ways of life. The continuous human habitation of small islands was made possible by the knowledge of small island peoples, adapting to the limitations brought about by their physical geography and challenges due to anthropogenic and non-anthropogenic environmental variations and stresses (Nakashima et al., 2012). Eerkes-Medrano and Huntington (2021) have documented the many ways indigenous peoples in Greenland have throughout their lifetimes adapted to varying sea ice conditions (periods of heavy to light or even no ice) and how the Sami herders in the Barents region have handled climatic variations better than others because their ‘herding knowledge requires effective adaptation to rapid and unexpected changes and variable conditions.’ Others have assembled substantial evidence which shows a positive relationship between policies that involve Indigenous peoples and local communities in all levels of

decision-making processes and what are termed ‘sustainability outputs,’ such as sustainable forest management and maintenance of vegetation cover (Adade Williams et al., 2020).

Alternatively, these approaches are sometimes combined in a **critical** overview that calls for transformation. Tāitān scholar Candis Callison (2021) offers a cogent example of how the topic of fire emergencies can lead to a transformation in thought. She draws on the increasingly destructive fires in Canada, the US, and Australia to show that addressing the climate crisis requires a deeper shift than mere collaboration around concrete impacts in specific regions: it entails a full acknowledgement of the prior, often violent, exclusions that accompanied colonialism, a restoration of those who have been excluded, and a reshaping of the relations of humanity and nature which acknowledges the diversity of both. Given the long history of sustainable Indigenous incorporation of fire, the devastating effects of colonial and neocolonial practices that rendered forests more fire-prone, she questions the useage of the term “wild fires.”

Drawing on both the pragmatic and critical overviews, a number of sources have discussed the engagement and contributions of Indigenous knowledge and local knowledge in climate adaptation planning and implementation. They suggest that, due to multiple factors, such as the historical marginalisation of Indigenous peoples, the consideration of Indigenous knowledge in climate policy is also marginal (Granberg and Glover, 2014), being largely reduced to the primary and diagnostic stages (Nakashima et al., 2012). Indigenous peoples tend to be portrayed as victims of climate change (Callison, 2017) or idealised guardians (Ulloa, 2013). Both approaches promote the protection of Indigenous Peoples, and place them as policy objects—omitting the historical causes that have determined their vulnerability, such as coloniality and marginalisation (Belfer et al., 2017). Indigenous knowledge has not been effectively considered in formal adaptation in national policy efforts and research (Adger et al., 2013; IPCC, 2014; Jones et al., 2014; Petzold et al., 2020). Although the literature discusses local knowledge systems to a lesser extent, recent studies show that similar obstacles are encountered (Klenk et al., 2017; Yeh, 2016).

#### **4.4. Justice and plural knowledge systems**

We look to the future, cognizant that the past and the present are marked by inequities and injustices in the relations between different knowledge systems and the peoples that have held them, though that past offers some examples of positive encounters and exchanges marked by mutuality. We are cognizant as well that all recognise the importance of action at the present time, and the need to draw on all to address our current emergencies, climate change as well as others. We have discussed the potential for collaboration between different knowledge systems, in which each preserves its autonomy and self-determination while working together. Such collaborations, characterised by the justice of their processes, can operate with greater legitimacy, supporting more equitable and sustainable outcomes and leading to the transformations that the current moment demands (Chakraborty and Sherpa, 2021; Nightingale et al., 2020).

Nevertheless, justice has often been absent in interactions of knowledge systems. Though scientific knowledge specifically related to climate change has been strengthened by collaboration with and contributions from local communities and Indigenous Peoples (Green et al., 2010), these collaborations

mainly occur under colonial and extractive approaches and do not recognise all components (e.g., spiritual elements, values, worldviews) as a fundamental part of a knowledge system. Moreover, there are still considerable gaps that restrict the equal participation of Indigenous peoples in science and technology (Nelson and Madsen, 2018; McAllister et al., 2022).

If the origin of anthropogenic climate change can be linked to processes of colonisation and at the same time reinforces colonial structures, addressing it also requires us to overcome colonial relations (Gram-Hanssen et al., 2021). This requires non-Indigenous scientists and researchers to question oppressive structures reproduced in working and even living spaces. Therefore, any collaboration for climate change action demands justice—not only as an abstraction, but also as concrete processes of co-construction of knowledge and action (Bremer et al., 2018).

To avoid catastrophic consequences, we must focus not only on changing the future quickly but also on consciously transforming the past (Whyte, 2017). To prevent climate policy from reinforcing the exclusion of Indigenous Peoples and local communities and rendering their knowledge invisible, or worse, facilitating new avenues of assimilation and colonialism, we have to generate mechanisms for intercultural participation based on Indigenous relational climate justice (Ulloa, 2017). Although transformative governance is often depicted as being good for all, the reality is that the envisaged need for widespread changes across societies will most likely result in winners and losers across social sectors and actors (Pickering et al., 2022; Blythe et al., 2018). In addition, vested interests by powerful actors often limit or derail attempts towards sustainability transformations (Blythe et al., 2018; Pickering et al., 2022; Visseren-Hamakers et al., 2021). Hence, not only should issues of justice and equity be at the core of transformative governance discourses (Pickering et al., 2022), but also correspondingly problems of power, corporate capture or greenwashing must be tackled as well (Supran and Oreskes, 2021; Teichmann et al., 2020).

In terms of generating just mechanisms for intellectual participation of Indigenous peoples, a main prerequisite is that these mechanisms must be designed jointly with the Indigenous Peoples and local communities, safeguarding their personal and collective rights, and promoting the continuity of knowledge and governance systems, especially in relation to nature (Tsosie, 2007). Thus, such mechanisms must ensure legal protection consistent with diverse Indigenous and local histories, cultures, worldviews and territorialities, as well as with the historical processes that have shaped each people's relationship with the states (Gilio-Whitaker, 2019). In addition to identifying solutions, these mechanisms should also enable Indigenous Peoples and local communities to monitor and verify climate action progress.

Overall, this issue of justice within plural knowledge systems has received quite cursory attention rather than meaningful recognition in international climate policy processes (Ford, Cameron, et al., 2016; Ford, Maillet, et al., 2016; Mustonen et al., 2021). Despite well-established acknowledgement of the importance of engaging with diverse knowledge systems, sources of information, and scales of evidence, the practical combination or collaboration of these systems has been more difficult to operationalise (see also section 3.2, 3.3). Some constraints on such collaboration include informational, financial, institutional, technological, linguistic, educational, political, cultural, epistemological, ontological, and human factors

(Tengö et al., 2017). Moreover, to date, most forms of communication between knowledge systems have taken an *extractive approach*, incorporating some aspects of one knowledge system (implied as secondary) into another (implied as primary) through validation of the secondary knowledge system within the framings of the primary knowledge system (see also section 4.3). Attempting to overcome diversity and dissonance by universalising systems of knowledge, truth, and value through integration of different knowledge systems has been described as ‘doing violence to other ways of knowing’ (Löfmarck and Lidskog, 2017).

Therefore, approaches for diversifying sources of knowledge should be transparent, critically reflexive, collective, dialectic, and adapted to their specific context and scale using careful consideration of existing relationships between knowledge systems, rather than aiming at plain integration. It is important to reflect on who determines what is considered as ‘knowledge’ and how it comes together, as these considerations will not only determine what evidence feeds our global and local responses to climate change but also whether they are just and equitable responses.

#### *4.4.1. Key conditions: recognition and respect*

We emphasise the importance of recognition and respect as the two key pre-conditions for successful collaboration and co-production (see 5.2). We use ‘recognition’ broadly and to indicate sustained acknowledgement of the full agency and autonomy of other groups and actors. It connotes a commitment to attentive, constructive engagement, even in the face of differences of understanding of facts, values, and interpretations. The term can also refer more narrowly to official recognition, typically by a state agency; such official recognition can lead to full recognition, though in some respects complements recognition; These two conditions complement each other, since respect deepens and is predicated upon recognition.

Recognition between knowledge systems must be based on and promote horizontal meeting spaces, which take into account historically constructed inequalities (de la Maza et al., 2008). The histories may include colonisation by foreign settlers and their assimilation policies, which endanger cultures through suppression, misrepresentation, and appropriation or assimilation. Those impacts are experienced by Indigenous Peoples and local communities through the disconnection of people and their land; the destruction of ecosystems, heritage and heritage sites; the loss of languages; and killing of custodians of knowledge (Fernández-Llamazares et al., 2015). The knowledge holders, together with the social and ecological spaces needed to enact and transmit local knowledge, are invariably affected.

Some researchers have noted the efforts to promote participatory and respectful methodologies that allow for the co-production of knowledge in the contexts of climate change (Bremer et al., 2018; Gram-Hanssen et al., 2021, p.) and in national climate assessments (Maldonado et al., 2016), as well as specific domains, such as biodiversity (Heinrich and Hesketh, 2019), disaster risk reduction (Howitt et al., 2012), national assessments, food systems (Parlee et al., 2021) coastal zone management (Loch and Riechers, 2021) and ocean monitoring and management (Proulx et al., 2021). Nonetheless, some challenges remain to ensuring the appreciation of Indigenous knowledges and local knowledges vis-a-vis scientific knowledge in climate domains as elsewhere (Brugnach et al., 2017).

Recognition (and misrecognition) occur not simply through written statements acknowledging people's values and practices or even providing legal recognition of Indigenous identity or rights (Vermeulen, 2019). It must be based on and promote egalitarian meeting spaces, which take into account historically constructed inequalities (de la Maza et al., 2008). Recognition and respect may also be established, maintained, and enhanced through ongoing actions and interactions, such as spaces to explicitly address and enhance accountability for longstanding conflict and historical injustice, efforts to build intersubjective understanding, express perspectives or promote diffusion of norms, behaviours and structures that mitigate power inequalities and avoid reproducing forms of discrimination (Álvarez and Coolsaet, 2020). In this way, respect and recognition complement each other.

In terms of recognition, a distinction can be made between the *multicultural approach* (Kymlicka, 1996) and the *intercultural approach* (Tubino, 2002; Walsh, 2006). The multicultural approach can be characterised as a liberal perspective that addresses cultural difference as a value in itself and not as a product of the contents and meanings that actors give it in practice (Martínez-Novo, 2011). Therefore, multicultural recognition does not question or aim to modify the structures of power that cross-cut differences and produce inequality. Moreover, a multicultural approach can even promote assimilation (McMurry, 2021) and be configured as a new form of colonialism (Antileo, 2013; Chavez, 2011). In contrast, intercultural recognition does not attribute an inherent value to diverse knowledge systems. It does, however, value them for their capacity to resist homogenisation and thus offer other possibilities for building society (Palermo, 2010), and can be conceived as a counter-hegemonic project based on the historical experience of Indigenous peoples and movements and their resistance to colonisation.

	Heritage					Knowledge Systems				
	Tangible Heritage			Intangible Heritage		Thought			Action	
	Monuments, buildings and sight	Landscapes	Movable Heritage	Rituals and Festivals	Practices, knowledge, skills	Observations	Values	Analysis, understandings	Tools and objects	Caring, responsibility
1. Fiji Meetings	X		X	X	X	X	X	X		X
2. Mapuche forests	X	X		X	X	X	X	X		X
3. Water management in Sierra Nevada, Spain	X	X	X		X	X	X	X	X	X
4. Fire Management in Lomerio, Bolivia		X			X	X	X	X	X	X
5. Forest Governance in Nepal		X		X	X	X	X	X		X
6. Stonewalling in Philippines	X	X		X	X	X	X	X	X	X
7. Informal urban settings in Sierra Leone	X				X	X	X	X		X
8. Urban Native Americans in Southwest US	X	X	X	X	X	X	X	X	X	X

Figure 3: Heritage and knowledge systems

#### *4.4.2. Procedures and mechanisms to support productive collaboration*

We face here a critical contemporary issue without a clear roadmap or well-developed precedents: how can full, just interaction of knowledge systems be envisaged, supported and protected, and how can these knowledge systems be most fairly and constructively braided or interwoven? How can recognition and respect become practices rather than slogans or aspirations?

To date, global environmental and climate governance have only allowed a superficial appreciation of Indigenous Peoples' and local communities' contributions to climate change adaptation and mitigation (David-Chavez and Gavin, 2018), or even resulted in their assimilation (McMurry, 2021) under the 'tyranny of participation,' the unequal terms on which Indigenous Peoples and local communities commonly interact (Enns et al., 2014). But there have also been engagements of respect and voluntary co-production between scientists and Indigenous Peoples and local communities.

Moreover, different Indigenous Peoples and local communities have chosen to engage with scientists to work together around common agendas (Fernández-Llamazares et al., 2021; Sidik, 2022). Indeed, there have been efforts in part of the scientific research community to promote respectful methodologies that allow for the co-production of knowledge in the contexts of climate change (Bremer et al., 2018; Gram-Hanssen et al., 2021). Generally, these experiences require collaboration and must be adjusted to the specific cultural, social and historical contexts in which they are implemented. Diverse experiences have been developed in the Arctic. For instance, Inuit have conducted workshops to identify vulnerabilities and plan responses (Furgal and Seguin, 2006), and in 2005, the Arctic Climate Impact Assessment was developed collaboratively, building on a long history of prior collaborations (ACIA, 2005). Case Study 7 in Sierra Leone demonstrates how knowledge co-production based on the consideration of local ways of knowing enables the design and implementation of development and risk reduction plans with more holistic and culturally appropriate approaches. As these examples demonstrate, there is no single process for bringing different knowledge systems together. Tengö et al. (2014) note, for example, that while diverse knowledge systems have always experienced 'cross-fertilisation' or transfer, it is vital to consider the differences of power and perspectives in the process of how new knowledge is created. In the context of climate change, where global multilateral and governmental responses predominate, this consideration is of real importance, particularly for place-based knowledge systems (Ulloa, 2011).

A justice approach raises potential for more biocultural approaches and knowledge-centred governance for climate resilience (Wheeler and Root-Bernstein, 2020). Demands for climate justice have been at the heart of the international Indigenous movement, and many communities have already organised and responded to the practices imposed on them in their territories. For instance, Indigenous peoples of the Amazon drafted their own proposal in order to be compensated for their work in forest conservation within the framework of REDD+ (the name given to country-level efforts to reduce emissions from deforestation and forest degradation), creating RIA (REDD+ Indígena Amazónico) (ECA-RCA, 2018). And in Canada, the Indigenous Climate Action (2021) collective calls for the decolonisation of climate policy. Furthermore, recent research has demonstrated that when Indigenous peoples' rights are respected, there is greater conservation of biodiversity (RRI, 2015; 2020; 2021).

The braiding of knowledge systems to advance understanding about climate change, its impacts, and possible actions to address it requires not only a fair use of the different knowledge systems, but also fair processes through which those knowledge systems can interact, or, in other words epistemic justice, sometimes termed cognitive justice (Dutta et al., 2021; Temper and Del Bene, 2016). There are various aspects of epistemic justice to consider regarding the interaction of different knowledge systems and their influence on climate reporting. These include the quality of participation and representation, the narratives through which the concerns of Indigenous Peoples and local communities are depicted and the cultural appropriateness of forums, both formal and informal, through which knowledge holders or representatives interact with other knowledge systems (Bäckstrand and Lövbrand, 2019; Finnemore and Sikkink, 1998).

Importantly, beyond the immediate processes of engagement between knowledge systems, issues of climate justice centre on the lack of recognition of Indigenous Peoples' and local communities' worldviews, identities, values, place attachments and practices throughout the long-term history of colonisation, commercialisation, causation of environmental and climatic change, and discrimination (Fernández-Llamazares et al., 2021; Marino and Ribot, 2012). Scholars of justice and intercultural theory across various fields, including climate politics, have emphasised how any attempt to promote fairer distribution of funds and impacts, or to enhance participation of Indigenous peoples and local communities in decision making, can have little impact without meaningful recognition of the fundamental differences in values between groups and their political histories (Anderson and Honneth, 2005; Blais-McPherson and Rudiak-Gould, 2017; I. M. Young, 1989). For example, Case Study 4 in Bolivia illustrates the opportunities that are missed when Indigenous knowledge is misrecognised and Indigenous rights are neglected.

Specifically, it demonstrates how Indigenous knowledge can promote more appropriate responses to land management than those positioned by governments based on contemporary mechanisms that prohibit specific practices, in this case, the controlled use of fire. Furthermore, the revitalisation of Indigenous knowledge associated with fire also allows for strengthening capacities to cope with the increase in fires due to the combination of climate change and land use intensification.

There is increasing agreement that bringing different knowledge systems together should be a 'two-way' process in which knowledge holders from different systems have the equal opportunity and authority to critique findings and framings from the other knowledge system; validation should only take place within knowledge systems and not between them (Tengö et al., 2014). A parallel approach, therefore, applies a process in which knowledge systems remain distinct and separate, maintaining their own integrity and quality, while simultaneously being considered together. The processes of knowledge co-production, sometimes referred to as 'bridging,' are collaborative efforts in which multiple paradigms are applied at all stages of knowledge generation, in which both knowledge and those who produce it are transformed during the process. For an examination of the interactions in the case studies, see Figure 2.

#### 4.4.2.2. Specific procedures and mechanisms

In line with the commitment to pluralism and justice, a number of mechanisms exist, or are being developed, to support productive and effective collaboration. The establishment and use of concrete mechanisms is necessary to assure that relations between knowledge systems are truly just in both their outcomes and processes. These draw on the principles of recognition and respect, discussed in 5.5.1. Some of these have been established in other domains, such as biodiversity conservation. In some instances, the governance is described loosely in terms of cooperation or co-production, without fully specifying the forms of knowledge governance and protection, as in the case of Multiple Evidence Base Approach (Tengö et al., 2017). To see some areas of coordination between knowledge systems and heritage approaches, see Figure 3.

First, free, prior and informed consent (FPIC) is widely recognised as a mechanism to promote equitable partnerships in the climate domain as in other environmental domains (Williams and Hardison, 2013). It has been discussed in the contexts of specific climate projects, including in forest management for mitigation, where some research reports positive outcomes (Godden and Tehan, 2016), though others suggest that FPIC in practice can be limited in terms of the scope of its agreement and in the short duration of its application, so that it sometimes does not lead to long-term relationships of respect and trust (Papillon and Rodon, 2017). There is a good deal of discussion of FPIC, but attention to knowledge systems builds on and expands ideas of what constitutes recognition and respect. FPIC is often project based, and projects often begin above/outside.

Second, customary law is a form of recognition by national governments in many settings. Recognition of customary laws is a fundamental step towards local communities and Indigenous Peoples achieving environmental self-determination. Traditional laws can also contribute to the conservation, management and restoration of ecosystems because they promote respectful practices aimed at the benefit of both human and non-human constituents. This is demonstrated by Case Study 5 in Nepal, where customary laws and institutions play a central role in regulating the relationship with the territory and the use of its resources. These practices, in addition to ensuring the care of crops, allow for the regeneration of forests and pastures and thus facilitate climate change mitigation and adaptation.

Third, intellectual property rights and other related safeguards and protocols can protect intellectual property rights; moving beyond Indigenous data sovereignty Indigenous knowledge systems have their own data governance rules including how and who can use and share culturally sensitive information (Kukutai and Taylor, 2016). Such data governance systems regulate how peoples, lands, resources, histories, and knowledge are represented and who has the right to use data and for what end (Carroll et al., 2020; The First Nations Information Governance Centre, 2014). Given historical contexts of injustice and power differentials between knowledge systems, to date most research outputs related to Indigenous knowledge (e.g., national statistics, scientific publications) are produced and shared following non-Indigenous data governance rules. Several scholars and organisations have responded to this situation signaling the need to address Indigenous data sovereignty (IDS) (Oguamanam, 2020), or the management and governance of information according to the laws and protocols of the nation within which that information is located (Kukutai and Taylor, 2016). For example, although the IPCC is

increasingly recognisant of the contributions of Indigenous knowledges to the understanding and addressing of global environmental challenges (Ford, Cameron, et al., 2016; Hill et al., 2020), it does not explicitly call for the use of Indigenous data governance protocols in protection of Indigenous data (Krug et al., 2020; Stockhause et al., 2019). This potentially denies Indigenous peoples the rights to protect their knowledge as stipulated by the United Nations Declaration on the Rights of Indigenous Peoples (United Nations General Assembly, 2007). The question of ways for Indigenous Peoples to protect their intangible cultural heritage remains largely unaddressed.

Finally, a number of efforts seek to establish documentary bases of case studies to find patterns of governance that support (or block) just and effective collaboration between knowledge systems. In general, these case studies document the importance of preserving autonomy of knowledge systems within these collaborations, and indicate the value of long-term interactions to support recognition and respect (Crate et al., 2019). The set of eight case studies in this white paper is one such base. In another, researchers compared Indigenous decision making about climate-related impacts on floods in China, wildlife populations in the US, herd-pasture relations in Peru, and irrigation water availability in Pakistan (Orlove et al., 2020). Each of these cases involved the use of Indigenous knowledge, practices, and customary law. The positive outcomes were based on three elements: orality (decisions are reached and implemented through face-to-face conversations in Indigenous languages, sometimes supplemented by written records); embeddedness (decisions are reached long-established social institutions and cultural frameworks from which they draw their legitimacy) and articulation (Indigenous Peoples have ties with other parties, particularly representatives of national governments and NGOs, with elements of recognition and respect; these ties can provide support, though they can also undercut Indigenous autonomy).

An example of such a database has been developed by Local Indicators of Climate Change Impacts (LICCI), a project designed to establish an inventory of local indicators of climate change impacts documented by Indigenous Peoples and local communities. It collects data from remote areas that are difficult to extensively sample with traditional field methods, and then stores the geolocated data on an open-source platform, generating a community of practice around the contribution of Indigenous knowledge and local knowledge to climate change research (Reyes-García et al., 2019). Researchers anticipated that the LICCI project may not fully consider the marginalised position of Indigenous Peoples and local communities in climate change research and policy forums, and has sought to engage Indigenous Peoples and local communities in the co-design of a digital platform. On this platform, communities can document their knowledge of climate change impacts in a way that is useful to them, as well as to communicate the impacts of climate change on their livelihoods. Furthermore, the project follows principles of Indigenous data sovereignty, a nascent but increasingly urgent issue given the digitalisation of traditional knowledge, Indigenous knowledge, and local knowledge (Kukutai and Taylor, 2016).

	Is the collaboration full?				Is the collaboration just?				Overall: High (6-8), Medium (3-5), Low (0-2)
	Observations	Values	Practices	Ethics	Recognition	Respect	Sustained engagement (>5 years)	Mechanisms	
1. Fiji Meetings	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>		<b>X</b>	<b>7</b>
2. Mapuche forests		<b>X</b>		<b>X</b>	<b>X</b>				<b>4</b>
3. Water management in Sierra Nevada, Spain	<b>X</b>		<b>X</b>		<b>X</b>		<b>X</b>		<b>3</b>
4. Fire Management in Lomerio, Bolivia			<b>X</b>		<b>X</b>				<b>2</b>
5. Forest Governance in Nepal	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>		<b>X</b>	<b>7</b>
6. Stonewalling in Philippines	<b>X</b>		<b>X</b>		<b>X</b>	<b>X</b>			<b>4</b>
7. Informal urban settings in Sierra Leone	<b>X</b>		<b>X</b>						<b>2</b>
8. Urban Native Americans in Southwest US	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>8</b>

Figure 4: Fullness and justice dimensions of collaboration between knowledge systems

Figure 4 offers an illustration of the relations of the dimensions of fullness and justice within collaborations between knowledge systems. It offers suggestions of several findings, to which we assign low to medium confidence. First, there is a diversity of forms of collaboration; there are seven different configurations of cells for the eight cases. Second, there is a diversity of levels of collaboration across the cases, with two cases at low levels, three at intermediate and two at high levels. Third, there is a diversity in the frequency of the criteria, with some more frequent than others; we note in particular that recognition (n=7) is higher than respect (n=4). Two other findings, at lower confidence levels because the differences are not, are that the fullness criteria (n=21) are met somewhat more often than the justice criteria (n=16), and that cases tend to have similar rankings across the fullness and justice criteria.

#### *4.4.3. Recent steps towards full, just collaboration: COP26 Glasgow 2022*

The most recent UNFCCC Conferences of Parties (COP26) was held in Glasgow in November 2021; it also served as the Meeting of the Parties to the Kyoto Protocol (CMP16) and the Meeting of the Parties to the Paris Agreement (CMA3). Box 3 briefly discusses the COP and lists some decisions that are of relevance to the discussion of plural knowledge systems, including full, just collaboration between knowledge systems.

A full analysis of this COP, its decisions, and their significance for the role of knowledge systems for climate action and climate justice will require significant time and broad, inclusive discussion. To support that discussion, we note several points:

First, the decisions mention knowledge and culture in general and also mention specific components of knowledge systems, such as practices, discussed in this white paper. There is also a reference to expertise, a close synonym of knowledge. These references can help guide future assessments of knowledge systems, culture and heritage.

Second, the decisions mention climate action in general, and also mention specific phases of activity. The Glasgow Pact ‘urges Parties to actively involve indigenous peoples and local communities in designing and implementing climate action,’ also noting the ‘important role’ of indigenous peoples and local communities in ‘effective action on climate change.’ This phrasing is significant for its breadth, since it covers ‘climate action’ in general, and since ‘designing and implementing’ comprise a great deal of climate action. This language might be read as leaving unresolved the question as to whether any elements of climate action are *not* included: for example, is the detection and attribution of impacts included under ‘designing’ and is monitoring, reporting and evaluation included under ‘implementing’? And, more broadly, does the term ‘climate action’ include the reframing of the relations between people and nature, as discussed in Box 2 and in sections 2.1 and 2.3?

Third, the decisions mention a number of concrete sites of climate action. The Local Communities and Indigenous Peoples Platform (LCIPP) offers a broad call for ‘fostering full and effective participation of indigenous peoples and local communities in achieving the objective of the Paris Agreement’ and ‘continued collaboration among Parties and indigenous peoples and local communities on addressing and responding to climate change’ and, importantly, provides some deadlines for further action. The

breadth of its scope is signalled in its call to 'enhance engagement of indigenous peoples and representatives of local communities in diverse and innovative ways in addressing and responding to climate change.' The draft decision on the Green Climate Fund (GCF) mentions Indigenous and local knowledge and practices in parallel with scientific knowledge from the IPCC, and calls for a clarification of the role of these knowledges and practices in assessing proposals for financing from the GCF. The documents also signal the Nationally Determined Contributions as contexts in which Indigenous knowledge systems and local knowledge systems form part of a broad scope of climate 'efforts,' and in which they are tied to the full participation of Indigenous peoples and local communities. These references, along with the ones mentioned in the second point above, can help guide future assessments of climate action and its phases, bridging discussions of knowledge systems, culture and heritage with discussions of climate action in IPCC reports, including AR6, WGII, Chapter 17, 'Decision-making' and Chapter 18, 'Climate-resilient development pathways.'

#### **Box 4: Decisions and outputs from COP26 that address Indigenous knowledge and local knowledge**

COP26 Glasgow in November 2021 contained a number of significant steps for the inclusion of diverse knowledge systems in climate action. As discussed in 5.1 a key element in the 2015 Paris Agreement is decision number 1 of the COP21 (p.135) promoted the creation of the Local Communities and Indigenous Peoples Platform (LCIPP). Since 2018, the LCIPP has been operationalised and promotes the inclusion of local communities and Indigenous Peoples in the UNFCCC processes and all levels of states' climate policies and legislations. The engagement of Indigenous Peoples and local communities has continued to grow.

At Glasgow, this engagement increased. The Indigenous Peoples Pavilion was located in the Blue Zone for the first time, allowing for slightly more direct exchange between Indigenous Peoples and Party delegates. The presence of Indigenous Peoples in public-facing events was notable. And for the first time in the history of the UNFCCC, a meeting with Indigenous knowledge holders was held at the COP. As a product of the negotiations during the COP26, there were a number of significant outcomes for Indigenous Peoples and local communities. These include more references to Indigenous Peoples rights and the promotion of full inclusion in all levels of policy, and to recognition of Indigenous autonomy. More specifically, and of relevance to this white paper, there were a number of references in pledges and decisions to knowledge systems and to elements of knowledge systems. The list that follows is assembled in part from advanced versions of drafts, and so is not meant to be a definitive compilation of references to knowledge systems, but rather to contain key points.

Draft Decision of the COP26:

'Emphasises the important role of indigenous peoples' and local communities' culture and knowledge in effective action on climate change, and urges Parties to actively involve indigenous peoples and local communities in designing and implementing climate action.' (p. 66);

Regarding the Green Climate Fund (Agenda item 8(c)), the COP26 Draft Decision

'Encourages the Board to further clarify the role of data and information from, inter alia, the Intergovernmental Panel on Climate Change, and traditional, local and Indigenous knowledge and practices in the assessment of concept notes, project preparation funding applications and funding proposals;' (p.7);

From the UNFCCC Secretariat (September 2021), in advance of COP26: Nationally determined contributions under the Paris Agreement. Synthesis report by the secretariat:

22. 'Some Parties described the role of local communities and the role, situation and rights of indigenous peoples in the context of their Nationally Determined Contributions (NDCs), describing the specific vulnerabilities of indigenous peoples that are particular to their circumstances, the importance of drawing on Indigenous and local knowledge to strengthen climate efforts, and arrangements to enable greater participation in and contributions to climate action by indigenous peoples.'

114. 'Some Parties described the role of indigenous peoples and local communities in the context of their NDCs, including the situation and consideration of the rights of indigenous peoples at the national level, such as legal and consultative arrangements for protecting their rights. They emphasised the vulnerabilities of indigenous peoples relating to their intrinsic relationship with forests and ecosystems and conditions of poverty. The benefits of drawing on Indigenous knowledge and expertise, in particular for adaptation, were highlighted, as was the importance of combining traditional and modern practices and of ensuring the participation and leadership of indigenous peoples in climate efforts. Parties outlined how Indigenous peoples were engaged in NDC preparation, including through consultations on sectoral proposals, risk assessment and analysis of Indigenous knowledge.'

Regarding the LCIPP, the Draft Decision of the COP26:

'Recognises the role of the Facilitative Working Group in fostering full and effective participation of indigenous peoples and local communities in achieving the objective of the Paris Agreement' (p. 4);

'Recommends that the activities under the second three-year work plan facilitate exchange of experience between indigenous peoples and local communities and Parties of approaches to managing all ecosystems, which are key to achieving the objectives of the Convention and the Paris Agreement, in order to enhance national climate policy, including NDC'(p. 7);

'Recognises that the second three-year work plan facilitates continued collaboration among Parties and indigenous peoples and local communities on addressing and responding to climate change' (p. 9);

'Invites Parties and stakeholders to enhance engagement of indigenous peoples and representatives of local communities in diverse and innovative ways in addressing and responding to climate change' (p. 10);

'Requests the Facilitative Working Group to report on its outcomes, including a draft third three-year work plan of the LCIPP, and on the activities under the Platform for consideration by the Conference of the Parties at its twenty-ninth session (November 2024) through the Subsidiary Body for Scientific and Technological Advice at its sixtieth session (June 2024)' (p. 11);

Regarding the Climate Technology Centre and Network (Decision -/CP.26, 9c)

'A representative of Indigenous peoples' organisations, with relevant technology, finance or business experience will be included in the Advisory Board. This representative will be self-nominated by the Indigenous peoples organisations.'



## Indigenous peoples Traditional Governance Systems for Conservation and Sustainable Management of Natural Resources (Nepal)

[Keywords: intangible heritage, governance, solutions]

The government of Nepal has officially recognised 59 Indigenous groups in the country (NFDIN, 2003), who comprise 35.6% of the national population (Dahal, 2014). They live in different geographical regions, each with a distinct culture, identity, and way-of-life. Despite their differences, Indigenous peoples in Nepal have similar symbiotic relationships with nature, which form the basis of their livelihoods and are interlinked with their worldviews. This relationship is protected by longstanding traditional institutions, customary laws, and practices which govern and assure the conservation and sustainable management of nature. Moreover, these institutions and practices maintain peace, prosperity and unity in the society.

Many such traditional practices, customary governance systems, and the knowledge systems in which they are embedded are already threatened, or rendered extinct, due to government policies and development activities promoting globalisation and modern education systems. However, these traditional practices and knowledge systems have made substantial contributions to the conservation of natural resources and biodiversity. To mention one important example, the Mithewas manage and protect forests in the Ngishyang valley. The Mithewa is a customary institution of the Ngishyangba people in Manang district led by groups of elderly, respected individuals. Livestock-raising is the traditional occupation and a major source of livelihood of the Ngishyangba people. Beginning in mid-May each year, they move their livestock from the village to pastures in higher areas, a process called transhumance. The date for transhumance is specified by the Mithewas. Once the date to move the livestock is set, the Choun or Katuwal, a traditional messenger, informs the villagers about the decision. Every year, following crop cultivation, communities collectively select the crop guards, called Chhowa, from among the households involved in the farming.

Following their selection, the Chhowas hold a meeting to discuss and allocate their responsibilities. If an animal is not taken to the pasture land after the scheduled date, but instead remains below, potentially damaging crops in the village, Chhowas seize the animal and fine its owner. The level of the fine on the type of animal, the quantity of the loss, and duration of the harm. The amount collected from fines used for religious activities and community development. Following customary laws, no animals are brought back to the village until all the crops have been completely harvested. Once harvesting is over, Mithewas and Chhowas hold a joint meeting and set the date to bring back the livestock. People can collect grass from the grassland for three or four days after the Mithewas specify a date for grass collection ( Sherpa, 2018).

These practices allow pastures to regenerate naturally, protect agricultural crops from damage, and assure that the community abides by the principles of the Mithewa customary institution. More broadly, it contributes toward sustainability, viable livelihoods, and societal harmony (Sherpa et al., 2010). For centuries the Mithewas have played a crucial role in conservation and sustainable management of forests, agricultural land and pastures. The protected forests (*teising*) are seasonally opened for collection of firewood, timber, and fodder. People have the permission to collect dry firewood and fallen leaves only from certain protected forests. No one is allowed to cut down the trees and trim green branches. However, people can collect timber for the construction of a monastery, school, or abridge with permission of Mithewas. They have prohibited collecting firewood and fallen leaves from the *teising* of Tanki Manang and Chikung forest of Ngawal.

The Ngishyangbas also protect trees on sloped land, and around the monasteries and water sources. Afforestation and vegetation protection mitigate the hazards posed by landslides, rockslides, and floods. Recently, the Ngishyangbas documented the impacts of climate change related disasters, particularly landslides, drought, and glacial lake outburst floods, which have adversely affected their community. However, the forests protected through their ancestral practices have contributed to biodiversity conservation, protection of erosion-prone slopes, and carbon sequestration, thereby mitigating climate change impacts. Many similar institutions are found among other Indigenous Peoples of Nepal. For example, the Tumba of Gorkha district have a set of practices and laws based on their principle of nonviolence, *Shagya*. Based on this principle, they have established committees and regulations, with some resemblance to the Mithewas, which protect forests, pastures, fields, wildlife, and water sources, assuring sustainable livelihoods, biodiversity conservation, and general social well-being (CIPRED, 2021).

## Case Study 6:

### Stone Walling Practice in the Cordillera Region (Northern Philippines)

[Keywords: tangible heritage, governance, solutions, learning from the past]



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). The economic wellbeing, survival, cultural life, political and social organisation, and cognitive system of the Igorot are all woven through rice terracing agriculture (Florendo and Cardenas, 2001). 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 in general, to prevent erosion. In many cases, they are also used to increase the area of rice paddies. Other Indigenous peoples in mountainous regions, including Nepal and Peru, also have long-established traditions of building stone walls and terraces for agriculture, irrigation, and slope management.



Building a stone wall (Photo by WV Alangui)



A newly built stone wall (Photo by WV Alangui)

Stone walling is a highly technical knowledge where everything from stone selection to backfilling to 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 and many of them become respected elders and knowledge holders. As an Indigenous technology developed in upland communities that has been practiced for hundreds of years, stone walls have jumped application from holding rice terraces to supporting 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. Stone walling, with some modifications, has become widely adapted in urban centres, and many other areas outside of the Cordillera region. Modern-day stonewalling involves the use of cement as an added element to keep the stones together. Building stonewalls prevents erosion and promotes soil destabilisation in upland communities (both rural and urban) which have become increasingly vulnerable to strong typhoons. Back in the Indigenous villages of the Cordillera, stonewallers continue to use only natural materials.

## 5. Approaches to Different Knowledge Systems

Over the years, international conventions and intergovernmental panels have given different treatment to different knowledge systems, and signalled their relevance in a variety of ways. While it is beyond this paper to analyse in detail such treatment in all international documents relevant to natural and cultural heritage, we provide some insights into how different knowledge systems have been approached within UNESCO conventions, IPCC reports, and other relevant documents. We also summarise commonalities and differences with other relevant international bodies (e.g., UNFCCC, IPBES, CBD). We refer to UNESCO documentation and to literature that has reviewed reports from the IPCC and other conventions for mentions of Indigenous Peoples, local communities, and their knowledge systems. We do not review these reports and literature systematically, nor do we quantify the use of relevant terms. Instead, our review methods might be described as a non-systematic narrative synthesis. We sought to pick out key passages and terms related to intangible cultural heritage and diverse knowledge systems from this substantial range of processes and set of documents and to critically explore and compare the themes and narratives attached to them, so as to draw out points of difference and of progressive practice. This review is important because the way in which different knowledge systems are evidenced and considered in global assessment processes will determine how future priorities are shaped, decisions are made, and actions are taken.

### 5.1. International and national organisations

#### 5.1.1 UNESCO

For the last 20 years, UNESCO has acted as a hub of learning and exchange of how Indigenous and local knowledge are conceptualised in the broader UN system and how knowledge holders participate in its processes. The World Heritage Convention regards heritage as both natural and cultural, thus highlighting the ways in which people interact with nature, and of the fundamental need to preserve the balance between the two. In 2002, UNESCO established the Local and Indigenous Knowledge Systems (LINKS) programme as an inter-sectoral initiative on knowledge mobilisation. The LINKS programme was partly shaped by the debate regarding cultural landscapes and stewardship by Indigenous Peoples within the UNESCO Man and Biosphere programme, the 1972 UNESCO Convention concerning the Protection of the World Cultural and Natural Heritage, the 2003 Convention for the Safeguarding of Intangible Cultural Heritage, as well as advances in Geneva and New York on what would become the 2007 UN Declaration on the Rights of Indigenous Peoples.

The LINKS programme has been foundational to the IPCC, UNFCCC, IPBES, CBD, and other intergovernmental and UN processes detailed within this section. For example, UNESCO co-convened the international meeting on 'Indigenous Peoples, Marginalised Populations and Climate Change: Vulnerability, Adaptation and Traditional Knowledge' in 2011 to bring together Indigenous peoples and local community knowledge holders and experts, developing country scientists, and members of IPCC WG II (the main channel through which IPCC engages with Indigenous knowledge holders and local knowledge holders). Building on the momentum created by Indigenous movements in the LCIPP in the

UNFCCC and more widely, UNESCO also contributed substantially to the Nairobi Work Programme (NWP) of the UNFCCC on impacts, vulnerability, and adaptation to climate change, established in 2005. A key contribution from UNESCO to generate dialogue among different knowledge systems on climate change was the organisation of 'Resilience in a Time of Uncertainty: Indigenous Peoples and Climate Change,' a conference in Paris in November 2015—on the eve of the UNFCCC COP21. The high-profile international event brought together Indigenous peoples, researchers and policy experts to consider the importance of Indigenous knowledge to the climate agenda. UNESCO LINKS was also active in the initial conceptual workshops in the design of IPBES, and notably facilitated a key meeting in 2012 where Indigenous and local knowledge were highlighted and integrated into the design of IPBES conceptual framework (Díaz et al., 2015). UNESCO LINKS also hosted the IPBES 2014-2018 task force on Indigenous and local knowledge systems for the implementation of deliverable 1(c) of the work programme, concerning procedures for and approaches to working with Indigenous and local knowledge systems (see Hill et al., 2020 for results on the work of this task force).

UNESCO has been at the forefront of exploring and managing the impacts of climate change on the world's heritage, including intangible cultural heritage (Nakashima and Nilsson, 2006). The 2003 Convention for the Safeguarding of the Intangible Cultural Heritage recognises and promotes community-based initiatives to leverage the contribution of intangible cultural heritage to the protection of biodiversity, reduction of disaster risk, and mitigation of climate change impacts. This Convention broke new ground in this area of international law by affording a central role to the cultural communities in question, recognising their own cultural rights (Blake, 2008; Kurin, 2004). In 2006, under the guidance of the World Heritage Committee, UNESCO produced a report on 'Predicting and Managing the effects of Climate Change on World Heritage', as well as a 'Strategy to assist States Parties to Implement Appropriate Management Responses', which were considered and endorsed by the Committee in 2006 (<http://whc.unesco.org/en/series/22/>).

UNESCO developed a series of Thematic Indicators for Culture in the 2030 Agenda (Culture|2030 Indicators), as a framework of thematic indicators whose purpose is to measure and monitor the progress of culture's contribution to the national and local implementation of the goals and targets of the 2030 Agenda for Sustainable Development [<https://whc.unesco.org/en/culture2030indicators/>]. Indicator 3 focuses on climate adaptation and resilience and aims to assess measures taken to foster climate change mitigation and adaptation and enhance resilience through sustainable safeguarding and management of tangible and intangible cultural heritage, as well as natural heritage ([http://uis.unesco.org/sites/default/files/documents/publication\\_culture\\_2020\\_indicators\\_en.pdf](http://uis.unesco.org/sites/default/files/documents/publication_culture_2020_indicators_en.pdf)).

### 5.1.2. IPCC

The IPCC develops and refine its guidance for undertaking evidence evaluation in assessment reports, including measures of confidence (i.e., level of agreement and quality of evidence), as well as probabilistic quantification of uncertainty. These processes have been designed primarily to evaluate peer-reviewed scientific, technical, and socioeconomic quantitative evidence. As such, the guidance is often less applicable to qualitative evidence and frequently irrelevant to some forms of non-Western scientific evidence.

The inclusion of diverse knowledge systems has not been present since the beginning of the IPCC—the first two IPCC reports do not consider Indigenous knowledge and local knowledge at all. Nevertheless, since 2001, the IPCC has gradually included Indigenous Peoples in its reports, though mainly through the work of Working Group II, which assesses the vulnerability of socio-economic and natural systems to climate change (Ford, Cameron, et al., 2016). Most chapters from Working Group I, which assesses the physical scientific basis of the climate system and climate change, do not include considerations or evidence from Indigenous knowledge and local knowledge in their findings (IPCC, 2021).

Since 2007, there has been a growing acknowledgement of Indigenous knowledges and local knowledges. The 2007 Assessment Report (AR4) makes a shift as it considers the role these knowledges in adaptation and sustainability research, paying attention to the value of the Indigenous knowledge systems for adaptation, mitigation, and weather forecasting. The Special Report of Working Groups I and II of 2012 mentions that traditional behaviours can reduce vulnerabilities. Local knowledge is also linked to reporting and risk prevention. The AR5 established the need to consider different knowledge systems in climate change research (Petzold et al., 2020). Van Bavel (2021) also finds that since AR5, Indigenous-focused content is increasingly cited using specific examples rather than vague or undifferentiated references. This occurs most notably within the Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC), which acknowledges Indigenous knowledge within their specific contexts and included numerous examples from the Arctic, Pacific, Americas, Africa, and Asia (de Coninck et al., 2018; Hurlbert et al., 2019; Petzold et al., 2020). Furthermore, this acknowledgement comes with a recognition that ‘some forms of Indigenous knowledge and local knowledge are also not amenable to being captured in peer-reviewed articles or published reports, and efforts to translate Indigenous knowledge and local knowledge into qualitative or quantitative data may mute the multidimensional, dynamic and nuanced features that give Indigenous knowledge and local knowledge meaning’ (Crate et al., 2019).

Notwithstanding these advances, the predominant narrative within IPCC reports concerning Indigenous peoples and local communities and their knowledge systems emphasises their vulnerability to the impacts of climate change on economic, social, and cultural systems. Without paying any attention to the historical processes of marginalisation and disruption of their knowledge systems that underlie vulnerability (Ford, Cameron, et al., 2016). Furthermore, Indigenous-focused content is often presented without reference to specific Indigenous peoples. Sometimes, as in the SRCCL, indigenous peoples are often lumped into an overarching category of ‘those most vulnerable to climate change,’ including women, the poor, local communities, and marginalised populations. Finally, although their knowledge is recognised, this has mainly been limited to their role in supporting local resilience. As a result, only some knowledge systems components are recognised, but not the whole as integrated and holistic (see section 4.3).

This approach can be observed again in the last cycle of the IPCC (AR6). Specifically, the WGI has emphasised the role of Indigenous knowledge, specifically in historical climatology. However, the mentions of Indigenous peoples in this report are scarce and generally linked to vulnerability. Furthermore, the Summary for Policymakers, the document most widely disseminated and reviewed by

those who take the relevant decisions at the national and international level, does not even mention Indigenous peoples–nor local communities–and their rights.

However, further progress can be observed in the contributions of WGII and WGIII. The WGII has more substantially integrated Indigenous Peoples in its contribution, broadly recognising the contributions of their knowledge systems in the resilience of social-ecological systems. Although the report also emphasises the unique vulnerability affecting Indigenous Peoples, it goes a step further by linking this vulnerability to the intersection of multiple constructs that produce inequity–such as gender, ethnicity, income, and class–and the marginalisation that has historically excluded Indigenous Peoples from decision-making. Furthermore, for the first time in its history, the WGII refers to colonialism. It points out that marginalisation stems from patterns of inequity which have been shaped since colonial times and are reinforced in different forms today. In this regard, the report draws attention to maladaptive responses, which must be prevented by paying attention to recognition, procedural and distributive justice, and facilitating conditions for communities themselves to adapt to avoid harm. Because of this, the report makes a strong call to support Indigenous Peoples' participation, the consideration of their knowledge systems and the co-production of knowledge. This call is backed by compelling evidence that demonstrates how Indigenous Peoples' participation translates into more successful and sustainable, as well as more ethical and just, adaptation processes.

Although the consideration of Indigenous Peoples is not as strong as in WGII –it does not mention Indigenous Peoples in the Summary for Policy-makers–, WGIII also highlights the role of Indigenous Peoples in climate action. Nevertheless, the report acknowledges that Indigenous Peoples' role in mitigation has not been fully analysed and that their knowledge systems tend to be superficially approximated. The report thus calls for more research on the role and collaboration between different knowledge systems in climate change policy.

In recent years, the role of plural knowledge systems within the IPCC has attracted attention. Nevertheless, the current IPCC governance structures and organising principles, including the boundaries of its very mandate and the scientific integrity of its evidence valuation process, complicate these calls to be more inclusive of diverse forms of evidence and ways of knowing, limiting the expectations of including different stakeholders and knowledge systems (van Bavel, 2021). For example, the review of the sixth assessment cycle Special Reports and the review of AR5 rely heavily on analysing the content identified by keywords rather than the actual epistemology, ontology, methodology, and axiology underlying each concept and its presentation. This prioritisation influences how others interpret and apply report findings and can potentially disadvantage pertinent contributions from non-western, scientifically-validated knowledge (van Bavel, 2021).

Within the parameters of its current mandate and guiding principles, the IPCC process cannot achieve a level of procedural fairness necessary to work with diverse knowledge and promote equitable engagement (van Bavel et al., 2020). To diversify the evidence, not simply a greater diversity of peer-reviewed literature is needed, but mechanisms that can fairly assess diverse forms of knowledge. To move in this direction, attention to Indigenous knowledge holders and systems must be connected to Indigenous self-determination and governance.

### 5.1.3. *Other international bodies*

This section addresses how other international bodies have included and treated Indigenous knowledge and local knowledge in their work. In particular, we include bodies whose work contain a number of references of contributions from Indigenous knowledge and local knowledge to climate solutions and, more broadly, to sustainability. Overall, the main approach is one that focuses on the protection of the intellectual component of knowledge systems and does not fully address the increasingly rapid loss of biological and cultural diversity, often driven by loss of rights to use, access, and control over traditional resources and territories, even though the protection of knowledge systems as a whole requires the safeguarding of their cultural, biological, and landscape components.

#### 5.1.3.1. UNFCCC

Indigenous Peoples and local communities have since the 1970s raised concerns about the marginaliation of their knowledge systems at the UN Climate Change Conferences and processes (P. D. Sherpa, 2019). Ignored during the first years of the UNFCCC, the attention to their knowledge systems in negotiations and policies has largely centred on narratives related to their vulnerability and the avoidance of unnecessary harms, rather than on their contribution to climate actions attuned to different vulnerabilities on the ground.

The demands of the international Indigenous movement have promoted some progress in the international arena. During the first decade of the present century, the omission of Indigenous peoples began to be reversed. In 2001 they formed their own constituency and in 2005 they began to appear in COP decisions. The International Indigenous Peoples Forum on Climate Change (IIPFCC) was established in 2008, as the caucus for Indigenous Peoples in the UNFCCC processes. The specific mandate of the IIPFCC is to bring together Indigenous Peoples from around the world to voice their issues and concerns in relation to climate change in order to reach agreement on the specific negotiating points for UNFCCC COPs and intersessional meetings. Therefore, their consideration as agents has started to gain momentum. Since 2010, the Cancun Safeguards have expressed principles of: respect for the knowledge and rights of Indigenous peoples and local communities; full and effective participation; free, prior and informed consent; and equitable benefit sharing in REDD+ projects. However, these have been included as 'social safeguard' principles linked to local implementation and not in terms of direct participation at national and international levels to influence policy design and policy financing (Bayrak and Marafa, 2016; McDermott et al., 2012). A best practices technical paper on Indigenous and local knowledge (UNFCCC, 2013) later initiated what eventually became key text within the Paris Agreement of 2015, which promotes respect for the rights of Indigenous Peoples and local communities and consideration of their knowledges. At the same conference (COP21), the LCIPP was established under Decision 1/CP21, paragraph 135. The LCIPP has been operationalised since 2018 and promotes the inclusion of Indigenous Peoples in the UNFCCC processes and all levels of states' climate policies and legislations. The Facilitative Working Group of the LCIPP is a constituted body composed of both Indigenous peoples' representatives and government representatives.

Indigenous and local knowledge has also been recognised by the Subsidiary Body for Scientific and Technological Advice. For example, COP22 2016 promoted the use of Indigenous knowledge and local knowledge for adaptation, especially in the context of the implementation of the NWP. Furthermore, since 2018, the Conference of the Parties serving as the Meeting of the Parties to the Paris Agreement (CMA) promotes the participation of Indigenous Peoples in planning processes (Decision 4/CMA.1). It also encourages Parties to include traditional, Indigenous peoples and local knowledges related to adaptation in their National Adaptation Communications under the Paris Agreement (Decision 9/CMA.1.). These decisions have been reinforced at the last COP26, where both the CMA and the COP 'Emphasises the important role of Indigenous peoples' and local communities' culture and knowledge in effective action on climate change, and urges Parties to actively involve Indigenous peoples and local communities in designing and implementing climate action.' (Draft Decision -/CP.26; Draft Decision-/CMA.3).

### 5.1.3.2. IPBES

The Intergovernmental Platform on Biodiversity and Ecosystems Services (IPBES) has developed, to date, one of the ongoing most inclusive processes to bring together several sources of knowledge to tackle a global challenge (i.e., biodiversity loss). From its conceptual framework, IPBES has promoted dialogue across different knowledge systems (Díaz et al., 2015). Moreover, beyond the deliberate framework that facilitates recognition of different knowledge systems from the start, the work has also mobilized funding and recognised time required and engaged networks of stakeholders with diverse worldviews (McElwee et al., 2020).

The approach followed in IPBES includes procedures for assessments of nature and nature's linkages with people, including Indigenous s and local communities; a participatory mechanism; and institutional arrangements for including Indigenous Peoples and local communities throughout the process (Hill et al., 2020). This pioneering approach makes important steps in supporting Indigenous and local knowledge by respecting rights, supporting care and mutuality, strengthening communities and their knowledge systems, and supporting knowledge exchange through effective empowering dialogues (Hill et al., 2020). This has resulted for example in attempts to better articulate environmental values of Indigenous Peoples and local communities through attention to plural knowledge and relational values (McElwee, 2020; Tengö et al., 2017) and pushing narratives in environmental policy beyond ecosystem services to the Nature Contributions to People (NCP) framing (Díaz et al., 2015). However, while IPBES has made important progress on being more inclusive in its approach to diverse forms of evidence and ways of knowing, as well as being more flexible on the evaluation of what is considered "evidence", progress has been slower regarding changes in IPBES governance structures and organising principles. Thus, while Indigenous-focused content and sources of Indigenous knowledge are largely present in the work of IPBES, the mechanisms for ensuring equitable engagement have not changed.

### 5.1.3.3. IPCC-IPBES joint activities

During 2020 and 2021, scientists that had previously participated in the IPBES Global Assessment or the IPCC joined in a common effort to examine the synergies and trade-offs between biodiversity protection

and climate change mitigation and adaptation, as well as the potential impacts for people's quality of life (Pörtner et al., 2021). The need for transformative change was also one of the key messages to policymakers of the first joint report, which pointed out the need for a system-wide reconfiguration of societal structures and institutions (i.e. norms and formal rules), as these largely determine societal goals, practices and values, all of which are essential to address the underlying drivers of the dual crises. While including only the voices of scientists, the report generally recognises that there are diverse worldviews, values and epistemologies, including worldviews of Indigenous Peoples and local communities that have historically been marginalised, and who are especially vulnerable to biodiversity-climate interactions and have fewer rights to participate in decisions. In work derived from this report, authors generally note that transformative governance to tackle the biodiversity-climate-society nexus should be sensitive to local people's autonomy and rights of self-determination, especially with regard to Indigenous peoples and local communities, so that they also have the capacity to decide what is meant to be just and sustainable according to their worldviews, value and knowledge systems (Pascual et al., 2022). As is generally true for IPBES and IPCC work, while this joint activity shows some consideration towards Indigenous-focused content and some sources of Indigenous knowledge are present in the report, Indigenous Peoples' representatives were not invited either to contribute or to review the work.

#### 5.1.3.4. The Convention on Biological Diversity (CBD)

The CBD has perhaps the longest history of including terms to recognise Indigenous knowledge and local knowledge. During the 1990s, traditional environmental knowledge (TEK), generally coextensive with Indigenous knowledge and local knowledge as defined here, was specifically recognised by the Convention on Biological Diversity, which encouraged national governments to protect it and promote its wider application (CBD 1992, art. 8). This approach was later consolidated with the establishment of the International Indigenous Forum on Biodiversity in 2000, and the consolidation of a working group on article 8(j) on traditional knowledge and associated Programme of Work. This precedent provided for participation of Indigenous Peoples and local communities in international policy processes, and has resulted in frequent inclusion of text not only recognising the potential impacts of policies and environmental change upon Indigenous and local knowledge systems, but the role of customary institutions as forms of governance that in many cases support stewardship and effective conservation of biodiversity. In this sense, the level of participation and recognition in written form of Indigenous knowledge systems and local knowledge systems was, until recent years, more advanced within the CBD than other conventions (Cariño and Ferrari, 2021). However, although the principles pertaining to recognition of those knowledge systems, to the participation of Indigenous Peoples and local communities and benefit distribution have been frequently repeated and encapsulated in decadal targets such as 'equitable protected area management,' they have not been considered equal to western scientific knowledge in assessment of biodiversity status or in forms of governance promoted for conservation, (Tauli-Corpus et al., 2020). Indeed, only in 2018 were principles of recognition adopted as voluntary guidance for conservation governance (CBD, 2018).

Recent examples of progress to advance recognition of plural knowledge systems in biodiversity include initiatives to incorporate Indigenous knowledge systems into red list assessments (Cross et al., 2017), as well as the addition of some existing territories and areas conserved by Indigenous Peoples and local

communities to the global protected and conserved area network (Dudley et al., 2018). Many such examples of conservation actions based on the knowledge systems and relational values of Indigenous Peoples and local communities exist; however, they are geographically concentrated and globally represent a small minority relative to initiatives controlled by states, NGOs and private companies and based on priorities identified and governance designed through western scientific approaches to biodiversity (Colchester, 2004; Tauli-Corpuz et al., 2020). For example, a growing network of Indigenous peoples and local communities is recognised for their contribution to the diversity of life on Earth through their unique governance systems and cultural practices (Chhatre and Agrawal, 2009). For the majority of existing area-based conservation, restoration programs, and sustainable use regulations, changing governance to reflect and recognize plural knowledge systems would require a fundamental change in approach (Zafra-Calvo et al., 2019), which the Kunming 2022 negotiations for the post-2020 biodiversity framework appear unlikely to invoke an epistemic transformation towards (Kashwan et al., 2021).

#### 5.1.3.5. FAO

The UN's Food and Agriculture Organisation's (FAO) technology-for-agriculture platform, TECA [<http://teca.fao.org>] (Technologies and Practices for Small Agricultural Producers), established in 2002, provides an online platform for practical information on agricultural technologies and practices to help smallholders in the field. One report states: 'indigenous peoples' skills and expertise ... may be of valuable assistance to global development efforts. Throughout their history, indigenous communities have developed specialised knowledge of the environment and a strong ability to adapt to its changing circumstances. If given the opportunity, the joint resources of indigenous peoples and the international community may lead to innovative solutions for such issues as climate change and biodiversity loss' (FAO, 2009). It indicates a number of programmes to support Indigenous knowledge and local knowledge, including the FAO's Globally Important Agricultural Heritage Systems programme. This programme addresses both tangible and intangible heritage through its definition of agricultural heritage: 'local (including indigenous) farming systems and their associated landscapes, biodiversity, knowledge systems, and cultures' (FAO, 2009). This platform also contains other documents that indicate the usefulness of local knowledge in promoting organic agriculture and rural development (Gomez and Thivant, 2015).

#### *5.1.4. The treatment of different knowledge systems in national assessments and plans*

Despite the advances promoted in the UNFCCC framework indicated above, the adequate consideration of Indigenous knowledge and local knowledge systems in climate policy remains marginal. Overall, national climate measures generally underestimate or ignore the cultural and symbolic relationships that each people establish with their territory (Adger et al., 2005). This is mainly due to a gap in the understanding of these knowledges and their potentials resulting in a lack of concrete mechanisms to bring them together and the sustained exclusion of these groups from relevant decision-making processes (Nakashima et al., 2012),.

The NDCs are the guiding principles for the design and implementation of states' climate policy and allow comparing countries' priorities. A mapping of these contributions along with other commitments

subscribed to the UNFCCC, identified many gaps related to the consideration of different knowledge systems, including episodic rather than sustained engagement with Indigenous Peoples and local communities; little respect of rights; lack of engagement and consideration in climate processes; lack of collaboration with different knowledge holders; lack of infrastructure to facilitate engagement with Indigenous Peoples, local communities, and their respective bodies of knowledge; and limited references to Indigenous peoples' practices and technologies (Facilitative Working Group, 2021). The LCIPP includes, among its tasks, the facilitation of the integration of diverse knowledge systems into climate policy, along with NDCs. On this basis, Indigenous representatives have demanded to be considered in the design of climate governance, and specifically in the NDC processes, although various Indigenous representatives indicated that they had received little to no information about climate processes in their countries.

In summary, most countries do not even mention in their commitments any engagement with Indigenous Peoples and local communities (Facilitative Working Group, 2021). Therefore, Indigenous and local knowledges have not been effectively taken into account in national policy efforts and research (Adger et al., 2013; IPCC, 2014; Jones et al., 2014; Petzold et al., 2020; Shea and Thornton, 2019). However, the advances promoted by the Paris Agreement and the operationalisation of the LCIPP determined that Indigenous and local knowledge require a greater presence in national climate agendas, which is reflected in an increase in their mentions in the subscription of the second NDCs, a process that is currently underway. Nevertheless, most of the NDCs that refer to Indigenous Peoples recognise their vulnerability, but few elaborate on the role of communities in generating responses to climate change impacts (UNFCCC, 2021).

However, in some countries, there is more substantial involvement of Indigenous Peoples, and some national assessments and action plans have begun to include Indigenous Knowledge explicitly. For example, in the Pacific islands, where the percentage of Indigenous Peoples is high, involvement is significant. 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 (Māori knowledge) throughout the assessment process. Although these markers of progress are relevant, there is still a long way to go. Standards of participation and recognition of diverse knowledge systems remain weak and inconsistent with the transformative change required to respond to climate change.

## **5.2. Sources documenting Indigenous knowledge and local knowledge**

There are a range of initiatives collecting and highlighting Indigenous and local knowledge systems in the context of environmental governance and climate change adaptation and mitigation. Some of these are led primarily by Indigenous organisations, others primarily by international (intergovernmental) organisations, and some involving academic researchers. A number reflect extensive collaboration. Some initiatives are hosted through UN agencies and international organisations with the specific aim of informing international policy processes. However, through these efforts, scholars with high profiles and a large number of publicized reports in multiple widely-spoken languages gain greater visibility than local or regional knowledge sharing networks (Mafongoya et al., 2017).

### 5.2.1 Sources led by Indigenous organizations

- The National Museum of the American Indian in Washington, DC, USA has created Native Knowledge 360 as an online digital hub to educate about Indigenous knowledge and Native American history and culture. This site is produced and managed by Native American educators and museum specialists. It is Indigenous-led content addresses the environment, climate, arts and culture (<https://americanindian.si.edu/nk360>).
- First Nations Development Institute (FNDI) has an online digital Knowledge Center that includes Indigenous-produced content and tools on Indigenous rights, environmental and economic justice in Indian Country, and philanthropy. As a major Native-led foundation, FNDI funds and supports Native initiatives, tribal programmes, and organisations in the US (<https://www.firstnations.org/knowledge-center/>).
- [Nga Pae o te Maramatanga](#) is New Zealand's Māori Centre of Research Excellence and serves as a national and global hub for Indigenous knowledges research and education. One of their December 2021 reports and publication series focused on 'A threat to our identity: The impact of climate change on Māori.'
- The [Alaska Native Knowledge Network](#) partners with the Alaska Rural Systemic Initiative to provide a resource which gathers and exchanges information related to Indigenous knowledge systems and ways of knowing in Alaska. Its audiences include Native people in Alaska and elsewhere, as well as government agencies, educators and the general public, helping them obtain access to the knowledge that Alaska Natives have acquired through their millennia of experience.

### 5.2.2 Sources led by international organizations

Although not Indigenous-led, many of these international organisations have advisors, consultants, and collaborators from Indigenous groups and local communities who provide input, guidance and review of content, thus representing a collaboration of knowledge systems.

- The Climate Frontlines initiative was launched by UNESCO in 2009, providing a repository of Indigenous observations and knowledge on climate change, including discussions on early impacts, coping with change, rituals and spirituality, and impacts of climate mitigation action. The initiative was established through community dialogues, field research, and events at local, national, and global levels to support Indigenous peoples, scientists, and policymakers to understand how climate change impacts communities and how communities in turn use their knowledge to observe and respond ([www.climatefrontlines.org](http://www.climatefrontlines.org)).
- The Adaptation Knowledge Portal is an online resource of the UNFCCC Knowledge-to-Action Hub for Climate Adaptation and Resilience (also called the Nairobi Work Programme, or NWP). The portal provides free information about adaptation knowledge and learning provided by

the NWP's network of over 400 partner organisations  
(<https://www4.unfccc.int/sites/NWPStaging/pages/home.aspx>).

- The Local Environmental Observer Network is a group of local observers and topic experts who share knowledge, raise awareness and seek understanding and solutions to significant animal, environment, and weather events (<https://www.leonetwork.org/en/docs/about/about>).
- The ICCA Consortium supports Indigenous Peoples and local communities to document, sustain and defend 'territories and areas conserved by Indigenous peoples and local communities' or 'territories of life.' The UN Environment World Conservation Monitoring Centre (UNEP-WCMC) provides communities with the option of documenting their ICCAs directly in the World Database on Protected Areas and/or in a dedicated international ICCA Registry that they manage. In January 2021, the ICCA Consortium comprised 187 members from over 80 countries (<https://www.iccaconsortium.org/index.php/members-en/>).
- In 2010 the United Nations University Traditional Knowledge initiative published a compendium of case studies on climate change adaptation, mitigation and Indigenous peoples titled 'Advance Guard' comprising more than 400 projects, case studies and research activities specifically related to Indigenous Peoples' and local communities' observations, perceived impacts and adaptation and mitigation strategies being implemented ([https://i.unu.edu/media/tfm.unu.edu/publication/242/UNU\\_Advance\\_Guard\\_Compndium\\_2010\\_final\\_web.pdf](https://i.unu.edu/media/tfm.unu.edu/publication/242/UNU_Advance_Guard_Compndium_2010_final_web.pdf)).
- UNESCO Local and Indigenous Knowledges Systems (LINKS) focuses on the inclusion of local and Indigenous knowledges in global climate science and policy decisions. It focuses on four major thematic areas: science policy, biodiversity, climate change, and knowledge transmission. The site serves as a critical information resource with publications, videos, reports, media, and news items (<https://en.unesco.org/links>).



## Local Knowledge and Flood Risk Management in Urban Informal Settlements (Sierra Leone)

*[Keywords: impacts, governance, solutions]*

In Freetown, Sierra Leone, flooding is a major and recurring hazard affecting residents annually. Major flood disasters in the city were documented in 2015, 2017, and 2019. Freetown's more than 60 informal settlements are most affected by flooding because of their location in marginal, coastal, and flood-prone areas as well as because of poor quality of housing (World Bank, 2018). Informal settlements highly vulnerable to flooding include Portee-Rokupa, Kroo Bay, Susan's Bay, Cockle Bay, Congo Town, Murray Town, and Mabella. These informal settlements continue to accommodate large numbers of migrants from the provinces, thereby increasing in both population size and spatial footprint. In the case of informal settlements located along the coast (e.g., Kroo Bay and Cockle Bay), spatial expansion is a result of land reclamation from the sea undertaken by community members.

Among efforts directed at flood risk management in Freetown's informal settlements, there is need to 1) enhance social inclusion, 2) better understand and address interconnections among hazards, vulnerabilities, and their underlying causes and 3) consider different stakeholder perspectives including vulnerable populations in addressing risks in cities (Clark-Ginsberg et al., 2020; Taylor and Peter, 2014). There are recent national and local efforts, supported by international development and aid agencies, to reduce flood risk and build resilience to flood hazards in Freetown's informal settlements. These efforts incorporate local knowledge at individual informal settlement level. Local knowledge elicited from community members and community groups using participatory approaches include the location of areas that are affected by flooding, community risk contexts and profiles, vulnerabilities of different social groups to flood risks, coping strategies, and decision-making in communities.

Among such national and local efforts are those undertaken by Concern Worldwide and Comic Relief, which deployed participatory risk assessment techniques and trained communities in risk participation to map community risk profiles. The assessment of risk accumulation in Cockle Bay and about one dozen other informal settlements in Freetown was also undertaken through co-production of knowledge led by community members using participatory methods (community-led mapping, settlement timelines, and disaster risk management wheel). This was facilitated by researchers from the Urban Africa Risk Knowledge (Urban ARK) programme. Exchange of local knowledge elicited from communities with governmental and non-governmental organisations enabled the co-design of action plans for risk reduction (Allen et al., 2020). Holistic approaches embracing complexity such as participatory risk network analysis conducted with residents in Kroo Bay, Susan's Bay, Mabella, and Kuntorloh have helped to elicit local knowledge aiding the production of maps showing the interconnected perspectives of flooding related to other challenges (Clark-Ginsberg, 2017).

When integrated with scientific knowledge, local knowledge has been highlighted as the basis for inclusive action in building climate resilience and climate change adaptation in informal settlements (Dodman et al., 2018). Studies show that effective measures at reducing flood risks and building resilience to climate hazards must incorporate local, place-based knowledge. Such solutions have the added benefit of flexibility in a dynamic context (Olthuis et al., 2015).

## Case Study 8:

### Indigenous Knowledge in Urban Settings (United States)



*[Keywords: tangible heritage, intangible heritage, governance, solutions]*

Both longstanding and recent Indigenous Peoples in cities in the US Southwest (San Francisco and Phoenix) draw on Indigenous knowledge to address multiple challenges, including climate change. The tangible heritage associated with historical sites, such as the Misión de San Francisco de Asis, a colonial Spanish mission, and the 19th century Phoenix Indian School, play an important role.

The American Southwest is a region of diverse Indigenous peoples, and today, over 70% of the Indigenous peoples of the US live in urban centres. The San Francisco Bay Area of California and the Phoenix Valley of Arizona are two urban centres that are characteristic of this diversity.

The San Francisco Bay Area is the largest estuary on the West Coast of North America and historically was home to over a dozen distinct American Indian communities. This fertile bay area was an 'urban' centre for people going back between 5,000 and 15,000 years (Forbes et al., 1970; Lightfoot and Parrish, 2009). Remnants of their extensive 'shellmound' heritage complexes are found at only a few locations (Luby and Gruber, 1999).

The Bay sits in the heart of the California Floristic Province, making it a global hotspot of biodiversity due to the number of native plant species (Myers et al., 2000). The pre-contact intangible and tangible heritage of the Native California peoples, including their diverse languages, has been significantly diminished, but is not 'extinct' as some have said (Kroeber, 1976). In fact, the Ohlone people say 'they are back from extinction' and are asserting their rights for political recognition through appeals to historical and environmental justice (Levanthal et al., 1994).

The San Francisco Bay area is home to one of the largest urban Indigenous populations in the country due, in large part, to the Indian relocation programme of the 1950s-1970s, when Native Americans from around the US were moved to the San Francisco area as part of the Bureau of Indian Affairs policy of assimilation. In addition to the Native American peoples from the US, the Bay Area is also home to numerous Indigenous peoples of the world, from Maya groups from Meso-America to Tibetan communities from India.

The Phoenix Valley is the traditional home of the Akimel O'odham and Piipaash tribes who together make up the Salt River Pima-Maricopa Community. The Phoenix Valley lies in the heart of the Sonoran Desert, the most biodiverse desert in America and one of the most biodiverse deserts in the world (Center for Biological Diversity). For over 1,600 years pre-colonization, these strong desert tribes utilised complex water irrigation systems to channel water from the Salt and Gila Rivers to create rich agricultural lands (Berger et al., 2004). These Hohokam precontact irrigation canals represent Indigenous knowledge and technology and both tangible and intangible heritage, as the canals are associated with several other archaeological features.

Today the Salt River Pima-Maricopa Community owns a significant percentage of the Phoenix Valley—over 50,000 acres (Inter Tribal Council of Arizona, 2021). Arizona today has the largest number of Native American language speakers in the United States ('Census Shows Native Languages Count,' 2021). Phoenix was the home to the

Phoenix Indian School, which was a US government run school from 1891 to 1990. Native American children from all around the US were sent to this school for one hundred years. This school had devastating impacts on Native children, including physical and sexual abuse, psychological trauma, loneliness, accidents, illness, and death (Trennert, 1979). Yet many of the survivors stayed in the Phoenix area after graduation and intermarried with other tribal members, creating multi-ethnic, diverse, urban Indigenous communities that incorporate multiple local and Indigenous knowledges.

Despite the rich Indigenous heritage of these two regions, many urban Native communities are socio-economically vulnerable, food insecure, and live in 'food deserts.' These communities disproportionately suffer from diet-related health disparities. They also lack regular access to healthy, affordable, or culturally relevant foods (Jernigan et al., 2017). Additionally, urban Native communities don't generally have access to clean soil and open land to gather or cultivate traditional foods, which is not only part of food sovereignty but part of Indigenous identity, cultural heritage, and community well-being. In both urban centres, there is a grassroots upwelling of traditional knowledges by local tribes and diasporic Indigenous communities, like Lakota traditional gatherers, Navajo basket weavers, Oneida seed keepers, Maya farmers, Mestizo urban gardeners, and intertribal cooks and chefs, who exchange Indigenous knowledge and heritage and assert food sovereignty to increase resilience in the face of climate change.

The Indigenous peoples of the San Francisco Bay Area and Phoenix Valley lived in densely populated communities before contact. After colonisation, when the Spanish invaded Arizona in the 1500s and California in the 1700s, the people and their biocultural heritage (such as the shellmounds and irrigation canals) suffered from devastating impacts of ecocide and genocide. Much of the California tribes' material culture was based on plants, which are biodegradable, so their tangible heritage has been largely erased except for the remnants of their shell and earthen works. Now, ironically, the sites of colonisation, such as the Spanish Missions and Presidio in San Francisco and Missions and boarding schools in Phoenix represent contested sites of memory, loss, heritage, and revitalisation

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