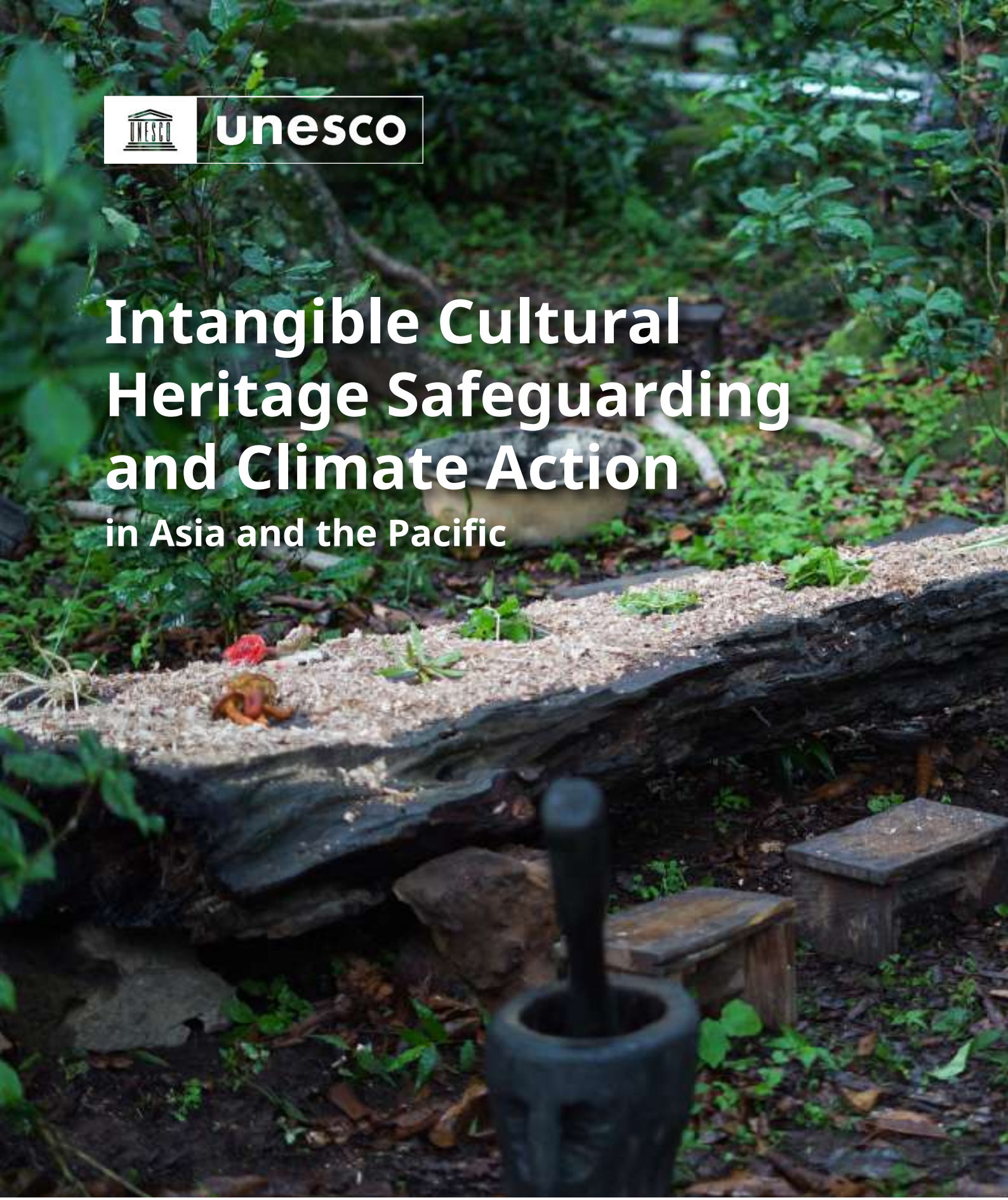

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Intangible Cultural Heritage Safeguarding and Climate Action

in Asia and the Pacific

ichcap
International Information and Networking Centre for Intangible Cultural Heritage in the Asia-Pacific Region under the auspices of UNESCO
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IRDR
Integrated Research on Disaster Risk

Published in 2025 by the United Nations Educational, Scientific and Cultural Organization, 7, place de Fontenoy, 75352 Paris 07 SP, France;
UNESCO Regional Office for East Asia, Waijiaogongyu 5-15-3, Jianguomenwai Compound, Beijing 100600, People's Republic of China;
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Integrated Research on Disaster Risk (IRDR), Room B713, No. 9 Dengzhuangnan Rd., Beijing, 100094, People's Republic of China.

ISBN 978-92-3-100783-5

DOI: https://doi.org/10.58337/PXIC4199

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Graphic designer: Rachel Rui Hou

Cover photo: © Initiative in Ethnic Minority Youths Participation in Indigenous Food Biodiversity in China (Zeyuan Wang) & Primitive Print (Zhaluo Li)

Back cover photo: © National Commission for Culture and the Arts, Philippines, 2018

SHORT SUMMARY

Living heritage for climate resilience in Asia and the Pacific

Cultural practices strengthen a sense of identity among local communities and foster sustainable development. Intangible cultural heritage also plays a vital role in achieving robust responses to climate change.

In the face of unpredictable climate patterns, communities across the culturally diverse Asia-Pacific region are increasingly adopting response and mitigation approaches that are rooted in intangible heritage. Traditional practices are receiving renewed interest and being integrated into innovative strategies. This also contributes to the continuity of local culture and sense of belonging, as well as intergenerational transmission. Indigenous knowledge is also widely recognized as a strong contributor to fostering climate resilience in the region.

In ten Asia-Pacific countries, over 28 million people are using living heritage in climate response

This UNESCO publication features examples of ongoing efforts to adapt rights-based and people centred approach to climate action for living heritage, while demonstrating the interconnectedness between cultural heritage and environmental sustainability. It provides one example of how the proposed areas of intervention of the UNESCO's Guidance note on climate action for living heritage (2024) can be taken forward. It invites a wider conversation on ways to safeguard living heritage and to enhance its climate change adaptation, mitigation and measures for safeguarding living heritage in the climate emergency.

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"Since wars begin in the minds of men and women it is in the minds of men and women that the defences of peace must be constructed"

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Foreword

"Living heritage is not always a passive casualty of climate change but can be an important source of strategies for adaptation and resilience, developed by communities to accommodate and thrive in changing environmental conditions and socio-economic circumstances" (UNESCO's Guidance note on climate action for living heritage, para. 1). Recognize this potential, and in an era increasingly defined by the implications of climate change, UNESCO launched a pivotal initiative that resulted in this publication: *Intangible Cultural Heritage Safeguarding and Climate Action in Asia and the Pacific*.

This compilation of fifteen case studies, representing a microcosm of the broader Asia-Pacific region, shines a light on the myriad ways in which communities across the region are leveraging their intangible cultural assets to mitigate the impacts of climate change and forge paths towards sustainability. It follows the call of UNESCO's Guidance note, which identified the promotion of collaborative research and case study development as one area for intervention.

The case studies highlight the daunting challenges brought about by climate change and the innovative solutions that communities have devised in response. In particular, these case studies underscore the profound role of intangible assets such as social networks, community cohesion and traditional practices in shaping resilience strategies. They reveal that communities do not need to be passive victims of climate change but can be, and in many cases already are, active agents of adaptation, using their ICH assets to navigate complex challenges and seize new opportunities.

These case studies are grounded in evidence-based research and were conducted with the widest possible participation of the communities concerned, ensuring that diverse voices and perspectives were heard. This approach not only respects the ethical principles of the UNESCO *2003 Convention for the Safeguarding of the Intangible Cultural Heritage*, but also ensures that the insights presented in this publication are deeply rooted in the lived experiences of those on the front lines of climate change.

As we respond to the urgent global mandate to address climate challenges, the lessons learned from these case studies offer valuable insights and inspiration. These insights highlight how intangible cultural heritage fosters resilience and adaptation, offering pathways to confront today's environmental crises. They also serve as a resounding call to researchers, communities and other stakeholders to deepen their understanding and documentation of the interconnections between intangible cultural heritage and climate action.

This publication is a collective effort to document, disseminate and celebrate the vital role of ICH in climate resilience across the Asia-Pacific region. It is our sincere hope that the case studies will serve as a catalyst for further action, inspiring communities, policy-makers and researchers to work together in safeguarding our living heritage and creating a future rooted in cultural wisdoms.

On behalf of UNESCO, the Secretariat of the 2003 Convention for the Safeguarding of the Intangible Cultural Heritage and our partners – ICHCAP, IRCI and IRDR – I am pleased to present this publication, and I commend the efforts of all those who contributed to its realization. Let us continue to harness the power of our intangible cultural heritage to navigate the complexities of climate change and steer towards a brighter and more sustainable world for all.

Professor Shahbaz Khan

Representative and Director, UNESCO Regional Office for East Asia

Acknowledgements

This UNESCO publication is the result of a collective effort, made possible through the generous collaboration and support of numerous institutions and individuals dedicated to exploring the vital intersections of culture and climate change and guidance from the Secretariat of the 2003 Convention for the Safeguarding of the Intangible Cultural Heritage.

First and foremost, we extend our deepest appreciation to our key partner organizations. The International Information and Networking Center for Intangible Cultural Heritage in the Asia-Pacific Region (ICHCAP) and International Research Center for Intangible Cultural Heritage in the Asia-Pacific Region (IRCI) – both are Centres under the auspices of UNESCO – have provided valuable financial support and technical expertise. Integrated Research on Disaster Risk (IRDR) – an international scientific programme co-sponsored by the International Science Council and the United Nations Office for Disaster Risk Reduction (UNDRR) – has expanded the outreach of this initiative far beyond the culture sector and contributed essential scientific perspectives. International Training Center for Intangible Cultural Heritage in the Asia-Pacific Region (CRIHAP) – also a Centre under the auspices of UNESCO, and the People's Government of Chengdu Municipality, have provided instrumental support in convening the authors for an exchange session that significantly advanced the discussion on this critical topic. We commend our partners for their leadership in promoting the role of intangible cultural heritage in climate resilience and their commitment to fostering sustainable cultural practices amid global environmental challenges.

We owe a profound debt of gratitude to all the contributing authors whose expertise and insights form the foundation of this volume. Their willingness to share knowledge, engage in critical dialogue, and offer innovative perspectives has greatly enriched this publication. Each chapter reflects their dedication to advancing understanding at the nexus of culture and climate action.

This publication would not have reached its final form without the efforts of the editors – Duong Bich Hanh (UNESCO Regional Office for East Asia), Yoko Nojima (IRCI), Fang Lian (IRDR), and Christopher Ballard (Australian National University) – who provided editorial support for the four sections of the volume, respectively. We deeply appreciate their time and expertise.

We also extend our heartfelt thanks to all colleagues from UNESCO and partners' organizations who provided strategic guidance, as well as technical and coordination support throughout this lengthy process – from shaping the initial framework to finalizing the publication: Shahbaz Khan, Duong Bich Hanh, Yunheng Zeng, Juan Guo, Rachel Rui Hou, Tana Tongjia, Laura Frank, Ingrid Pastor Reyes, Matilda Saori Machimura, Seoyoung Oh, Juliette Hopkins, Susanne Schnuttgen, Mathilde Crochet, Ana Gonzalez Medina, Nicholas Tan, Ai Sugiura and Nigel Crawhall (UNESCO), Deoksoon Kim and Jaeyeong Jang (ICHCAP), Machida Daisuke and Yoko Nojima (IRCI), Fang Lian (IRDR), Jing Zhang, Kaibo Yang, Xuan Shi and Xiaoxi Chen (CRIHAP).

As we present this volume, we hope it will inspire further research, policy dialogue, and collaborative action at the intersection of culture and climate change. May it serve as a stepping stone toward more inclusive, culturally grounded strategies for building resilience and sustainability in communities worldwide.

Contents

Living Heritage for Climate Resilience in Asia and the Pacific

Duong Bich Hanh

Climate change is no longer a distant threat; it is a present reality reshaping the world in profound ways. Among its many consequences are its impacts on cultural practices — particularly traditional artisanal crafts, indigenous knowledge systems and agricultural heritage. These practices, deeply rooted in local traditions and environments, face unprecedented challenges as climate change disrupts social fabric, economic structures and natural resources. This edited volume explores the intersection of climate change and intangible cultural heritage (ICH) — also known as living heritage — highlighting how communities are drawing on traditional knowledge, heritage assets and community-based strategies to build resilience and adapt to changing environmental conditions.

The volume is divided into four sections, each addressing a key aspect of the relationship between climate change and cultural heritage. While the sections are thematically distinct, they are deeply intertwined, reflecting the multifaceted nature of climate impacts and the need for holistic responses. The first section, "Climate impacts on cultural practices", sets the stage by examining how climate change is affecting cultural practices, especially traditional crafts. The subsequent sections, "Indigenous knowledge and climate resilience", "Cultural adaptation and sustainable agriculture" and "Community-based strategies for climate action", build on this foundation, exploring how communities are leveraging traditional knowledge, adapting cultural practices and leading collective efforts to address climate challenges. In overall, the volume serves as an example of how the proposed areas of intervention of the UNESCO's Guidance note on climate action for living heritage (2024) can be taken forward.

Climate impacts on cultural practices

The first section of the volume examines how climate change threatens traditional crafts and cultural practices, and it sets the stage for a deeper exploration of the intersection between climate change and cultural heritage. The case studies from Malaysia and Sri Lanka highlight the vulnerabilities of artisanal communities as they confront changing conditions — from altered rainfall patterns and soil salinity levels to increased frequency and severity of extreme weather events. These studies underscore the urgent need for integrated approaches that balance tradition with innovation and safeguard both cultural traditions and the ecosystems they depend on.

The paper "Crafting Resilience of Traditional Artisanship: Navigating Challenges in Sustaining Traditional Chinese Lantern-Making amidst Global Climate Change" by Nicole Chang Shu Fun delves into traditional artisanship in Malaysia and how it is impacted by climate change. Through an ethnographic case study of the work of Chuen Mun Wai, a Perak-based artisan specialising in handcrafting traditional Chinese lanterns, the paper highlights how climate change disrupts the sourcing and preparation of raw materials, particularly bamboo, and affects the crafting process, ultimately threatening the continuity of this ICH.

The case study "Impacts of Climate Change on Rush and Reed Weaving Heritage: The Case of the Cultural City of Anuradhapura, Sri Lanka" by Sanjaya Fernando, Amila Lankapura, Sriyan Jayasuriya and Swarna Ihalagama documents how shifting weather patterns, intensified flooding and soil salinization have compromised the quality and availability of raw materials, disrupted harvesting cycles and fostered invasive species. These issues threaten not only the craft itself but also associated ICH elements such as harvesting

rituals and songs sung during reed gathering.

Indigenous knowledge and climate resilience

Indigenous communities, with their deep-rooted connections to their local environments, have developed sophisticated cultural traditions and practices that have enabled them to navigate environmental challenges for centuries. In the face of escalating climate change, these traditional knowledge systems, passed down through generations, offer valuable insights into sustainable resource management, disaster risk reduction and community resilience, and are increasingly recognized as vital sources of resilience and adaptation. This section explores the role of traditional ecological knowledge in managing natural resources sustainably, drawing on case studies that highlight the interplay between cultural heritage, ecological wisdom and contemporary environmental challenges.

The paper "The *Bawadi* System of the Kullu-Mandi Valley, Himachal Pradesh, India: Traditional Ecological Knowledge" by Madhusudan Singh and Ritika Khanna examines the *bawadi* system, a traditional water management practice. Made up of small water reservoirs, channels and springs, the system historically provided a reliable water supply for local communities and supported agricultural activities. The authors discuss the cultural and ecological significance of the *bawadi* system, emphasizing its role in disaster risk reduction and community resilience, and the threats to the system posed by climate change and the introduction of modern water infrastructure. The authors call for the preservation and revitalization of this traditional practice through documentation, community involvement and locally appropriate water policies.

The next paper, "Exploring the Heritage Aspects of Indigenous Knowledge in Sustainable Use and Management of Forest Resources in the Context of Climate Change: A Case Study from the Black Hani People in Lao Cai Province, Viet Nam" by Ngoc-Anh Luu Dam, Huong Van Bui,Lien Huong Tran and Anh-Thu Dinh focuses on a sophisticated system of forest classification, including sacred and forbidden forests, that is protected through the local community's customary laws and spiritual beliefs. These practices have helped the community maintain biodiversity, regulate water resources and prevent floods and landslides. The paper underscores the importance of documenting and promoting indigenous knowledge, particularly in the face of the threat of deforestation and economic development pressures.

In "*Dzud* and Climate Change and their Links with Intangible Cultural Heritage in Mongolia", Saruul Arslan and Galbadrakh Enkhbat explore how Mongolian herders leverage centuries-old ICH to navigate the challenge of *dzud* — a severe winter weather phenomenon intensified by climate change. The study underscores the importance of traditional knowledge systems, including seasonal migration practices and weather prediction as foundational to sustainable pasture management and community resilience. The authors argue for the urgent integration of traditional knowledge and practices into modern disaster preparedness frameworks to safeguard cultural heritage and increase climate resilience.

Cultural adaptation and sustainable agriculture

As the climate crisis intensifies, the agricultural sector is encountering shifting weather patterns and increasingly frequent and intense extreme weather events. These challenges threaten not only food security but also the cultural heritage embedded in traditional agricultural practices. However, as the papers in this section demonstrate, cultural heritage related to agriculture can serve as a vital source of innovation and adaptation, particularly when integrated with sustainable modern techniques and community-based approaches. The section explores how diverse communities are adapting their agricultural practices to climate change, highlighting the interplay between cultural heritage and sustainable development.

The paper "Floating Agriculture in Bangladesh: An Assessment of the Potential Risks and Effectiveness in the Context of Disasters Risk Management and ICH Safeguarding" by Saifur Rashid, Tahsin Momin Antor and Tasnim Khan Lamisa focuses on traditional agricultural practices in Bangladesh, a nation highly vulnerable to climate change impacts, including frequent and severe flooding, erratic rainfall and increasing salinity. The authors explain how floating agriculture, a traditional method that has gained renewed importance as a response to prolonged flooding and waterlogging caused by climate change, not only enhances food security but also fosters social cohesion and resilience.

Focusing on the Ifugao and Bali rice terraces in the Philippines and Indonesia, both designated as UNESCO World Heritage sites, the paper "Climate Risks and Resilience in South-East Asia's Culturally Significant Ricescapes" by Laurence L. Delina, Ivee Fuerzas, Wiwik Dharmiasih, Kim-Pong Tam, Michele Jaymalin Dulay, Nicolo Paolo Ludovice and Albert Salamanca explores how traditional rice farming practices are being adapted to cope with climate change. The study emphasizes the role of intangible assets such as community solidarity, traditional rituals and indigenous knowledge in building resilience among rice growers to the impacts of climate change. To sustain these culturally significant agricultural landscapes, the authors call for support for the rice growing communities, including through integrating intangible assets into management frameworks, supporting local initiatives that sustain traditional knowledge and practices and creating knowledge-exchange platforms.

The paper "Safeguarding Intangible Cultural Heritage: Assessing the Impact of Climate Change on Traditional Agricultural Knowledge and Wisdom in Sri Lanka" by Olupathage Tharanga Dilhari Silva, Raveendra Kumara Withanachchi and Yasanjali Devika Jayatilleke explores Sri Lanka's traditional agricultural knowledge and wisdom, which is under threat from the impacts of climate change. The study highlights how communities are adapting age-old practices to maintain resilience, including by reviving local drought-resistant rice varieties, realigning planting calendars with observed shifts in weather patterns and leveraging traditional water management systems to mitigate water scarcity.

The next paper, "The Significance of Mangjing Blang Tea Ecological Culture Reserve in Jingmai Mountain, Yunnan Province, China, for Climate Mitigation and Adaptation" by Zeyuan Wang, Mengyao Ma, Xiaohui Liu, Yihong Li, Chaohui Li and Nam Kang explores how the Blang people are adapting to climate change through drawing on their ICH. Their agroforestry system buffers the impacts of extreme weather, while rituals like the Tea Ancestor Festival promote ecological stewardship. Traditional bans on pesticides preserve biodiversity and innovative pest management techniques promote adaptive resilience. The study advocates integrating Blang knowledge into climate policies and fostering interdisciplinary research to sustain their adaptive practices, positioning Jingmai as a model for climate-resilient tea cultivation.

Community-based strategies for climate action

As the impacts of climate change intensify, communities around the world are increasingly recognized as vital actors in both mitigating and adapting to environmental challenges. This section explores how collective, community-driven strategies, rooted in local knowledge and cultural values, can not only lead to innovative and sustainable solutions to climate-related challenges but also safeguard cultural heritage, ensuring that traditional knowledge and practices are preserved for future generations.

The paper titled "Applying the Koyori Concept to Traditional Weaving as an Adaptation to Climate Change: A Case Study of Baan Phayao Woven Fabric Group", by Naruemon Saewang, Preeyanuch Wangngio, Nikorn Palangrith, Nattawut Auttawong, Matas Waiviriya, Haruyuki Maruyama, Narucha Chiewsakon, Luxmee Srisomphetch and Suraphon Chaiwongsar, examines how the Tai Lue community in Nan Province, Thailand, is adapting its traditional weaving practices to changing climatic conditions. By collaborating with designers and students, the community has modified its weaving techniques and patterns, making

them more suitable for warmer temperatures while preserving their cultural significance.

Exploring community resilience, the paper "Living Heritage and Climate Action in the Indian Sundarbans" by Sneha Bhattacharyya and Ananya Bhattacharya, describes how local livelihoods — fishing, honey collection and handicrafts — are deeply intertwined with sustainable ecosystem management. Community-led initiatives, such as mangrove restoration and folk traditions like Bhatiyali music and Banbibir Pala theatre, promote climate adaptation while safeguarding intangible cultural heritage. By integrating indigenous knowledge into climate action, this Sundarbans case offers a model for community-based strategies that balance environmental sustainability with cultural preservation.

In the paper "Safeguarding Intangible Cultural Heritage from Disasters and Climate Change: An Ethnographic Study in Ifugao, Philippines", Fatima Gay J. Molina and Marlon M. Martin highlight how traditional practices like *baddang* (community mutual aid), *hongga* (healing rituals) and *bayuhibi* (rain rituals) serve as vital tools in disaster risk reduction and climate adaptation among rural communities in the Philippines. The case study presents community-led initiatives such as the School of Living Traditions and Indigenous People's Education, and demonstrates that by integrating ICH into climate policy and action, cultural heritage can drive sustainable solutions to environmental challenges.

In "Seasonal Migration Practices of the Gujjar and Bakarwal Communities", Shahzad Ahmed Malik and Mrinalini Atrey document how nomadic communities are adapting their traditional migration routes and practices in response to climate change. The authors describe the challenges posed by changing weather patterns, urbanization and inappropriate government interventions, which threaten the continuity of the nomadic communities' intangible cultural heritage. The study underscores the need for policies that support the livelihoods and cultural practices of pastoral communities while addressing the impacts of climate change.

"Cyclone Houses, Living Heritage and Climate Change in Vanuatu" by Anna Naupa, Chris Ballard, and Richard Shing examines the revival of *nimo norop* – traditional cyclone-resistant houses on Erromango Island – as a community-led strategy for climate resilience. The study highlights how these structures, built using native materials and customary techniques, embody both disaster preparedness and cultural governance. Despite threats from deforestation, invasive species, and waning interest in vernacular architecture, the Erromango Cultural Association (ECA) and local chiefs are revitalizing *nimo norop* construction to safeguard intergenerational knowledge, sustainable resource management, and socio-political cohesion.

The final paper in this volume, "Reconceptualizing Socio-cultural Sustainability in the Era of Climate Change: The Case of Jeju Haenyeo Culture" by Wonseob Song examines the cultural values of the Jeju Haenyeo, female fishers (divers) from Jeju Island, Republic of Korea, and explains how this ICH has ensured the sustainable harvesting of seafood for centuries. The author highlights the Jeju Haenyeo's extensive traditional knowledge of the island's marine ecosystems and how it has been invaluable in shaping effective local climate change response policies and programmes. The author also explores innovative strategies, such as eco-friendly aquaculture, that would allow the Haenyeo to continue their cultural practices and livelihoods in the face of the threats posed by climate change.

Cross-cutting themes

As well as corresponding to the four thematic focuses — Climate impacts on cultural practices; Indigenous knowledge and climate resilience; Cultural adaptation and sustainable agriculture; and Community-based strategies for climate actions — the papers in this volume also reveal themes that transcend these categories. Across diverse geographies, recurring challenges and insights emerge from the various studies, pointing to the complex interplay between local knowledge and global pressures; tradition and adaptation;

and ecological sustainability and economic viability. The following discussion unpacks the transversal themes, highlighting how the volume's findings collectively advance our understanding of the roles and risks of intangible cultural heritage in the face of climate change.

Interconnected threats of climate change and socio-economic challenges

While climate change has direct impacts on communities, such as rising temperatures and sea level rise, those impacts are amplified by socio-economic factors — including globalization, urbanization and changing market dynamics — creating a cascade of challenges that threaten the very fabric of traditional practices. In Malaysia, for example, the art of handcrafting Chinese lanterns, as practiced by artisans like Chuen Mun Wai, faces a dual crisis. Unpredictable weather patterns have disrupted the delicate balance of humidity and temperature needed to dry bamboo and dye fabrics, while the economic context, with rising costs of materials, collides with dwindling demand in society for handmade crafts. At the same time, younger generations increasingly view employment in meticulous artisanship trades as economically unsustainable, leaving masters like Chuen with fewer apprentices, with the result that knowledge and skills are less likely to be passed on.

A similar unravelling is unfolding in Sri Lanka, where rush and reed weaving, once a cornerstone of rural livelihoods, is buffeted by climate change and commercial competition. Prolonged floods and salinization of wetlands have degraded the quality of reeds, reducing the quality of woven goods, yet the greater threat may lie in the plastic substitutes flooding local markets. These synthetic alternatives — cheaper and more durable — undercut the economic viability of the traditional weaving industry. As production of woven items plummets, communal harvesting rituals — where songs and stories once animated collective labour — fade into memory. The economic losses become social and cultural ones: the threads connecting generations fray as artisans abandon their looms for precarious work in cities.

Nowhere is this interplay of climate and socio-economic forces starker than in Mongolia. Harsh winters, often following periods of drought and intensified by extreme cold spells, decimate livestock herds — the lifeblood of nomadic culture. As herders sink into debt from lost animals, many are forced to migrate to urban areas where they face unemployment and cultural dislocation. Their traditional knowledge of predicting storms by observing the skies, wind and animal behaviour is irrelevant in urban slums, severing a millennia-old bond between people, animals and the land.

In the World Heritage designated ricescapes of South-East Asia, rice farmers are grappling with droughts and erratic rainfall, while tourism-driven land conversion and generational abandonment of farming threaten the traditional *subak* management system and the rice terraces themselves. In Vanuatu, the decline of native hardwoods and wild cane underscores the dual pressures of climate change and socio-economic shifts, as modern construction materials and waning interest in traditional practices disrupt both ecological balance and intergenerational knowledge transmission.

In the Sundarbans, increasingly severe cyclones and salinity intrusion are forcing rural-to-urban migration, dismantling communities whose traditional livelihoods and cultural practices — including honey collection and Bhatiyali folk songs — are tied to the mangroves. Meanwhile, in Viet Nam's highlands, the Black Hani people guard their sacred forests against both logging and the impacts of climate change. Yet economic desperation sometimes forces villagers to violate their own conservation rules, chopping down forests they once revered — a poignant example of how poverty can unravel ecological wisdom cultivated over centuries.

Marginalized communities, such as farmers and minority ethnic groups, often bear the brunt of these compounded impacts as they face pressures from land encroachment, resource exploitation and limited access to education and healthcare. This creates a vicious cycle: climate change exacerbates socio-economic

inequalities, and socio-economic struggles hinder the capacity of communities to respond to the impacts of climate change. Addressing these interconnected threats requires holistic and inclusive approaches to resilience-building and sustainable development, ensuring that both cultural heritage and community well-being are safeguarded.

Traditional knowledge, identity and inter-generational transmission

Traditional knowledge, encompassing cultural, spiritual and environmental dimensions, is deeply embedded in communities and is linked to their local contexts. This knowledge reflects centuries of adaptive practices, balancing human needs with environmental stewardship. For example, Sri Lanka's *kem* knowledge and practices — centuries-old pest control techniques based on knowledge of bird behaviour and natural insect repellents. These are fading, however, as modern agricultural techniques displace traditional wisdom. Practices such as the *kulh* irrigation systems of the Kullu-Mandi Valley in India and the beliefs surrounding the sacred forests of the Hani people in Viet Nam — that sustain cultural identity, traditional rituals and collective values — are likewise dwindling away.

Inter-generational knowledge transmission plays a critical role in sustaining cultural practices. Elders pass down traditional knowledge to younger generations, preserving centuries of wisdom while also adapting it to contemporary challenges. This transmission is increasingly under threat, however, due to a combination of socio-economic, environmental and cultural factors. Migration to urban areas, often resulting from environmental disasters and economic hardship, was mentioned across many papers as the main cause that disrupts this transmission. For instance, the Blang people of Jingmai Mountain in China traditionally synchronize tea cultivation with forest ecosystems and ancestral rituals, yet youth disinterest in farming, as a result of environmental degradation, declining incomes from agriculture and socio-economic pressures, risks severing this lifeline. Younger generations are also abandoning traditional farming in Ifugao in the Philippines, weakening the transmission of traditional agricultural rituals and terrace maintenance methods. Similarly, the Gujjar and Bakarwal communities of Jammu and Kashmir are losing traditional knowledge as these formerly-nomadic communities adopt sedentary lifestyles, no longer travelling the migratory routes that serve as a "living classroom" for passing on knowledge of livestock herding, medicinal plant use and seasonal rituals.

Climate change exacerbates socio-economic challenges by altering the environment in which traditional practices are rooted. For instance, the Jeju Haenyeo of Republic of Korea, who rely on marine resources, are struggling to pass on their extensive ecological knowledge as warming oceans and declining kelp forests disrupt their livelihoods and traditional practices.

These examples underscore a universal challenge: as environmental and societal transformations accelerate, traditional knowledge systems — rooted in place-based wisdom — risk being lost. In the face of rapid environmental and socio-cultural changes such as these, there is an urgent need for innovative strategies to ensure the continuity of traditional knowledge.

Thankfully, all over the world communities are rising to the challenge and are innovating to safeguard their heritage while demonstrating how adaptive strategies can bridge generational gaps. In Bangladesh, floating agriculture (*baira*) is seeing a resurgence through inter-generational knowledge-sharing. Similarly, Sri Lanka's rush and reed weavers are actively seeking ways to pass on traditional skills to youth, while the Hani people of Viet Nam are codifying forest management practices through spiritual rituals and community laws, and the Jeju Haenyeo of the Republic of Korea have established training programmes to sustain their legacy.

Communities need support, however, from governments and society at large. Policies must be put in place to support inter-generational learning, whether through education, legal recognition or community-led

initiatives. Without such support, traditional knowledge and practices will continue to erode, threatening not only cultural identity but also proven models of sustainability in an uncertain world.

Adaptation, innovation and hybrid solutions

Climate change threatens communities through altered precipitation patterns and more frequent extreme weather events, and by intensifying socio-economic pressures such as resource scarcity and economic marginalization. Yet, across the case studies, communities are not responding as victims of these circumstances, they are demonstrating remarkable ingenuity and adaptability, showcasing an ability to navigate complex environmental and socio-economic landscapes. Innovation emerges as a central theme across the case studies, often through combining traditional knowledge and practices with modern tools and techniques.

For example, communities in the Kullu-Mandi Valley in India have revived the *bawadi* system — a traditional decentralized network of water sources and reservoirs — to address water scarcity, so that ancient systems operate alongside contemporary water supply technology. Similarly, in Sri Lanka rush weavers are preserving their craft by using alternative materials and modern storage methods, while enhancing water management systems using digital monitoring tools. These adaptations highlight how innovation emerges from reimagining heritage in contemporary contexts.

The fusion of old and new is increasingly evident in livelihood strategies. The Haenyeo divers of Jeju are blending ancestral seafood harvesting practices with large-scale seaweed cultivation projects, supported by local governments, to restore marine biodiversity. In Bangladesh, rice farmers are cultivating new crops (vegetables) on floating water hyacinth beds to combat flooding and salinity, transforming climate challenges into income-earning opportunities. Ifugao rice farmers combine new forms of crop diversification (rooted in traditional calendars) with traditional mechanisms of communal labour and spiritual rituals to sustain yields amid erratic weather patterns.

Such hybrid approaches reveal a critical insight: modernization need not displace tradition. Instead, communities can selectively integrate technologies (e.g. irrigation sensors and aquaculture science) with traditional systems (forest management and water-sharing rituals) to create contextually rooted solutions. This balance mitigates the risk of cultural erosion.

In Thailand's Nan Province, the Koyori concept exemplifies this fusion: Tai Lue weavers collaborated with urban designers to reinvent the dense Nam Lhai fabric into a breathable, climate-adaptive textile, merging ancestral patterns with contemporary needs. Likewise, Jingmai Mountain's tea farmers turned insect infestations into an opportunity by marketing nutrient-rich "insect tea", leveraging traditional pest management knowledge into an innovative livelihood.

The papers across all four themes highlight the complex interplay between cultural heritage, environmental sustainability and community resilience in the face of climate change. Communities act as both custodians and innovators, blending ancestral knowledge with adaptive strategies to navigate climatic upheavals while preserving cultural identity.

Ultimately, these cases underscore that resilience lies in dynamic continuity — honouring the past while innovating for the future. Innovation, the integration of modern and traditional practices, cultural identity, community-based strategies, inter-generational knowledge transfer and policy support are all critical factors in ensuring the continuity of intangible cultural heritage. By harnessing these factors, communities can develop adaptive strategies that not only preserve their cultural heritage but also enhance their resilience to the impacts of climate change. By embracing innovation, combining modern and traditional approaches and empowering communities, it is possible to build a more resilient and culturally rich future in the face of climate change.

Community-driven resilience

A recurring theme across the case studies is the central role of communities in resource management and climate adaptation. Indigenous systems often rely on collective decision-making, shared responsibilities and customary laws to ensure the sustainable use of natural resources. Communities leverage their deep understanding of local ecosystems to develop adaptive practices, ensuring that solutions are grounded in the realities of their lived experiences. Such knowledge and practices not only protect the environment but also strengthen social cohesion and resilience.

The Jeju Haenyeo community's shared values, democratic consultations and strict regulations ensure equitable resource sharing and sustainable management of marine resources. In Bangladesh, the success of floating agriculture is largely due to the combined efforts of local communities. Farmers work together to build floating beds, share resources and support each other during periods of flooding. This cooperation fosters social cohesion and collective resilience.

In Sri Lanka, rush and reed weavers have organized into production clusters and societies that provide a platform for sharing knowledge, resources and strategies for coping with environmental challenges, giving the weavers the resilience to adapt to the impacts of climate change on their livelihoods. Similarly, in the Kullu-Mandi Valley, local communities work together to maintain shared traditional water management systems, ensuring that these systems continue to benefit future generations.

The Hani people in Viet Nam also exemplify community-driven resilience through their collective management of sacred forests. By involving the entire community in forest conservation and water regulation, they have created a sustainable system that protects both cultural heritage and the ecosystems they depend on. The Gujjar and Bakarwal communities of Jammu and Kashmir likewise demonstrate an ability to collectively adapt to changing environmental conditions while maintaining their cultural heritage, in the face of socio-economic challenges.

At the heart of resilience-building lies the power of communities — their collective wisdom, shared governance and deep-rooted connection to place. Collaborative frameworks — whether in managing water systems, reviving weaving collectives or safeguarding sacred forests — demonstrate that resilience is inherently social, woven into the fabric of shared labour, mutual aid and inter-generational learning.

These case studies reveal that sustainable adaptation is not imposed from above but cultivated from within. This is evident in the Sundarbans, where folk theatre groups perform *Banbibir Pala* — a ritual drama promoting forest conservation — to mobilize mangrove replanting efforts. Similarly, Balinese *subak* farmers and Ifugao terrace communities rely on collective labour (*gotong royong* and *bayanihan*) to repair irrigation systems post-disaster, reinforcing resilience through shared values and identity.

Collaboration and institutional support

While community-led initiatives are essential, their success often depends on collaboration with external sectors, including governments, non-governmental organizations (NGOs), researchers and private entities. Institutional and policy support are valuable in creating an enabling environment for sustainable development. Governments and international organizations can play a key role by developing policies that recognize and protect traditional knowledge, providing funding for community-driven projects and establishing frameworks for inclusive decision-making. By bridging the gap between local practices and broader systems, collaborations ensure that adaptation strategies are supported by the necessary infrastructure and governance mechanisms. This was seen in the case of the Jeju Haenyeo; their close collaboration with the local government resulted in policies and projects to support their traditional practices,

including a large-scale seaweed planting project. Similarly, the Erromango Cultural Association's partnership with the Vanuatu Forestry Department illustrated how community-led revival efforts gain traction when supported by institutional frameworks – a recurring theme in effective climate-cultural resilience.

However, to confront the dual crises of climate change and cultural erosion, policies and interventions to support communities must prioritize community agency, ensuring that resilience is not just about surviving disruption but is also about sustaining the bonds that make societies thrive. An example of this is the work of the Save the Ifugao Terraces Movement, which focuses both on preserving built heritage and ensuring the continuity of cultural practices.

In empowering communities as leaders of their own futures, it is important to recognize that the most enduring solutions are those forged by the people who live the challenges — and hold the wisdom to overcome them. This was the case in Viet Nam, for example, where the Hani people's sacred forest management practices were integrated into conservation policies, demonstrating how traditional knowledge can inform and enhance institutional efforts to protect the environment. This integration of traditional practices into formal policy frameworks is crucial for ensuring the sustainability of both cultural heritage and natural ecosystems.

Partnerships can also provide technical expertise, financial resources and tools that complement traditional practices — increasing the effectiveness of local mechanisms and scaling them up. For example, strengthening traditional water management systems with modern monitoring technologies and bolstering community-based conservation efforts with scientific research. The Koyori project's partnership between Thai artisans, universities and urban-based designers, for example, underscores how cross-sector collaboration and the introduction of new concepts and tools can revitalize traditional livelihoods.

Conversely, when modern technology is introduced that is not suitable for local conditions and displaces traditional technology, this can leave communities worse off than before. This was seen when modern water pipes were introduced in the Kullu-Mandi region of India. The modern pipes froze in the extreme temperatures, leaving communities without a reliable water supply, as their traditional *bawadi* water management system had been abandoned when the modern system was introduced. Similarly, when traditional knowledge and systems are overlooked, government policies and partners' programmes may fail. For example, in Sri Lanka if traditional knowledge of water management and the ancient tank cascade systems — though proven to mitigate droughts — are not integrated into national climate policies, this could lead to gaps and failures in policies and associated programmes.

Recommendations and ways forward

The case studies in this volume reveal that as the impacts of climate change intensify across Asia and the Pacific, intangible cultural heritage has both vulnerabilities and resilience embedded in it, and communities need support to ensure the continuity of their ICH.

From the bamboo-dependent lantern-makers of Malaysia to the *dzud*-navigating herders of Mongolia, communities are drawing on centuries of knowledge to adapt — yet their efforts often unfold in isolation, without the institutional support or policy recognition needed to sustain them. The interconnectedness of cultural practices, ecosystems and climate resilience demands a fundamental shift in how we approach safeguarding.

The recommendations provided below are drawn from the papers presented in this volume, aligning with the priorities outlined in UNESCO's Guidance note on climate action for living heritage, which emphasizes three key goals: (1) harnessing living heritage as a resource for climate adaptation and mitigation,

(2) safeguarding heritage from climate threats and (3) ensuring community-led approaches that respect rights and values. The Guidance note calls for integrating traditional knowledge into policy, fostering partnerships, advancing research and strengthening capacity-building — all of which resonate with the following pathways for action.

At the heart of the challenges facing communities in the region lies the precarious transmission of knowledge across generations. The erosion of inter-generational learning — through youth rural-to-urban migration, the decline of apprenticeship systems and the disruption of communal rituals — threatens the very continuity of ICH. Programmes like Thailand's Koyori collaborations, the Jeju Haenyeo's training for young divers and the Ifugao's Schools of Living Traditions demonstrate how community-based initiatives can bridge generational gaps. Educational institutions, media and digital platforms must amplify such efforts, embedding ICH in school curricula, creating virtual apprenticeships and developing storytelling archives to document vanishing practices like the songs of Sri Lankan reed harvesters and the Hudhud chants of the Ifugao. Moreover, efforts to ensure the continuity of traditional festivals, such as Kiangan's Gotad Ad Kiangan, can reignite youth pride in cultural heritage.

It is particularly important to address the socio-economic pressures that are threatening ICH and are undermining inter-generational transmission of traditional knowledge and practices. Climate change interacts with globalization, urbanization and inequitable access to resources, pushing artisans and farmers toward unsustainable livelihoods. In Sri Lanka, artisans are abandoning rush weaving in the face of an influx of cheap plastic alternatives, while Mongolian families are migrating to urban slums where employment prospects are remote after losing their livestock to climate-induced disasters. Safeguarding ICH must be linked to broader efforts to secure land rights, foster ethical markets for traditional crafts and create adaptive livelihood opportunities. Initiatives like Bangladesh's floating agriculture and the Sundarbans' mangrove-based ecotourism demonstrate how cultural practices can anchor economic resilience. Similarly, the Koyori project in Thailand, which merges traditional weaving with contemporary design, shows how innovation can revitalize crafts while meeting modern demands.

Advancing research and advocacy is essential to bridge gaps in understanding and action. While localized adaptations abound, scalable solutions require comparative studies to identify patterns, such as how climate shifts affect textile dyeing traditions or rice cultivation across regions. Interdisciplinary collaboration — uniting social scientists, climate scientists and communities — is key to addressing pressing issues. International frameworks, such as the United Nations conventions on culture and climate change, can elevate these issues, but grassroots advocacy must empower communities to define their own priorities. The Gujjar-Bakarwal's knowledge of Himalayan ecosystems, for example, could inform regional climate strategies, while the Jeju Haenyeo's governance model offers lessons for inclusive policy-making.

A critical component is the integration of traditional knowledge into broader climate adaptation strategies. Indigenous systems — such as the *bawadi* water networks of Himachal Pradesh, the Hani's sacred forests in Lao Cai and the Blang's agroforestry practices in Yunnan — are not relics of the past but living frameworks for sustainable resource management and can be harnessed to combat the impacts of climate change. For instance, local knowledge of sapling spacing for mangrove restoration in Sundarbans demonstrates how community expertise enhances ecological resilience, while Mongolian herders' traditional weather prediction knowledge could be used to refine national early-warning systems. Similarly, the Ifugao rice terraces' maintenance rituals and the Gujjar-Bakarwal nomadic pasture management practices offer models for participatory land stewardship and sustainable livelihoods. Traditional practices have endured precisely because they are attuned to local conditions and ecosystems, yet they are increasingly sidelined by top-down interventions. Governments and development agencies must recognize their value as central to climate planning, and policy-makers should partner with communities to document traditional knowledge, practices and systems, ensuring they inform water governance, disaster preparedness and biodiversity conservation policies.

Finally, robust policy and institutional support are needed to sustain community efforts to combat the impacts of climate change. As well as integrating traditional knowledge into national climate plans, governments should allocate resources for ICH safeguarding and uphold land rights for indigenous communities. Financial mechanisms, such as subsidies for traditional farmers and disaster relief funds for pastoralists, can mitigate climate impacts, while participatory governance models — such as the Jeju Haenyeo's direct engagement with policy-makers — can ensure community voices shape decisions.

The resilience of ICH lies in its adaptability — a quality that must be nurtured, not stifled. From the floating farms of Bangladesh to the drought-resistant crops of Sri Lanka, these practices offer blueprints for sustainable living in an uncertain climate. The path forward demands policies based on listening to communities, investments that value traditional knowledge and alliances that span local and global scales. By transforming ICH from a casualty of climate change into a cornerstone of resilience, we can honour the past while securing a liveable future. The inter-dependence of cultural and climatic survival has never been clearer; the imperative to act on that understanding has never been more urgent.

Chapter 1

Climate Impacts on Cultural Practices

Crafting Resilience of Traditional Artisanship: Navigating Challenges in Sustaining Traditional Chinese Lantern-Making amidst Global Climate Change

Nicole Chang Shu Fun

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Crafting Resilience of Traditional Artisanship: Navigating Challenges in Sustaining Traditional Chinese Lantern-Making amidst Global Climate Change

Nicole Chang Shu Fun

Summary of the Case Study

This ethnographic case study was conducted to examine the challenges of handcrafting traditional Chinese lanterns, a local traditional craft in Malaysia, and the resilience of this craft in the face of the global challenge of climate change, so as to better understand the impact of climate change on intangible cultural heritage. In particular, this study examines how climate change affects the intricate processes and cultural significance of traditional Chinese lantern artisanship in the Malaysian context.

Traditional Chinese lantern artisanship in Malaysia, deeply rooted in its cultural heritage, reflects centuries-old practices and intricate skills, especially among local Peranakan[1] and Chinese communities. Ipoh-based artisan Chuen Mun Wai, who is renowned for his mastery in traditional Chinese lantern artisanship, learned the craft from a revered master many years ago.

As climate change poses a threat to both the artisan's traditional practice and the continuity of this traditional artisanship, it is necessary to explore how climate change impacts the crafting processes and cultural significance of this unique craft, and how we can ensure it continues to be practiced and maintain its role in representing and sustaining local identity.

Through in-depth interviews with the artisan and participatory observations during a mentorship programme conducted by the artisan in July 2023, this study identified the adaptive strategies employed by the artisan to navigate the impacts of climate change. The artisan revealed his major challenges as disruptions in sourcing suitable raw materials and preparing high-quality materials required for the craft-making process. Extreme weather conditions, whether excessively dry or humid, directly affect the quality, suitability and durability of the materials, leading to inconsistencies that pose challenges for ensuring high quality products. These variations also complicate the crafting process and impact the lifespan of the finished lanterns, and require the artisan to adapt his techniques to maintain the quality.

By offering a detailed exploration of this specific artisan's experiences, this case study enhances understanding of the challenges inherent in preserving traditional Chinese lantern artisanship in the context of climate change, thereby contributing valuable insights to the broader discourse on resilience and sustainability of intangible cultural heritage in Malaysia.

About the Artisan

Chuen Mun Wai was born in 1979 in Ipoh, Perak. He holds an architecture and building drafting diploma. He was inspired by a senior lantern artisan he met in Penang and gained a passion for traditional Chinese lantern artisanship. He is now a renowned artisan based in Ipoh, Perak. Besides crafting for commissioned orders, he conducts lantern-making workshops to promote the craft. With his Peranakan roots, he aspires to promote and preserve this traditional craft, hoping that future generations

1 The Peranakan or Baba Nyonya community, also known as the Straits Chinese, originated in the fifteenth century through intermarriage between Chinese immigrants in Malacca and local women. Peranakan culture is unique with a blend of Malay and Chinese influences, incorporating fusional elements from Javanese, Batak, Thai, and British cultures (Lim, 2008)

will continue to see traditional lanterns in our neighbourhoods instead of only in museums. While embracing traditional artisanship, he incorporates innovative ideas to create lanterns that not only honour tradition but also cater to contemporary tastes. His creative lantern designs are popular both locally and internationally.

Background: Relevance of ICH for addressing climate change

Intangible cultural heritage (ICH) is closely associated with locations, landscapes, sense of place and identity. The impacts of climate change, which include more frequent extreme weather events, greater intensity of storms, changes in the hydrological cycle, modified growing seasons, loss of biodiversity, spread of disease, etc., poses a threat to the capacity to pass on traditions and safeguard intangible cultural heritage (ICH). The loss of physical landscapes and displacements of humans will restrict the ability of communities to access the resources they need for daily life and to sustain cultural practices and transmission (Wilson and Ballard, 2017; Higgins, 2022). Discontinuation of cultural traditions and practices, including traditional artisanship, accelerates the loss or extinction of traditional knowledge.

Traditional artisans worldwide, who are dedicated to upholding the legacy of traditional skills through crafting distinctive and locally representative crafts, are all encountering the challenges presented by the climate crisis. Different cultures and communities at different locations are confronting the same challenges.

Traditional artisanship, reliant on locally-specific materials and associated techniques, is threatened due to resource depletion and extreme weather events (UNESCO, 2003). Climate change-induced disruptions, such as changes in rainfall patterns and increased frequency of natural disasters, pose threats to supply of the raw materials essential for craft-making (Akturk and Lerski, 2021). The reduced availability and quality of basic essential raw materials significantly challenge artisans to maintain traditional techniques. According to the British Council and Fashion Revolution India (2023), the climate crisis, through extreme weather events and other impacts, is posing a threat to traditional crafts in India, including textiles, pottery, metalwork and woodcraft, as artisans face significant challenges in obtaining consistent supplies of high-quality raw materials such as wood and plant-based dyes. Extreme weather events have also disrupted artisans' production processes, thereby threatening this cultural heritage.

According to Wilson and Ballard (2017), the increasing frequency and intensity of extreme weather events, such as typhoons, have the potential to destroy villages and artisanal workplaces, displacing communities and causing the discontinuation of valuable artisanal knowledge at its origin. These challenges not only threaten traditional artisanship and dilute the cultural richness and diversity embedded within it, but also undermine the socio-economic well-being of artisans as climate change disrupts traditional supply chains and increases the cost of raw materials. These challenges also threaten the potential contributions of these practices to sustainable and resilient development (British Council and Fashion Revolution India, 2023).

There is therefore an urgent need to address the challenges. It is essential to ensure the continued vitality of traditional artisanship (e.g. traditional Chinese lantern-making) and safeguard the intangible cultural heritage of communities (e.g. the Chinese community in Malaysia) in the face of the changing climate.

ICH is a valuable resource for increasing climate resilience and should be incorporated into adaptation planning (Henderson and Seekamp, 2018). Cultural practices, knowledge and traditions, including artisanship, are not only valuable in sustaining cultural diversity but also hold practical significance in helping communities adapt in the face of climate-related challenges. ICH plays a role in fostering community unity and maintaining cultural continuity, and it provides a framework for adaptive strategies. Traditional knowledge and practices that have evolved over generations offer valuable insights into sustainable use of natural resources and practical adaptation initiatives (UNESCO, 2015). This inherited context-specific knowledge and these practices are highly relevant in addressing today's multifaceted climate change challenges.

Objectives of the study

This in-depth ethnographic case study examined the traditional Chinese lantern-making practice by Ipoh-based artisan Chuen Mun Wai and the challenges encountered by this traditional artisan in the face of climate change, in the Malaysian context. It also examined and analysed the adaptive strategies adopted by artisan Chuen Mun Wai, and the resilience of the artisan in navigating the evolving threats brought about by climate change. This includes understanding how he adjusts or modifies traditional practices and incorporates innovative approaches to sustain this traditional craft. Within the broader discourse on the resilience and sustainability of intangible cultural heritage in Malaysia, this study sought to provide valuable insights that could inform policies and practices aimed at safeguarding traditional artisanship amidst global challenges, particularly climate change.

Research design and methods

This study adopted a qualitative ethnographic research approach. The researcher recorded and documented the practical knowledge and hands-on skills on handcrafting traditional Chinese lanterns via participatory observation of three eight-hour workshops held under an artisan mentorship programme conducted by Chuen Mun Wai in July 2023. The knowledge and skills passed on during the series of mentorship workshops covered the cultural and heritage significance of traditional Chinese lantern artisanship in Malaysia; the basics of materials, including the preparation of ready-to-use or ready-to-assemble materials; the fundamentals of lantern structural components; and the process of crafting a traditional Chinese lantern.

In addition to the participatory observation, the research involved fieldwork conducted at Chuen Mun Wai's workplace. Interviews with Chuen Mun Wai were a pivotal component, serving to explore his crafting experience and practices in-depth. The data collection process involved documentation through observation notes, audio and video recordings and photographs. These diverse forms of data were compiled and organized for subsequent analysis and to draw insights.

This multifaceted approach aimed to capture the details of his artisanship and the challenges he faced, and identify his resilience strategies.

The study upheld ethical standards and protected human rights by ensuring informed consent from artisan Chuen Mun Wai, following a clear explanation of the purpose and scope of the research. This secured the artisan's voluntary participation, respecting his autonomy to participate or withdraw at any time. Cultural sensitivity issues were avoided by respecting the local customs, traditions and the artisan's practices and cultural background in all interactions and interpretations. The research process was conducted with transparency, with the artisan fully informed about the methods and potential outcomes. Data security was prioritized, and the findings and implications were discussed with the artisan to address any concerns or questions.

Strengths and limitations of the study

Strengths

The ethnographic approach enabled a rich and in-depth exploration of the challenges and resilience associated with traditional Chinese lantern artisanship based on the experiences and practices of the studied artisan. The researcher's active and engaged participatory observation during the series of mentorship workshops enabled the collection of first-hand insights about the intricate processes, step-by-step procedures, dos and don'ts, and nuanced details involved in crafting a lantern.

This approach allowed the researcher to comprehend not only the technical aspects of lantern crafting but also the refinements in decision-making and problem-solving, and the artisan's adaptive strategies in real time. This insider view enhanced the authenticity and contextual relevance of the study. By focusing on the entire lantern-making process, from material preparation to the final stages of construction and finishing, the case study ensures a complete understanding of the craft and artisanship. This approach captures the interconnectedness of the different stages and sheds light on the artisan's work as a holistic and intricate practice.

By investigating the impact of climate change on traditional Chinese lantern artisanship, this study addresses a critical global issue. The findings contribute valuable insights to the broader discourse

on how environmental challenges affect cultural heritage and the adaptive strategies employed by artisans.

Limitations

While this study excels in its in-depth exploration of challenges and resilience in traditional Chinese lantern artisanship, focusing on the experiences of artisan Chuen Mun Wai, it has certain limitations. The singular focus on one artisan may limit the generalizability of findings to capture the diverse experiences of the broader artisan community doing the same craft in the country. Moreover, in order to capture the long-term impact of climate change on traditional Chinese lantern artisanship, a longer study duration would have offered insights into the evolution of challenges and adaptive strategies over time. Despite these limitations, the case study contributes valuable and contextualized insights into the challenges and resilience of traditional Chinese lantern artisanship in the face of climate change.

Findings and discussion

The cultural significance of traditional Chinese lanterns in Malaysia

To Chuen Mun Wai, a traditional Chinese lantern embodies a fusion of living culture, lifestyle, cultural aesthetics, ancestral wisdom, cultural interpretation, symbolic cultural representation and traditional handicrafts. From his research, he found that Chinese lanterns were brought to the Nanyang region between 1405 and 1433. Initially, lanterns were made to shield candles from wind. During that era, lanterns were designed for illumination only, and were usually crafted with a simple bamboo frame in a cage-like shape that was covered with white paper, without much decoration. Over generations, Chinese lanterns transformed from their initial utilitarian purpose into symbolic representations deeply ingrained in the cultural heritage of the Peranakan and Chinese communities in Malaysia. Traditional Chinese lanterns typically feature Chinese calligraphy and intricate Chinese brush art.

Despite a decrease in use of lanterns due to the advent of electricity in the nineteenth century, Chinese lanterns continue to hold cultural importance in the community. Serving as distinctive identifiers for Peranakan or Chinese residences, businesses and establishments, Chinese lanterns are adorned with family names, county numbers and commercial designations and are placed in front of houses, shops and buildings. Reflecting traditional artisanship with cultural significance, the Chinese lanterns serve as a testament to the enduring legacy of the Chinese diaspora in the vibrant tapestry of Malaysian culture.

Figure 1. A pair of Chinese lanterns: one with the Chinese character 連 (the family surname) and the other with the character 上黨 (the county/province in China from which the family originated.
© Chuen Mun Wai

According to the responses of Chuen in interviews conducted between April and December in 2023, Chinese lanterns symbolise concepts of brightness, joy, hope, new beginnings and good fortune. Some also signify vitality and social status. In the Malaysian context, they serve as expressions of attachment to Chinese roots and cultural heritage, symbolising tradition, spirituality and community.

Chinese lanterns are often used in ceremonial settings, such as weddings, and at cultural events, gracing Chinese temples and ritual spaces. Chinese lanterns are not mere artefacts. They are also family heirlooms passed down through generations. It is customary to give Chinese lanterns as a wedding gift to bless the newlyweds with prosperity and fruitfulness in marriage. This practice reflects a deep commitment to preserving family legacies and cultural heritage, further underscoring the significance of Chinese lanterns in the cultural tapestry of the Peranakan and Chinese communities in Malaysia.

These lanterns represent a living testament to the cultural identity, values and celebrations of the

Figure 2. Chinese lanterns are often hung at Chinese temples
© Chuen Mun Wai

Peranakan and Chinese communities, making their preservation essential for the continued vibrancy and richness of Malaysia's cultural heritage. Given their importance, it is crucial to safeguard the traditional artisanship of Chinese lantern-making in Malaysia.

The creation of traditional Chinese lanterns by artisan Chuen Mun Wai

A learning module that captured the crafting process of a Surname/Chop-mark/Umbrella lantern was selected to serve as an example. This type of lantern holds significant cultural value within Peranakan and Chinese families. It is characterized by its umbrella-like structure, creating an appealing visual display when illuminated. Incorporating the family surnames ('chop marks') in the lantern's fabric cover, the lantern contains a personalized and symbolic element.

Apart from serving as a unique identifier for homes, businesses and establishments, this type of lantern has particular cultural value. It is beyond a traditional functional object, it is a cherished artefact with symbolic significance. It symbolises familial pride and acts as a visual representation of Peranakan and Chinese cultural heritage (Lee, 2019). The intricate designs and personalized markings on the lantern provide a glimpse into the rich history and familial connections within these communities.

As Chuen mastered this craft, he strove to maintain the traditional crafting materials and techniques to preserve the significance of Chinese lanterns as symbols of Peranakan and Chinese heritage in Malaysia.

The crafting materials

Crafting high-quality Chinese lanterns requires the careful selection of high-quality raw materials in order to produce robust and well-crafted components. The frame structure is built using bamboo strips cut from bamboo logs supplied by trusted sources. The bamboo strips should exhibit flexibility and workability for crafting the structure that defines the lantern's shape.

Chuen generally obtains bamboo logs via basket crafters, who often procure the bamboo from Indigenous or Orang Asli communities. These communities harvest bamboo from their local areas, and they possess extensive knowledge of the growing nature and habitat of bamboo plants.

Figure 3. A sample page of the learning module
© Author, 2023

Figure 4. Lanterns created by artisan Chuen Mun Wai
© Chuen Mun Wai

Alternatively, Chuen acquires bamboo directly from growers who cultivate it on their land.

Upon receiving bamboo logs from his suppliers, Chuan cuts each log up and the logs are then left to air-dry indoors for approximately six months (without using preservatives). Chuen insists on a chemical-free approach to bamboo preservation. Any bamboo showing signs of insect infestation during this period is discarded. Only straight and sturdy bamboo logs are selected for crafting purposes.

The lantern frame is made of three key materials. First, the processed bamboo strips, precisely cut to the required size and shape. Second, round wooden blocks with dividers, which are crafted by skilled wood crafters, secure the bamboo strips in a stable position. Third, metal L-shaped bars, manufactured by skilled metalworkers, play a crucial role in attaching the top and bottom wooden blocks, providing robust support for the bamboo frame structure.

The lantern cover is crafted from cloth, which is decorated with intricate designs that serve both functional and aesthetic purposes.
In addition to the primary materials of bamboo, wood, metal and cloth, the assembly and finishing process uses supplementary materials including thread to strengthen the structure, glue to adhere the fabric to the lantern frame structure; dye to dye the cloth in the desired colour; a substance to create an adhesive layer on the fabric cover before it is adorned with drawings and writings; and colour pigments for drawing and writing on the cloth cover.

The crafting techniques

Handcrafting traditional Chinese lanterns involves multiple steps. Each step is crucial and must be undertaken with great care and attention to detail, and each step is vital for the success of the subsequent steps. This meticulous approach ensures high-quality finished products.

In the initial step, bamboo strips are prepared by cutting, cleaning, stripping and shaping them into the desired form and size. These strips are then ready to be assembled to construct the cylinder-shaped frame structure. Before installing the bamboo strips to create the frame structure, the upper and lower wooden blocks, both intricately crafted with dividing compartments, are securely fixed and positioned using two metal L-shaped bars to establish the core supporting component. Following this, each bamboo strip is fixed into its designated divider on the lower wooden block. Subsequently, each bamboo strip is attached to the corresponding divider on the upper wooden block.

With the frame now secure, the artisan proceeds to tie threads around it, then affixes the fabric cover onto the structure. An adhesive layer is applied as a foundational base on the cloth cover before embellishing the cloth with drawings and words. This adhesive substance not only provides a stable surface for artistic expression but also contributes to fortifying the entire structure.

Challenges and adaptive strategies

Bamboo, as the main raw material, is used with minimal or even zero waste, from the moment it is harvested until the final lantern is crafted. Even the leftover debris after the crafting process is burned and the ashes are then repurposed to craft lacquer thread, which is used for decorative carving onto the lantern's wooden base at the bottom. Alternatively, it can be used as a supplementary dyeing agent

Figure 5. Crafting process: Traditional thread-tying technique to strengthen the shape of the assembled frame structure
© Chuen Mun Wai

Figure 6. The complete lantern frame structure – ready to affix cloth cover
© Chuen Mun Wai

Figure 7. A traditional Chinese lantern with cloth cover – ready to be decorated
© Chuen Mun Wai

during the fabric dyeing process, as a substitute for bicarbonate soda, commonly referred to as alkaline water. "Some [ashes] might eventually turn into soil fertiliser", explained Chuen, to underscore traditional Chinese lantern artisanship's holistic, eco-conscious and sustainable approach. This traditional artisan practice not only minimises waste but is also resourceful.

In the context of climate change, Chuen faces challenges and has developed strategies to adapt to this context. One challenge Chuen faces is in sourcing suitable raw materials. A key issue is in securing a reliable source of high-quality bamboo logs. Without high-quality bamboo, he cannot produce the durable and flexible bamboo strips necessary for crafting the lantern frame.

According to Chuen:

> *The lantern frames are usually made using two particular types of bamboo, namely "ba" bamboo (芭竹) and "diaosi" bamboo (吊丝竹). Typically, the preferred choice for crafting is bamboo plants aged between two to three years. This category yields more mature and durable bamboo logs, characterised by evenly distributed nodes.*

When there is excess rain [which is one of the impacts of climate change], bamboo shoots compete to grow and reach for sunlight. This competition results in the bamboo growing with unevenly distributed nodes. This kind of bamboo typically has immature wall cells, which makes it less tough and more prone to breakage. And logs are not flexible enough.

Another challenge Chuen faces is that the conditions for working with the bamboo are also impacted by climate change. Preparing bamboo, especially the indoor air-drying process, is susceptible to sudden changes in temperature and humidity, which affect how bamboo logs absorb and lose moisture.

Excessive rain leads to high humidity, causing bamboo to swell and increase in thickness, while excessively high temperatures lead to dry conditions, causing the logs to shrink. Sudden temperature fluctuations may result in uneven drying across parts of a single bamboo log, leading to varying thicknesses and affecting the log's uniformity. These issues align with Kim's (2011) findings about the impacts of climate change on cultural heritage, where changes in relative humidity and sudden humidity shock were identified as causes of material degradation, including splitting, cracking and flaking.

According to Chuen,

> *The optimal results are achieved in moderately rainy, warm weather during the waiting [drying] period. Under such conditions, the logs maintain a regular shape and uniform in thickness, making them ideal in strength and workability for constructing durable lantern frames.*

Fabric-dyeing is another weather-sensitive process. Chuen hand-dyes the cloth himself because the specific colours of fabric required for his lanterns, especially for those customised orders for specific occasions or celebrations, is often not available. Generally, hand-dyeing results depend on factors that are highly sensitive to climate, during both the dyeing and drying processes.

As Chuen notes:

> *To this day, I'm still experimenting with better options to enhance the quality of hand-dyed fabric, particularly when using natural dyeing agents such as plant-based pigments extracted from turmeric powder for yellow fabric and mangosteen skins for orange fabric. Due to the natural oxidation process of the pigments on the fabric, achieving the expected colours and fixing the lasting desired tones is challenging.*

To ensure the best outcomes, the dyeing process is carried out under favourable weather conditions. As Chuen explained, "After the dye bath, the dyed fabric is left to dry in sunlight. Sunny days result in vibrant and bright colour tones, while rainy or humid days may produce dull and pale tones".

Rainy and humid weather can also lead to uneven colouring, and water bubbles may become trapped in or adhere to the fabric during drying, resulting in white spots or marks.

Moreover, in rainy and humid weather there is a risk of potential colour bleeding, where the dye spreads beyond the intended boundaries, causing an uneven distribution of colours. To address this challenge, the artisan chooses days with ample sunlight to do the dyeing process.

Figure 8. Defective bamboo logs with cracks, ruptures and splits, and irregular shapes. These defects are were probably due to excessively high temperatures or sudden temperature fluctuations, which caused irregular drying during the six-month drying process
© Chuen Mun Wai

Figure 9. Defective bamboo logs with small holes, a result of infestation by ants, spiders and scorpions
© Chuen Mun Wai

Figure 10. Defective bamboo logs with powdery dust from bamboo holes after insect infestation
© Chuen Mun Wai

Figure 11. Excessive humidity can result in the formation of white spots on the cloth
© Chuen Mun Wai

Figure 12. Uneven distribution of colour tones on hand-dyed fabric after drying
© Chuen Mun Wai

The preferred colours for lanterns are typically earthy tones such as antique beige, bright yellow, black, and red. As part of his eco-conscious practice, the artisan creatively repurposes discarded fabric trimmings to craft smaller lanterns or other crafts, minimising waste and demonstrating his commitment to sustainable artisanship.

The process of preparing supplementary materials such as natural glue and adhesive substances/mediums using natural ingredients is also affected by the weather. For instance, the drying time and quality of the starch or rice paste mixture used as an adhesive medium for attaching the cloth cover onto the bamboo frame is influenced by the level of humidity. In addition, when there is excessive rain, the high humidity can cause the natural glue made from starch paste to become mouldy. Similarly, the *agar-agar*, a seaweed-derived substance, as the adhesive layer for sealing the cloth and maintaining the shape of the finished lantern is also highly weather-dependent. Rainy or humid conditions can degrade its properties. Kim's (2011) study notes the impact of humidity in terms of insect infestation and the growth of mould and fungi.

Chuen copes with these issues by scheduling his crafting processes to align with favourable weather conditions for each step.

The usual practice for lantern artisans is to apply a protective oil-based layer onto the finished lantern after drawing, painting or writing on fabric is completed. This serves to safeguard the finished lantern, prolonging its life span. Traditional plant-seed oils can be substituted with modern alternatives like clear lacquer.

In recent years, because of unexpected temperature fluctuations, Chuen has changed his practices and no longer applies an oil-based layer on the surfaces of his lanterns. Instead, he uses a plastic cover or wrapper to protect and store the finished lanterns.

As Chuen explained:

> *Traditionally, artisans apply tung oil (桐油) as a protective layer on the lantern's surface, then reapply it annually and store the lanterns in a shady place to preserve and extend the lanterns' lifespan. However, I have observed that the oil-based layers thicken over time and eventually become brittle due to sudden fluctuations in temperature. Thus, for storage purposes, I prefer using a plastic cover to wrap and protect the lantern rather than applying the oil-based layer. Based on my personal experience, the plastic cover works more practically, and the lanterns can last around twenty to thirty years.*

In summary, Chuen employs adaptive strategies such as carefully timing the crafting processes to coincide with suitable weather conditions and material substitutions, all without sacrificing the quality and durability of his products. These measures aim to maintain the quality of his traditional crafts in the face of climate-related challenges.


Figure 13. Imperfections on lantern fabric covers:
Wrinkles in the cloth due to excessively rapid drying or changes in the glue that attaches the cloth to the frame or to the adhesive layer applied on the cloth surface. These occur in situations of high temperatures and high rainfall and humidity
© Chuen Mun Wai


Figure 14. A protective oil has been applied to the lanterns' surfaces
© Chuen Mun Wai

Figure 15. Clear lacquer can be applied as a transparent coating on the lanterns' surfaces
© Chuen Mun Wai


Figure 16. Chuen protects his lanterns by covering them with plastic
© Chuen Mun Wai

Conclusions

This ethnographic case study on traditional Chinese lantern artisanship, focusing on artisan Chuen Mun Wai in Malaysia, describes the challenges a traditional artisan faces in adapting to the impacts of climate change and explains some practical adaptive strategies adopted by Chuen in ensuring the continuity of cultural heritage under the constraints caused by climate change. Chuen's commitment to sustaining his artisanship while confronting environmental uncertainties demonstrates the resilience of a traditional artisan. His creative responses, including weather-conscious crafting processes, innovations in material applications and flexible adaptation, showcase this artisan's dedication to maintaining the premium quality and durability of the finished craft despite facing contemporary climate-related challenges. Moreover, Chuen's environmentally conscious practices, inspired and inherited from traditional lantern-making artisanship, underscore the potential of intangible cultural heritage in promoting sustainability through the passing on of these exemplary practices. This study provides valuable insights into the intersection of intangible cultural heritage (i.e. traditional artisanship), climate change, and adaptive resilience, contributing to a nuanced understanding of the ongoing efforts to safeguard traditional practices in the contemporary world.

Recommendations

Chuen Mun Wai, a rare practitioner who has inherited and continues to practice the traditional artisanship of handcrafting traditional Chinese lanterns, has expressed grave concern about the sustainability of this craft for local communities, particularly among the Chinese communities. In addressing the inevitable global climate challenges, Chuen has proposed exploring clean room facilities to support the traditional lantern-crafting processes. "Crafting in a clean room environment would significantly mitigate the negative effects of fluctuating weather conditions and humidity, which can impact the quality and longevity of the crafted lanterns." By maintaining a controlled environment in a clean room, artisans and practitioners can better manage the impact of varying temperatures and moisture on the materials and crafting components involved. This would enhance the consistency of the quality of finished crafts. Therefore, supporting practitioners by offering clean room technology support or providing specific crafting workplaces with such facilities could be a strategy in driving the continuity and sustainability of this traditional artisanship and safeguarding it as a vital component of Malaysia's intangible cultural heritage.

The participants' engagement during Chuen's mentorship workshops highlights the possibility of promoting the artisan's adaptive resilience strategies and eco-conscious practices through workshops, which offer learning through demonstrations and hands-on experiences. Besides learning traditional artisanship, participants in workshops would gain awareness and understanding of adaptive alternatives and practical solutions for dealing with the impacts of climate change. Therefore, organizing workshops, demonstrations and knowledge sharing platforms across different levels and groups of communities is a recommended strategy. This demonstrates the significance of experiential learning and community engagement in preserving intangible cultural heritage. Chuen's approach of integrating traditional knowledge with contemporary adaptive strategies to create resilient and sustainable craft-making practice should be shared, as a model or reference for other traditional craft practitioners, showing how cultural heritage can be preserved and adapted in the face of global climate challenges.

This study advocates for extending the research scope to encompass a broader artisan community engaged in the same type of artisanship across the South-East Asia region or worldwide. By doing so, it would capture the diverse experiences of multiple lantern-making artisans situated in various locations within the region or across different regions. Such an extension would provide an opportunity to discover and compare the distinct challenges encountered by each of the artisans, identifying any differences shaped by regional or global variances. This expanded scope of study would enable a more comprehensive understanding of the adaptive resilience strategies employed by artisans in addressing climate change challenges at a regional or worldwide level. This would not only contribute to the enrichment of knowledge on traditional Chinese lantern artisanship, but also potentially inform broader strategies or policies for sustaining traditional crafts and artisanship in

Figure 17. Artisan Chuen Mun Wai in his studio © Chuen Mun Wai
A video of the mentorship workshops conducted by Chuen Mun Wai is available at: *https://youtu.be/pSIdAaGsGl4?si=UqDl7Os3KVfAhugH*

the face of evolving environmental changes within the region or across different countries/regions. In addition, broadening the study's geographical scope would pave the way for a more holistic and regionally informed approach to preserving and adapting traditional cultural heritage practices in the context of a changing climate.

Acknowledgements

The author gratefully acknowledges Think City Sdn Bhd for financing and supporting the Artisan Mentorship Program of the Perak Intangible Cultural Heritage Project under its Cultural Economy Catalytic Grants Programme 2023.

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Impact of Climate Change on Rush and Reed Weaving Heritage: The Case of the Cultural City of Anuradhapura, Sri Lanka

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Impact of Climate Change on Rush and Reed Weaving Heritage: The Case of the Cultural City of Anuradhapura, Sri Lanka

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Amila Lankapura
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Summary

Sri Lanka has rich intangible cultural heritage (ICH), and one such ICH element is rush and reed weaving. This case study assesses the impacts of climate change on rush and reed weaving in the Anuradhapura area of Sri Lanka, a UNESCO World Heritage site.

The study results indicate that climate change is having direct and indirect impacts on rush and reed weaving. One such impact is a decline in the distribution, abundance and fibre quality of commonly used rush and reed species. Climate change is also impacting the process of rush and reed harvesting, processing and weaving, and is affecting the quality of the products. Moreover, climate change is having an impact on the cost of production and is eroding local markets for the products, leading to reduced income from rush and reed weaving, which is challenging the continuation of the practice. Climate change is also leading to disruptions that are endangering related ICH and the institutions linked to this activity.

Various strategies have been adopted to protect rush and reed weaving ICH and to help the transfer of knowledge and practice to new generations, at the community, regional and national levels. At the community level, these strategies include supporting the transfer of knowledge within families, organizing production into clusters and societies, adapting methods of cultivating rush and reed and modifying storage techniques to prevent deterioration of the materials and products. At the regional and national levels, strategies include the promotion of ICH of rush and reed weaving for commercial purposes by establishing production societies and providing tools, instruments and training to practitioners and other interested individuals; national-level programmes include those that reward and recognize the efforts and innovations of people involved in rush and reed weaving; and trade fairs to connect weavers to markets. To build on these initiatives, targeted programmes and research are required. Such efforts will help to safeguard the ICH knowledge and practices associated with rush and reed weaving in the context of climate change.

Background

Sri Lanka has a long history and rich heritage. The intangible cultural heritage of Sri Lanka encompasses knowledge and skills that are manifested in many forms, including cultural practices, rituals, arts, crafts, beliefs and values, all of which are interconnected (Manawadu, 2005; Blake, 2008; Ranaweera et al., 2014).

In traditional Sri Lankan society, the agricultural system relied on cascading 'tanks' (reservoirs) to collect and store rainwater for the irrigation of rice paddies (Bhathiya et al., 2021). Traditional society had a lifestyle supported by renewable resources for food, housing, clothing, medicine and transport needs (Bandara, 2009; Perera, 2014; Sarathchandra et al., 2021).

The culture of craft making from local resources is deeply inscribed in traditional Sri Lankan society

(Coomaraswamy, 1956). A wealth of knowledge, skills and practices associated with Sri Lankan rush and reed craft making has been transmitted from generation to generation for centuries (Wickramaarachchi, 2022). This includes knowledge about the natural environment, product design, fibre processing, weaving techniques, rituals and beliefs. This knowledge and the skills and practices connected to weaving are part of Sri Lanka's ICH (Naduni et al., 2022).

Handicrafts are the basis of livelihoods for many rural communities, and for women in those communities in particular. Rush and reed products were traditionally used by Sri Lankan people in their everyday lives. Typical products include kitchen utensils, floor mats and so forth. Rush and reed handicrafts are also commercial products that are popular with tourists and some urban customers. Hence, these products play a significant role in the rural economy.

Sri Lanka, like every other country, is feeling the impacts of climate change (IPCC, 2022). For example, Sri Lanka has experienced increasing ambient temperatures and more frequent occurrence of extreme rainfall anomalies (Marambe et al., 2015; Jayawardena et al., 2018). Intangible and tangible cultural heritage in Sri Lanka and worldwide are also being impacted by climate change. Impacts include loss of natural resources, including extinction of specific plant species used in handicrafts; reduction in social cohesion; and loss of indigenous and local knowledge (Adger, et al., 2013; Ahmadreza et al., 2019; Higgins and Noelle, 2022).

The heritage of rush and reed weaving, in particular, is being impacted by climate change in several ways. First, climate change is affecting the availability of raw materials, which are harvested from marshy lands and flood plains, which are highly vulnerable to climate change. Second, the culture of collective reed harvesting is being affected by extreme weather events such as heavy rains and flooding. Third, raw material preparation and processing are being affected by temperature rise. Fourth, the quality and durability of raw materials and finished products are being affected by increased humidity. In the context of climate change, it is uncertain if traditional rush and reed crafts can be sustained in the long term.

Statement of the problem

The practice of rush and reed weaving is being negatively affected, directly and indirectly by climate change (Christidis et al., 2008; Stefano and Corsane, 2012; Lynn et al., 2014; Birch, 2016). However, the practice can be a means of mitigating the impacts of climate change because it is a sustainable industry based on renewable resources, and it is carbon neutral.

This study investigated the impact of climate change on rush and reed weaving in Anuradhapura District of Sri Lanka. The findings of this study offer important insights for policy-makers, international organizations working on ICH, such as UNESCO, and practitioners engaged in safeguarding and managing this valuable ICH.

Objectives

This case study had the following objectives.

- To understand how climate change has impacted Anuradhapura District in recent decades.
- To assess the environmental, economic, social and cultural impacts of climate change on rush and reed weaving heritage in Anuradhapura District.
- To explore community, regional and national level strategies adopted to safeguard the heritage associated with rush and reed craft weaving.
- To recommend appropriate management practices for the long-term sustainability of the rush and reed weaving practice and to safeguard the associated knowledge.

Research design and methods

The study team selected Anuradhapura District because the district is well known for its tangible and intangible cultural heritage. In 1982, UNESCO inscribed Anuradhapura as a World Heritage site. Handicrafts (for example mats, wall hangings and kitchen utensils) were historically widespread in Anuradhapura (Coningham et al, 1997).

Today, rush and reed weaving is less common than in the past in Anuradhapura, but it is still practiced by some communities as self-employment or as a hobby. The district has favourable conditions for rush and reed growth including numerous reservoirs,

rivers, streams, marshy lands and abandoned rice fields. However, Anuradhapura is among the areas that are highly vulnerable to climate change (Marambe et al., 2015), which represents a threat to the future of rush and reed weaving.

The study adopted a qualitative research method. Data for the study were collected from focus group discussions, interviews, observations and the literature. A focus group discussion was conducted with members of a rush and reed weaving society in the village of Kunuragama, about 20 kilometres east of Anuradhapura city. The topics discussed included climate change, unusual weather events, impacts of such events on rush and reed weaving activities, cultural and social elements associated with rush and reed weaving, activities of the weaving society, governmental and non-governmental support and strategies to safeguard skills and knowledge.

Interviews were held with representatives of ministries and institutions, including top management and technical staff of organizations associated with rush and reed craft and institutions (e.g. the folk museum) and practitioners of rush and reed weaving. The interviews were held either face to face, over the phone or online. The interviews with management and technical staff primarily focused on eliciting information about awareness of climate change, the impact of climate change on rush and reed craft weaving and policy interventions to safeguard the practice of rush and reed craft weaving. The interviews with practitioners elicited information about their experience of climate change impacts; rush and reed growing, harvesting, production, processing and weaving; social, cultural and economic aspects of the industry; and strategies they adopt to safeguard rush and reed weaving ICH.

The study team made a number of site visits for observations, which assisted in triangulating the data that had been collected through the discussion group and interviews. Visits were made to rush and reed growing wetlands, artisan workplaces, museums, households and rush and reed craft shops. During the visits, observations were made regarding rush and reed growth, wetlands, craft making facilities and infrastructure, rush and reed based objects, crafts used by households, crafts sold in shops, and the designs and materials used. Secondary data were gathered from published literature, including institutional reports, research articles, text books and websites, to supplement the primary data collected.

Ethical and human rights considerations

All possible steps were taken in this study to protect participants' rights and well-being. Participation in interviews and the focus group discussion was voluntary. Informed consent was taken from participants via a consent form, which contained a brief description of the study, the research methods (including about taking photographs of participants and objects, and electronic recording of interviews and observations of sites), the length of the interview, contact information of the researchers and a statement of the participants' right to withdraw from the study. The anonymity of research participants was maintained, with the exception of those participants who appeared in photographs. Permission was obtained for making such photos accessible to the public. Research data were stored by the researchers in secure digital folders to protect the participants' privacy. The research was designed to ensure no psychological, social or physical harm to the participants. Compensation was not paid for the participants, and participants were informed of this before participation. Proper channels were used to access participants, sites and objects.

Strengths and limitations of the case study

The researchers were able to gather data in a short period of time from multiple sources, including interviews of nineteen key informants, site visits and study of the literature. The multiple sources of data enabled triangulation and verification. Interviews were conducted in several ways (face-to-face, telephone and online), which enabled researchers to save time and increase the number of research participants.

The study had limited time and a limited budget, so it was confined to one specific area, which limited its generalizability to other parts of Sri Lanka. Another limitation is that although there is a rich collection of preserved rush and reed objects in museums, there is little information available about their meanings and about the artisans who made them.

Findings

Changes in weather patterns in the study location

In the study area, there has been significant variability in rainfall patterns (Pawar et al., 2022) and over the past three decades there has been an increase in rainfall (Nisansala et al., 2020). Other changes include more frequent extreme weather events, floods and droughts. Additionally, there have been temperature fluctuations in the region and a complex interaction of multiple climatic factors.

Impacts of climate change on the raw materials

Rush and reed grow in wetlands in the study area, and these wetlands are being impacted by climate change. One impact is greater salinity in some areas (Corwin, 2020). According to the owner of an abandoned rice field where rush and reed grow, "The soil of our rice field where we used to collect rush and reed has white patches [of salt] on the surface".

Salinity in soils where rush and reed grow adversely affects the physical properties of the rush and reed plants, causing them to have a rough stem, which is not suitable for fine weaving since such stems are less flexible.

An interviewee noted that "Rush and reed available near to our home can no longer be used for weaving. They have a very hard and thick stem and are less flexible after drying. This affects the fineness of the weaving".

Such observations by local residents are backed up by the literature which indicates that soil salinity affects plant morphology by thickening cuticles and causing early lignification (Yadav et al., 2011). Lignification reduces the flexibility of rush and reed, which in turn makes them unsuitable for fine weaving.

Another issue observed in the wetlands is that changing weather patterns are leading to the suppression of rush and reed plants by other plant species. The commonly used rush and reed plants are therefore now less abundant. For example, aggressive growth of *Typha angustifolia* (locally known as *hambu pan*) was noticed in wetlands and it is suppressing the growth of *Cyperus corymbosus* (locally known as *gal-ehe pan* or *pan*).

A study participant remarked, "Since we receive heavy rains, the sites where we used to collect rush and reed now remain flooded for long periods. When those sites remain waterlogged for a long time, some plants grow very quickly, suppressing the *gal-ehe pan*. Now *gal-ehe pan* is scarce in those sites".

Impact on the process of craft making

When rush and reed growing wetlands are flooded for long periods, the harvesting of the raw material (rushes and reeds) is delayed. As one of the interviewees said, "When the water level in wetlands is high, we can't harvest rush and reed on time. Unlike in the past, today the wetlands where we collect rush and reed remain submerged for a long time. So, we can't harvest at the right time now. The

Figure 1. A Site of "*Gal-ehe pan*" (*Cyperus corymbosus*)
© Authors

Figure 2. A reed site invaded by other aquatic plants
© Authors

pan is over-matured if not harvested on time, and it is not suitable for weaving".

Climate change is also disrupting the processes of drying and dyeing of raw materials. As a participant in the group discussion said, "There were many occasions that our *pan* got wet when we sun dried them, due to unexpected rains. The colours of the dyed pan washed out".

Another result of increased and erratic rainfall and greater humidity is the growth of mould on processed raw materials and finished crafts, which affects their quality and durability. Another participant in the study commented that "We now can't store dried rush and reed and finished crafts in the open environment for a long time. Mold grows on them more frequently due to moisture". This experience of increased mould as a result of increased moisture in the atmosphere is a frequent occurrence elsewhere too (Kim, 2011).

Economic impact

As a result of climate change impacts such as longer inundation of wetlands and reduced abundance of rush and reed, the supply of the raw materials has declined. With this decline in supply, the cost of the raw materials has increased, and so has the cost of rush and reed craft products. This higher price has affected demand for the rush and reed products.

Another factor that has contributed to reducing demand for these products is the lower agricultural incomes of rural communities due to extreme weather events such as heavy rain, which cause flooding and destroy crops. Over 80 per cent of the people in the study area depend on agriculture (mainly rice and maize) for their income. An artisan noted that "The incomes of the farmers in our villages have declined due to losses of rice crops from flooding and the lower maize yield, which is due to too much sedimentation from heavy rains. Therefore, they don't have enough money to buy our products".

Some of the rush and reed artisans interviewed said that the competitiveness of rush and reed products compared to plastic versions has declined due to the higher costs of production for rush and reed products. During the site visits, researchers witnessed displays where both rush and reed products and synthetic (plastic) craft products were for sale, and when they asked why both types were sold, traders responded that synthetic products were much cheaper and customers could often afford them, but not the rush and reed products. As one of the artisans in the focus group said, "Our income has declined by more than a half due to the drop in the sales of our products. High costs

Figure 3. Vessel with colours used to dye raw materials
© Authors

Figure 4. Stored raw materials infested with mould.
© Authors

Figure 5. Rush and reed craft products on display at the market
© Authors

of production made our products less affordable to local customers, and there are cheap synthetic alternatives to our products in the market".

Social impact

The scarcity of rush and reed is affecting local practices associated with rush and reed weaving. As one of the interviewed participants said, "In the past we harvested *pan* in groups. We shared labour in harvesting, collecting and transporting the harvested pan. And we weavers shared the *pan* that was available in common wetlands more equally. But we cannot do it as a group now since there is not enough pan to harvest and share as a team".

Low availability of rush and reed, the inability to harvest them at the right time, the lack of markets for the products and insufficient incomes from rush and reed weaving is leading to artisans abandoning the practice of rush and reed weaving as a livelihood.

The sustainability of institutions associated with rush and reed weaving has also been affected. The focus group discussion revealed that members of the weaving societies are becoming inactive in the society and some are giving up their memberships because of the scarcity of raw materials and the erosion of local markets. Reduced participation in weaving societies threatens their continuation.

Cultural impact

The tradition of using rush and reed products in daily life is being lost, with synthetic household products becoming more popular. A woman participant in the study explained, saying "Unlike in the past, there is now a short supply of rush and reed craft products. And they are very expensive so we find it difficult to afford them. We now use synthetic kitchenware because they are much cheaper".

Researchers also observed that most of the kitchenware in the houses they visited were made of plastic and were decorated with artwork that originated abroad. Rush and reed made kitchenware (containers, storage boxes, table mats, baskets, bags, mats and trays) which were once common in Sri Lankan homes were rarely observed in the visited houses. The popularity of plastic items is not only due to their lower price, but also because they are sometimes more durable and because they are sometimes perceived as being better because they are more modern.

With the decline in the harvesting of raw materials and the lower level of production of traditional rush and reed products, the folk/oral culture

associated with rush and reed work has diminished. In particular, the poems and songs that groups of people sang while harvesting rush and reed have almost completely disappeared. As one of the participants of the focus group discussion said:

> *We sang and chanted poems when we harvested pan as groups, so that we wouldn't feel tired. Singing was refreshing while working. There are specific poems that describe the different parts of rush and reed weaving activities, associated skills and conflicts among weavers. For example, there are some poems in which the daughter-in-law challenges the weaving skills of the mother-in-law. But we don't have opportunities to sing the poems now because we no longer do collective harvesting.*

Table 1: Summary of the findings

Investigated impact factor from climate change	**Impact on ICH of rush and reed weaving**		
	Evident	**Potential but data deficient**	**Data deficient**
Impacts on the raw materials			
Reduction of rush and reed population	√		
Changes to rush and reed morphology	√		
Changes to rush and reed growing ecology (Salinity formation, long term submersion)	√		
Domination of rush and reed by other plant species	√		
Process of craft making			
Disruption to Collecting and harvesting of rush and reed	√		
Raw Material and process quality	√		
Disruptions to drying and dyeing activities	√		
Use of natural dyes extracted from plants and minerals			√
Economic			
Cost of production	√		
Market for rush and reed crafts	√		
Competitiveness of rush and reed crafts		√	
Livelihood and income	√		
Social			
Collective action associated with weaving practice	√		
Continuity of weaving societies	√		
Abandonment of weaving by weavers	√		
Cultural			
Culture of using rush and reed natural crafts and wares		√	
Disappearance of associated folk literature		√	

Pan is scarce now and there is not enough pan for a team.

Another change to practices is that weavers no longer use natural dyes extracted from plants and minerals to decorate crafts, although these were commonly used in the past (Coomaraswamy, 1956). Similarly, some of the patterns, motifs and artworks used to decorate items in the past are no longer used by the practitioners today.

Strategies to safeguard rush and reed weaving heritage

The interviews, discussion group and review of published documents and reports revealed a number of community-level and regional and national strategies being adopted to safeguard and promote the ICH practice of rush and reed weaving.

Community level strategies

As a solution to the scarcity of rush and reed scarcity, some weavers have tried using alternative plants that are locally available. For example, some weavers are using the leaves of *thal* (*Borassus flabellifer*) and *thala* (*Corypha umbraculifera*) plants instead of rush and reed. In addition, some weaving societies have started cultivating rush and reed in communal wetlands, rather than relying on wild plants, so as to ensure sufficient supply of the raw materials they need to make their products.

To overcome the issue of mould growth, some weavers are using plastic bags or plastic film to preserve their finished products and prevent mould from growing on them.

To ensure that knowledge is not lost, some practitioners have begun systematically ensuring the inter-generational transfer of family knowledge and skills. For example, some weavers have begun training their children in the traditional knowledge and skills. Box 1 shows an example of this.

The societies or groups of producers formed by some leading rush and reed weavers are also taking steps to ensure the dissemination of traditional knowledge and practices. Leaders of such weaver groups provide training to individuals who supply craft products to them. One such leader said during the interview, "I provide training and sometimes materials to those who supply crafts to me".

Another community-level strategy to safeguard this

Box 01: "Passing the Thread: A Weaving Heritage from Mother to Daughter"

Mrs. K. Somawathi

At 97 years old, Mrs. K. Somawathi is a highly respected and recognized expert in rush and reed craft weaving. Her skill set includes creating various products and designs, making her an essential contributor to the National Craft Council. Dedicated to keeping the craft alive, Mrs. Somawathi has shared her vast knowledge with her daughter, Mrs. K.H. Lalani, teaching her to make detailed designs and carry on the family's craft tradition. The training centre, which Mrs Somawathi used to run herself, is now managed by her daughter, who continues to uphold the family's commitment to traditional craftsmanship for future generations.

Mrs. K.H. Lalani

Figure 6. An artisan with her husband displaying the items they produce
© Authors

ICH is to document the traditional knowledge and skills associated with rush and reed weaving. The study team observed that weavers are documenting their product designs, patterns, artwork, materials used and procedures. As one participant said in an interview, "I have a record of every item we produce. It includes a photograph of every item and a small description of the weaving procedure".

Regional and national level strategies

At the regional and national levels, strategies to safeguard rush and reed weaving ICH include promoting weaving societies and encouraging them to produce rush and reed products for commercial purposes.

Efforts by governmental and non-governmental organizations to promote rush and reed weaving include creating clusters of weavers, providing weavers with tools and instruments such as pressing machines and weaving shelters, and providing training to develop skills and to share the traditional knowledge with other interested individuals. In addition, there are state-sponsored programmes to reward and recognize the efforts and creations of people involved in rush and reed weaving. This has encouraged the practitioners. National and regional governmental and non-governmental institutions also organize trade fairs, and they have helped practitioners to establish market links and find buyers. The Department of National Museums has assisted in safeguarding this ICH by preserving and documenting knowledge related to rush and reed craft weaving.

Discussion and conclusions

This case study explored the impacts of climate change on rush and reed weaving in Anuradhapura District of Sri Lanka. The findings reveal significant impacts of climate change in the study area, including increased rainfall and flooding which have affected the availability and quality of rush and reed materials and the practices of rush and reed craft weaving.

Figure 7. A woman using a pressing tool provided by the government
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Figure 8. Members of a rush and reed weaving society with their crafts and tools provided by the government
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Figure 9. Specimen preserved at the Colombo Museum
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Figure 10. Specimen preserved at the Colombo Museum
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This study found that climate change is having direct and indirect impacts on rush and reed weaving intangible cultural heritage. Economic impacts include increased costs in making rush and reed products, resulting in declining local demand for these products, leading to reduced incomes for weavers. In terms of social impacts, the study identified a decline in community activities associated with weaving, including group harvesting, and a shift from using traditional rush and reed crafts to using plastic alternatives. The study found that some cultural practices associated with rush and reed crafts, such as singing traditional songs while harvesting the raw materials, are no longer practiced.

Various strategies have been adopted by the communities, governmental and non-governmental organizations to safeguard the ICH of rush and reed weaving. Community-level strategies include systematic inter-generational transfer of weaving skills, the formation of weaving groups, the use of alternative local materials for weaving and the cultivation of rush and reed. Governmental and non-governmental organizations have also implemented actions to safeguard this ICH, including encouraging the formation of weaving societies, providing tools and training and organizing trade fairs.

Recommendations

To mitigate the impacts of climate change on rush and reed weaving heritage in Anuradhapura District, weavers need to be able to adapt to changing conditions while continuing to practice and share their knowledge and skills.

Many weavers are already showing adaptability, by switching from using rush and reed to using alternative plants. Some weavers are also taking care to document their knowledge and skills in the various stages of preparing rush and reed products. To support this, initiatives should be launched to document knowledge related to ICH on rush and reed weaving and the poems and songs that were once sung during the harvesting of raw materials. This needs priority attention as this heritage has almost completely disappeared. Including this valuable knowledge in school curricula will disseminate it to youth.

To counter the lack of demand for reed and rush products in local markets, programmes should actively promote these eco-friendly products in foreign markets, introducing them at international trade fairs and exhibitions and engaging in online trade. Training artisans in IT and English language skills will be essential for their success in online sales.

Finally, programmes should be implemented to increase the resilience of local agriculture, as it is the foundation for the rural economy and for the rush and reed products. Research into the impacts of climate change on rush and reed ecology and plant morphology is also important, so as to identify mitigating mechanisms. This research could include studying the impact of climate change on the availability of raw materials and the processing of raw materials. Combined, these actions will assist in preserving Sri Lanka's ICH of rush and reed weaving for future generations.

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Chapter 2

Indigenous Knowledge and Climate Resilience

The *Bawadi* System of the Kullu-Mandi Valley, Himachal Pradesh, India: Traditional Ecological Knowledge

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The *Bawadi* System of the Kullu-Mandi Valley, Himachal Pradesh, India: Traditional Ecological Knowledge

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Introduction

The *bawadi* system, deeply embedded in the cultural fabric of the Kullu-Mandi Valley, represents intangible heritage that intertwines traditional practices and community resilience. These small water structures, primarily fed by freshwater springs, have historically been instrumental in meeting the water needs of local communities, and are also vital for wildlife.

The *bawadi* system, encompassing *bawadi, nalla* and *kuhl*, serves as more than a water management mechanism, it is an enduring intangible practice reflecting local knowledge and wisdom. Beyond practical utility, *bawadi* hold cultural significance, shaping daily activities and playing a pivotal role in rituals.

This age-old system faces existential threats from climate change-induced impacts on water sources and the introduction of modern water infrastructure. Climate change is disrupting the natural flow of water, jeopardizing the reliability of *bawadi,* while modernization, marked by the introduction of pipelines, poses a threat to their relevance.

The gradual abandonment of the *bawadi* system not only endangers a traditional ecological practice finely tuned to local conditions but also exposes communities to water scarcity and heightened risks of fire-related hazards.

Safeguarding the *bawadi* system is imperative for multiple reasons. One reason is that it preserves an invaluable intangible cultural heritage, a repository of indigenous knowledge intricately linked to sustainable water use practices. Another reason is that the *bawadi* system, deeply rooted in local communities' daily lives, contributes to disaster resilience. Its continuity ensures a decentralized water supply, particularly in remote areas where modern infrastructure is limited.

This case study advocates for the preservation of the *bawadi* system as a beacon of resilience, cultural heritage and sustainable water management in the face of contemporary challenges. It emphasizes the urgency of comprehensive documentation, mapping initiatives and the preservation of community insights to safeguard the *bawadi* system. Interdisciplinary collaboration, capacity-building programmes and the integration of indigenous wisdom into water policies emerge as crucial strategies.

Background

The *bawadi* system, also known as *bawri / baoli,* is a traditional water management system deeply ingrained in the hydrological landscape of the Kullu-Mandi Valley in Himachal Pradesh, India. Eponymous with the system itself, *bawadi,* small water structures (Figure 1), have historically been crucial for meeting the water needs of local communities in the Kullu region.

Situated at the foothills, these modest structures source water from freshwater springs, glaciers, under-mountain water networks, rainwater and mountain streams. Freshwater springs in mountainous regions originate when precipitation, such as rain or snow, infiltrates the ground, gradually saturating permeable rock layers. Eventually the water encounters a layer of impermeable rock (bedrock) that impedes further downward movement. Accumulating pressure in this confined space forces the water to seek an exit, typically through cracks or openings in the rock, resulting

Figure 1. Example of a functional *bawadi* at Kolibehar, Kullu
© Madhusudan Singh

in the emergence of a spring on the surface. These springs are a crucial source of clean water for the well-being of both local communities and wildlife. The water in the *bawadi* is also valued for its mineral content.

This water is considered sacred and plays a significant role in cultural practices such as marriage rituals, so has multifaceted importance in the community.

In addition to their utilitarian function of supplying water, *bawadi* also historically served as communal spaces for social interaction and daily routines such as bathing, washing clothes and drawing water for livestock. In the past, entire villages depended on *bawadi* for water. While modern water tanks and pipes now exist, remote villages in Kullu still rely on *bawadi* for their water requirements.

The age-old tradition in the region of creating structures to harness water from freshwater springs illustrates the local traditional knowledge of the region's hydrological conditions, and the ingenuity and sustainable water management techniques of local communities in the Kullu region. The diverse applications of these *bawadi* by the residents exemplify resourcefulness and resilience.

This enduring practice not only ensures a stable water supply but also supports the community's use of *gharat* — traditional watermills that harness energy from flowing water to power grain milling, and thereby provides a sustainable source of energy for local food processing (Bhatt et al., 2021). Together, these interlinked practices constitute a valuable intangible heritage deeply embedded in the cultural fabric of the Kullu region.

Climate change has significantly altered water flows in the Kullu region. The community has observed a noticeable reduction in snowfall, and this reduction has directly impacted the recharge of natural springs that feed the *bawadi.* In addition, erratic rainfall, including prolonged dry spells, has further diminished water supply to the *bawadi*.

The reduction in water availability from the *bawadi* has affected the local community in several ways. Community members who once depended on their local *bawadi* for their daily needs now face challenges, particularly during the winter months. The lack of readily available water also means that agricultural activities, which depend on a consistent water supply, have also been negatively impacted, putting additional stress on residents.

The altering patterns of water flow due to climate change have disrupted the natural supply, compelling communities to transition towards contemporary water tanks and pipes. But with modern water pipelines often being unreliable during freezing temperatures, the resilience of the community has been weakened. The scarcity of water has become a pressing issue.

Climate change-induced water scarcity, combined with the increasing adoption of modern water tanks and pipelines in the Kullu region of Himachal Pradesh, have diminished the relevance of the traditional *bawadi* system. The gradual abandonment of this age-old water management system presents a significant challenge to village communities (Figure 2).

Figure 2. A dried-out *bawadi* in Kullu
© Madhusudan Singh

The transition to modern water supply systems, driven by climate change and evolving urban needs, poses a dual challenge. On one hand, it endangers the continuity of the *bawadi* system. On the other hand, it elevates the vulnerabilities of village communities, exposing them to water scarcity and heightened risk of fire-related hazards.

Objectives and methods

This study examined the significance of the *bawadi* system as a traditional practice and explored how its preservation could contribute to disaster-risk preparedness for local communities. It delved into the delicate interplay between intangible heritage, environmental sustainability and resilience amid contemporary urban challenges.

The objectives of this case study were as follows:

- To examine the historical uses of the *bawadi* system and its cultural and social significance.
- To investigate the reasons behind the gradual abandonment, examining both climate change and modern lifestyle factors.
- To assess the repercussions of replacing the *bawadi* system with modern water tanks.
- To explore strategies for the revival of the *bawadi* system and its potential advantages for disaster-risk reduction and sustainable water supply.

This study used a qualitative research design to explore the cultural, ecological and socio-economic dimensions of the traditional *bawadi* system in the Kullu-Mandi Valley, Himachal Pradesh, India.

Four distinct sites within Kullu-Mandi Valley, namely, Shaleen, Mandi ka Naun, Kolibehar and Kotla, were selected to cover varying environmental and cultural characteristics, ensuring a diverse and comprehensive exploration of the dynamics of the *bawadi* system, and to offer insights into how the system varies in different landscapes and how local communities interact with and maintain the *bawadi* structures.

The primary method of data collection involved interviews with community members, local authorities and other relevant stakeholders in each of the selected areas. These interviews gathered experiences, perceptions and insights into the historical uses, cultural significance and challenges associated with the *bawadi* system.

In addition to conducting interviews, the researchers visited Shaleen, Mandi ka Naun and Kolibehar and observed cultural practices, community interactions and the physical conditions of the *bawadi* systems. These observations allowed for a more contextual understanding of the system, complementing the insights gathered through interviews. Physically visiting these locations also enabled researchers to gain first-hand insights into the variations of the *bawadi* system across the differing terrains in the Kullu-Mandi Valley. This exploration underscored the geographic and cultural diversity present in the valley, revealing how the system meets different challenges.

Document analysis provided a historical and policy perspective on the *bawadi* system. Government reports and other documents related to water management policies were analysed to trace the evolution of water management practices in the region. This method helped to frame the *bawadi* system within broader regional and national water management strategies.

Findings

In village communities in the Kullu-Mandi Valley, the terms *bawadi, nalla* and *kuhl* are generally interchangeable. All of these structures play crucial roles in water management. While these three share the common goal of harnessing water resources, they differ in their construction and functions. *bawadi,* characterized by smaller water-holding ponds, serve as reservoirs to store fresh water for community use, particularly during dry periods. *Nalla* are constructed around small freshwater springs where water emerges due to aquifer saturation, creating open channels on land. Springs are naturally propelled to the surface by forces like gravity and hydrostatic pressure (Figure 3).

Kuhl or *kolhi* are artificial water channels, often carved into hillsides or dug through fields, functioning as shallow surface channels diverting water to collection points (Figure 4). This diversity in structures reflects the intricate water management

Figure 3. Water from a nalla driven to the surface in Shaleen village, Kullu
© Madhusudan Singh

Figure 4. Flowing water in a kuhl at Kolibehar, Kullu
© Madhusudan Singh

practices adopted by these communities.

Below are the specific findings from each field visit.

Shaleen eco-village

The visit to Shaleen in the Naggar block of Kullu District, offered insights into the intricate dynamics of traditional water management systems and contemporary challenges.

Developed under the Model Eco-Village Scheme,[1] Shaleen is a picturesque village in the Kullu-Mandi Valley with traditional *kathkuni* houses,[2] apple orchards, cedar/deodar trees and mountains. However, the impact of climate change is being felt. As of January 2024, the region had still not experienced the winter season's first snowfall (Government of Himachal Pradesh, 2024).

As part of an eco-development scheme, the government attempted to revive the *bawadi* water management systems in Shaleen. Unfortunately, villagers have witnessed a decrease in water supply since this development due to several factors. One is the reduction in snowfall. Previously, snowfall would reach between 8 feet and 10 feet in depth and persist for between 4 months and 4.5 months, covering the surrounding mountain peaks. Currently, snowfall is generally only between 1 and 2 feet in depth and lasts for only 1 or 2 months, substantially reducing the recharge of the natural springs that feed the *bawadi.*

Construction activities and other human interventions have also played a role in altering the natural pathways and catchment areas that support the *bawadi*, further exacerbating the decline in their water supply.

The village received electricity and water pipelines in 1978, and the community has gradually shifted towards the convenience of piped water over the

1 The Himachal Pradesh Model Eco-Village Scheme of 2017 aims to promotes sustainable development by building resilient communities. It focuses on water conservation, climate change mitigation, forest cover preservation and sustainable agriculture. It encourages community participation, integrates local traditional practices and aims to create environmentally sustainable and economically prosperous villages.

2 *Kathkuni* is a traditional architectural style native to Himachal Pradesh, characterized by the use of wood and stone. This ancient construction technique involves stacking alternate layers of these materials without the use of mortar, creating structures that are highly resistant to seismic activity. The interlocking of wooden beams with stone allows for flexibility and stability, making *kathkuni* houses both durable and well-suited to the region's mountainous terrain. This architectural form is not only functional but also holds cultural significance, reflecting the local artisanship and adaptation to the harsh environmental conditions of the Himalayas.

traditional practice of drawing water from *bawadi* (Figure 5). With increasing dependence on modern water pipelines, few community members rely on *bawadi* for their daily water needs today, diminishing the overall value of the *bawadi* to the community. As a result, the structures that were redeveloped in recent years have been neglected. Lack of regular cleaning and maintenance has caused these traditional structures to be abandoned once again.

Historically, *bawadi* were essential for daily tasks such as cooking, cleaning, agriculture and cattle raising. Today people use *bawadi* during conditions of extreme cold, when modern water pipelines freeze. Their temperature resilience is a key factor that makes *bawadi* an essential water source in harsh conditions.

Figure 5. Water pipelines for tap water, installed at Shaleen eco village
© Madhusudan Singh

*Mandi ka Naun b*awadi system

The Mandi ka Naun *bawadi* system, situated within the bustling market sector of Mandi, stands as one of the few remaining traditional water sources in the area. The *bawadi* itself, now covered with algae, coexists with a larger pond (*talaab*), which has shifted

Figure 6. A woman washing clothes at Mandi ka Naun *bawadi*, Mandi District
© Madhusudan Singh

from being a bathing area to a water storage basin. The local community, largely consisting of migrants from Rajasthan and Gujarat, uses the *bawadi* as a source of water for domestic uses, including cleaning and washing, but this *bawadi* is no longer a source of drinking water (Figure 6). Annual efforts are made to keep the *bawadi* clean, but a persistent smell is emitted from the water even after purification.

In emergencies, such as the 2023 floods that caused the failure of the modern water supply pipelines, the community turned to the *bawadi*. This highlights the continued importance of traditional water sources.

Kolibehar gharat, kuhl and *bawadi* system

Kolibehar has an interesting mix of historical water management structures, combining an abandoned *gharat* and a functional *bawadi* (Figure 7). The *gharat*, an old watermill once used for grain milling, is no longer in use, but the structure and internal components, including the wheels and pulley systems, remain. Adjacent to the *gharat* lies the

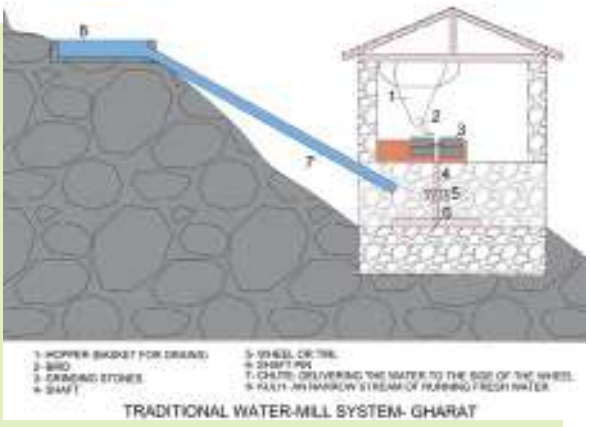

Figure 7. Drawing of a traditional *gharat* system
Source: Drawing by Samanata Kumar, FOLK

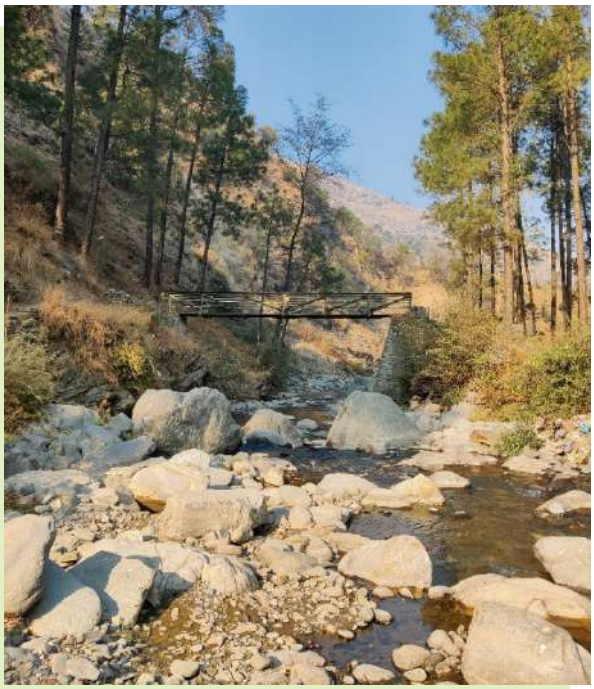

Figure 8. A creek (a water channel smaller than a river) near the Kolibehar Bawdi, Kullu
© Madhusudan Singh

bawadi, which continues to serve as a vital water source for both Kolibehar and Mohul/Mohal, which receive water via pipelines. This coexistence of ancient and contemporary water supply technology, shows how harmonious integration of old and new can help to ensure water accessibility for all.

The maintenance and cleaning of the *bawadi* is a collaborative effort between government officials in charge of modern water supply pipelines and the community, highlighting the shared responsibility for preserving these vital traditional water sources.

During the floods in July and August 2023, a nearby creek called Dohara Nala (Figure 8). flooded, but the *bawadi* continued to supply clean water to the community.

Insights from the Kotla village fire incident, 2015

The *bawadi* system was historically a key part of disaster risk reduction strategies in the Kullu region. Earlier, people constructed *bawadi* outlets to store water, and this water was directed as needed during emergencies like fires. These tanks were vital in hilly terrain and other places where building larger water storage systems inside villages was not feasible. The *bawadi* and associated water tanks provided a decentralized, reliable water supply that was crucial during disasters, emphasizing the importance of maintaining these traditional systems for local resilience. With the introduction of modern pipelines, these natural water tanks were gradually abandoned. However, this has diminished the community's ability to respond to emergencies.

A fire incident in the remote village of Kotla in the Kullu-Mandi Valley (Figure 9) serves as an important reminder of the critical role traditional water sources like *bawadi* play in disaster risk reduction. In 2015, a massive fire broke out in Kotla. The remote location of the village, on top of a hill, and the narrow access roads, exacerbated the fire's impact, as the fire fighters could not reach the location quickly (UNDRR, 2019). The lack of water in the local *bawadi* increased the firefighting challenge as a result, there was substantial fire damage. Extensive damage was caused to traditional *kathkuni* houses and a revered temple of the local community.

The lack of water in the local *bawadi* at the time was primarily due to the ongoing neglect and lack of maintenance of the the *bawadi* system. Over time, in many villages the shift to modern water pipelines has meant that traditional water structures like *bawadi* have been increasingly abandoned. Without regular cleaning and upkeep, the water flow in these systems is disrupted, rendering them ineffective to store water for emergencies such as fires. Additionally, climate change impacts such as reduced snowfall and altered precipitation patterns have further exacerbated the problem by decreasing the water recharge from natural sources.

Figure 9. Kotla village after the fire in November 2015 that gutted the entire village
© Madhusudan Singh

This fire incident demonstrates the vulnerability of remote villages that have diminishing traditional water sources. The damage to Kotla village from the fire was exacerbated because the traditional *bawadi* system was no longer in use. It had once served as a reliable water source for the community and in the past, it would have provided an accessible supply of water for firefighting.

The neglect and abandonment of the *bawadi* left the village without a critical resource during the fire. This explains why it is important to maintain traditional water systems like *bawadi*. They are valuable not only for meeting daily water needs but also for disaster preparedness and risk reduction, especially in remote mountainous regions that lack modern pipes and water storage facilities.

The abandonment of these *bawadi* systems has weakened the community's resilience to natural disasters. The Kotla incident thus underscores the importance of reviving traditional water sources as a means of improving disaster risk preparedness.

The subsequent construction of drivable roads and modern water tanks to address the challenges in Kotla introduced a large carbon footprint, an unintended consequence that might have been avoided if the traditional *bawadi* had been intact. This presents an additional dimension to the environmental impact of altering age-old practices.

Discussion: Impact of climate change and modernization

The case studies reveal the *bawadi* system's multifaceted role in water management, community resilience and disaster risk preparedness, in the context of climate change and modernization. As a sustainable water management practice, the *bawadi* system embodies an enduring intangible heritage, interwoven with the lives of the people in the Kullu-Mandi Valley. The *bawadi* system, deeply rooted in the hydrological landscape of the Kullu-Mandi Valley, holds profound cultural and ecological significance for the communities in Himachal Pradesh. This traditional water management system, involving *kuhl* and *nalla* channels and *bawadi* reservoirs, reflects significant traditional knowledge of the region's conditions.

However, the *bawadi* system is currently under severe threat, facing multiple challenges stemming from both environmental and societal changes. Climate change has altered rainfall patterns, disrupted the seasonal recharge of freshwater springs and led to longer droughts, making the natural flow of water increasingly unreliable. These environmental shifts have diminished the water supply available in *bawadi*. Concurrently, the growing reliance on modern water tanks and pipelines is accelerating the abandonment of traditional water management systems. Modern solutions, although efficient in certain contexts, often lack the localized, sustainable benefits inherent in the *bawadi* system, such as groundwater recharge and decentralized water access. As communities gradually adopt these new technologies, there is a risk of losing the invaluable cultural knowledge embedded in the *bawadi* practice. The erosion of this system not only jeopardizes water security but also increases vulnerability to fire-related hazards, especially in areas where modern water tanks are not widely installed, and weakens the social fabric, which has long relied on shared responsibilities in water stewardship. These cumulative pressures demand urgent attention. It is important to balance modern needs with the preservation of this ancient community-based water management practice.

In Shaleen, despite government-led efforts to revive *bawadi*, the community has experienced a decline in water in the *bawadi*, which is an indication of the broader impacts of climate change. The introduction of modern water pipelines, while intended to improve access to water also reduced the significance of traditional water structures, making the community more vulnerable. This demonstrates a common challenge: modernization, often seen as progress, can sometimes undermine resilient practices honed over generations. *bawadi,* once resilient during harsh winter conditions and crucial in emergencies, now face existential risks, leaving communities more vulnerable to future water scarcity.

The Mandi ka Naun *bawadi* illustrates the adaptability of these systems as they continue to serve domestic needs despite changing environmental and infrastructural conditions. The practice of community members keeping the *bawadi* clean demonstrates their connection to this traditional water source. In moments of crisis, such as floods and droughts, when modern infrastructure fail to supply drinking water, the community can often

turn instead to their *bawadi* for daily needs because that *bawadi* is cleaned and maintained regularly. This is a powerful example of how a *bawadi* can function as a decentralized safety net in the face of climate-induced risks.

The coexistence of traditional and modern systems in Kolibehar provides an example of the connection between heritage and modernization. Although modern water pipelines now serve the community, the *bawadi* remains an emergency backup. This case demonstrates the value of traditional systems and the risk of losing irreplaceable knowledge amidst modernization.

The presence of an abandoned *gharat* beside the functioning *bawadi* symbolizes the gradual erosion of traditional knowledge, even as some elements of this water management system continue to provide vital services.

The 2015 fire in Kotla village is a stark reminder of the critical role *bawadi* play in disaster risk reduction. In remote regions, where modern infrastructure cannot be relied upon, the presence of functional *bawadi* can be lifesaving. The fire revealed that when traditional water sources are abandoned as a result of the shift toward modern infrastructure, a village's vulnerability is heightened, particularly in the face of climate change and the increased threats it poses.

When modern systems like roads and water tanks are introduced, it should be noted that they bring unintended environmental consequences, such as increased carbon footprints. This highlights the need for a balanced approach that revitalizes traditional, low-impact water systems while meeting contemporary needs.

Together, these case studies highlight the link between *bawadi* and climate resilience. They show that while modernization introduces efficiencies, it often erodes traditional systems that are finely attuned to local conditions. As climate change progresses, it is intensifying water scarcity and disaster risks, so the revitalization of *bawadi* represents not only a cultural imperative but also a practical strategy for bolstering community resilience in the face of an increasingly uncertain future.

Recommendations

The following recommendations are proposed in the context of preserving and revitalizing the traditional *bawadi* system, which is essential for both water security and disaster risk reduction in the mountain region of Kullu-Mandi Valley. They are addressed to local government authorities, community leaders and environmental agencies responsible for sustainable water management in the region. These stakeholders need to act collaboratively to ensure the integration of traditional systems with modern infrastructure for greater resilience.

Document the *bawadi* systems: It is recommended that the *bawadi* systems be systematically identified and documented, including noting their geographic coordinates, and that groundwater levels at each *bawadi* be measured. This will enable early detection of declining water levels and the risk of a *bawadi* drying out. Such documentation offers essential data for informed water resource management.

Map the local water channels: A comprehensive mapping of the small water channels, known locally as *nalla*, is recommended. It should be noted that some of these channels have remained devoid of water replenishment for extended periods, and insights from the community, especially elderly residents, suggest a potential risk of floods upon their revitalization. A mapping initiative can serve to predict potential flood-prone areas. This proactive approach aligns community insights with scientific data, contributing to a more resilient water management strategy.

Preserve community knowledge and oral history: The rich insights and oral history embedded in the local communities of Kullu, particularly the elderly residents deeply connected to the region, represent an invaluable cultural and scientific resource. Recording these insights, especially concerning the seasonal flow and functions of water bodies, is crucial for preserving indigenous knowledge of traditional water management systems including *bawadi* and ensuring the sustainable use of natural springs, and the continuation of traditional construction techniques and seasonal water management practices, which are essential for community resilience in the mountain region. Beyond its cultural significance, this recorded wisdom becomes a vital dataset for future research endeavours.

Incorporate indigenous wisdom into water policies: Actively involve local communities in the formulation of water policies, ensuring their traditional knowledge and insights are integrated into decision-making processes. This inclusive approach contributes to culturally sensitive and effective water resource management strategies.

Promote interdisciplinary research collaboration: Interdisciplinary collaboration between scientific communities, local residents and cultural experts can provide holistic insights into the ecological, cultural and socio-economic aspects of traditional water systems, contributing to more informed decision-making. Such interdisciplinary partnerships can inform more effective preservation strategies, ensuring that both the ecological and cultural aspects of *bawadi* are taken into account in future decision-making processes.

Initiate capacity building programmes: Such programmes would empower local communities with the knowledge and skills necessary to sustainably manage and maintain traditional water systems. Such training should include the topics of water conservation, eco-friendly practices and disaster preparedness. The programmes can be led by local governments, NGOs, community-based organizations and academic and research bodies.

Acknowledgements: The authors would like to acknowledge the contribution of Ms. Samanata Kumar, an intern at FOLK and a Master in Heritage Management student at Ahmedabad University, and Ms. Lalita Waldia, a Field Researcher at FOLK in terms of assistance in the field and data collection.

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Exploring the Heritage Aspects of Indigenous Knowledge in Sustainable Use and Management of Forest Resources in the Context of Climate Change: A Case Study from the Black Hani People in Lao Cai Province, Viet Nam

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Introduction

Climate change is a pressing global issue that significantly impacts both tangible and intangible cultural heritage (ICOMOS, 2019). The impacts of climate change include changing weather patterns and increased frequency and severity of extreme weather events, which pose serious threats to the preservation and sustainability of cultural heritage sites and practices. While much research has been done on the impacts of climate change on tangible heritage, there is a need to give greater attention to the impacts on intangible cultural heritage (ICH), which includes traditions, practices and values transmitted across generations (Crowley et al., 2022; Pasikowska-Schnass, 2024).

Among ICH practices, the use of forests and plants holds a significant place (Falconer, 1990; UNESCO, 2015; Orlove et al., 2022). This ICH includes knowledge, skills and practices developed over time to use plants for various purposes including in medicine, food, textiles, construction and spiritual rituals. Such knowledge is essential for advancing research on the complex interplay between plants and people, conserving biodiversity and aiding in the protection of diverse ICH.

The preservation and sustainable use of natural resources are crucial in the face of climate change, especially for indigenous communities (Kim, 2011; Higgins, 2022; Pearson, Jackson and McNamara, 2023). The cultures and lifestyles of Indigenous Peoples are closely linked to the environment and because of this they are particularly vulnerable to environmental changes. Indigenous people are often considered "at-risk" populations, even though they have resilience to external environmental catastrophes, which is rooted in their robust traditional knowledge (Ford et al., 2020). Understanding this strength can provide valuable insights into how other communities can adapt to changing climate patterns and environmental stressors (Fatoric and Seekamp, 2017; UNEP, 2020).

Viet Nam is regarded as one of the most vulnerable countries in Asia to climate changes (USAID, 2023; World Bank, 2024), with deforestation being one of the most severe drivers of impact (Khuc et al. 2018; The Grantham Institute 2023). While there has been rampant deforestation in most regions of Viet Nam (Chu, 2021; Do and Bui, 2023), the forests in the Y Ty district of Lao Cai Province are still maintained, thanks to the strict forest management regulations and practices of the "Black Hani" community (hereafter called the "Hani").

Although the Hani have faced challenges associated with deforestation, they have developed perspectives and practices that aid in the sustainable use and management of their forest resources. These traditions include the perception of a connection between humans and environment and a sophisticated set of community laws governing the use and maintenance of resources. The Hani people's tradition of selecting *Rung thieng and Rung cam* (Sacred/Holy and Forbidden Forests) to avoid over-exploiting these forests and designating watersheds as 'holy' to safeguard water resources, has proven immensely beneficial to the community. Learning from the Hani's practices has provided insights when examining the repercussions of floods, droughts and the degradation of agricultural land due to disasters caused by watershed degradation, which is prevalent in several regions of Viet Nam.

The Hani

The Hani people are a Tibeto-Burman ethnic group, and most are located in the People's Republic of China. In Viet Nam, they are called *Hà Nhì*, and they are one of the 54 officially recognized ethnic groups in the country. They have a population of about 26,000 in Viet Nam, predominantly residing in the provinces of Lao Cai (Bat Xat District) and Dien Bien (Muong Te District). The Hani community participating in this case study live in the Y Ty commune of Bat Xat District, Lao Cai Province (Figure 1). This community has a population of about 4,000 people. Their ancestors are believed to have emigrated to Viet Nam about 180 years ago (Luu-dam, Bui and Sumimura 2016). Within the district, they account for 54.2 per cent of commune's population and eight of the sixteen villages. Like other underdeveloped communities in northern Viet Nam, the Hani face economic struggles, but they have implemented stringent regulations and practices to ensure the protection and sustainable use of their forests and water sources. These regulations and practices are part of the Hani's distinctive intangible cultural heritage.

Case study

Traditional knowledge offers significant potential for assisting in mitigating the impacts of climate change (Fatoric and Seekamp 2017; Chu 2021), so this study aimed to contribute to the documentation of such traditional sustainable knowledge and practices, particularly those related to the use and management of forest resources.

The Hani community in Y Ty commune was the subject of substantial research by the authors between the years of 2012 and 2016. During this period, we examined the heritage elements of the community's forest resources, notably the forest management in the context of climate change. Our study focused on the Hani's knowledge and practices of forest use and safeguarding, especially of flora, with the aim of understanding the Hani group's concepts of forest management.

We explored how they designate their sacred forests, including the watersheds, in order to safeguard forest and water resources and their villages, and the various customary laws and spiritual cultural values placed on the forests. Ultimately, we aimed to record cultural aspects affecting the use and sustainable management of resources in the

Figure 1. Choan Then Village, Y Ty Commune, Bat Xat District, Lao Cai Province. (Latitudes 22° 37′ 17″ (N) - Longtitudes 103° 37′ 04″ (E) - Height 1700 - 1800m)

community. From this knowledge, further values and methods for safeguarding ICH could be developed and implemented to help the community become more adaptive and resilient to climate change.

The case study employed a mixed-methods approach (Abbass, 1999; Luu-dam and Ninh, 2016) including qualitative interviews, participatory observations, botanical surveying and focus group discussions with members of the Hani community. The semi-structured interviews included questions related to the plants used by the Hani community and the processing techniques used, and questions about the respondents' experience and knowledge of forests and plants, as well as their perceptions regarding the importance of protecting sacred forests and watershed forests (Figure 2, 3). Picture cards featuring images of dye plants were shown to informants to determine local knowledge of these plants. Researchers spent extended periods on field trips, immersed in daily life to develop rapport and trust with community members, and they visited the forests to identify specimens and develop a comprehensive list of plant species that had uses in the daily life and cultural events of the community and to collect documented dye plants.

Interviewees included commune officials, village leaders, leaders of forest protection groups and families. Before the interviews, the purpose of the study was explained to the participants, and the participants signed consent forms to participate in the research.

The participants displayed a remarkable level of openness and approachability when it came to interviews and sharing their knowledge. While the women, who are primarily responsible for numerous household tasks, appeared to be more reserved and hesitant when approached, we were able to resolve this by involving their husbands, and we created an environment where they felt comfortable enough to engage in lengthy and fruitful conversations. This allowed us to delve deeper into their personal stories and tap into their specific knowledge, enriching our understanding of their culture and way of life. Our strong rapport with the village chiefs greatly facilitated our interactions and ensured a smooth flow of information. By incorporating cultural aspects into the research, it was possible to demonstrate that resource management is not merely a practical task but an integral part of the community's cultural identity. The interpretation of cultural significance can differ vastly across generations and individuals within the community, however.

Findings

The vital role of plants in shaping the Hani's ICH: An inventory of forest resource use

The Hani people use plants and forests in their daily life and cultural practices, and these plants and forests are intertwined with Hani identity. Our study documented ninety-six plant species (in fifty-three families) used by the Hani group in Y Ty commune. These plants are used for various purposes, including as medicines (forty-four species), food (forty species, including eight used as food for pigs)

Figure 2. The PI interviewing a community member at Choan Then village
© Van Huong Bui

Figure 3. Field survey in the forest in Y Ty, where plant and water resources are still safeguarded by the whole community
© Ngoc Anh Luu Dam

and as part of spiritual practices including worship and festivals. While the uses of plant species by the Hani in Y Ty commune are similar to the uses made by other ethnic minority groups in Viet Nam, the conceptualization and use of resources by the Hani are distinctive.

Edible plants used by the Hani people include beans, vegetables and spices (Figure 4). They grow rice and do not use wild plants such as wild yam (*Dioscorea* spp.) and giant taro (*Alocasia* spp.) as food. Some plant species (*Begonia* spp., *Gardenia* spp.) are used to create tofu, which is considered by the Hani as an important traditional food for holidays, house construction ceremonies and weddings. The Hani crush edible leaves and rinse them with water to produce a mixture used to ferment and prepare tofu.

Medicinal plants are used to treat various conditions, including epilepsy, arthritis pain, bone fractures, snake bites, digestive issues and allergies. Specifically, twenty-eight plant species are used for bone pain. Arthritic pain and bone fractures are prevalent due to living in harsh weather conditions and hazardous terrain. Medical facilities are in short supply in the region, therefore, knowledge of how to use medicinal plants is highly beneficial and practical to the Hani people. In Y Ty commune, there is only one person who possesses the knowledge required to use medicinal plants for treating bone fractures. The method is to crush the specific medicinal plants, then wrap them in a cloth and heat them, then apply the warm poultice to the affected area repeatedly.

The Hani have a practice of cultivating cotton to obtain thread to make dark-indigo coloured traditional clothing (Figure 5,6). Each Hani household selects a preferred spot to plant cotton. Woven material is dyed in Indigofera solution using Assam indigo (*Strobilanthes cusia*). In the dyeing process, the textile is boiled in the dye with rice bran or corn powder to fix the colour on the cotton fabric. This method of using fixing agents is similar to that used by the Dao group in Ta Phin commune, Sapa, Lao Cai Province.

Plants are also used for spiritual purposes. According to one of the interview participants, sacred plants include the Assam Apple (*Chua chát*) – *(Malus indica* (Wall.) Decne) and Himalayan Alder (*Tống quán sủi*) – (*Alnus nepalensis* D. Don). This is because they have many leaves and bear fruits that symbolize wealth. The Hani groups also believe that Mountain Wampi (*Randia canthioides* Champ. Ex Benth) can protect them from the ghosts of forest. In the sacred forest, they often place an altar for the forest god under the trees.

Documentation of the Hani's forest management mechanisms as ICH

The Hani people's capacity in forest protection and management stems from their knowledge of the forest. This knowledge is grounded in their practical experience in the forest and is also passed down from generation to generation.

There are three types of forests in the areas that are inhabited by people. The first type, economic forests, are planted for economic purposes, with Cardamon being a commonly planted species. Economic forests are invested in and managed by households. The

Figure 4. Preparing dinner with cultivated beans, Choan Then village, Y Ty commune, Bat Xat District, Lao Cai Province.
© Ngoc Anh LUU DAM

Figure 5. Dark indigo – the traditional colour of the Hani group.
© Ngoc Anh LUU DAM

Figure 6. Dark indigo – the traditional colour of the Hani group.
© Ethnicity and Development Newspaper (baodantoc.vn)

second type, communal forests *(li lo xa cha)*, are used by the community, providing essential materials for households. This type of forest is often large and includes both old-growth and regenerated trees. The communal forests in Y Ty commune has a total area of around 6000 ha, and is a source of wood for house construction and firewood, and is a source of medicinal plants and vegetables. The use of communal forest resources is managed under the community's general policies and rules. The third type is the sacred or forbidden forests. The Hani perceive these forests as supreme beings. The Hani do not hold worship days for their ancestors but perform a ceremony worshipping the forest gods. In addition, people pray to the forest's guardian god and request permission before cutting down trees or collecting firewood from the sacred forests. The Hani also believe that plants have a soul.

In the Hani villages in Y Ty commune, there are four types of sacred forest (Figure 8), including:

- ***Ga ma do*** (God-worshipping forest): A sacred forest whose god protected the lives of villagers. It is located in the upper basin of the village. The Hani group never build their houses higher than this forest.

- ***Mu thu do*** (Goddess-worshipping forest): A sacred forest whose goddess encouraged the flourishing of both crops and human reproduction. The *Mu thu do* forest is believed to bless the village with abundance. It is located on the left side of lower basin of the village.

- ***Thu ty*** (God-worshipping forest): A forest worshipping the Earth god, as well as the founders and ancestors of the village. It is situated on the right side of the village.

- ***A go la do*** (entertaining forest): Although there is

Figure 7. Collecting plants for feeding pigs (*Colocacia esculenta*, etc.).
© Ngoc Anh LUU DAM

Figure 8. The forbidden forests in Y Ty commnue, Bat Xat District, Lao Cai Province
© Ngoc Anh Luu Dam

no designated god in in this forest, the Hani people still consider this forest a holy site. Activities that exploit the resources of the forest are prohibited. It is located near the road leading into the village.

The Hani people's spiritual lives and livelihoods are deeply entwined with the forest resources. The relationship between the Hani people and the forest can be defined by the concepts of "respect" and "friendship". They always think carefully before using forest resources. This spiritual concept plays an important role in forest protection.

In the context of adaptation to climate change, the locations of the *Ga ma do* and *Mu thu do* forests are scientifically significant (Figure 9). The *Ga ma do* forest, at the upper edge of the village, protects the water resources of the village and helps to regulate the local weather and prevent erosion and landslides. The *Mu thu do* forest, at the lower edge of the village, regulates the water flow to the rice fields and prevents erosion of sediment that could damage the rice fields.

Thanks to the Hani's system of safeguarding the forests, which are located in important positions around the village, for many years these forests have contributed to keeping the community safe from disasters, such as floods and landslides, which plague other mountainous communities of Viet Nam.

Hani customary regulations: A model for community-based conservation

The village regulations of the Hani groups honour local beliefs and ensure adherence to national forest management guidelines. The local community has ownership of the forests, and considers them as valuable assets that require protection. To ensure the proper management of these forests, each Hani village appoints forest leaders annually; they are responsible for overseeing worship ceremonies and safeguarding the forests. The community nominates five to six individuals for this role, with the requirements that the chosen leaders must be

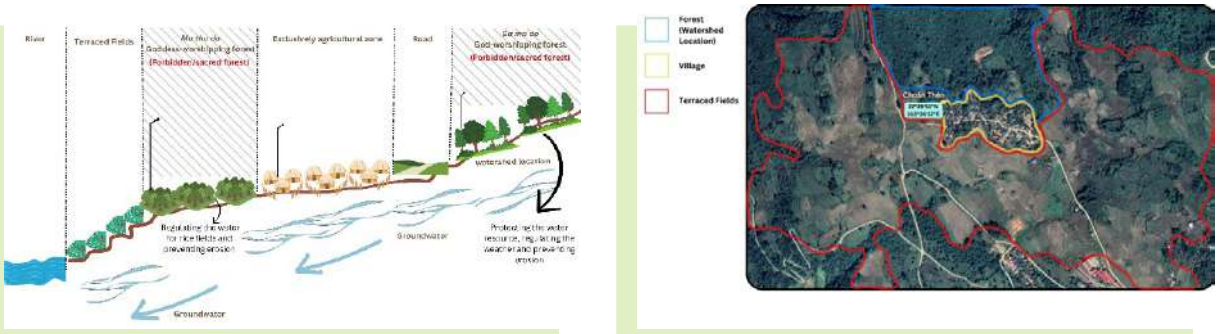

Figure 9. Visual presentation of a traditional Hani village, showing the placement of sacred forests
© Anh-Thu DINH

reliable and in good health and have healthy children and a contented family.

Harvesting forest products is strictly regulated, and the forest leaders have the authority to decide whether or not there is a need for additional plantations and to prevent tree felling. Villagers are only permitted to enter the forests on designated "forest days" and during specific forest opening events. On these occasions, they are allowed to collect fallen branches from the ground. On regular days, if villagers come across branches or twigs outside the forbidden and sacred forests, they are expected to return them to the forest. These regulations benefit both the community and the individual households. Moreover, the regulations help to protect the forests in accordance with national laws.

Punishments are imposed for breaking the rules. For example, those who cut down trees in the community forest without permission from the forest managers must make an offering of 36 kilograms of pork, 36 litres of alcohol and 20 kilograms of rice. They also need to provide food for the community members who witness the punishment ceremony. If they fail to give these things, then they are no longer allowed to attend the ceremony for worshipping the forest god. This is the highest level of punishment, so villagers do not dare to break the rule again or to refuse to offer sacrifices. The punishment combines material values (pork, alcohol and rice) the spiritual concepts (prohibition of attendance at the worship ceremony) and is effective in preventing people from breaking the rules.

The practice of worshiping sacred forests has been maintained for many generations and is integral to the distinctive cultural identity of the Hani people. Knowledge of forest management has helped them to protect their villages, regulate their water resources and create a cool microclimate in the village. Other areas near the community, where forest management is not practiced, are bare lands with very high temperatures and where it is hard to make a living.

Since the completion of the study in 2016, the authors have continued to monitor and reflect upon the evolving dynamics within the Hani community and between them and their forests. This ongoing engagement has provided valuable insights into the adaptation strategies employed by the Hani as they encounter the dual pressures of economic development and climate change. By continuing their traditional practices, the Hani have managed to protect their forests and avoid over-exploitation of resources. Recent observations indicate a growing recognition among both the Hani community and governmental entities of the importance of preserving indigenous knowledge and practices as fundamental components for building climate resilience.

Recommendations

The traditional knowledge and ICH practices of the Hani people in the management of forests and use of forest resources, including their spiritual beliefs and community-based rules and agreements, are highly effective in protecting forests and increasing community resilience to the adverse effects of climate change. Our case study confirmed the importance of respecting and safeguarding indigenous knowledge systems. This should be done via both legal recognition and regional and national support for the transmission and promotion of indigenous knowledge to younger generations. We make the following recommendations.

Document local ICH: These ICH values should be recognized and documented. It is necessary to continue collecting data through interviews, recording oral histories, videos and photographs, etc., and to document landscapes and community change, to ensure an up-to-date repository of ICH.

Disseminate these values to a wider audience and enhance knowledge about the role of forests in water management. It is essential to foster understanding and encourage action for conservation. For example, community-based training programmes and workshops in collaboration with educational institutes and cultural organizations can bring together scientific expertise and local knowledge to teach sustainable land and water management practices, with a focus on traditional methods. Through comprehensive training programmes, individuals can gain a deeper understanding of the ecological and water-management functions performed by forests. It is also important to recognize the roles of forest leaders appointed by

the community, and to promote the coordination between forest management authorities rangers and the village-level forest leaders. These initiatives can communicate the significance of watershed forests in protecting land and water resources.

Actively promote forest protection practices, including planting of medicinal and other plants in home gardens, to prevent the overexploitation of forest resources. According to the guidelines outlined in governmental legislative documents (Government of Viet Nam, 2022, 2023) the Law on Investment, the Law on State Budget, aiming to elaborate several Articles of the Law on Environmental Protection (LEP, the government has imposed restrictions on activities such as mining and hunting, which can have detrimental effects on the environment, including forests. Encouraging individuals to actively participate in home gardening can provide a sustainable alternative to collecting plants from forests. Plant breeding and cultivation in home gardens not only help in preserving species in watershed forests but also contribute to the overall well-being of the ecosystem. By emphasizing the importance of these practices, a harmonious balance between human activities and the conservation of watershed forests can be created.

Promote cross-sector coordination: In order to address the complex impacts of climate change on communities and their ICH, it is important to have cross-sector coordination and planning and joint actions.

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Dzud and Climate Change and their Links with Intangible Cultural Heritage in Mongolia

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Galbadrakh Enkhbat is the Director of Mongolia's National Center for Cultural Heritage. A museum methodologist and cultural heritage expert, his research focuses on heritage registration, preservation of Rashaan Rock Art, and climate risk assessment. He has authored over 20 publications, including *Historical and Cultural Immovable Properties in Mongolia* (1999), *Role of the Center for Cultural Heritage* (2015), and collaborative works such as *Registration Database for Cultural Heritage* (Japan, 2015) with Chinese, Japanese, and Russian scholars. His PhD thesis examined risks to cultural heritage, and he now investigates climate impacts on heritage preservation.

Dzud and Climate Change and their Links with Intangible Cultural Heritage in Mongolia

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Background

Mongolia is known for being a nation dominated by its vast grassy steppes, with around 80 per cent of the country's 1.6 million square kilometres being pasture land and arid rangelands. Less than 1 per cent of the land is classified as arable, between 8 per cent and 10 per cent is forest and the remainder is desert (National Statistics Office of Mongolia, 2022).

Given this landscape, animal husbandry has long been the key source of livelihoods in rural communities in Mongolia and livestock are key assets in those communities (MET, 2024). While there has been a sharp decline in livestock herding in recent decades, it remains an important part of the Mongolia's economy, society and culture. As of 2021, herding accounted for approximately one third of employment, and livestock accounted for about 63 per cent of rural households' assets (National Statistics Report, 2022).

Mongolia has one of the harshest climates in the world. The country has an extreme continental arid climate. Its summer lasts only two months, but it has a long winter with temperatures that can drop to minus 50 degrees Celsius. The short summers

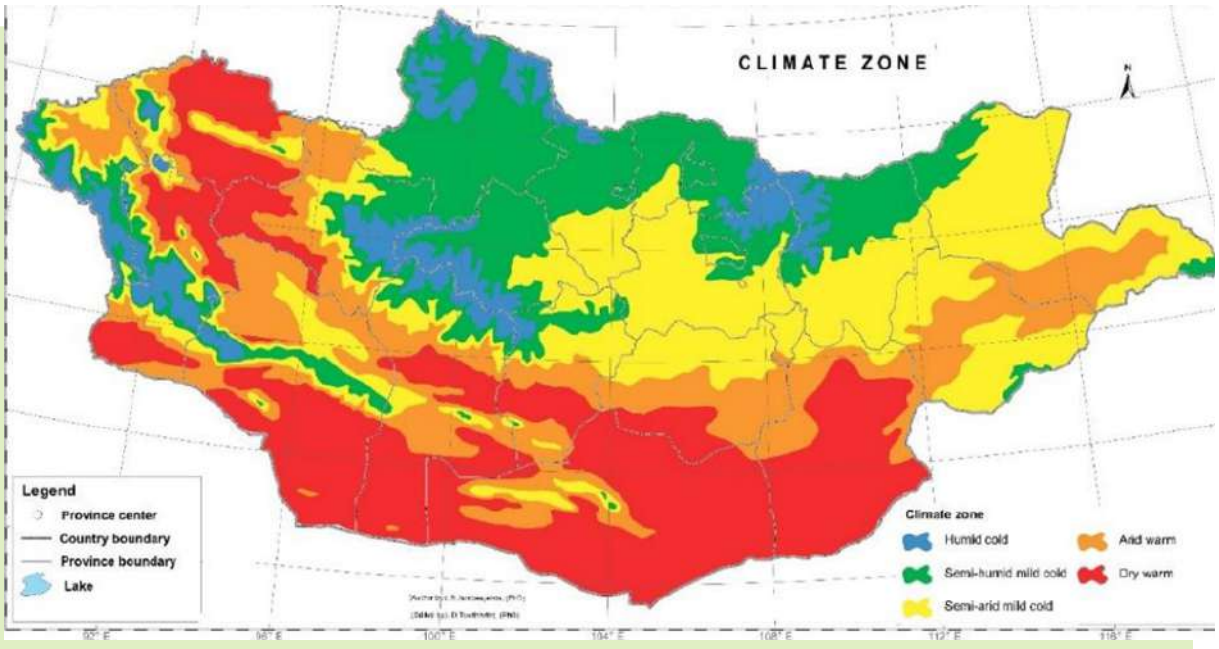

Figure 1. Climatic zones of Mongolia
Source: Munkbat B. et al., 2018

are when most precipitation occurs. The country has five climatic zones: humid cold, humid cool, arid cool, arid warm and dry warm (Figure 1).

The country's weather is variable and unpredictable, particularly in the summer months. Average long-term meteorological data often obscure significant fluctuations in precipitation levels, frost occurrence and the frequency of blizzards and spring dust storms.

Climatic hazards in Mongolia include extreme temperature variations, severe storms, droughts, forest fires, snow and dust storms, flash floods and *dzud* (extreme winter conditions, including severe cold, ice and heavy snowfall).

The phenomenon of '*dzud*'

This paper examines the phenomenon known as *dzud* — describing how climate change contributes to the frequency and severity of *dzud* and related climatic hazards, and examining its impact on intangible cultural heritage — with the aim of better understanding the complex relationship between climate change and cultural heritage preservation.

Dzud is an extreme weather event in which temperatures plummet below -46°C with severe winter conditions and often copious amounts of snow.

Mongolians recognize five types of *dzud*, as described below (Hahn, 2017).

- ***Tsagaan* (white) *dzud*.** This results from heavy snowfall, which prevents livestock from reaching the grass under the snow. The livestock are therefore unable to eat, and they die.
- ***Khar* (black) *dzud*.** This results from a lack of snowfall in grazing areas, leading to both livestock and humans lacking water. This type of dzud mostly happens in the Gobi arid rangeland region.
- ***Tumur* (iron) *dzud*.** This results from a short period of warming during winter, followed by a return to sub-freezing temperatures, resulting in snow melting then re-freezing and producing an impenetrable ice layer that prevents livestock from grazing and drinking. It also results in flooding in spring when the ice melts.
- ***Khuiten* (cold) *dzud*.** This occurs when the temperature drops to very low levels for several days and there are strong winds. These

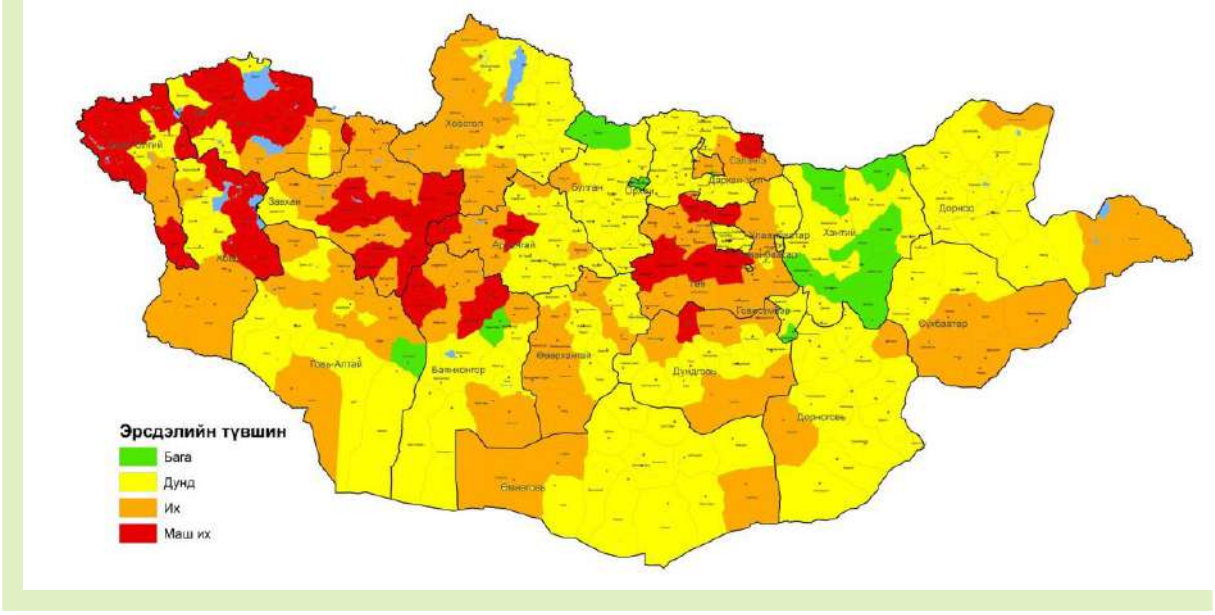

Figure 2. Map of *dzud* risk in 2024–2025
Source: Hydrometeorological and Environmental Research and Information Institute, Agricultural Meteorological Research Department

conditions prevent livestock from grazing; the animals have to use most of their energy to keep warm.

- ***Khavsarsan* (combined) *dzud*.** This is a combination of other types of *dzud*, and normally includes heavy snowfall and a sudden temperature drop.

Dzud is a risk in most parts of Mongolia (Figure 2) and can have significant economic and social impacts. A *dzud* becomes a serious disaster when it causes mass livestock deaths. For herders, a *dzud* is not just a harsh winter, but is often a life-altering crisis that can lead to poverty and long-term economic instability.

The impacts of climate change in Mongolia

Globally, climate change is resulting in an increase in the frequency and severity of extreme weather events. Mongolia is among the countries most vulnerable to climate change.

An evaluation published in 2021 by the International Federation of Red Cross and Red Crescent Societies (IFRC) projected the following impacts of climate change in Mongolia.

- Temperatures are expected to rise at a rate that exceeds the global average. (Certain)
- Significant warming and drying conditions will persist. (Certain)
- Heightened temperatures will increase the frequency and severity of heat waves and droughts, particularly in Mongolia's southern and southwestern regions. (Likely)
- Changes in seasonal weather patterns are expected to become more pronounced and impact negatively on agricultural cycles and natural ecosystems. (Highly likely)
- The phenomenon of *dzud* is predicted to occur with greater frequency and intensity, placing additional strain on livestock and herders. (Highly likely)
- Extreme rainfall events are anticipated to grow in frequency and intensity, leading to increased risks of landslides, flash floods and severe soil erosion, with devastating impacts on infrastructure and agriculture. (Highly likely)

Many of these predictions have already been borne out in reality. Climate change has increased temperatures and has reduced water availability, negatively impacting pastoral communities. Mongolia's average temperature has climbed at an alarming rate over the last seven decades. Since 1940, the mean annual temperature in Mongolia has risen by 2.2 °C — at a rate nearly three times faster than the

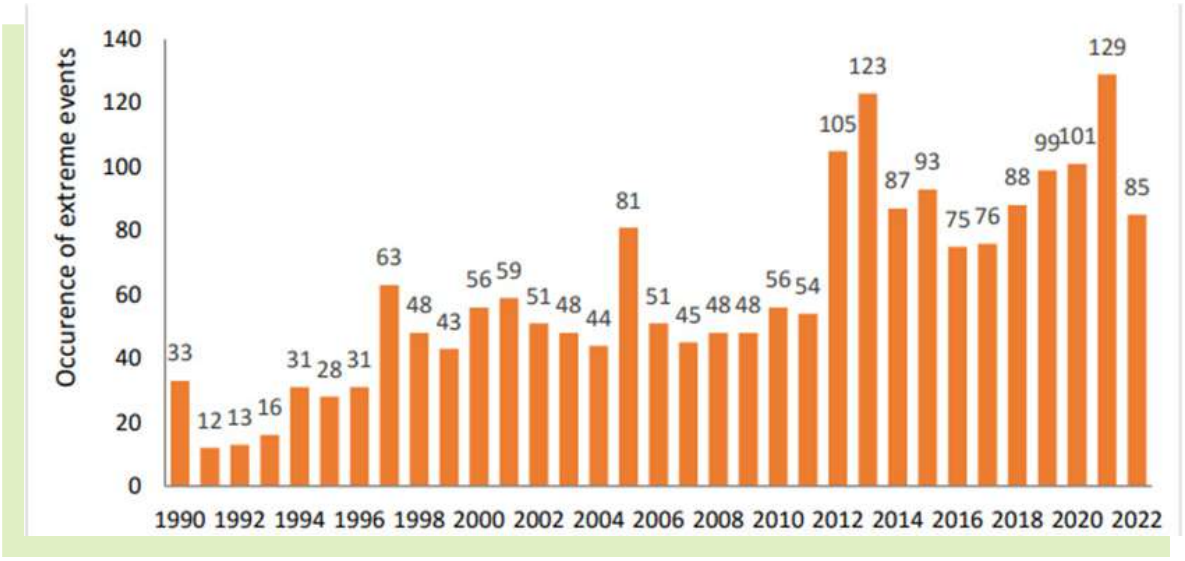

Figure 3. Frequency of hydrometeorological extreme and disastrous events in Mongolia
Source: Ministry of Environment and Tourism (MET) of Mongolia, 2024.

global average. This temperature rise is visible in the dramatic reduction of the nation's glaciers, which have receded by almost 40 per cent in the past 70 years (MET, 2024). In 2017, Mongolia recorded its hottest summer in half a century, resulting in severe drought conditions that affected roughly two thirds of the country.

Climate change has resulted in an increase in the frequency and severity of extreme weather events in Mongolia, including droughts. Between 2005 and 2020, Mongolia experienced a 67.9 per cent increase in the frequency of weather and climate-related disasters, and the number of annual deaths from such disasters increased by 37.5 per cent, rising from 180 in 2005 to 248 in 2020 (Figure 3 and Table 1). In 2020, fires accounted for 79.3 per cent of all disasters (National Emergency Management Agency, 2021).

Since 1940, Mongolia's annual precipitation levels have declined by approximately 10 per cent. At the same time, the frequency and extent of droughts has increased significantly. For example, in 2024 approximately 90 per cent of Mongolia was affected by drought and arid conditions (Figure 4).

Droughts not only reduce the amount of pasture available for livestock to eat and hinder the accu-

Table 1. Disasters, accidents and damage in Mongolia, 2000–2023

Disasters and damages	*Unit*	*2000*	*2010*	*2015*	*2020*	*2021*	*2022*	*2023*
Number of disasters and accidents	**number**	**2,547**	**2,976**	**5,422**	**3,977**	**4,053**	**4,299**	**4,484**
Forest and field fires	number	264	104	354	142	65	179	101
Burnt forests and fields	million hectares	1.1	1.0	6.5	0.3	0.2		2.5
Property fires	number	2,220	2,541	4,561	3,036	2,671	3,075	3,054
Strong dust and snow storm	number	7	32	21	51	91	56	75
Heavy rain and flooding	number	2	14	23	64	74	35	107
Deaths caused by disasters and accidents	number	76	223	198	143	319	247	320
Damages caused by disasters and accidents	billion tugrugs	87.1	534.8	79.9	31.3	25.8	33.2	52.1

Source: National Statistics Committee, www.1212.mn

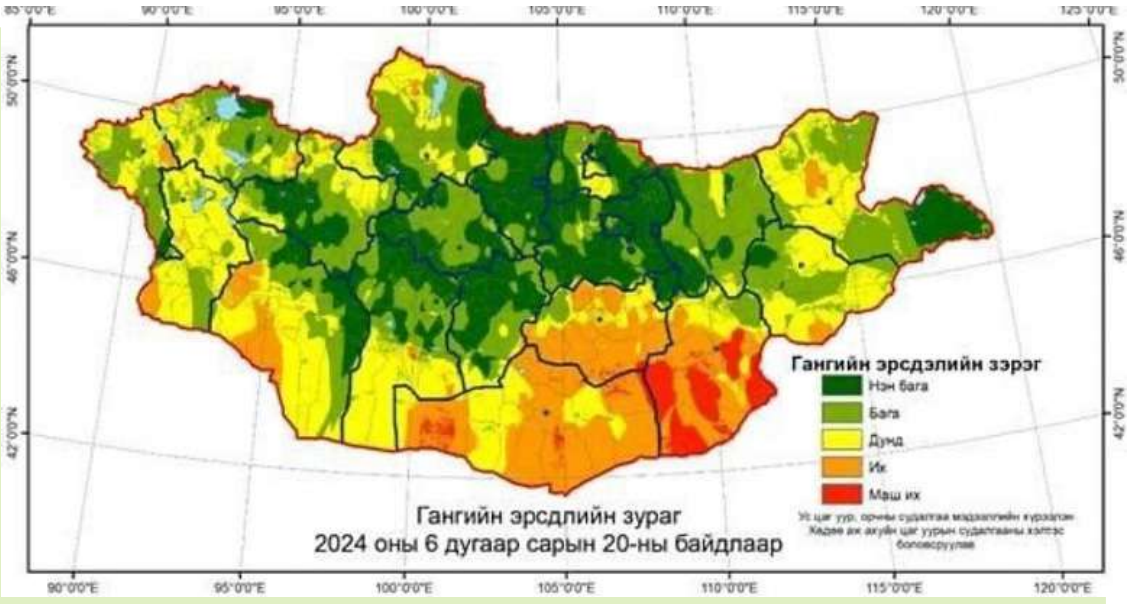

Figure 4. Map of drought risk in Mongolia, 2024
Source: Hydrometeorological and Environmental Research and Information Institute, Agricultural Meteorological Research Department

mulation of necessary body fat in livestock, but also prevent herders from adequately stockpiling fodder for the coming winter.

The dry conditions have also contributed to the relentless advance of desertification, which has consumed about 25 per cent of the nation's land area (Figure 5).

Desertification is intensified by overgrazing, which occurs when there are excessive numbers of livestock on pasture land, consuming vegetation faster than it can naturally regrow (Figure 6). This excessive grazing depletes the land's resources, harms the delicate grassland ecosystem (which becomes prone to erosion) and elevates the risk of livestock loss if there is a *dzud* in winter.

The higher temperatures, greater frequency and severity of droughts and loss of permafrost brought about by climate change (Slowinski et al., 2022) are resulting in more frequent and severe steppe fires and forest fires in Mongolia (Figure 7).

In the context of climate change, the frequency and intensity of *dzud* are increasing. *Dzud* used to occur about once every 10 years, but there were six between 2014 and 2024 (UNCT, 2024).

Dzud are connected to other issues, including droughts, wildfires, desertification and overgrazing. Within herding communities, they are commonly called a "devil's circle", indicating the connectedness of various adverse conditions and their cyclical nature. For instance, summer droughts serve as precursors to disastrous *dzud*. Diminished availability of forage during droughts leads to livestock malnutrition, which weakens them and makes them more susceptible to extreme winter conditions, such as severe cold and deep snow or ice covering the pasture land. This malnourishment not only leads to livestock deaths, it also reduces the strength and future productivity of surviving livestock.

A recent study found that mortality rates are markedly higher in years experiencing both drought and *dzud* compared to years in which only one occurs (Haraguchi et al., 2022). However, if the grassland yield is sufficient in summer (due to sufficient rainfall), a *dzud* does not necessarily cause disastrous losses for herders, even if there is heavy snow in winter. Thus, a *dzud* does not have to be a disaster;

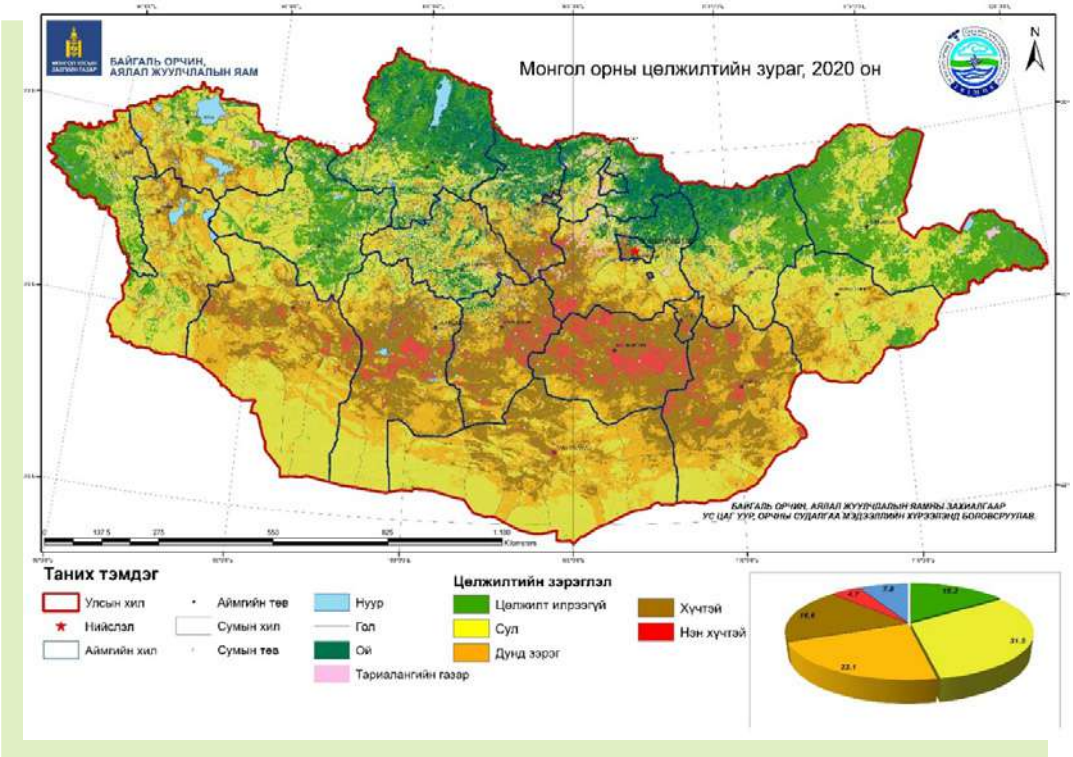

Figure 5. Desertification and land degradation in Mongolia, 2020
Source: Hydrometeorological and Environmental Research and Information Institute, Agricultural Meteorological Research Department

it generally becomes disastrous for herders if there was a drought in the preceding summer-autumn period.

Nevertheless, a *dzud* can be disastrous even without being preceded by a drought, if the *dzud* is severe. In the context of climate change, the intensity of *dzud* is increasing. One factor affecting Mongolia's weather is the polar jet stream, which is created through the interaction of cold Arctic air with warmer southern air. Due to climate change, the Arctic is experiencing more rapid warming than other regions, reducing temperature differentials. Consequently, the jet stream has become weaker and more erratic,

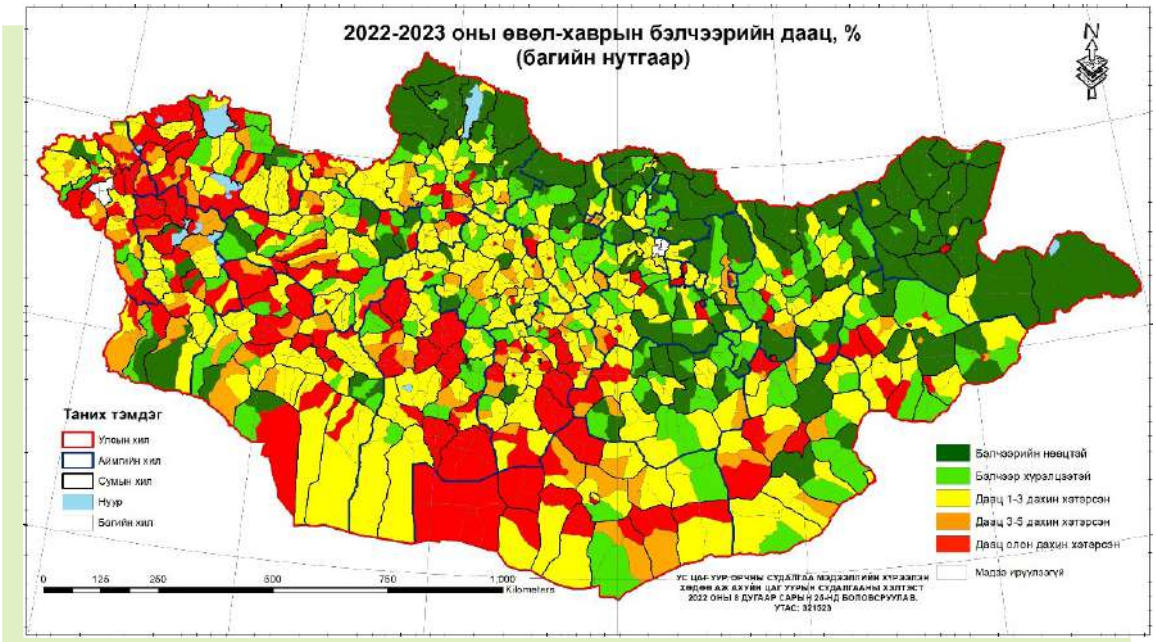

Figure 6. Map of overgrazing in Mongolia, 2022–2023
Source: Hydrometeorological and Environmental Research and Information Institute, Agricultural Meteorological Research Department

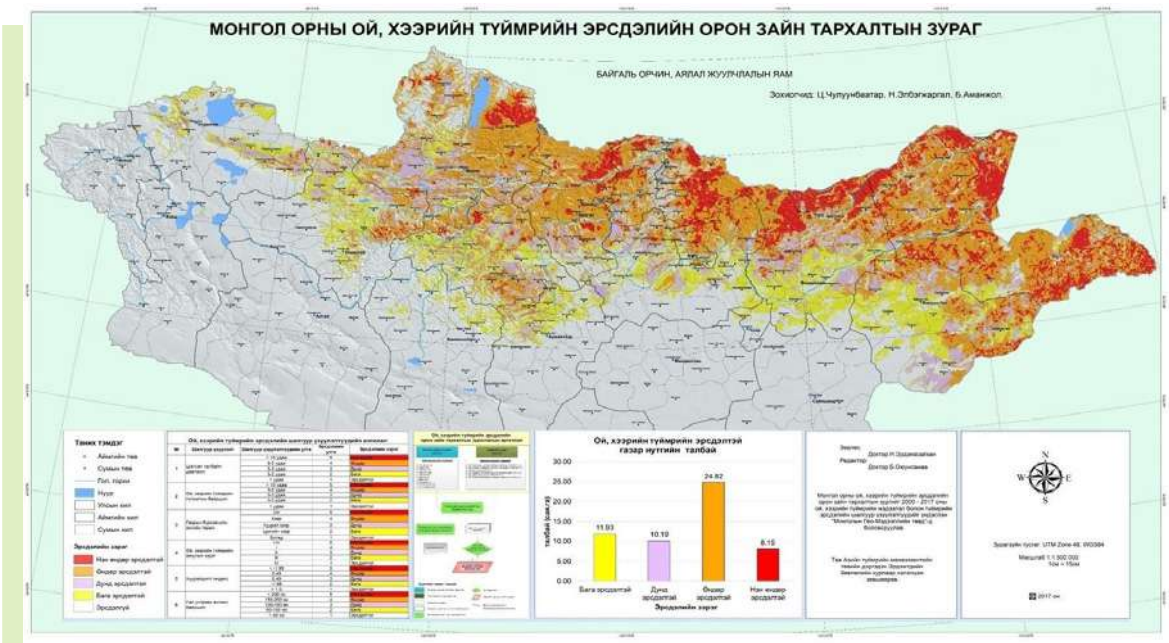

Figure 7. Map of wildfire risk in Mongolia
Source: Ministry of Environment and Tourism, Authors Ts.Chuluunbaatar, N.Elbegjargal, B.Amanzhol, 2017.

permitting frigid polar air to extend further into Mongolia and leading to more frequent and intense *dzud* (Delgerjargal, 2024).

The increased occurrence and severity of droughts and *dzud* as a result of climate change has had far-reaching implications for communities across Mongolia, but particularly for the country's herding communities, jeopardizing their lives and livelihoods. These communities require extensive disaster recovery support, which demands considerable time and resources.

Disasters that result from droughts and *dzud* are key contributors to rural-to-urban migration. In 2000, the number of herder households was 191,500, but after the *dzud* that winter, the number decreased by 22,500 (11 per cent) to 169,000 thousand in 2004. In the following four years the number of herder households increased slightly but decreased again by 24,000 during the *dzud* of 2009/2010, and in 2012 the number of herder households was 146,100. During the 25 years between 1995 and 2020, 636,300 people migrated to Ulaanbaatar from elsewhere in the country. This is a large proportion of the country's total population (approximately 3.5 million, as of 2024).

The worsening of food security and rise in poverty levels resulting from climate change is likely to prompt further rural-to-urban migration. This is expected to have an adverse impact on intangible cultural heritage (ICH) because when herders move to urban areas, this results in the loss of ICH.

Assessment of the impacts of disasters on ICH in the eastern region

In 2023, we conducted field research in the eastern region of Mongolia, specifically in the provinces of Dornod, Khentii and Sukhbaatar, supported by the International Research Centre for Intangible Cultural Heritage in the Asia-Pacific Region (IRCI). This research builds on data from our 2021/2022 desk study.

The study used data from the National Emergency Management Agency and the Institute of Meteorology and Environmental Studies, and it aimed to evaluate the impact of *dzud*, droughts and wildfires on intangible cultural heritage (ICH) in the eastern region, with the following three objectives.

- Observe the types and frequencies of natural disasters in the area.
- Explore the community's traditions, beliefs, culture, religion and lifestyles.
- Assess how natural disasters affect ICH.

Purposive sampling was employed to select areas of the eastern region that are severely impacted by wildfires, *dzud* and drought. Participants were randomly chosen from Dornod, Khentii and Sukhbaatar provinces. The study involved in-depth interviews with key informants and focus groups in local communities. All interviewees were over 45 years old, native to the region and had experienced multiple natural disasters.

The semi-structured interviews covered the topics of: social practices, rituals, festive events and traditional knowledge related to nature and herding. The interview questions focused on natural hazards, religion, beliefs, customs and local lifestyles.

The ICH domains and elements we identified are as listed below.

- Social practices, rituals and festive events:
  - Mongolian nomadic rituals and customs
  - Taboos

- Traditional knowledge, practices and techniques concerning:
  - observing and studying nature
  - protecting and preserving nature
  - choosing new pasture
  - observing and studying livestock
  - astronomy
  - naming of places

- Traditional knowledge, practices and techniques concerning:
  - preparing white (milk) dairy products
  - medical treatment and medicine
  - rearing and educating children
  - observing the sky and forecasting weather
  - observing plants and pasture
  - observing wild animals and birds

In Mongolia, summer is a period of growth in pastures, and a time of weight gain in livestock. Eastern Mongolia normally has good grazing capacity in the summer, but the region is at high risk for wildfires and has areas that have minimal

or no snowfall in winter, resulting in "black *dzud"*, which increase livestock mortality due to water inaccessibility and reduced grazing.

Mongolia's pastoral system is highly vulnerable to climate change, which is significantly affecting the region, causing rivers to dry up and glaciers to melt, and resulting in an increase in the frequency and severity of dust storms and floods. The light summer and autumn rains that once nourished the pasture land have disappeared, while the increase in dust storms during spring and summer has contributed to desertification.

In 2022, drought and overgrazing led to moisture deficits in some areas, reducing pasture quality and limiting the ability of livestock to build fat reserves. Subsequently, heavy snow and low temperatures during the winter hindered access to feed, resulting in livestock hunger, exhaustion and deaths; young animals were particularly vulnerable to the cold. During that winter, many pregnant livestock experienced miscarriage and/or death.

Ongoing drought and severe winter conditions in recent years have resulted in significant livestock losses, which is negatively impacting livestock and herders, increasing both poverty and rural-to-urban migration by herders.

Many of the herders interviewed in the study stated that intangible cultural heritage is essential for implementing appropriate measures to lessen the impacts of the issues they face. Mongolian nomads' customs and traditions represent a vast knowledge system developed and passed down through generations. Various factors inform this system, including geography, climate, herd structure, rituals and symbolism. The traditional lifestyle of herders has provided them with valuable knowledge and sustainable pasture management practices that help to prevent disasters.

Mongolians use traditional methods to predict weather patterns, including closely observing all visible and audible signs. Today they also monitor the weather forecasts from the Institute of Meteorology, Environmental Research and Information, and the forecasts on Malchin (Herder) TV. Being aware of the weather conditions enables them to predict potential challenges and minimize damage. However, climate change is making weather predictions more difficult.

A method of sustainable pasture management that Mongolian nomads (herders) have practiced for centuries is seasonal migration. This allows pasture lands to recover from livestock grazing and prevents soil deterioration. The nomads move with their herds, adapting to their surroundings based on the composition and distribution of their herds. Sustainable approaches such as this enable herders to adapt to challenging situations.

Households following the pastoralist way of life have also developed effective traditional methods and practices to cope with droughts and *dzud*. One traditional method is to reduce herd sizes in times of drought and to focus on livestock quality rather than quantity.

Today, herders are increasingly cooperating with each other to sustain their lifestyle and cultural heritage. For example, by pooling funds to buy fodder so that they can support their herds when feed is scarce or inaccessible (during drought and *dzud)*. They are also working together to rehabilitate water sources and are engaging in reforestation and forest protection activities to restore watersheds. In addition, herders are finding new ways to diversify their income sources, including through nature-based tourism and by processing raw products to add value (UNDP, 2023).

Despite their resilience and their efforts to prevent disasters, many herders are finding that coping with climate change is extremely challenging. In the interviews, elderly herders lamented the impacts of climate change on rivers, plains, glaciers and permafrost. Faced with the challenge of increasing frequency and severity of drought and *dzud*, the herders interviewed in the study reported that they are struggling with the following key issues.

- Deterioration of pastures and water supplies, leading to decreased fat gain among livestock in summer, as well as declining yield and quality of their livestock.
- Due to the decline in the quality of their livestock, herders are receiving lower amounts when selling their livestock. This significantly reduces herders' income, hampering their ability to prepare for winter, which can lead to poor livestock conditions in the following winter-spring period, compounding their losses.

- Lower incomes are coupled with rising costs, which means that herders are experiencing challenges in obtaining the goods they need to continue their herding livelihoods, lifestyle and cultural practices.

- Low-income families cannot afford the high cost of fodder and are at risk of falling into a poverty trap, facing disaster if their herds are lost.

- With repeated losses and increasing financial pressure, herders are experiencing greater psychological stress and depression.

- As a result of losing herds due to disasters, rural-to-urban migration is increasing.

Addressing these issues and providing sustainable solutions is crucial. The loss of traditional knowledge is a serious problem that requires urgent attention. To safeguard ICH, it is essential to ensure that traditional knowledge and sustainable practices are passed on to future generations.

Safeguarding ICH in the face of climate change

The increasing frequency and severity of disasters necessitates the establishment of a disaster risk reduction plan that integrates intangible cultural heritage and supports herders to prepare for, prevent and respond to emergencies in the future.

A comprehensive approach is required to mitigate the risks in Mongolia. The strategy must include the following elements:

- Assessments of herders' livelihoods and disaster preparedness
- Monitoring of drought and dzud risk indicators
- Ensuring adequate forage in times of drought
- Providing apprenticeship training for young herders on traditional, sustainable herding practices
- Supporting timely winter migration (*otor*) of herds
- Providing veterinary services to improve the health and quality of livestock
- Providing disaster preparedness training, including passing on traditional knowledge about preventing and managing disasters.

Including intangible cultural heritage in disaster reduction and resilience programmes is essential as it allows for safeguarding a community's cultural components, which are often overlooked in disaster management.

Recommendations

Based on the study findings, the field research team developed the following recommendations for Mongolian official bodies and international organizations working in the intangible cultural heritage field.

- Intensify research efforts on how ICH knowledge and practices can help to prevent and manage natural disasters.

- Increase public awareness of traditional knowledge about disaster prevention and promote it as a way of helping to prevent disasters in future.

- Include traditional knowledge in disaster preparedness and mitigation training of the National Emergency Management Agency.

- Consider the Law on the Protection of Cultural Heritage when preparing disaster management plans, and protect cultural heritage during disasters.

- Implement specific measures that support ICH practitioners and communities during any disaster or extreme weather event.

- Provide and strengthen social security for ICH practitioners.

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Chapter 3

Cultural Adaptation and Sustainable Agriculture

Floating Agriculture in Bangladesh: An Assessment of the Potential Risks and Effectiveness in the Context of Disasters Risk Management and ICH Safeguarding

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Floating Agriculture in Bangladesh: An Assessment of the Potential Risks and Effectiveness in the Context of Disasters Risk Management and ICH Safeguarding

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Summary

Climate change is a growing concern among heritage experts, scholars and policy-makers. The impacts of climate change are affecting many heritage properties, both natural and cultural, and are likely to affect many more in years to come. Bangladesh's inhabitants have long been accustomed to dealing with environmental crises, so can perhaps offer insights into adapting to changing conditions. This short ethnographic case study conducted in the floodplain and waterlogged areas of the south-central region of Bangladesh sought to understand the dynamics of the relationship between climate change-induced hazards and intangible cultural heritage practices in agriculture. The case study shows how various cultural elements belonging to different ICH domains have played different roles in developing social and cultural spaces and motivating people to help each other during disasters. It discusses the impact of climate change on various intangible cultural heritage elements and shows how floating agriculture is helping local communities to adapt to situations of extreme flooding, long-term waterlogging and increasing salinity, and how they respond to various disaster and post-disaster situations. It describes the role of 'floating agriculture' as a successful ICH practice in terms of increasing resilience to climate change, social inclusion and cohesion in the south-central region of Bangladesh.

Background of the case study and statement of the problem

Though its contribution to global warming is negligible, producing less than 0.47 per cent of global emissions (MoEF 2008), Bangladesh is one of the world's most vulnerable nations to the impacts of climate change (Climate Central, 2023). In the latest Global Climate Risk Index, Bangladesh was ranked seventh (Eckstein et al., 2020). Agriculture, upon which over 60 per cent of the population depends directly or indirectly for their livelihoods, is particularly vulnerable to the impacts of climate change (MoEF, 2024).

Impacts include increasingly frequent and severe tropical cyclones, erratic rainfall patterns, droughts, melting Himalayan glaciers, higher river flows and rising sea levels. These impacts exacerbate existing problems and natural hazards and are leading to more storm damage in coastal regions, riverbank erosion, increased sedimentation, drainage congestion, widespread flooding, loss of homes and agricultural land, waterlogged soils, increased saline intrusion, damage to key ecosystems like the Sundarbans mangrove forest and declines in agricultural output.

Floods, worsened by climate change, are the most common form of disaster in Bangladesh. An average of two flood occurrences affect the country

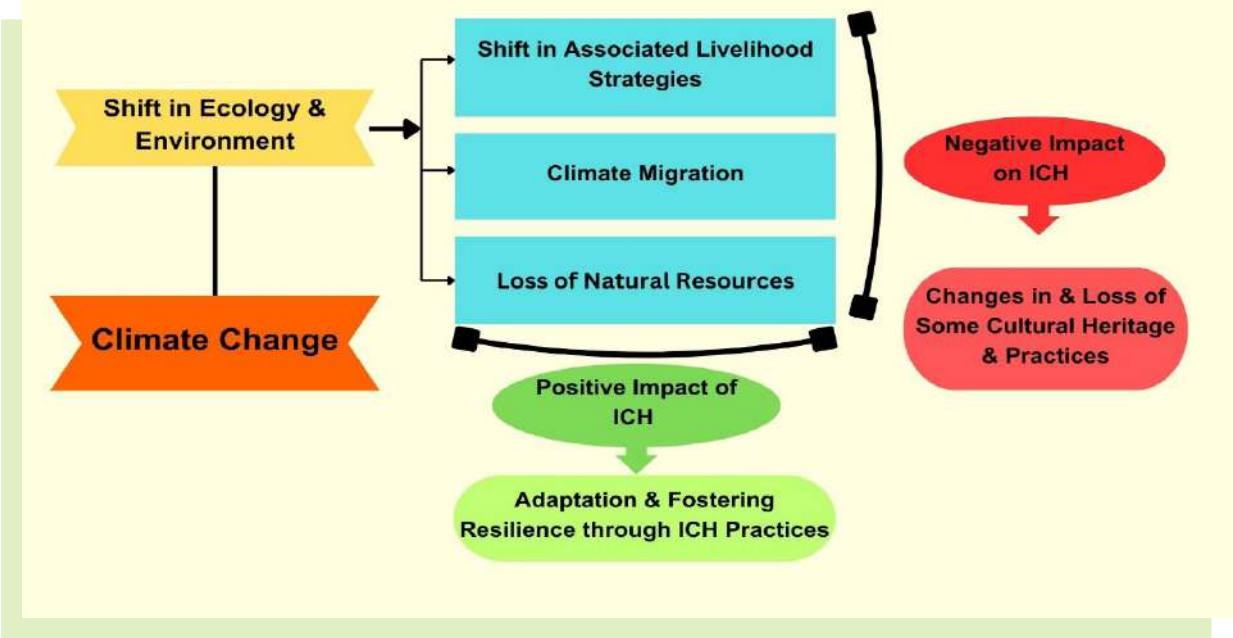

Figure 1. Climate change impacts on intangible cultural heritage
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annually, directly impacting over 42 million people, which represents over a third of the population (UNDP, n.d.). Climate change is leading to changes in traditional ways of life and shifts in livelihood strategies, and thus also poses a threat to cultural heritage elements and practices (Figure 1).

To mitigate the negative effects of climate change, safeguard cultural heritage and promote resilience, it is essential to implement adaptive measures and protective strategies. These may involve sustainably managing resources, reviving cultural traditions, incorporating indigenous knowledge systems into adaptation strategies and encouraging diverse livelihoods.

Objective of the case study

This case study aimed to understand the dynamics of the relationship between climate change impacts and intangible cultural heritage practices in the south-central region of Bangladesh.

In particular, the case study sought to answer the following questions:

- What are the general cultural heritage practices in the region?
- How is climate change affecting intangible cultural heritage practices in the region?
- How do intangible cultural heritage practices contribute to promoting communities' ability to adapt and their resilience to climate change?
- What is the interaction between climate change and intangible cultural heritage practices on advancing sustainable development to enhance resilience, social inclusion and cohesion, and to promote environmental protection and sustainable, inclusive development in the south-central region of Bangladesh?

The study examined the impact of climate change on the cultural heritage of two climate hotspots in the south-central region and how various intangible cultural practices in that region have helped people respond to the impacts of climate change. Specifically, the study examined how an intangible cultural heritage practice called floating agriculture helps the people of these areas build resilience in the face of climate change.

Research design and methods

This study is anthropological in nature, with the goal of understanding the relationship between cultural heritage practices and climate change in two climate hotspots in the south-central region of Bangladesh: Tungipara Upazila and Nazirpur Upazila (GED, 2019; LGED, 2021).

ICH DOMAINS(5)	CLIMATE HOTSPOT (6) DESK STUDY	SELECTED CLIMATE HOTSPOTS FOR CASE STUDY
• ORAL TRADITIONS AND EXPRESSIONS • PERFORMING ARTS • SOCIAL PRACTICES, RITUALS, AND FESTIVE EVENTS • KNOWLEDGE AND PRACTICES CONCERNING NATURE AND THE UNIVERSE • TRADITIONAL CRAFTSMANSHIP.	• RIVERINE SYSTEMS & ESTUARIES • BARIND & DROUGHT REGION • COASTAL REGION • HAOR & FALSH FLOOD REGION • CHITTAGONG HILL TRACTS • URBAN AREAS TO YOUR TOPIC.	FLOODPLAIN AND WATER-LOGGED AREA (TUNGIPARA OF GOPALGAGANJ AND NAZIRPUR OF PIROJPUR DISTRICT IN THE SOUTH CENTRAL REGION)

Figure 2. Process diagram: from desk study to case study
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The researchers undertook both desk research and fieldwork (Figure 2). The desk research was instrumental in laying the groundwork for a successful field investigation.

The fieldwork was conducted in two phases. In the first phase, which was five days in June 2022, the team located the villages for study and completed a pre-testing and reconnaissance survey to establish a relationship with the target group, identify key informants and establish good contacts with the various stakeholders. In the second phase, which was 15 days in August 2023, the team collected the data. The study's data-gathering methods included ethnographic observations, in-depth interviews and focus group discussions. The research team had five members, including the principal investigator, climate experts and anthropologists with knowledge of climate change, ecology and cultural heritage.

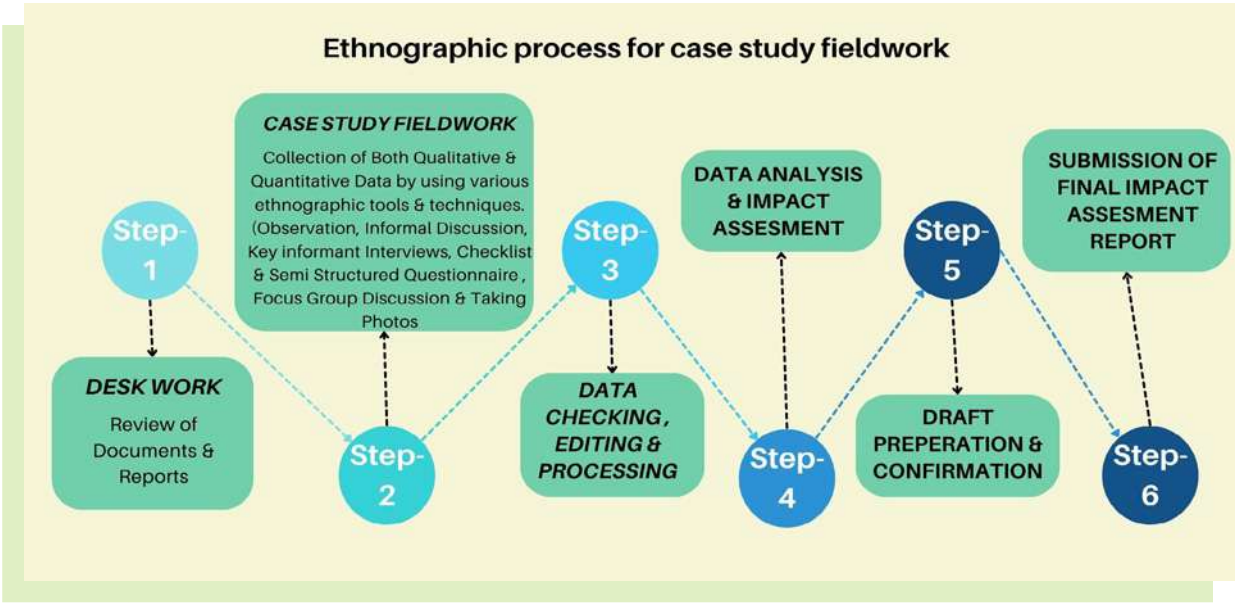

Figure 3. Ethnographic process for the fieldwork
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The researchers conducted focused ethnographic observations in the targeted sites, which entailed observing and documenting the villages' diverse cultural heritage, such as traditional knowledge and customary practices. The observation notes were used to gain a better understanding of cultural practices and their connection with climate change. Based on the ethnographic observations, the study team conducted in-depth interviews with residents of the selected areas to learn how people perceive and experience the impacts of climate change on their cultural heritage practices. Focus group discussions were conducted at the final stage of fieldwork to explore further the relationship between cultural heritage practices and climate change at the community level. The focus group discussions gave the researchers a better understanding of how climate change is influencing cultural heritage practices and how communities are responding to these impacts. All data obtained during the study, including recordings, images, videos and observation notes, were transcribed and triangulated among different tools and respondents. Finally, the researchers categorized and thematically analysed the filtered data to identify themes and patterns (Figure 3).

Ethical and human rights considerations

To ensure the study recognized and supported the human rights of all participants, including the rights to dignity, privacy and freedom from discrimination and harm, the study team has adhered to fundamental research ethics, including ensuring that the participants understood the purpose of the research, and were aware of their rights and how their data would be handled. The team secured verbal consent from participants before the activities, including before interviews, recordings and photo documentation.

Strengths and limitations of the case study

The study was only conducted in two specific areas of Bangladesh, so the findings cannot be generalized to the entire country. However, the findings could be transferable to other similar contexts. It was not possible for the researchers to conduct field work during a disaster, but the field work conducted under the study gave the researchers an understanding of how the communities in the two areas may respond if a disaster strikes. To better understand the dynamics between intangible cultural heritage and climate change in the studied areas, a longitudinal ethnographic study would be valuable.

Findings and discussion

The two areas covered by the case study: Tungipara Upazilla of Gopalganj District and Nazirpur Upazila of Pirojpur District, are located in the south-central region of Bangladesh, close to the coast. These areas are considered climate hotspots. Major challenges in these areas include:

- Floods
- Salt-water incursion
- Drought
- River-bank erosion

These issues are increasing in magnitude, frequency and longevity as a result of climate change.

Adaptation to climate change: A case study in Tungipara Upazila of Gopalganj

Tungipara, located in Gopalganj District, is a significant *upazila* (region) in Bangladesh. This region is characterized by its diverse agricultural landscape, where crops include rice paddy, jute, wheat, mustard, pulses, groundnuts, sunflowers, betel leaf, sugarcane, rubber, sweet potatoes and various other vegetables.

In recent times during the monsoon season, the rivers in this region have experienced prolonged overflow resulting in extended periods of flooding. Vast expanses of land are submerged for between seven and eight months per year. At the same time, there has been increasing soil and water salinity. The extended flooding and increased salinity have had profound implications for the staple crop, rice, as some farmers can no longer cultivate it.

Impact of climate change on intangible cultural heritage in Tungipara

The extended period of flooding and increased salinity have not only significantly impacted the local environment and agricultural activities, but have also affected daily life and the intangible cultural heritage of the area.

The disruption of the cultivation of rice has disrupted cultural practices associated with rice cultivation. For example, the celebratory tradition of *nabanna*, which marks the harvest season and the arrival of new rice, has waned in the absence of abundant rice cultivation. Likewise, the custom of making rice cakes, known as *pitha*, during the harvesting season has become a rare occurrence.

The change in agricultural practices is also affecting the traditional knowledge linked to myths and folklore about the natural environment. Furthermore, as rice farming has declined, people are out-migrating, which is resulting in a decrease in the number of people who are maintaining traditional arts such as *jaari gaan* and *shari gaan* (local operas), *jatrapala* (a traditional form of theater performance) and puppet dance.

Figure 4. Traditional boat and bamboo fishing equipment.
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Figure 5. Traditional fishing equipment.
© Tahsin Momin Antor

The changing local conditions, influenced by climate change, have led to people changing their habits and switching to different occupations. For example, in response to extended flooding, the local population is relying more on boats for transportation and there has been an upsurge in the making and selling of boats in the region. However, the local crafts are being impacted negatively. While historically the community relied on the locally-made fishing nets (*jaal*) and bamboo fishing traps, in recent years imported electric nets have become more popular.

What is Floating Agriculture?

Floating agriculture (*vasoman chash*) is a form of hydroponics that uses aquatic plants, such as water-hyacinth, to construct a floating platform or raft on which seedlings are raised, and vegetables and other crops are cultivated.

In this type of agriculture, crops are grown on the floating beds in the water, and the crops derive their nutrients from the water instead of from soil.

According to people from the south-central districts of Bangladesh, namely Barisal, Gopalganj, Madaripur and Pirojpur, floating agriculture has been in practice in the region for the last 200 to 300 years. The knowledge and skills involved in floating agriculture are part of Bangladesh's intangible cultural heritage. On 15 December 2015 the Food and Agriculture Organization (FAO) recognized Bangladesh's floating agriculture as a Globally Important Agricultural Heritage System (GIAHS).

Figure 6. Floating agricultural practice
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Floating agriculture and its role in adapting to climate change

In response to the flooding and increased salinity, farmers have adopted "floating agriculture", cultivating vegetable crops on floating beds, in periods of flooding outside the usual season. Floating agriculture was previously practiced on a small scale, but due to prolonged waterlogging and changing environmental conditions, almost every farmer in the area now practices it.

During periods of flooding, the usual cultivable lands are submerged under water so farmers set up their floating platforms on those submerged lands. Some farmers also set up floating agricultural beds in small rivers or canals where monsoon water accumulates, but not where the water is flowing rapidly.

The floating beds are prepared using water-hyacinth, aquatic algae, water-wort and other waterborne creepers, as well as straw and plant residues.

Farmers start by building a frame using bamboo, which they place on the water. They then gather water hyacinth and layer it over the bamboo. They collect the water hyacinth from the rivers, canals and other water bodies between the months of May and July. They then make a layer with it on the bamboo frame. After a week to ten days, the farmers make a second layer on top of the first layer of water hyacinth. After the first day, the bed usually reaches about 3 feet in height. The final height is about 5 feet. Once the water hyacinth is thick enough to support a person's weight, the bamboo is removed.

The bed is extended in the same way. Such beds are generally between 50 to 155 feet in length, 5 to 7 feet wide and between 2 and 5 feet high.

A small bed is generally easier to manage. Because the bed is floating, the farmers can easily move small beds around.

The floating farming season runs from June to December, during which period both men and women are actively involved. Men usually prepare the beds, and women and children make the *meda* (small balls of soil that contain seeds) and transplant the seedlings.

Once the floating beds have been prepared, farmers wait 15 to 30 days until the beds are ready for cultivation. The seedlings, grown from the *meda*, are then transferred to the floating beds.

After the season ends, men normally transition to dry land farming, while women continue home-based activities, including making and selling handicrafts.

As well as making floating beds for local use, people in Gopalganj District often sell floating beds to neighbouring districts like Pirojpur where there is less water hyacinth available so people cannot easily make their own floating beds. Some farmers have also introduced fisheries beneath the floating beds, enhancing food security.

Figure 7. Newly constructed floating bed (2 days old) utilizing water hyacinth
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Figure 8. Preparing the floating bed for sowing seedlings (14 days after creation).
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Figure 9. *Meda* where seeds are sown.
© Tahsin Momin Antor

Figure 10. Preparing *meda* and seedlings.
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Types of crops grown in floating agriculture

The farmers of Gopalganj produce vegetables and spices on floating beds. The vegetables and spices are food for the farmers' families and are also sold in the market, which generates income. Family members, neighbours and other local people tend to join in the growing process, which fosters social inclusion and cohesion. Some farmers hire labourers from the local area for tasks such as preparing the floating beds, making the *meda* and planting the seedlings. As of 2024, men earned BDT 600–700 (USD 5.02–5.86) per day, while women earned BDT 300–600 (USD 2.51–5.02) per day.

The vegetables they grow include gourd, beans, cucumbers, lady fingers, pumpkin, radishes, cabbages, capsicums and broccoli. Some of these vegetables are not usually farmed in the area. These farmers also practice fish farming in the same space.

Figure 11. Cultivating fish and floating vegetable in the same land space
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Conventional agriculture in the region uses chemical fertilizers to grow crops and vegetables. But in floating agriculture, farmers produce vegetables using organic methods, without using artificial fertilizers.

In the traditional farming process, crops are harvested twice a year, but with floating farming, they can now harvest up to four times per year, depending on the type of vegetable.

At harvest time, farmers share their produce with neighbours and their extended families.

Floating agriculture's contribution to sustainable resource management and sustainable agriculture

Adoption of floating agriculture by farmers is paving the way for sustainable resource management in the region. The primary component of the floating beds is water hyacinth, known locally as *kochuripana*. After six to eight months, when the floating bed disintegrates, the decomposing water hyacinths are used as an organic fertilizer, which is called *pochla*. People use it to fertilize their land and also mix it with soil to create seed balls, known as *meda*. Given the abundance of water hyacinths in the area, this practice allows for sustainable resource management.

Floating agriculture in Tungipara is considered an environmentally friendly and sustainable form of agriculture, and is a model for other regions facing similar challenges such as long periods of flooding induced by climate change in Bangladesh and in other countries.

Certain elements of intangible cultural heritage involved in floating agriculture play a role in helping the community build resilience against climate-related challenges.

The government's department of agriculture is conducting research on floating agriculture. It is also encouraging farmers elsewhere in the country to adopt this agricultural method and is providing the necessary training.

Floating agriculture is practiced extensively nowadays as an alternative income source and a way to respond to the impacts of climate change. This age-old traditional knowledge represents an innovative solution to grow crops and vegetables in the face of the challenges posed by climate change. It demonstrates the community's resilience and adaptive capacity in the face of climate-related adversities.

Figure 12. Decomposed water hyacinth (*pochla*)
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Figure13. Using *pochla* as a fertilizer on land agriculture.
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Figure 14. Government research project on advancement of floating agriculture
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Climate change, intangible cultural heritage and disaster risk management: a case study of floating agriculture in Nazirpur Upazila

The impacts of climate change have made the lives of rural people extremely challenging in Nazirpur Upazila of Pirojpur District.

Boro, *Aman* and *Ropa-aman* rice paddy are the main crops of this district. Cash crops include bananas, betel leaf and betel nut, guavas and coconuts. Wheat is cultivated in the winter. Other crops include pulses, grains, chilies, bay leaves and vegetables.

However, the cultivation of crops on land is now hampered due to climate change. Nazirpur Upazila now remains under water almost the whole year and farmers cannot produce traditional crops in such waterlogged conditions. Since the farmers in Nazirpur Upazila of Pirojpur District, cannot produce crops on the land, they are now practicing floating agriculture like the farmers in Tungipara.

Climate change, traditional agriculture and intangible cultural heritage practices in Nazirpur

As a means of adaptation to the changing climate, more people are practicing floating agriculture. This practice is rooted in indigenous knowledge and recognized as an intangible cultural heritage. According to an officer at the Nazirpur Upazila Agricultural Office, there are eight blocks of villages in Nazirpur Upazila where floating agriculture is practiced: Manoharpur, Gaokhali in Dewolbari Dobra union, Mugarjhor, Kholni, Kolardoania in

Kolardoania union, and Jugia, Malikhali in Malikhali union. Farmers from almost 2,500 households are practicing floating agriculture on 195 hectares of land in these areas.

In Pirojpur, farmers primarily cultivate seedlings for sale, but they also grow vegetables for personal consumption. Generally, these farmers grow crops such as bottle gourds, eggplants, tomatoes, cucumbers, papaya, beans, peppers, pumpkins, okra and red spinach and spices such as turmeric, etc.

Floating agriculture is now the primary strategy for livelihoods for many households, as climate change and prolonged monsoons are making traditional farming more difficult. During the monsoon, when there are limited earning opportunities, many local residents work as labourers in floating agriculture, earning daily wages working for other farmers.

Climate change and its impacts on cultural rituals, traditions, and traditional craftsmanship in the Nazirpur area

Climate change has led to the loss of some rituals and other intangible heritage in Nazirpur upazila. For example, the *nabanna* was once celebrated in this area with great enthusiasm, but it is now no longer observed because the whole area remains flooded and farmers cannot cultivate the crops associated with the *nabanna* ritual. Likewise, cultural practices like *jatrapala* (a traditional form of theater performance) are no longer found in this locality.

Other rituals still flourish in the locality, however. For example, before starting floating farming, most of the households arrange *milad* (a special prayer for a good harvest) in their houses.

The traditional floating market of Baithakata has become more significant in people's lives because of extended periods of flooding. Every Saturday and Tuesday, people sell boats in the Baithakata floating market. The increasing demand for boats and floating markets has supported traditional boatmaking, another ICH practice. Other floating markets have flourished in Nazirpur, including the floating guava market of Swarupkathi. which is now not only a tradition but also the only means of selling guavas in the area.

Figure 15. Floating beds or platforms.
© Tasnim Khan Lamisa

Figure 16. *Fena* (*azolla* or water weed) selling in floating market
© Tasnim Khan Lamisa

Figure 17. Baithakata floating market.
© Tasnim Khan Lamisa

Figure 18. Atchala ghar.
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Climate change and its impacts on indigenous knowledge and practices

A traditional type of building in this area is known as *atchala ghar.* These buildings have eight roofs: four over the main building and four over the verandas attached on each side.

The main purpose of these buildings was to store crops and other goods. Since the farmers no longer produce the types of crops that can be stored, the *atchala ghar* has lost its significance in everyday life. As a result, the indigenous knowledge related to constructing such buildings is less practiced than before.

Seasonality and production costs in floating agriculture

The floating farming season typically runs from June to December, and both men and women are involved in various stages of work. When not working on floating agriculture, women make mats with *beti* (a local leaf) and earn money by selling the mats at the local markets.

Floating agriculture provides economic benefits in two key ways. First, farmers grow vegetables on floating beds, locally known as "*baira*". In Pirojpur, farmers cultivate seedlings on floating beds and grow vegetables for household consumption. Crops are ready for harvest after one or one and a half months. As of 2024, a typical farmer with ten floating beds could invest BDT 20,000–40,000 (USD 167.34 to USD 334.68) and earn BDT 90,000–100,000 (USD 753.02 to USD 836.69) per harvest cycle. With three or four harvests per year, this can translate into annual earnings of BDT 270,000 to BDT 400,000 (USD 2,260 to 3,350).

Second, farmers in Gopalganj construct floating beds and sell them to other areas like Pirojpur, where the water hyacinth required for constructing the beds is in short supply. As of 2024, building a floating bed cost between BDT 2,000 and BDT 4,000 (USD 17 to USD 34), but they could be sold for BDT 6,000 to BDT 8,000 (USD 50 to USD 67), yielding substantial profit. In some cases, traders purchase beds from farmers in Gopalganj and transport them to Pirojpur for sale. The preparation of larger floating beds is more expensive. Beds that are 26 feet to 40 feet long cost between BDT 15,000 and BDT 20,000 (USD 125 and USD 167) to make.

As of 2024, men who worked as labourers for floating agriculture farmers earned between BDT 600 and BDT 700 (USD 5.02 to USD 5.86) per day, and women earned between BDT 300 and BDT 600 (USD 2.51 to USD 5.02) per day for making soil balls known as "*meda*".

Floating agriculture: a model of sustainability in a changing climate

In Bangladesh, floating agriculture, especially in Pirojpur and Gopalganj, is emerging as a model of sustainable farming. The sustainability of this agricultural model is enhanced through the use of organic fertilizers made from old floating beds. The floating beds decay after some months, leaving organic matter, which is known as "*pochla*", which used as fertilizer for growing crops.

Overall, floating agriculture offers a sustainable solution for farmers in these regions, providing income and increasing resilience in the context of a changing climate. As the practice continues to expand, it is likely to become an integral part of Bangladesh's agricultural and cultural landscape.

Conclusion and recommendations

Over the last few decades, the impacts of climate change have posed challenges for communities in Bangladesh, such as those in Tungipara, and Nazirpur Upazila, and to their intangible cultural heritage practices. At the same time, some ICH elements are also helping these communities to respond to the challenges they face. Floating agriculture is helping farmers to maintain their livelihoods even in changing conditions.

To ensure the preservation of various intangible cultural heritage elements belonging to the five major domains of ICH and the sustainability of the local communities, there is a need for long-term disaster response strategies that address their specific needs and support alternative livelihoods. By doing so, we can help farming communities to be more resilient and create a sustainable future.

Acknowledgement

This case study paper is based on a 'Desk Survey' and a 'Case Study Work' assessing the 'Potential Risks and Effectiveness of ICH in relation to Natural Hazards and Disasters" under a project "Research on ICH Safeguarding and Disaster Risk Management (2nd Phase)" with a generous financial support and technical guidance of International Research Centre for Intangible Cultural Heritage in the Asia-Pacific Region (IRCI), Japan.

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Climate Risks and Resilience in South-East Asia's Culturally Significant Ricescapes

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Summary

The UNESCO-designated World Heritage 'ricescapes' in South-East Asia face vulnerability to the impacts of climate change. The ricescapes examined here are the Hungduan and Mayoyao ricescapes in Ifugao province in the Philippines, as well as the Jatiluwih ricescape in Bali Province, Indonesia.

These case studies emphasise the importance of strengthening the resilience of the communities that produce and sustain the ricescapes, ensuring that their cultural heritage—including food supply chains, cultivation systems, and rituals—remains intact in the long term.

These case studies specifically identify the climate risks and impacts on the Ifugao and Balinese ricescapes, recognise the intangible cultural heritage within those ricescapes, and examine the role of intangible assets in supporting the resilience of rice farming in the context of climate change. This includes the 'transpersonal capacity' of rice farmers to be influenced by their encounters with the physical, social, and spiritual environments (Delina et al., 2024).

Using a mixed-methods approach, the study found that (1) these ricescapes face climate risks from droughts and intense precipitation, leading to reduced yields; (2) community bonds and social capital through shared labour, cooperation and mutual support strengthen resilience in agricultural activities and (3) family, customary villages, relatives, neighbours and organized farming groups are the sources of intangible assets for coping with climate change pressures and sustaining traditional practices and community well-being. The studies also indicate the importance of cultural and spiritual dimensions in fostering community cohesion and preserving indigenous rice farming traditions.

The findings provide lessons for achieving rice farming resilience, including the necessity of (i) diverse coping strategies, (ii) community-based resilience efforts, (iii) a balance between formal and informal support mechanisms, (iv) adaptation and innovation in Indigenous rice farming, and (v) effective community leadership and governance structures, and harmonious alignment of local and national efforts in disaster response and preparedness.

The findings of the case studies led to nine recommendations for agricultural policies tailored to these ricescapes that will support the preservation of Indigenous rice farming traditions, foster sustainable agriculture and respond effectively to future challenges. These include (i) recognizing the significance of intangible assets, (ii) encouraging

community-based projects that promote traditional knowledge and practices, (iii) facilitating knowledge exchange, (iv) empowering local institutions, (v) designing disaster preparedness plans, (vi) improving government support systems, (vii) promoting sustainable rice cultivation, (viii) investing in rural infrastructure and (ix) encouraging collaboration between stakeholders.

Background

Over half of the global population depends on rice as a significant part of their diet, but rice farmers are among the most vulnerable to climate change. Enhancing the resilience of rice crops in the context of climate change is crucial to securing the sustainability of food supply for the populations that rely on rice as a staple part of their diet.

While extensive literature exists on rice cultivation practices worldwide, little attention has been given to UNESCO-designated ricescapes. Our case studies focus on rice-farming communities in Ifugao Province, Philippines and Bali Province, Indonesia, which were designated as World Heritage sites by UNESCO for their natural beauty and cultural significance (UNESCO 2021a, 2023a). These ricescapes are characterized by small-scale rice farming communities that face numerous challenges, including those emerging from climate change, which poses particular threats to rice crops by affecting weather patterns, temperatures and water availability.

Our first case study focuses on the Ifugao rice terraces in the landlocked province of Ifugao in the northern Philippine region of Luzon Island. UNESCO (2021a) inscribed five clusters of these rice terraces on the World Heritage list in 1995, recognizing the communal production system associated with this ricescape. Our study focuses on the Hungduan terrace cluster, which resembles a spider web (Figure 1), and the central Mayoyao terrace

Figure 1. Hungduan rice terraces in Ifugao, Philippines
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Figure 2. Rice terraces in Subak Jatiluwih in Bali, Indonesia
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cluster, which features traditional farmers' *bales* and *alangs*. Interspersed throughout these clusters are *muyong*, which are family- or community-owned forested areas that serve as essential watersheds.

Our second case study focuses on Subak Jatiluwih's ricescape (Figure 2), a part of the Cultural Landscape of Bali Province (UNESCO, 2023a). As well as being a ricescape, this World Heritage Site includes various cultural and natural landmarks, such as notable temples, including Taman Ayun and the eight temples along the Pakerisan and Petanu rivers, and the *subak* system, which dates back to the ninth century. It is a traditional Balinese organizational system serving multiple purposes, including equitable water distribution and allocation, conflict resolution, irrigation infrastructure operation and maintenance, performing of religious rituals and fundraising. This system embodies the *tri hita karana* philosophy, emphasizing a harmonious relationship between the spiritual realm, humans and nature.

Building and strengthening resilience to climate and other impacts

The Subak Jatiluwih and Ifugao ricescapes require careful management due to their vulnerability to various pressures, especially the emerging impacts of climate change (Delina et al., 2024). See Table 1 for a summary of these pressures.

Climate hazards compound other risk drivers. For instance, land conversion, driven by the demands of new immigrants, settlers, tourists, and landowners seeking financial gain, has threatened these ricescapes, which are further jeopardized by climate change. Similarly, the lack of support for traditional farming practices has led to a decline in identity and social cohesion, as well as alterations in the local population and community structure, a situation aggravated by the impacts of climate change. The natural and physical changes interact with cultural shifts, resulting in the loss of knowledge systems and traditional ways of life. The absence of climate-responsive and sustainable management plans means these threats remain unaddressed. Overall, the interplay of climate change and other risks heightens the vulnerability of these UNESCO-designated World Heritage ricescapes (Delina et al., 2024).

Objectives of the case studies

While resilience-building initiatives exist at these heritage sites, they focus on developing, enhancing, and strengthening the tangible forms of rice production capital—namely, financial, human, physical, and natural resources. However, they neglect the intangible processes that promote agricultural resilience.

Table 1: Aspects of the heritage sites of Ifugao and Bali that have been impacted as a result of climate change

Case Study 1: Ifugao (UNESCO, 2023b)	**Case Study 2: Bali** (UNESCO, 2021b)
• Traditional ways of life and knowledge system • Financial resources • Human resources • Illegal activities • Legal framework • Management activities • Management systems/ management plan • Society's valuing of heritage	• Traditional ways of life and knowledge systems • Governance • Housing • Identity; social cohesion; local population and community • Land conversion • Management systems/ management plan • Society''s valuing of heritage

To close this gap, our case studies seek to understand the intangible processes, in particular how people and communities in these ricescapes use their intangible heritage to build and strengthen their climate resilience and address risks. These case studies enrich the literature concerning sustainable agricultural livelihoods in UNESCO-designated World Heritage ricescapes. At a practical level, the insights from these case studies could assist in supporting the management of these critical sites.

These case studies focus on the rice farmers' 'transpersonal capacity' (Anderson, 2006: 735). Filipino rice farmers' transpersonal capacities profoundly influence their resilience. Examples of these capacities include their willpower, determination, and affiliation with the Divine, which motivate them to persist in farming despite social and environmental stresses. Moreover, people's connections with others and the places they inhabit also play an important role in resilience-building.

Before undertaking the studies, we understood that Indigenous knowledge played a significant role in Ifugao rice farming, especially in pest management, and that the rice-farming schedule in Indigenous Balinese rice farming is linked to ceremonies and rituals that act as a calendar to remind people of particular tasks. However, we possessed limited information on how these intangible assets foster, build, and strengthen climate change adaptation and resilience in rice landscapes. The role of these rituals in managing natural resources remained unclear.

Our first objective was to understand the lived experiences of Indigenous rice farmers regarding their climate-related vulnerabilities and resilience-building efforts. We sought to uncover the intangible assets that help bolster farmers' capacity to overcome the challenges of climate change and adapt to changing circumstances.

Specifically, we aimed to:

- Identify the risks and impacts of climate change on Ifugao and Balinese ricescapes.
- Recognize the local intangible cultural heritage that serves as a foundation for ensuring resilience in the ricescapes.
- Examine the roles of transpersonal capacities as forms of intangible cultural heritage in fostering resilience.

Research design and methods

Our case studies focused on two UNESCO-designated World Heritage ricescapes: the Hungduan and Mayoyao rice clusters in Ifugao and the Jatiluwih rice terraces in Bali.

The first case study includes two sites. The Hungduan rice terrace cluster spans approximately 888 hectares, which accounts for about 3.09 per cent of Hungduan's land area. Most of the rice farmers in Hungduan belong to the Tuwali ethnolinguistic group. The second site is the Mayoyao rice terrace cluster, situated in the Municipality of Mayoyao, where roughly 12 per cent of the municipality's total area is allocated to terraced rice cultivation. The majority of residents in the municipality are part of the Ayangan ethnolinguistic group.

The second case study, the Jatiluwih ricescape in the Penebel District of Tabanan Regency, Bali, is part of a network of *subak* on the southeastern side of Mount Batukaru. This *subak* encompasses approximately 303 hectares and consists of seven sub-*subak*, known as *tempek*, which include 545 households. Jatiluwih rice farmers cultivate crops twice a year, with one of the growing cycles dedicated to traditional red rice cultivation.

Our research employed a mixed-methods approach, incorporating focus group discussions, in-depth semi-structured interviews, and site visits. Through local teams, we gathered data in Ifugao in August and November 2022, and in Bali in December 2021.

Our local teams compiled lists of potential study participants and employed snowball sampling to enhance them for the interviews and focus group discussions (FGD) (Figure 3 and 4).

Our case study participants were adult rice farmers who had been cultivating their fields for a minimum of five years, regardless of land ownership status, gender, ethnicity, or religion. Table 2 presents the study participants along with their codes.

Our local research teams recorded all interviews and focus group discussions, transcribed them manually, and translated them into English. Primary data collection concluded upon reaching saturation, as participants began to repeat information that had already been provided.

Figure 3. Focus group discussion in Mayoyao in Ifugao, Philippines
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Figure 4. Focus group discussion in Subak Jatiluwih in Bali, Indonesia
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Table 2: Case study participants, their brief descriptions and location

Participant code	Participant description and location
FG/I1	FGD with six (Indigenous People's Representatives) IPMRs from Hungduan, Ifugao
FG/I2	FGD with ten IPMRs from Hungduan, Ifugao
FG/I3	FGD with representatives from the various departments of the municipal government of Hungduan, Ifugao
FG/I4	FGD with eight IPMRs from Mayoyao, Ifugao
FG/I5	FGD with nineteen IPMRs from Mayoyao, Ifugao
FG/I6	FGD with six *subak* members, Jatiluwih, Bali
FG/I7	FGD with four *subak* members, Jatiluwih, Bali
FG/B1	FGD with four *subak* members from Tempek Kedamean, Bali
FG/B2	FGD with five *subak* members from Tempek Telabah Gede, Bali
FG/B3	FGD with five *subak* members from Tempek Gunungsari, Bali
FG/B4	FGD with four *subak* members from Tempek Kesambi, Bali
FG/B5	FGD with five *subak* members from Tempek Umadui, Bali
FG/B6	FGD with four *subak* members from Tempek Umakayu, Bali
FG/B7	FGD with five *subak* members from Tempek Besikalung, Bali
I1	Interview with an Indigenous farmer from Hungduan, Ifugao
I2	Interview with an Indigenous farmer from Hungduan, Ifugao
I3	Interview with an Indigenous farmer from Hungduan, Ifugao
I4	Interview with an agriculturist at the Municipal Agriculturist Office in Hungduan, Ifugao
I5	Interview with an IPMR and Chair of the Indigenous Peoples Organization in Hungduan, Ifugao
I6	Interview with the Municipal Mayor of Mayoyao, Ifugao
I7	Interview with an indigenous farmer from Mayoyao, Ifugao
NS1	Interview with a staff of the Department of Agriculture, Bali Province

NS12	Interview with the Secretary of the Department of Agriculture, Tabanan Regency, Bali
NS16	Interview with the Head of Culture and Tradition Section, Department of Cultural Affairs, Tabanan Regency, Bali
NS17	Interview with the Head of Subak Institutional Division, Department of Cultural Affairs, Tabanan Regency, Bali
NS2	Interview with staff for Tradition and Cultural Heritage, Department of Cultural Affairs, Bali Province
NS3	Interview with the Head of Tradition and Culture, Department of Cultural Affairs, Bali Province
NS13	Interview with the Head of Tourism Attractions Section, Department of Tourism, Tabanan Regency, Bali
NS4	Interview with the Head of Tourism Destination Section, Department of Tourism, Bali Province
NS15	Interview with the Head of Section for Pollution Control and Environmental Damage, Department of Environment, Tabanan Regency, Bali
NS14	Interview with the Secretary, Food Security Department, Tabanan Regency, Bali
NS7	Interview with a staff of the Water Resource Section, Department of Public Works and Housing, Bali Province
NS8	Interview with a staff of the Water Resource Section, Department of Public Works and Housing, Bali Province
NS5	Interview with the Staff Planning Section, Regional Rivers Office, Bali
NS9	Interview with the Section Chief of Regional River Flow, Department of Forestry and Environment, Bali Province
NS10	Interview with the Functional Staff, Department of Forestry and Environment, Bali Province
NS11	Interview with the Head of Division 1, Department of Forestry and Environment, Bali Province
NS6	Interview with the Head of Indigenous Village Development and Empowerment, Department of Advancement of Indigenous Peoples, Bali Province
NS18	Interview with the Head of Prevention and Preparedness Section, Regional Disaster Management Board, Tabanan Regency, Bali

We then employed MAXQDA software to facilitate the coding and analysis of the English transcripts. We developed both general and specific codes in line with the research questions and assigned relevant text segments to the appropriate codes. We recorded overarching ideas and insights using MAXQDA's in-document memo feature, grouped related codes with similar meanings, and exported them to a spreadsheet for further analysis.

Ethical and human rights considerations

The Human Research Ethics Protocol Committee of the Hong Kong University of Science and Technology approved the research ethics protocol for this project (Protocol No. 2021-0145) on 6 September 2021. With the assistance of the National Commission for Indigenous Peoples in the Philippines, we obtained free, prior, and informed consent from the Indigenous communities of Mayoyao on 7 December 2021 and Hungduan on 18 November 2021. We also secured a research permit in Bali from the Bali Provincial Government and received clearance from Badan Kesatuan Bangsa dan Politik (Permit No. 071/1124/BKBP/2021) on 3 October 2021.

Our local teams were all local residents. Collectively, we had 45 years of experience working with and conducting research with the communities in the study sites.

Strengths and limitations of the case study

Our case studies present the most recent account of climate risks, lived experiences of climate vulnerabilities, and resilience-building efforts in the UNESCO-designated World Heritage ricescapes of Hungduan, Mayoyao, and Subak Jatiluwih.

Our case studies relied on data collected by teams of local researchers, which were duly validated and verified by the lead and second authors to ensure

reliability. Our mixed methods of data collection yielded rich information for an in-depth analysis.

Despite this, we acknowledge certain limitations in our study. Firstly, data were collected during the pandemic, which may have impacted its quality. As former residents returned to the ricescapes, the sites regenerated, only to be abandoned again after the pandemic with the resumption of increased economic activities outside the locations. This situation suggests that the data may not be generalizable to typical conditions.

Secondly, our limited resources prevented us from conducting case studies on all the UNESCO-designated World Heritage ricescapes. Although three sites were listed, this project did not examine other sites, especially in Ifugao.

Climate-induced challenges and adaptive responses in Ifugao and Balinese ricescapes: Key findings

Risks and impacts of climate change on the Ifugao and Balinese ricescapes

The rice terraces are facing climate risks, particularly from droughts and intense rainfall. Study participants reported experiencing water shortages during the dry season and unpredictable rainfall patterns in the wet season (Pax 1 (FG/B7), Pax 1 (FG/B3), Pax 3 (FG/B7), Pax 3 (FG/B3), Pax 1 (FG/B3)). Climate change is acting as a threat multiplier, exacerbating local issues (Delina et al., 2024). Projections indicate that by 2100, rainfall in Ifugao and Bali will likely decline by between 10 and 20 per cent, further worsening the drought issue (Tangang et al., 2020).

Drought conditions adversely affect essential aspects of rice cultivation, including plant growth, root development, and leaf surface area, ultimately leading to decreased yields. In response to water scarcity during the dry season, some Ifugao farmers have shifted from rice farming to vegetable gardening (FG/I5), a trend that has also been noted in other studies regarding declining water availability in the region (Calderon et al., 2008). Cropping patterns have transformed, and the farmers' lack of knowledge has diminished their earnings, jeopardising their livelihoods in Ifugao (see also Santiago and Buot, 2018).

In Bali, the use of water in tourism complexes also contributed to water scarcity on the island (Cole and Browne, 2015). For example, in the Tempek Gunungsari study, participants encountered difficulties obtaining water during the dry season, leading to unsuccessful planting seasons (Pax 1, FG/B3). Moreover, a lack of water led to a large area of rice fields being uncultivated (Pax 3, FG/B7). Thus, tourism undermined rice farming.

Excessive rain during the wet season has posed a challenge of submergence (Wassmann et al., 2009). Study participants in Bali indicated that persistent rainfall can hinder rice plant growth, ultimately rendering fields unproductive (Pax 2 (FG/B1)), and can also result in the loss of unhusked rice and stunted rice plants, leading to a complete failure in grain harvest (I4).

The study also revealed that landscapes were degrading due to excessive chemical inputs. Furthermore, the generational challenges of replacing farmers were worsened by climate change.

Furthermore, the study revealed that farmers in these regions depend mainly on their personal experiences instead of acknowledging the wider implications of climate change and variability.

Community solidarity as a critical intangible cultural heritage for ensuring resilience in the ricescapes

Our data indicate that social capital plays a crucial role in strengthening community ties and ensuring the success of agricultural activities. The bonds within the community underpin farming practices in these ricescapes, where rice cultivation is approached as a collective endeavour. This approach emphasizes shared labour and fosters interpersonal relationships based on cooperation and reciprocity. Moreover, communal efforts are imbued with spiritual connections, which enhance community cohesion.

In examining the sources of intangible assets employed to cope with various pressures, the significance of family, customary village ties, relatives and neighbours is apparent among Ifugao farmers. These sources provide essential support for coping, farming assistance and financial backing (I1, I2, I3, I4, I7, FG/I1 & FG/I4). The foundational unit of Philippine

society — family and kinship — serves as a critical support system and decision-making entity within the communities (I1, I2, I3, I4, I5, I7, FG/I1 & FG/I4). Complementing these familial connections are relationships with relatives, neighbours and friends, whose spatial proximity and consistent presence are important (I1, I2, I3, I4, I5, I7, FG/I1 & FG/I4). Organized groups become particularly relevant when specialized knowledge is required to enhance the resilience of rice farming. Farmer groups are significant as they embody collective knowledge regarding farming methods (I5, FG/I1, FG/I4 & FG/I3) (Figure 5).

Figure 5. Community members working together (*bayanihan*) to tidy up areas along the rice terraces in Ifugao, Philippines
© Ivee Fuerzas

Semi-formal organisations, such as farmer groups and credit unions, also promote resilience within these communities (I1, I2, I5, FG/I4). These groups, characterized by a shared identity or purpose, bridge the gap between rice-farming communities and formal state institutions. They engage locally and exist in close proximity, making them ideal instruments for influencing community decision-making and providing a buffer against disasters.

Semi-formal organizations leverage trust, social networks, norms of reciprocity and flexible rule implementation, facilitating access to intangible assets through kinship, neighbours, friends and ancestral villages (I1, I2, I5, FG/I4). As new agricultural technologies emerge, farmer groups facilitate knowledge dissemination among their members, ensuring the adoption of sustainable practices (FG/I1, FG/I4). In the context of Ifugao, credit unions provide financial relief when access to formal credit and insurance is lacking (I1, I2, I5, FG/I4). While there have been instances in which individuals opportunistically exploit solidarity mechanisms during disasters (Baland et al., 2011; Buggle and Durante, 2021; Stephane, 2021), in general semi-formal organizations promote resilience strategies within their communities.

In the Bali *subak* system, strong cooperation is evident among families and institutions at local and various scales (FG/B7, FG/B3, FG/B1, FG/B4, FG/B2, FG/B5, FG/B6, NS15 & NS18). Locally embedded networks between *subak* and *tempek* (sub-*subak*) are highly responsive and supportive. The traditional practice of *gotong royong*, which exemplifies mutual assistance and cooperation, remains a vital institution wherein *subak* family members help with local repairs, support one another during labour-intensive periods, oversee field plots, conduct rituals, and partake in various other activities (FG/B7, FG/B3, FG/B1, FG/B4, FG/B2, FG/B5, NS14 & NS18).

Subak institutions also have distinct mechanisms to seek support from various agencies, including agricultural assistance from the Department of Agriculture (FG/B7, FG/B3, FG/B1, FG/B4, FG/B2, FG/B5, FG/B6, NS1 & NS12), irrigation development aid from the Public Works Agency (NS7), forest restoration support from the Forestry Agency (FG/B5 & NS10), and assistance in preserving cultural values from the Department of Culture (NS10, NS6 & NS16). This support encompasses the provision of engineering designs (NS17), construction and repair work (FG/B7, FG/B3, FG/B1, FG/B2, FG/B5, FG/B6, NS17, NS1 & NS12), seed and input distribution (FG/B7, FG/B1, FG/B5, FG/B6, NS1 & NS12), disaster subsidies (FG/B3, FG/B1, FG/B5 & NS18), upstream water preservation mechanisms (FG/B3, FG/B1, FG/B2, FG/B6, NS6, NS16, NS12, NS15 & NS13), and financial assistance for maintaining *subak* values (FG/B7, FG/B3, FG/B1, FG/B5, NS6, NS1, NS16, NS12 & NS15). However, these relationships are complex and can sometimes have negative impacts on the farmers.

Whether rooted in familial ties, communal organizations, or semi-formal institutions, these systems emphasise the importance of cooperation, reciprocity, and shared identity in sustaining traditional agricultural practices and community well-being within ricescapes. Our data highlight the crucial role

of these groups (I5, FG/I1, FG/I4, FG/I3, FG/B3, FG/B5, NS1, NS12 & NS14), as well as women's groups (I4, FG/I1, FG/I4, FG/I3, FG/B3, FG/B1, NS1, NS12 & NS14) and immediate networks in providing essential farm support in these ricescapes. These mutual assistance mechanisms are vital for reinforcing the sustainability of agricultural practices, serving as systems that enable the synchronisation of farming activities, resource management, labour availability, water management, and pest control (I4, FG/I1, FG/I4, FG/I3, FG/B7, FG/B3, FG/B1, FG/B4, FG/B2, FG/B5, FG/B6, NS17 & NS12).

The farming groups provide essential support in coordinating various aspects of agricultural life, as documented by Acabado (2013) and Lansing (2007) in Ifugao and Bali, respectively. These groups facilitate efficient resource management, ensure the availability of labour when required, and regulate water usage and pest infestations. Such semi-formal institutions are particularly effective in regions characterised by centralized resources and irrigation systems, as observed in our study sites.

The Ifugao rice farming system differs from those at other sites as it relies on customary communal work groups known as *uggbu* and *baddang* (Acabado, 2013). These groups oversee agricultural activities within specific *muyung* or agricultural districts, operating under the guidance of kinship and territorial affiliations (I1, I2, I3, I4 & FG/I1) (see Figure 5 for an example of a farm activity in Ifugao). Supported by the Ifugao's primogeniture system of property rights, along with customary laws and practices, these communal work groups form a robust socioecological system that sustains resource management and cooperation among community members (I2, I3, I4 & FG/I1). Notably, the *tomonak*, the ritual leader of an agricultural district, guides rice communities in synchronizing their activities, ensuring efficient sharing of labour and water resources, and enhancing pest management (FG/I1 & FG/I4). Thus, while formal farming groups exist, the customary work groups serve as more effective sources of direct farm support due to their self-organized nature and integration into the community's social structure (Acabado and Martin, 2015).

Figure 6. Land preparation in Hungduan Rice Terraces, Ifugao, Philippines
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The Ifugao and Bali communities have developed mechanisms for immediate farm support and mutual assistance in various situations, including disasters, farm production periods, and rituals to restore balance. Floods, droughts, landslides, and heavy storms can disrupt farming activities and the sharing of water resources. In response, farmers liaise with government agencies for assistance or coordinate within their respective *subaks* to tackle these challenges (FG/B7, FG/B3, FG/B1, FG/B4, FG/B2, FG/B5, FG/B6, NS7, NS12, NS15 & NS14). Labour coordination during planting and harvest periods, involving a mix of wage-based and reciprocal arrangements, is essential across the study sites (FG/I1, FG/I4, FG/B7, FG/B3, FG/B1, FG/B2, FG/B5, FG/B6, & NS12). Pest management decisions are crucial, as pests can impact growing periods and require structured decision-making (FG/I1, FG/I4, FG/B7, FG/B1, FG/B4, FG/B2, FG/B5, FG/B6, NS12 & NS14).

In both case study locations, residents continue to engage in rice-farming rituals that help maintain ecological and spiritual balance within their respective ricescapes. However, the performance of such rituals has declined in frequency in Ifugao, reportedly due to the introduction of Christianity. Nonetheless, these rituals are still conducted when negative environmental and spiritual signs arise, such as pest outbreaks or unusual weather phenomena (FG/I1, FG/I4, FG/B7, FG/B3, FG/B1, FG/B4, FG/B2, FG/B5, FG/B6, NS12 & NS14).

The role of intangible cultural heritage in building resilience to climate impacts

The experiences of Indigenous rice farmers in ricescapes, as they build their resilience, provide valuable insights into navigating the complex challenges and opportunities associated with preserving rice farming traditions and promoting agricultural sustainability. The lessons derived from this research are summarized as follows.

Diverse coping strategies: A central theme in our findings is the variety of strategies employed to build resilience, particularly within the context of Indigenous rice farming. Our research identified diverse perspectives among farmers. While some farmers firmly believe in the future of Indigenous rice farming, highlighting the deep spiritual connection this practice holds for their communities, others do not. Similarly, farmers vary in the coping strategies they adopt in response to the impacts of climate change. Some individuals opt to diversify into alternative livelihoods, while others remain resolutely committed to traditional Indigenous rice farming techniques.

Community-based resilience efforts: Indigenous rice farming communities have demonstrated remarkable resilience, fundamentally grounded in collective efforts. Our findings highlight the essential role of community bonds, particularly within the Indigenous context. *Bayanihan* and *gotong royong* are crucial in establishing and maintaining resilience among Ifugao and Balinese rice farmers. Beyond the practical dimensions, the cultural and spiritual elements foster community cohesion, often intertwined with Indigenous rice farming rituals and practices. Observations from the ricescapes illustrate how these communal networks and institutions facilitate resource management, thereby enhancing the overall resilience of the agricultural system.

Formal vs informal support: A crucial aspect of resilience building in Indigenous rice farming lies in balancing formal and informal support mechanisms. Our findings indicate that familial and social networks are significant within Indigenous communities, providing essential support during crises. Furthermore, semi-formal organizations, such as the *subak* institution, farmer groups, and credit unions, serve to bridge the gap between Indigenous communities and formal state institutions. The role of such institutions in facilitating access to resources and support is particularly evident in preserving Indigenous rice farming traditions. Formal government assistance programmes faced challenges during the pandemic, and bureaucratic inefficiencies pose significant hurdles for Indigenous rice farmers due to overtourism.

Adaptation and innovation in Indigenous rice farming: Resilience within Indigenous rice farming often relies on the ability to adapt and innovate when faced with unforeseen challenges. It is crucial to embrace adaptation and innovation, particularly during times of crisis. Indigenous knowledge and traditional techniques inform the adaptation strategies used by Indigenous rice farmers, enabling them to respond effectively to various challenges. Local wisdom plays a significant role in shaping adaptive responses in the context of Indigenous rice farming. Indigenous rice farmers have adapted in numerous ways, including exploring alternative livelihoods, diversifying their income sources, and venturing into new sectors, all while preserving their Indigenous rice farming traditions. Upholding cultural values and practices is fundamental to this process.

Harmonization of efforts: Achieving resilience within ricescapes demands coordinating local and national efforts in disaster response and preparedness. The study findings indicate a need for improved collaboration, focusing on the unique challenges faced by Indigenous rice farming communities. Difficulties arise as a result of fragmented responses from formal institutions. Effective community leadership and governance structures are essential for harmonizing local and national efforts. The inclusivity of decision-making processes emerges as a crucial factor, ensuring that the voices and needs of Indigenous communities are adequately represented and addressed in broader agricultural policies and disaster management strategies.

Conclusion

Our case studies highlight the critical importance of understanding the emerging climate risks that intersect and cascade with other pressures faced by Indigenous rice farmers in the UNESCO-designated

World Heritage ricescapes of South-East Asia, as well as the intangible assets that communities utilize to develop resilience strategies within these cultural landscapes.

The prominence of water-related stressors, which are intensifying as climate change progresses, is central to the lived experiences of these communities. The study found that in coping with this stress, intangible assets are a primary source of resilience and are particularly important when formal institutions fail to deliver their mandated services effectively. Such assets include organizations and affiliations that foster collaboration, cooperation and reciprocity. However, resilience strategies in these ricescapes are diverse and evolving, primarily due to unequal access to tangible and intangible assets. Addressing the challenge of ensuring equitable access for all stakeholders remains a vital goal.

The future of these sites as cultural landscapes is intrinsically linked to the recognition of intangible assets as essential to their proactive and fit-for-purpose management. Such recognition is imperative, as these assets contribute significantly to the sustainability and cultural integrity of these invaluable agricultural heritage sites in the face of ongoing challenges exacerbated by climate change.

Recommendations

In light of the conclusions presented above, we propose the following recommendations to enhance, strengthen, and sustain the capacity of Indigenous rice farmers and their communities in coping with the myriad challenges they face.

- **Recognize intangible assets:** Explicitly recognize the significance of intangible assets, particularly social networks, traditional knowledge and community cohesion, in building climate resilience among rice farmers. This recognition should be woven into policy frameworks, particularly within the management plans of these sites. By recognizing the significance of intangible assets and the complex dynamics of resilience, policymakers can more effectively support these communities in preserving their traditions, promoting sustainable agricultural practices and responding to future challenges.
- **Review management plans:** UNESCO, in collaboration with site managers, should conduct a comprehensive review of existing management plans to assess their fitness for purpose and implementation status and to identify any emerging issues. This review should also evaluate whether emerging challenges are being adequately addressed, particularly in alignment with the findings of UNESCO's site conservation reports from Ifugao (UNESCO, 2021a) and Bali (UNESCO, 2023a). Where deficiencies are identified, UNESCO should proactively engage with site managers to address these appropriately. It is worth noting that Ifugao's master plan expired in 2024 (Province of Ifugao, 2015). While a master plan was included in the nomination documents for Bali, as of 2024 the site did not have an active master plan.
- **Support community-based initiatives:** Encourage and support projects and initiatives within communities and villages that aim to preserve and share traditional knowledge and practices of rice cultivation. This support should encompass funding for cultural events, knowledge-sharing platforms, and intergenerational programmes that foster the transmission of Indigenous rice-farming wisdom.
- **Create knowledge-exchange platforms:** Create platforms and programmes to exchange knowledge between Indigenous farming communities and formal institutions. This can be achieved by establishing partnerships with local agricultural agencies, universities, and Indigenous knowledge holders. The goal is to bridge the gap between traditional and modern farming practices and foster the development of extreme weather early warning systems.
- **Empower local institutions:** Empower local institutions, such as *subak* and communal work groups, by providing them with the necessary resources and authority to manage their agricultural systems, and encourage local decision-making and sustainable resource management.

- **Prepare disaster management plans:** In consultation with rice farmers, design and implement *subak* or communal disaster prevention, preparedness, response, and recovery plans and ensure they are tailored to local needs, taking into account their particular climate change-related challenges.

- **Improve government support systems:** Enhance the efficiency and accessibility of government support systems for extreme weather events. This includes streamlining bureaucratic processes, ensuring the timely distribution of aid, and communicating with farmers about available support.

- **Provide support for livelihood diversification:** Encourage livelihood diversification through providing training programmes, access to credit for alternative income-generating activities and support for small businesses and sustainable agrotourism ventures.

- **Promote sustainable practices:** Encourage sustainable rice cultivation techniques that align with Indigenous stewardship principles. This encompasses incentivizing agroecological farming methods, supporting organic agriculture, and safeguarding traditional seed varieties.

- **Invest in rural infrastructure:** Invest in infrastructure such as sustainable irrigation systems, transportation networks and market access to enhance agricultural productivity and sales and to improve the capacity of communities to cope with climate challenges.

- **Support collaboration:** Encourage cooperation among governments, non-governmental organizations, Indigenous communities, and academic institutions to promote a holistic approach to *subak* and community-oriented resilience building.

- **Recognize Indigenous wisdom:** Facilitate discussions about the value of Indigenous agricultural knowledge and practices. This includes understanding how local farmers utilize intangible assets when addressing challenges and sharing these insights with international and intergovernmental organisations.

- **Integrate climate change indicators:** Encourage UNESCO to integrate climate change indicators into its monitoring and reporting processes for World Heritage sites, which site managers must undertake annually.

Acknowledgements

The work described in this paper was substantially supported by a grant from the Hong Kong Research Grants Council (Project No. HKUST-26600521). The HKUST Institute of Emerging Market Studies also made available partial funding with support from EY Project No. HKUST-IEMS21IPO1). We thank the Indigenous cultural communities of Hungduan and Mayoyao for participating in the study. The case studies are excerpts from Delina et al. (2024).

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Safeguarding Intangible Cultural Heritage: Assessing the Impact of Climate Change on Traditional Agricultural Knowledge and Wisdom in Sri Lanka

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Summary

Sri Lanka's traditional agricultural knowledge and wisdom (TAKW) constitute a vital component of its intangible cultural heritage, deeply rooted in centuries-old practices and adapted to local ecological and climatic conditions. However, climate change poses a significant threat to these traditions. This study critically examines how shifts in temperature, rainfall patterns and extreme weather events jeopardize the sustainability of TAKW, focusing particularly on practices such as traditional farming and water management. Through a systematic literature review and thematic analysis, the research identifies key vulnerabilities and adaptive strategies within Sri Lanka's agricultural communities. The findings underscore the resilience embedded in TAKW, highlighting its role in promoting biodiversity conservation and sustainable land use practices. The study also explores socio-cultural factors influencing the transmission of traditional knowledge and proposes strategies to safeguard TAKW in the face of the impacts of climate change. By integrating insights from policy frameworks and community perspectives, this research contributes actionable recommendations aimed at enhancing the resilience of Sri Lanka's agricultural heritage and ensuring its continuity for future generations in the face of evolving challenges.

Background

Sri Lanka, an island nation with a rich cultural heritage, is deeply rooted in traditional agricultural practices that have been passed down through generations. These practices, collectively known as traditional agricultural knowledge and wisdom (TAKW), encompass a wide range of techniques, beliefs, and rituals that are linked to the island's ecosystems (Perera, 2015). TAKW includes methods of crop rotation, organic farming, water conservation, and pest management, all adapted to the specific climatic and geographical conditions of Sri Lanka (Seneviratne, 2009).

The significance of TAKW extends beyond agriculture, playing a crucial role in maintaining the cultural identity and social cohesion of rural communities. It embodies the collective experience and innovations of generations, contributing to sustainable land use and biodiversity conservation (Wijesuriya, 2015). However, climate change poses a serious threat to these traditional systems. The Intergovernmental Panel on Climate Change (IPCC) has highlighted that developing countries, including Sri Lanka, are particularly vulnerable to climate change due to their reliance on agriculture and because they have fewer financial and technological resources to enable them to adapt (IPCC, 2014).

Climate change impacts in Sri Lanka include rising temperatures, altered precipitation patterns, and increased a greater frequency of extreme weather events such as storms that lead to flooding (Eriyagama et al., 2010). These impacts have profound effects on agricultural productivity. For instance, shifts in monsoon patterns disrupt planting and harvesting cycles, while temperature

extremes affect crop yields and pest dynamics (De Costa, 2010).

The erosion of TAKW is further exacerbated by socio-cultural factors such as urbanization and the shift towards modern agricultural practices. As younger generations migrate to urban areas or adopt commercially driven farming methods, the intergenerational transmission of traditional knowledge is threatened (Perera, 2015). Consequently, the rich repository of knowledge that historically ensured agricultural sustainability and ecological balance is at risk of being lost (Seneviratne, 2009).

In response to these challenges, there is a growing recognition of the need to integrate TAKW into climate adaptation strategies. Berkes (2008) notes that traditional ecological knowledge (TEK), a subset of TAKW, can enhance community resilience and adaptive capacity by providing context-specific solutions to environmental changes. Similarly, UNESCO (2016) advocates for the documentation and revitalization of intangible cultural heritage (ICH) as a means of fostering sustainable development and cultural continuity.

The Sri Lankan government, in cooperation with international organizations, has initiated several projects aimed at conserving TAKW and promoting sustainable agricultural practices. These include the restoration of traditional irrigation systems, the promotion of organic farming and the development of climate-resilient crop varieties (Herath, 2018). However, the effectiveness of these initiatives depends on the active participation and empowerment of local communities, as well as the creation of supportive policy frameworks (Moser and Ekstrom, 2010).

In light of these considerations, this study seeks to identify the vulnerabilities of TAKW and highlight local adaptive strategies to climate change in Sri Lanka. By examining the interplay between environmental changes and traditional practices, the study aims to contribute to the broader discourse on safeguarding intangible cultural heritage in the face of global climate challenges.

Statement of the problem

The rich tapestry of traditional agricultural knowledge and indigenous wisdom in Sri Lanka constitutes a vital component of the nation's intangible cultural heritage (ICH) (Perera, 2015). However, the impacts of climate change present a significant threat to this invaluable heritage (IPCC, 2014). The problem at hand is to understand the impact of climate change on the traditional agricultural practices deeply embedded in Sri Lankan culture.

Traditional agricultural knowledge and wisdom (TAKW) in Sri Lanka include practices such as crop rotation, organic farming and water conservation, which have been adapted to the local climatic and ecological conditions over centuries (Seneviratne, 2009). These practices not only sustain agricultural productivity but also preserve biodiversity and maintain ecological balance (Wijesuriya, 2015). However, climate change is disrupting these age-old practices through changes in weather patterns and agro-ecological zones, and increased frequency and intensity of extreme weather events (Eriyagama et al., 2010).

Recent studies indicate that changing rainfall patterns and temperature extremes are already impacting crop yields and farming cycles in Sri Lanka (De Costa, 2010; Premalal, 2012). For instance, farmers are experiencing lower yields of traditional rice varieties, which are central to Sri Lankan agriculture (De Silva, 2016). Socio-economic pressures such as urbanization and mechanization further threaten the transmission of TAKW, as younger generations migrate to urban areas or adopt commercial farming methods (Perera, 2015).

Given these challenges, there is an urgent need to explore how the reliability and efficacy of traditional agricultural practices are affected by climate change. This is critical for identifying adaptive strategies that can enhance the resilience of TAKW and ensure its transmission to future generations (Berkes, 2008). Furthermore, understanding the vulnerabilities and adaptive capacities of TAKW can inform the development of integrated climate adaptation strategies that incorporate traditional knowledge into contemporary agricultural practices (Moser and Ekstrom, 2010).

The urgency of safeguarding Sri Lanka's intangible cultural heritage is underscored by the broader

implications of such heritage for sustainable development and cultural identity (UNESCO, 2016). By addressing the impacts of climate change on traditional agricultural practices, this study aims to contribute to increasing resilience and to ensuring the continuity of TAKW, so that it remains a living heritage capable of supporting sustainable agriculture and enriching cultural diversity in the face of evolving environmental conditions (Herath, 2018).

Objectives of the study

Main objective

- Evaluate the impact of climate change on traditional agricultural knowledge and practices in Sri Lanka, with the aim of safeguarding and promoting sustainable agricultural heritage.

It is necessary to understand and mitigate the impacts of climate change on Sri Lanka's rich intangible cultural heritage (Perera, 2015; UNESCO, 2016).

Sub-objectives

- Assess how traditional agricultural methods in Sri Lanka are vulnerable to the impacts of climate change, identifying specific practices that are most at risk.

The first sub-objective aims to pinpoint the vulnerabilities to climate change within traditional agricultural systems in Sri Lanka. It seeks to identify practices most susceptible to changes in temperature, rainfall patterns, and extreme weather events, which have been shown to disrupt traditional farming cycles and reduce crop yields (De Costa, 2010; Eriyagama et al., 2010). Understanding these vulnerabilities is essential for developing targeted interventions (IPCC, 2014).

- Document traditional knowledge and indigenous wisdom related to agriculture, considering practices, rituals, and seasonal predictions embedded in the cultural heritage.

The second sub-objective focuses on the comprehensive documentation of TAKW, capturing not only the practical agricultural techniques but also the associated rituals, beliefs, and seasonal knowledge that form an integral part of the cultural fabric (Seneviratne, 2009). Such documentation is vital for preserving this knowledge for future generations and providing a foundation for further research and conservation efforts (Wijesuriya, 2015).

- Examine the extent to which climate change is contributing to the erosion of intangible cultural heritage, with a specific focus on the potential loss of traditional agricultural knowledge.

The third sub-objective seeks to analyse the relationship between climate change and the erosion of ICH, focusing on the decline in traditional agricultural knowledge (De Silva, 2016). By exploring how climate-induced changes are affecting the transmission and practice of TAKW, this research aims to highlight the broader cultural impacts of environmental changes (Moser and Ekstrom, 2010).

- Formulate practical recommendations for safeguarding traditional knowledge and indigenous wisdom in the realm of agriculture, considering both community-based strategies and policies.

The fourth sub-objective aims to develop actionable recommendations for preserving TAKW. It considers community-driven initiatives, such as the revitalization of traditional practices and knowledge-sharing networks, as well as policy measures that support the integration of TAKW into national adaptation strategies (Herath, 2018; UNESCO, 2016). The goal is to ensure that traditional knowledge continues to contribute to sustainable agricultural practices and cultural resilience in the face of climate change (Berkes, 2008).

Limitations of the study

While this study provides a comprehensive analysis of the impact of climate change on traditional agricultural knowledge and practices in Sri Lanka, several limitations should be acknowledged.

- The reliance on secondary data sources may introduce biases related to the original data collection methods and interpretations.

The availability and accessibility of literature in English might have resulted in the exclusion of relevant studies published in local languages, potentially overlooking region-specific insights.

- The temporal scope of the literature review, spanning publications from 1900 to 2023, may miss recent developments and the most current data on climate impacts and adaptation strategies.

Although efforts were made to include the latest research, the rapidly evolving nature of climate science means that some findings could be outdated.

- The study's thematic analysis, while thorough, is inherently limited by the subjective interpretation of the researcher.

This subjectivity could influence the categorization and synthesis of information, potentially affecting the conclusions drawn.

- The geographical focus on Sri Lanka's diverse agro-ecological zones may limit the generalizability of the findings to other regions with different climatic and cultural contexts.

The unique interplay between local environmental conditions and traditional knowledge systems means that results may not be directly applicable elsewhere without significant adaptation.

- The integration of expert opinions, while valuable for validation, also introduces the potential for bias based on the experts' perspectives and experiences.

- The study's recommendations, while informed by comprehensive data analysis, may face practical challenges in implementation due to socio-political, economic, and infrastructural constraints in Sri Lanka.

Recognizing these limitations is crucial for contextualizing the study's findings and underscores the need for ongoing research and adaptive strategies to address the dynamic and multifaceted impacts of climate change on traditional agricultural practices.

Research design and methods

This study included a comprehensive literature review to evaluate the impact of climate change on traditional agricultural knowledge and practices in Sri Lanka. The method involved systematic steps to ensure a thorough analysis of existing research and data. Researchers conducted a systematic search across multiple sources including Google Scholar, JSTOR, and Science Direct using search terms such as 'traditional agricultural knowledge', 'climate change', 'Sri Lanka', 'intangible cultural heritage', 'adaptive capacity', and 'sustainable agriculture'. The researchers also examined peer-reviewed articles, journals, e-journals, books, book chapters published between 1900 and 2023, as well as government and NGO reports, and studies focusing on the impacts of climate change on agriculture and traditional knowledge in Sri Lanka. In total, the researchers reviewed over sixty documents, ensuring a comprehensive analysis of the intersection between climate change and traditional agricultural practices in Sri Lanka. Exclusion criteria filtered out studies not directly addressing the intersection of climate change and traditional agricultural practices or those with insufficient methodological rigor.

From the selected literature, the researchers extracted key information, including study objectives, methodological approaches, findings related to the impact of climate change on traditional agricultural practices, identified vulnerabilities, adaptive strategies, and policy recommendations. This information was thematically categorized into areas such as the impacts of climate change on specific traditional agricultural practices, socio-economic factors affecting traditional knowledge transmission, successful adaptation strategies, and policy frameworks supporting traditional agriculture.

The researchers conducted a thematic analysis to identify patterns, trends, and gaps within the literature, comparing findings across different studies and highlighting the unique adaptive strategies employed by Sri Lankan farmers. The Sri Lankan experience was contextualized within a broader global framework through comparison with similar studies from other regions. Synthesized findings were organized into a coherent narrative describing the vulnerabilities of traditional agricultural knowledge to climate change, the role of TAKW in promoting sustainable agriculture, and the adaptive capacities of rural communities. Expert opinions were integrated to validate the findings, cross-referencing with policy documents, reports from international organizations such as the IPCC and UNESCO, and other academic literature to ensure reliability. Discrepancies or gaps in the

literature were noted, with suggestions for further research.

Based on the synthesized findings, the researchers developed practical recommendations for safeguarding traditional knowledge and promoting sustainable agricultural practices. These recommendations emphasize community-based strategies, policy changes and the integration of traditional knowledge into national and local climate adaptation plans, ensuring a comprehensive approach to resilience and sustainability.

Ethical and human rights considerations

The study prioritized ethical considerations and human rights principles to ensure the welfare and dignity of all participants.

- Participants were provided with detailed information about the study's purpose, procedures, and potential outcomes before obtaining their informed consent. Participants were assured that their involvement was voluntary, and they had the right to withdraw from the study at any stage.
- Cultural sensitivity was a paramount consideration in interactions with participants. The research team respected and integrated local customs, traditions, and languages during interviews and group discussions.
- For participants who communicated in Tamil, a translator was engaged to ensure accurate and respectful communication.

Figure 1. Finished harvesting of the Yala season over floodwaters using a Sri Lankan traditional canoe, followed by paddy field preparation for the Maha season in the wet zone, low country – Bentota region (WL4).
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- Participants had the right to privacy, and measures were implemented to protect their personal information, ensuring that no identifiable data was disclosed without explicit consent.
- The research was conducted without discrimination, ensuring that all individuals, regardless of ethnicity, gender or social status, had equal opportunities to participate and contribute to the study.

Results and discussion

Assess how traditional agricultural methods in Sri Lanka are vulnerable to the impacts of climate change, identifying specific practices that are most at risk.

Sri Lanka's agricultural sector faces significant challenges due to climate change due to the increasing variability and extremes in temperature, rainfall and weather events (Eriyagama et al., 2010). Understanding these vulnerabilities is necessary in order to develop targeted interventions to ensure food security and rural livelihoods (IPCC, 2014).

- Rainfed agriculture and changing rainfall patterns:

In Sri Lanka, staple crops like rice are grown via rain-fed cultivation, which makes them vulnerable to changing rainfall patterns, with both erratic precipitation and prolonged droughts becoming more common (De Costa, 2010). Traditional planting schedules, which are based on historical rainfall patterns, have been disrupted, leading to crop failures and reduced yields (Eriyagama et al., 2010).

- Water management and droughts:

Traditional water management systems and water reserves like tanks and canals are being depleted due to more frequent droughts. Additionally, rising temperatures increase evapotranspiration, further reducing available water for crops (National Building Research Organization, 2018).

- Crop yields and rising temperatures:

Many crop varieties, including rice cultivars, are adapted to specific temperature ranges. Rising temperatures can stress these crops, resulting in lower yields and quality (Eriyagama et al., 2010).

Figure 2. Drought and rising temperatures stressing crops, resulting in lower yields and quality: Impact on chili cultivation in the dry zone, low country (DL3) – Jaffna region.
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Figure 3. Farmer explaining and showing his damaged chili cultivation affected by drought and rising temperatures during the data collection process in the dry zone, low country (DL3) – Jaffna region.
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Additionally, heat stress can increase pest and disease outbreaks, further impacting yields.

- Extreme weather events and crop losses:

The increased frequency and intensity of extreme weather events like cyclones and floods pose a significant threat to crops. These events can disrupt planting cycles, cause widespread crop losses and damage infrastructure like irrigation canals and storage facilities (De Costa, 2010).

- Loss of local knowledge and adaptation capabilities:

Traditional farming knowledge is passed down through generations and relies heavily on historical patterns. Climate change disrupts these patterns and affects the ability of farmers to predict changes in the weather and the best times for planting, which is essential for their traditional agricultural practices. Consequently, they are often compelled to deviate from traditional cultivation methods, jeopardizing the sustainability of their agricultural heritage. Adaptation efforts are hindered by limited access by farmers to resources and information (National Building Research Organization, 2018).

Document traditional knowledge and indigenous wisdom related to agriculture, considering practices, rituals, and seasonal predictions embedded in the cultural heritage.

Sri Lanka's agricultural heritage is rich in TAKW, which includes practical techniques, rituals, beliefs, and seasonal predictions passed down through generations. Documenting this knowledge is crucial not only for preserving cultural heritage but also for understanding its potential contribution to sustainable agriculture in a changing climate (Seneviratne, 2009).

Traditional practices

- Crop selection and planting:

Traditional farmers possess knowledge of diverse crop varieties adapted to local microclimates and soil conditions. Practices like selecting and saving seeds from well-performing plants ensure genetic diversity and resilience (Wijesuriya, 2015). Planting rituals often involve offerings and reflect the deep connection between agriculture and cultural beliefs.

The Helmalu (terraced) paddy cultivation in Hill Country, Sri Lanka: Due to the region's heavy rainfall, farmers traditionally choose rice varieties with shorter maturation periods. Although not expected to produce high yields, these varieties, such as the *Hatada Vee,* which takes sixty days to cultivate, were favoured because they could be harvested quickly, reducing the risk of crop damage from excessive rain. For example, the *Mutthas,* a type of low-season samba rice, and *Mutu Samba* (Pearl Samba Rice). During the short monsoon season, known as *Yala* season, farmers also traditionally planted short-term rice varieties, which were also quick to mature. Ubesekhara Dissanayake has noted that there were numerous rice varieties cultivated in this manner, with W. Ivers mentioning several inferior

varieties such as *El Vee, Heenati,* and *Ilangamattan*. *Ilangamattan,* a variety sourced from neighbouring India that is characterized by its thin and elongated grains. *Heenati,* another variety, was particularly valued for making porridge, especially for the sick and those recovering from illness due to its nourishing properties (Tennakoon, 2017).

- Water management:

Traditional irrigation systems, like the ancient tank cascade network, demonstrate a sophisticated understanding of water management and engineering knowledge. Communities traditionally engaged in rituals and cooperated to ensure equitable water distribution (Mendis et al., 2017).

Figure 4. Sri Lankan traditional water management and control system used to fulfill water needs for paddy cultivation.
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Our ancestors possessed a thorough understanding of rice varieties and the different soil and water conditions they were particularly suited. They had knowledge of the specific water, soil, environmental, and climatic conditions best suited to each of the traditional rice varieties. For example, *Thawalu paddy, Heenati,* and *Muppagan* rice varieties were ideal for cultivation in the soils around Vawu Tavalu. After the water tank overflowed, the *Muppagan* rice variety was sowed. They carefully selected the varieties to ensure optimal growth and yield, reflecting a deep connection with and understanding of their natural surroundings (Devanarayana, 2020).

As described by Tennakoon (2017), Robert Knox once remarked that water is a feast for the farmer, and when the fields are full of water, farmers experience the same joy as when their barns are full, recognizing the essential role of water in cultivation. Water has always been the foremost requirement in rice farming in Sri Lanka. Rice grown in paddy fields requires careful water management techniques. For example, seven days after sowing, the paddy fields are flooded to prevent weeds from sprouting. This is a practice known as issan bandeema.

To meet the need for reliable supplies of water, farmers constructed 'tanks' (lakes, dams and ponds) to store water. Knox noted that the farmers' ingenuity and agricultural practices helped them achieve this goal. He observed that during the hot summer season, water in these tanks often dried up completely. It was customary not to dig the tanks too deep because although: deeper tanks could retain more water, the water would become inaccessible for irrigation, as it would stagnate in the depths (Tennakoon, 2017).

John Dave, in a report about Ceylon, commented on a water reservoir, Kantale Lake, describing it as a remarkable feat of engineering. He noted, "The Kantale tank, or reservoir, is a very large project. It is one of the finest I have ever seen. The dam is about a mile and a quarter long, and runs straight from a hill at one end to the rock at the other". Such water storage facilities supported extensive rice cultivation (Tennakoon, 2017).

- Pest and disease control:

TAKW incorporates traditional pest and disease control methods such as using natural repellents, companion planting and indigenous crop varieties with inherent pest resistance (Seneviratne, 2009).

Use of *kem* methods in Sri Lankan agriculture: Sri Lankans have been employing *kem* methods for crop protection for thousands of years. These traditional

Figure 5. Coconut branch stems set in the paddy field to support birds in standing and collecting insects from the field.
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techniques are used to safeguard crops from pests, diseases and threats posed by animals. The long-standing practice of *kem* methods demonstrates the agricultural knowledge and ingenuity of the Sri Lankan people in maintaining and protecting their crops over the centuries (Rathnayake, 2016).

For examples, when a crop is infected with a worm disease, the traditional method of eradicating the pest involves the following steps. First, a fresh pot is placed on a three-stone hearth *(thunatta)* to boil milk. Once the milk boils over, raw rice is added to cook milk rice *(kiribath).* After preparing the milk rice, seven sticks are planted in seven locations around the affected field, each adorned with a piece of banana leaf. Some of the milk rice is then spread over the banana leaves, and the remaining milk rice is sprinkled across the paddy fields. It is crucial not to blow on the stove while cooking the milk rice and to refrain from speaking during the entire process. This traditional method is believed to protect the crop, typically showing results within two to three days, as the worms are completely removed (Rathnayake, 2016).

The scientific rationale for this traditional method is that when milk rice is placed on banana leaves around the field it attracts birds, who scatter the leaves causing the rice to fall to the ground. The birds then eat the rice on the ground and in the field where the rice was sprinkled. While in the fields, they eat the worms removing the worm infestation in the crop. This ingenious method leverages the birds' natural feeding behaviour to remove pests from crops (Rathnayake, 2016).

To protect seeds that have been sown, such as brinjal, chili, and tomato seeds, from ants, the *kem* method that Sri Lankan farmers traditionally used involved taking soil from a distant anthill and sprinkling it over the sown seeds. The scientific rationale behind this practice is that ants have territorial instincts so when soil from a distant anthill is introduced, the resident ants perceive it as a sign of an invasion by a hostile ant colony. This perceived threat prompts the ants to abandon the area. This method demonstrates the practical application of traditional knowledge in managing pests behaviour effectively (Rathnayake, 2016).

To drive away insects that damage crops, a traditional method involves a specific ritual, which begins by catching one of the harmful insects from the crop and then, without speaking, carrying the insect walks around the field seven times. After completing the seventh round, the insect is released, and the person claps their hands with their back to the field. The scientific basis for this practice might be that the act of walking around the field with the insect disperses the pest's pheromones or disrupts their normal behaviour patterns, potentially confusing other insects of the same species and discouraging them from remaining in the area. Additionally, the clapping sound could startle the insects, prompting them to flee. This method reflects an understanding of insect behaviour and aims to exploit their responses to environmental cues to protect crops (Rathnayake, 2016).

Seasonal predictions

Farmers traditionally had extensive knowledge of weather patterns and the behaviour of birds and animals as indicators (biological indicators) of seasonal changes (Wijesuriya, 2015). They possessed deep knowledge of various natural signs that indicated season changes, helping them to optimize their farming practices.

- Traditional agricultural calendars:

Traditional calendars based on lunar cycles and celestial observations guide planting times and agricultural activities. According to Kandegama (2011, 2014), in traditional agriculture the paramount principle is cultivating at the right time (*kal yal bala wagaa kirima*), by observing the weather patterns. The wisdom passed down from generation to generation emphasizes the need to wait for the opportune moment to cultivate in order to ensure a successful harvest. For traditional farmers, nature serves as their guide, and they have acquired cultivation techniques by closely observing and learning from nature. To those well-acquainted with nature, that not every crop can thrive at any time of the year to yield a prosperous outcome. Farmers possess the traditional knowledge that there is a specific window of time for cultivating to achieve a bountiful harvest. Natural cues such as sun, rain, wind, heat, cold, light, and darkness exert varying degrees of influence on crop growth.

Table 1: Indicators to predict the weather conditions

Indicators that predict the rainy seasons	Indicators that predict the dry seasons
When swallows migrate in September, it suggests the commencement of the convection rain period, lasting approximately 23 weeks.	The drying of nine coconut palm branches by January serves as an early sign of an impending drought.
The presence of Grey Wagtails signifies the arrival of rain in the maha season.	Pairs of hawks flying in crosses in the sky indicates the conclusion of the dry season.
The scream of a Forest Eagle-Owl serves as a signal that the rainy season is approaching.	When a drought is imminent, crows exhibit strange behaviour such as digging into their nests and feeding only one baby crow.
If foxes are heard howling in the middle of the night, it indicates the imminent arrival of a rainy season.	When quail (a type of bird) construct nests close to the ground, it signifies the arrival of the dry season.
The formation of many small clouds close together, known as *'Binara Kaluwa,'* serves as a traditional indicator for the arrival of rain in September.	The blooming of flowers on Red Seeds plants *(Adenanthera pavonina)* symbolizes the onset of the dry season.
Cloud formations resembling tuskers, crocodiles, lions, and sharks before sunrise indicate the likelihood of rain within the next two weeks.	When cows experiencing joint pain and are unable to produce milk it indicates the start of the dry season.
An overabundance of flowering in the Katupila plant *(Flueggea leucopyrus)* serves as an indicator of the upcoming rainy season.	The creation of new termite ant-hills serves as an indicator of the impending dry season.
When coucals (a type of bird), scream it indicates changes in atmospheric conditions that precede rain.	

Sources: Devanarayana (2020) and Kandegama (2011)

- Biological indicators:

In addition to following the traditional agricultural calendar, Sri Lankan farmers traditionally had an extensive understanding of biological indicators to guide their activities. Farmers observed specific biological indicators in the environment and determine the best times for planting and harvesting. The blooming of certain flowers, the behaviour of animals, and changes in vegetation were all closely monitored (see Table 1). For example, the traditional wisdom of farmers is to observe the cycle of the flame lily plant *(Gloriosa superba)* to predict temperature changes and distinguish between the *yala* and *maha* seasons (Kandegama, 2013; 2014). These indicators were used alongside the traditional calendar to ensure that agricultural activities were aligned with natural cycles, thereby enhancing crop yield and sustainability. This combination of traditional calendars and biological indicators is part of the rich agricultural heritage of Sri Lanka.

- Folklore:

Folklore often convey wisdom about weather patterns, pest outbreaks, and appropriate crop management for specific seasons (Mendis et al., 2017) and are embedded within agricultural practices. Farmers, with their deep connection to the land, have a profound understanding of the correlation between weather changes and shifts in the environment. This intricate knowledge has been skilfully woven into the fabric of poetry, where the rhythms of nature find expression in verses. Through their verses, farmers capture the essence of changing seasons, depicting the nuances of weather patterns, and the cyclical nature of life.

The poems below show that Sri Lankan traditional

farmers crafted their own timetables through careful observations of climatic conditions and changes in the natural environment (Kandegama, 2013; 2014).

kjï ufya § le,hg je§,d
(Nawam mahedi kalayata vadila)
uila muK l,a j,a fldgd,d
(masak pamana kal val kotala)
ueÈka ufia § j,a .sks ;nd,d
(madin mase dee val gini thabala)
l=ryka jmqruq l¨ƒjr n,d,d
(kurahan vapuramu kaluwara balala)

Meaning: In February farmers prepare for the upcoming planting season. During this month, farmers spend considerable time removing weeds. In March, the focus shifts to burning the weeds and preparing the land to ensure the soil is ready for sowing. Farmers meticulously observe the phases of the moon, particularly the upcoming black moon days, to time the sowing of millet. This practice is deeply rooted in traditional knowledge, which holds that specific lunar phases can influence crop growth and yield. By aligning their agricultural activities with these lunar observations, farmers optimize the conditions for planting, with the aim of ensuring a successful harvest.

fjila fmdfidka ui ìï f;dard .kag
(Vesak Poson masa bim thora ganta)
wei, ksls, ui ìï mSrd .kag
(Esala Nikini masa bim peera ganta)
ìkr ufya jegfldgq wyqrd .kag
(Binara mahe vatakotu ahura ganta)
jma ui mqr jmqrka wgq mqr jkag
(Vap masa pura vapuran atu pura vanta)

Meaning: In May and June, farmers focus on choosing suitable lands for cultivation. This period involves evaluating the fertility, water availability, and overall suitability of different plots to determine the best areas for farming. July and August are dedicated to preparing the soil on the selected farms. This includes activities such as ploughing, enriching the soil with organic matter, and ensuring that it is in prime condition for planting. The actual cultivation process begins in September. Farmers sow seeds and plant crops with the intention of leveraging the favourable weather during this month. The agricultural activities culminate in October, when farmers aim to achieve a bountiful harvest. The planning and preparatory work done throughout the year are designed to ensure that crops are ready for harvest during this season. This traditional agricultural calendar indicates the importance of timely and coordinated efforts in land selection, soil preparation, and cultivation to achieve successful harvests and sustainable farming outcomes.

Such folklore serves as a repository of collective knowledge that has been passed down through generations, offering insights for maintaining sustainable farming practices and ensuring the resilience of crops against threats, and providing farmers with time-tested strategies for maximizing yields.

Resilience

In Sri Lanka, Indigenous Knowledge (IK) and Traditional Knowledge (TK) have been applied in several ways to reduce losses and damages caused by climate change and natural disasters. These knowledge systems are deeply rooted in centuries of observation, adaptation, and sustainable practices.

Crop diversity is a key strategy for mitigating the effects of weather variability, as different varieties thrive under different environmental conditions. Farmers traditionally cultivated several varieties of crops, each of which was adapted to specific microclimates. These included drought-tolerant and flood-resistant varieties of rice such as *Hatada Vee* and *Mutu Samba*.

Seed-saving, which involves selecting and storing seeds from robust plants that performed well, including those that flourished in adverse conditions, is another traditional practice. This helps maintain genetic diversity and enhances crop resilience to changing weather patterns, pests and diseases.

Other traditional practices crop rotation and intercropping, which reduce soil depletion and pest outbreaks, contributing to long-term sustainability. Natural pest control methods, like companion planting and using plants as organic repellents to repel harmful insects, help reduce the damage caused by pests without the need for harmful chemicals. Farmers also traditionally used organic manure and compost as fertilizer, which keep soil healthy.

The *kem* methods, involve ritualistic natural techniques for pest management and help prevent losses. For instance, the placement of milk rice around fields attracts birds who control worm infestations in crops. This knowledge of natural pest control, passed down through generations, enables communities to manage agricultural pests.

Certain cultural rituals, such as the timing of planting ceremonies based on lunar cycles, help to ensure that crops are sown at optimal times, to maximize the chance of a good harvest. The rituals blend spiritual and practical approaches and incorporate traditional knowledge about the best times for agricultural activities.

In hilly regions, traditional terraced farming techniques *(helmalu)* are used to slow down the water flow, retain moisture in the soil, minimize soil erosion, manage water runoff, prevent land degradation and protect crops from landslides. These terraces are essential in maintaining agricultural productivity in the face of increased rainfall intensity due to climate change.

In recent years, there has been growing interest in incorporating modern technologies and methods into traditional agricultural practices. For instance, traditional water management systems are being enhanced with modern tools for monitoring rainfall and water levels, allowing for better prediction of water availability. Similarly, traditional crop varieties are being studied for their resilience traits, to develop new climate-resilient cultivars using modern techniques.

Disaster risk reduction

IK and TK systems in Sri Lanka provide valuable insights into climate adaptation and disaster risk reduction. By applying these methods, whether water management, resilient crop varieties or pest control, rural communities can farm sustainably. Integrating these time-tested techniques with modern innovations can enhance yields and ensure long-term food security in the face of ongoing climate-related challenges.

Examples:

- Traditional tank cascade system

Location: Dry Zone, Sri Lanka (e.g., Anuradhapura, Polonnaruwa)

Context: Frequent droughts and water scarcity, exacerbated by climate change.

Application: The tank cascade system is an ancient water management method developed to store and manage water in arid regions. The system consists of a network of interconnected reservoirs ('tanks') that capture and store rainwater for agricultural and household use. Each tank has a *kattakaduwa*, a protective embankment of trees that filters silt and enhances water retention.

Outcome: This system helps prevent water shortages, aids in ensuring continuous agricultural productivity, and reduces the risk of floods by controlling excess water. Reviving this traditional method has been recognized as an effective adaptation strategy to combat the impacts of climate change.

- Traditional knowledge of coastal communities in mangrove conservation

Location: Coastal areas, particularly in the Puttalam, Batticaloa, and Jaffna districts.

Context: Coastal erosion and storm surges due to sea-level rise and increased frequency and intensity of extreme weather events.

Application: Coastal communities in Sri Lanka have traditionally used mangroves to protect their shorelines from erosion, storm surges, and flooding. Mangrove forests act as natural buffers, reducing wave energy and trapping sediment. Local communities have long understood the importance of preserving mangroves for both protection and resources; they harvest fish and other products from mangrove ecosystems.

Outcome: In recent years, the traditional practice of conserving mangroves has been revived and supported through community-based mangrove restoration projects, which have proven effective in reducing the impacts of storm surges and in protecting biodiversity. These efforts have also been

integrated into climate adaptation programmes elsewhere to safeguard vulnerable coastal regions.

- Vedda knowledge of forest management and fire control

Location: Uva and Eastern Provinces (e.g. Dambana, Mahiyanganaya)

Context: Increasing frequency of forest fires due to prolonged droughts and higher temperatures.

Application: The Vedda people, an indigenous community in Sri Lanka, have traditionally practised controlled burning and selective forest clearing. They burn small patches of forest during wet seasons to reduce the buildup of dry fuel, which would otherwise be likely to ignite during droughts. This practice, combined with their deep understanding of local ecosystems, helps reduce the risk of large-scale forest fires.

Outcome: Controlled burning has been an effective traditional technique for reducing the frequency and intensity of wildfires, protecting forest ecosystems and human settlements.

- 'Home gardens' (Agroforestry)

Location: Wet Zone, Central Highlands, and rural areas throughout Sri Lanka.

Context: Changes in rainfall patterns are affecting agriculture, increasing the risk of crop failure.

Application: 'Home gardening' is a traditional form of agroforestry where diverse species of trees, shrubs, and crops are grown together around homes. This practice combines multiple layers of vegetation, which helps maintain soil moisture, prevent soil erosion, reduce dependence on single crops and provide food security throughout the year.

Outcome: Home gardens enhance biodiversity, which by allowing for greater flexibility in adapting to changing weather conditions, increases the resilience of ecosystems to climate change. This system has been recognized as a model for sustainable agriculture.

- Traditional warning system for landslides

Location: Central Highlands (e.g., Nuwara Eliya, Kandy, Badulla)

Context: Increased landslide risk due to deforestation combined with heavy rainfall.

Application: In Sri Lanka's central highlands, communities monitor traditional landslide indicators, such as changes in the behaviour of animals, cracks in the soil, and unusual water flow patterns, and use these as early warning signs of potential landslides. Local knowledge of the land and its natural changes helps people anticipate landslides before they occur.

Outcome: These traditional warning systems, combined with modern landslide risk mapping and early warning programmes, have helped save lives by allowing timely evacuations in areas prone to landslides.

- Dew collecting techniques in arid zones

Location: Arid regions of Sri Lanka, such as Hambantota and Moneragala.

Context: Severe water shortages due to prolonged droughts and erratic rainfall.

Application: Farmers in arid regions have developed techniques for collecting dew in the early morning hours, by using leaves, nets, and other items to trap moisture from the air. This dew collection is used to water crops and sustain small-scale agriculture when rainfall is insufficient.

Outcome: Dew collecting is a traditional, low-tech solution to water scarcity that helps farmers continue agricultural activities during droughts, contributing to food security in these regions.

These examples highlight how indigenous traditional knowledge in Sri Lanka has been crucial in mitigating the impacts of climate change and natural disasters. They not only offer practical, localized solutions but also foster resilience within communities facing increasingly unpredictable environmental challenges.

Challenges of documentation

Documenting TAKW can be challenging. The knowledge is often oral and can be place-specific. Additionally, some rituals may be considered sacred and require sensitive approaches to documentation (Seneviratne, 2009).

Importance of documenting TAKW

Documenting TAKW ensures that the benefits of TAKW are retained. These benefits include the following:

- TAKW safeguards a valuable part of Sri Lanka's cultural identity and facilitates its transmission to future generations.
- TAKW promotes biodiversity, soil health, and water conservation, and offers valuable insights for developing sustainable agricultural models in a changing climate (Wijesuriya, 2015).
- Understanding TAKW helps bridge the gap between traditional and modern agricultural practices, leading to the development of more holistic and resilient farming systems.
- TAKW represents a rich tapestry of agricultural knowledge, rituals, and beliefs. Documenting this knowledge is crucial for cultural preservation, fostering sustainable agriculture, and developing climate-resilient practices for the future.

Examine the extent to which climate change is contributing to the erosion of intangible cultural heritage, with a specific focus on the potential loss of traditional agricultural knowledge

Climate change poses a significant threat to intangible cultural heritage (ICH), particularly traditional agricultural knowledge (TAKW). This erosion occurs through various mechanisms,

Climate impacts on TAKW transmission

- Displacement and disruption:

Climate change impacts like floods, droughts, and rising sea levels can displace communities. Scattered communities struggle to maintain traditional practices and associated knowledge, thus disrupting the transmission of TAKW from elders to younger generations (De Silva, 2016).

In island nations like Sri Lanka, rising sea levels threaten coastal communities whose livelihoods and TAKW are centred on traditional fishing practices, and erratic rainfall patterns impact agricultural communities by disrupting planting cycles. These disruptions lead to a decline in associated traditional rituals and beliefs.

- Loss of relevance:

Changing weather patterns and environmental conditions can render some traditional practices ineffective. This loss of relevance can discourage younger generations from learning TAKW, leading to its gradual erosion (Moser and Ekstrom, 2010).

- Changes in livelihoods:

Climate change can force a shift from traditional agricultural practices to more modern practices. As communities abandon traditional practices, the associated knowledge and rituals fade away (Madian-Nadeem et al., 2018).

Erosion of cultural identity

The loss of traditional agricultural knowledge leads to the erosion of cultural identity and the loss of the deep connection between communities and their environment. Rituals, seasonal predictions, and traditional crop varieties all contribute to a shared cultural heritage that weakens with the decline of TAKW (Madian-Nadeem et al., 2018).

Potential for adaptation

Despite the challenges, some communities are adapting their traditional agricultural knowledge and practices to adapt to climate change. For example, farmers might adjust planting times and incorporate drought-resistant varieties based on traditional forms of experimentation. Knowledge exchange programmes can help communities learn from each other's experiences and adapt their TAKW for changing conditions.

Importance of safeguarding TAKW

- Climate resilience: Traditional practices often promote biodiversity, soil health, and water conservation, offering valuable insights for developing climate-resilient agriculture.

- Cultural continuity: TAKW embodies the cultural identity and historical knowledge of farming

communities. Its preservation strengthens social cohesion and cultural heritage.

- Food security: Traditional knowledge about local crops and pest management can contribute to more sustainable and food-secure agricultural systems in the face of climate change.

Climate change is a significant driver of the erosion of TAKW, impacting cultural transmission, practices, and the broader cultural identity of communities. Safeguarding TAKW requires a multi-pronged approach, including documentation, knowledge exchange, and community-based adaptation strategies.

Formulate practical recommendations for safeguarding traditional knowledge and indigenous wisdom in the realm of agriculture, considering both community-based strategies and policy implications.

TAKW should be safeguarded for its contribution to sustainable agriculture and cultural resilience.

Community-based strategies

- **Knowledge keepers and youth engagement:** Programmes that pair experienced farmers with younger people can facilitate knowledge transmission through hands-on training and cultural exchange (Herath, 2018).

- **Farmer-to-farmer learning networks:** Establishing platforms for knowledge exchange within and between communities allow farmers to share successful adaptation strategies and innovations (Berkes, 2008).

- **Community seed banks:** Preserving and sharing traditional crop varieties through community seed banks increases biodiversity and access to climate-resilient crops (Messerli et al., 2019).

- **Revitalization of traditional practices:** Supporting the revival of sustainable practices like rainwater harvesting, natural pest control and indigenous soil management techniques can enhance agricultural resilience (UNESCO, 2016).

Policy recommendations

- **Recognition and documentation:** Governments can support the documentation of TAKW through grants and collaborative research projects with indigenous communities.
- **Integration into national strategies:** National adaptation plans should acknowledge the value of TAKW and integrate it into climate-smart agriculture initiatives (Herath, 2018).
- **Intellectual property rights and benefit sharing:** Policies establishing fair intellectual property rights and benefit-sharing mechanisms can incentivize communities to share their knowledge (Messerli et al., 2019).
- **Indigenous knowledge centres:** Such centres serve as platforms for research, education, and knowledge exchange related to TAKW (Berkes, 2008).

Challenges and considerations

- **Secrecy and sacred knowledge:** Some communities may have reservations about sharing certain knowledge due to their cultural or religious beliefs. Sensitive approaches are crucial to build trust and respect.

- **Power dynamics and equity:** Safeguarding TAKW should ensure equitable benefits for knowledge holders and communities. Top-down approaches should be avoided in favour of community-driven initiatives.

- **A collaborative approach** that combines community-based strategies with supportive policy frameworks is essential for safeguarding TAKW.

- **Combing modern science with traditional wisdom**, can build more resilient and sustainable agricultural systems that ensure food security, cultural preservation and a connection to the land in a changing climate.

Conclusion

The 2003 Convention for the Safeguarding of the Intangible Cultural Heritage definition of Intangible Cultural Heritage (ICH) encapsulates the essence of traditional knowledge (TK) and indigenous knowledge (IK) (UNESCO, 2003). Acquired through centuries of observing the natural environment,

biological and non-biological indicators and experiential learning, this knowledge forms the bedrock of Sri Lankan traditional agriculture.

Traditional agriculture heavily relies on practices, representations, expressions, knowledge, and skills recognized by communities and individuals as integral to their cultural heritage. The impacts of climate change threaten to erode this cultural heritage. Farmers, who have traditionally been stewards of TAKW, are reporting drastic changes in weather patterns and an increase in the frequency and intensity of extreme weather events such as storms and prolonged droughts, with negative consequences for their crop yields and livelihood. The adverse impact of climate change significantly affects the economic stability of farming communities, often leading farmers to seek alternative occupations, which reduces the transmission of TAKW.

Sri Lankan traditional agriculture faces an existential threat due to the climate change, which is leading to economic instability within farming communities and the erosion of traditional agricultural knowledge and indigenous wisdom. There is an urgent need for comprehensive strategies to manage the impacts of climate change on Sri Lanka's traditional agriculture, in order to preserve the associated cultural heritage and safeguarding the livelihoods of communities. In particular, there is a need for interventions that combine traditional knowledge with contemporary climate resilience strategies.

Preserving Sri Lanka's agricultural heritage requires collaborative efforts encompassing cultural conservation, climate adaptation, and sustainable livelihood development. Policies and practices that integrate traditional wisdom with modern scientific advancements can form the basis of a resilient and adaptive agricultural system. Ultimately, the preservation of Sri Lanka's traditional agriculture is not just a cultural imperative but a crucial step towards securing the livelihoods of communities deeply rooted in their ancestral practices.

Recommendations

- Facilitate collaborative efforts between traditional farmers and experts in sustainable agriculture that is adapted to the context of climate change, creating a hybrid land management approach that combines the strengths of both.
- Implement community-based climate resilience programmes that empower local farmers with the tools and knowledge to adapt to changing climate conditions. These programmes should include training on climate-smart sustainable agriculture practices.
- Undertake comprehensive documentation of indigenous wisdom related to agriculture, including traditional practices, rituals, and insights. Establish archives and digital repositories to safeguard this invaluable intangible cultural heritage for future generations.
- Develop and promote agro-ecological zoning strategies that tailor agricultural practices to the specific conditions of each region. This ensures that farming methods align with the unique environmental characteristics of the diverse agro-ecological zones in Sri Lanka.
- Invest in research and development initiatives to build on traditional agricultural knowledge about resilient crops and identify climate-resilient crop varieties that can withstand the changing climate conditions.
- Strengthen mechanisms for the dissemination of timely and accurate weather information to farming communities. This empowers farmers to make informed decisions about planting and harvesting based on real-time data, contributing to increasing their resilience.
- Provide financial support and incentives for farmers to adopt new technologies, and diversify income sources.
- Foster international collaboration and knowledge exchange platforms to facilitate the sharing of best practices, experiences, and innovations in climate-resilient agriculture.

Acknowledgements

This work was supported by the Research Council [ASP/01/RE/HSS/2022/01], University of Sri Jayewardenepura.

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The Significance of Mangjing Blang Tea Ecological Culture Reserve in Jingmai Mountain, Yunnan Province, China, for Climate Mitigation and Adaptation

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Introduction

Jingmai Mountain is located in Yunnan Province, China, and has the world's largest, oldest and best-preserved ancient tea forest. It is the location of the UNESCO World Heritage site: Cultural Landscape of Old Tea Forests of the Jingmai Mountain in Pu'er. Part of the region's intangible cultural heritage is the Mangjing Blang Ethnic Ecological Cultural Protection Area.

The Blang people are one of the earliest ethnic groups to cultivate tea in the area, growing it since the seventh century. This tea-growing heritage is at risk, however. In recent years Jingmai Mountain and other parts of Yunnan Province have been experiencing abnormally high temperatures and drought conditions.

Between 2019 and 2024 a group of youth scholars funded by Good Food Fund China conducted a study to explore the intangible cultural heritage (ICH) of Mangjing Blang Ethnic Ecological Cultural Protection Area and the role of that ICH in climate change mitigation and adaptation. They conducted five field visits and used interviews, focus groups and art-based strategies to collect data. The findings of the study indicate that the traditional worldview of the inhabitants of the Mangjing Blang Ethnic Ecological Cultural Protection Area contributes to sustainable harmony between humans and the local ecosystem. Challenges are presented, however, by climate change and the desire to plant more tea to earn higher incomes. These factors, along with obstacles to the ongoing transmission of traditional knowledge, pose a threat to the ICH of the region. To ensure sustainable use of the Mangjing Blang Ethnic Ecological Cultural Protection Area, it is recommended that international organizations, national governments, local governments and academics work with local communities to identify and implement solutions.

Background

Jingmai Mountain is the location of the world's largest, oldest and best-preserved ancient tea forest (Chen et al., 2013). The International Tea Committee recognizes Jingmai Mountain as the "origin of the tea around the world", and it is the largest tea growing, processing and trade centre for Pu'er tea in China, with 17,704.50 hectares of tea plantations (Durighello, Currie and Luengo, 2021).

At the 45th UNESCO World Heritage Conference in 2023, the "Cultural Landscape of Old Tea Forests of the Jingmai Mountain in Pu'er" was inscribed on the World Heritage List. It is the world's first

Figure 1. View of Jingmai Mountain
© Xiaohui Liu

tea-production World Heritage site. This cultural landscape aligns with the evaluation criteria of Outstanding Universal Value (OUV) in Criteria III[1] and Criteria V[2] for World Heritage (China National Cultural Heritage Administration, 2020).

Situated in Lancang Lahu Autonomous County in Yunnan Province, at the junction of Xishuangbanna, Pu'er and Myanmar (Su et al., 2017), Jingmai Mountain is at an altitude of between 1250 metres and 1550 metres (Chen et al., 2013). The area has a subtropical mountain monsoon climate with distinct dry and wet seasons. The annual average temperature is 18 °C and annual rainfall is 1800 millimetres (Chen et al., 2013). The region has high biodiversity and an abundance of edible and medicinal plants (Jiang et al., 2011). It is these conditions and geographical features that have nurtured the diverse cultural heritage of Jingmai Mountain.

The largest ethnic group in Jingmai Mountain is the Blang group, which is one of the earliest ethnic

1 Criterion (iii): Provide unique or at least exceptional evidence of a cultural tradition or civilization that continues to exist or has disappeared. The cultural landscape of the ancient tea forests in Jingmai Mountain is a typical example of the traditional tea planting under forest cover practiced by Indigenous Peoples in southwestern China, which has been passed down through generations. It serves as a living fossil of early human tea planting practices and stands out remarkably against the backdrop of today's world dominated by large-scale plateau tea plantations. Source: "Cultural Landscape of Ancient Tea Forests in Jingmai Mountain, Pu'er," page 160.

2 Criterion (v): It represents an outstanding example of traditional human settlement, land use, or marine exploitation, which is a manifestation of a cultural interaction (or several interactions) between people and their environment, particularly when it becomes vulnerable and fragile due to irreversible changes. The cultural landscape of the ancient tea forests in Jingmai Mountain exemplifies the protection and rational utilization of mountainous and forest resources by Indigenous Peoples, who employ traditional knowledge systems such as land terracing, vertical land use techniques, settlement site selection, and village construction techniques adapted to local conditions. Through the rational allocation of land for production, living, and ecological purposes centered around ancient tea forests, they have created a wise mountainous living environment where tea grows within the forest, villages are nestled within the tea plantations, and farmland and other production activities occur outside the tea forests. This represents an outstanding example of sustainable development in mountainous forest agriculture and cultural landscapes. Source: "Cultural Landscape of Ancient Tea Forests in Jingmai Mountain, Pu'er," page 165.

Figure 2. Wengji village, a traditional Blang village in Jingmai Mountain.
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Figure 3. Secretary Nam Kang, a Blang culture inheritor.
© Xiaohui Liu

groups to cultivate tea in the region, growing it since the seventh century (Durighello, Currie and Luengo, 2021). The Blang people in Jingmai Mountain, who follow Southern Theravada Buddhism also worship their ancestors and "Tea Father", Pa'aileng, who, according to local legend, discovered tea (Durighello, Currie and Luengo, 2021).

The Blang group have rich Indigenous knowledge of the region. A study conducted in twenty-two Blang villages in Yunnan Province identified 290 local plants that are consumed by the Blang people (Jiang et al., 2011). Jingmai Mountain has an uninterrupted culture for centuries, with the main ethnic group unchanged, and the locations and varieties of tea plants remaining unaltered. Traditional residential buildings continue to be used and tea resources continue to be used by the Indigenous Peoples.

Jingmai Mountain has two provincial-level intangible cultural heritage conservation projects: the Shangkang Tea Ancestor Festival and the Mangjing Blang Ethnic Ecological Cultural Protection Area, and three municipal-level intangible cultural heritage projects: the Blang legend of tea planting, traditional handmade tea-making techniques and the traditional dances of the Blang ethnic group. At the county level, there is one intangible cultural heritage conservation project: the production technique of tea paste in Jingmai Mountain (Pengpai News, 2021).

Located in the southern part of the World Heritage site, the "Mangjing Blang Ethnic Ecological Cultural Protection Area" centres on the Mangjing Upper and Lower Villages and the Manghong Ancient Tea Forest. The total area of the tea forest in the region is approximately 440 hectares, housing three traditional Blang villages: Mangjing Upper and Lower Villages and Manghong, with a total population of 1,890 people. The area's elevation ranges from 1,120 to 1,580 metres, with a maximum north-south distance of 3,700 metres and a maximum east-west distance of 2,150 metres[3].

Statement of the problem

Camellia sinensis var. *assamica* (tea plants) in Yunnan predominantly inhabit the western and southwestern regions, encompassing Liangshan, Baoshan, Lincang, Pu'er and Xishuangbanna (Li et al., 2019). Suitable habitats primarily lie along the banks of the Lancang River and the extending areas on the western side of the Ailao Mountains. The central, eastern, northwestern and northeastern Yunnan regions are deemed unsuitable for growing tea plants due to their higher elevations.

3 Data from the exhibition hall museum in Mangjing Village, Jingmai Mountain, February 2024.

In recent years, several regions in Yunnan, including Jingmai Mountain, have experienced abnormally high temperatures and drought conditions (You et al., 2024; Rong et al., 2018). The distribution and growth patterns of tea shrubs, like many other species, are susceptible to the impacts of climate change (Li et al., 2019). As global temperatures rise, suitable habitats for *Camellia sinensis* var. *assamica* are anticipated to shift towards higher altitudes and latitudes (Li et al., 2023).

Studies indicate that the tea ecosystems of Jingmai Mountain currently have significant biodiversity. Climate change is expected to negatively impact this biodiversity.

Figure 4. Wild vegetables, herbs, and spices gathered for lunch.
© Yumu Su

Objectives of the case study

This study examined the intangible cultural heritage of the Mangjing Blang Ethnic Ecological Cultural Protection Area, analysing its role in assisting local villagers in adapting to climate change. In particular, the study had three primary objectives, as expressed in the following three questions.

- How does intangible cultural heritage contribute to facilitating community adaptation and resilience to climate change?
- What are the direct and indirect impacts of climate change on the practices and transmission of intangible cultural heritage, and what are the risks?
- What changes to ICH are required in order to adapt to climate change?

Figure 5. Every village centre has an altar for praying to ancestors and gods of nature.
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Research design and methods

To identify the impacts of climate change on local communities and their ICH, and on tea production and the associated livelihoods, the research team conducted a study in the Jingmai Mountain region.

With the support of the Good Food Fund China, the research team conducted five field surveys in Jingmai Mountain in October 2019, March 2021, July 2021, July 2023 and February 2024. The timing of the surveys ensured that both the rainy and dry seasons were covered.

The research team members possess backgrounds in disciplines such as in nutrition, anthropology, folklore studies, agronomy, forestry, botany, art design and behavioural health.

The primary research methods were participatory observation, interviews and artistic co-creation with local residents. The team observed the dietary behaviour and tea-related economic activities of six Blang ethnic families, conducted ten individual interviews and held eight focus group discussions.

We used the "snowball sampling" method to identify key informants recommended by locals to provide the best insights into our research questions. We interviewed a total of forty-one individuals, including local ritual leaders, herbalists, restaurant chefs, vegetable vendors, elders, and youths, comprising fifteen women and twenty-six men.

During the field visit in July 2023, we organized an

artistic event with locals, hosting a multi-species ingredient banquet. Through co-creating recipes with locals, we identified the impact of climate change on the local species and ecosystems and ways to help the community to mitigate and adapt to climate change.

As well as the data collected through the methods described above, we also conducted scholarly research to better answer the questions posed by this study.

Figure 6. A Blang woman picking wild vegetables and mushrooms while gathering tea.
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Ethical considerations and human rights issues

All of the interviews strictly adhered to the internationally recognized principle of "free, prior and informed consent". The research team explained the purpose of the study in Mandarin and obtained consent from the interviewees before conducting the interviews. The Ethics Review Board (REB) of the University of Toronto approved the ethical review for this research: Protocol #: 00044431.

Strengths and limitations of the case study

This case has the following four strengths:

- By conducting multiple field surveys in different seasons and years, the study provides an understanding of the impact of climate change on local livelihoods and of adaptation to climate change across different seasons.
- The interdisciplinary nature of the research team means that the team could analyse and interpret the impacts of climate change and adaptation to climate change from various disciplinary perspectives.
- The project leader and main members of the research team were all under 30 years old, which aligns with the United Nations initiative to promote youth participation.
- The project addresses a gap in studies, as not many studies have been done on Indigenous Peoples from tea-growing areas. The study records the perspectives of the local Blang ethnic group, which can offer valuable insights for adaptation to climate change by other groups in society.

The limitations of the study were as follows:

- Despite conducting research in Jingmai Mountain during different seasons, the significant climate variations in the mountains may still prevent a full understanding of the impact of climate change on local livelihoods.
- Due to budget constraints, the researchers did not use high-tech equipment to monitor environmental indicators, relying mainly on interview methods, so there is a lack of quantitative data for those indicators.

Findings

This section discusses the findings for each of the three objectives.

Objective 1: What role does intangible cultural heritage play in promoting community adaptation and resilience to climate change?

In Jingmai Mountain, ethnic groups such as the Blang people cultivate tea using an agroforestry system. They use natural forests as shade trees for the tea plants. This agroforestry system has existed for centuries, embodying the wisdom of many generations. The tea-growing system in Jingmai Mountain system is tailored to the local climate and soil conditions (Zou et al., 2015).

The ICH of the community in the Mangjing Blang Ethnic Ecological Cultural Protection Area promotes adaptation and resilience to climate change in the following ways.

- Local residents have a profound ecological consciousness, holding deep respect and reverence for the natural world. The Blang people perceive humans and the natural system as being in a symbiotic relationship. They refrain from disturbing the land. They revere nature and show reverence for the "Tea Ancestor" (Pei et al. 2022). Every year, the local community conducts rituals to worship the Tea Ancestor, which are a key part of their intangible cultural heritage. They also take part in local festivals, influenced by the Hinayana Buddhism, such as the Closing Door Festival and the Opening Door Festival. The community members use local ingredients to prepare dishes for these rituals. The local priests refuse to use foreign ingredients for rituals. Around 125 traditional local ingredients (plants, fish, etc.) are used.

- The traditional practices of the local community maintain the balance of the ecosystem and prevent overexploitation of the local species. For example, the Blang people only fish during fixed seasons because they believe that fishing in other seasons will lead to possession by evil spirits or being dragged into the water and drowned by white snakes in the river. Traditional beliefs such as this ensure that the local wildlife continue to thrive, and they contribute to the protection of local biodiversity. The sustainable management of local ecosystems also helps to ensure food security.

- From the literature, the research team learned that Jingmai Mountain has experienced prolonged drought and delayed precipitation in recent years. The ICH practices of the local community of Jingmai Mountain help to minimize the effect of these climate change impacts on human livelihoods. For example, planting tea shrubs in natural forests provides some protection for the tea plants. The forests have a tree layer, tea shrub layer and a herbaceous layer, with the forest canopy absorbing a large amount of light and creating a favourable microclimate for the tea shrubs, which helps to protect them in dry and hot weather. The forest ecosystem also has the functions of storing water and retaining moisture, and the interactions between the various species in the forest create a resilient system that helps to protect tea plants from extreme weather, such as heavy rainfall, and from pests (Tan et al., 2023). At the same time, birds and other wildlife contribute to pest control and nutrient cycling, thereby reducing the need for external inputs such as pesticides and fertilizers.

Figure 7. A sketch map of the three-dimensional community structure in the tea ecosystem in Jingmai Mountain
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The residents of the Mangjing Blang Ethnic Ecological Cultural Protection Area have knowledge of a wide variety of local food and medicinal plants and animals. The study identified 174 species that are used as ingredients for traditional food and medicine, with 162 being plant based, accounting for 93.1 per cent of the traditional food and medicine sources. Excluding different parts of the same plant, the researchers found 142 plant-based ingredients, which can be classified by their ecological layer. From top to bottom, the six layers are: the tree layer, with twenty-four species; the shrub layer, with eight species, the herbaceous layer, with sixty-three species; the litter layer, with seventeen species; the interlayer, with twenty-five species, and the aquatic layer, with five species. A total of 67 species were used for traditional medicinal, serving to promote

Figure 8. Wild mushrooms in the tea forest
© Mengyao Ma

digestion, detoxify, nourish the lungs and spleen, and treat diseases. Many of these species hold particular cultural significance.

Objective 2: What are the direct and indirect impacts of climate change on the practices and transmission of intangible cultural heritage, and what are the associated risks?

According to our research findings, the current positive and negative impacts of climate change exist together in three aspects of the Mangjing Blang Ethnic Ecological Cultural Protection Area.

- Due to the high economic value of tea, the tea-picking seasons — spring and autumn — are the busiest times for the Blang people. As heritage management regulations prohibit the use of artificial fertilizers and insecticides and herbicides on tea shrubs, the tea from Jingmai Mountain is of high quality and has received high praise from tea enthusiasts. The prohibition of artificial fertilizers and pesticides also protects local ecosystems and supports biodiversity, which increases resilience to climate change.

- Another issue is that many young Blang people no longer understand the medicinal or food value of wild plants, and some do not speak the Blang language. Temples with a history of thousands of years no longer have resident monks, which is detrimental to the transmission of traditional culture and beliefs. This loss of traditional knowledge and traditional values results in an overemphasis on tea harvesting and income generation, which can lead to over-planting and the neglect of space needed by the surrounding trees and herbaceous plants to grow, resulting in negative impacts on biodiversity and economic homogenization.

- Between 1961 and 2014, the average temperature in Pu'er increased by 0.2 degrees centigrade (Wu et al., 2017). According to the study participants, Jingmai Mountain experienced a significant drought in the spring of 2023, resulting in smaller tea leaves. This did not significantly affect the sales of spring tea for the season, as locals believe the smaller leaves have greater richness of flavour, but, in times of reduced rainfall and late rains there are more insects, which was a challenge. Because the tea growers of Jingmai Mountain prohibit the use of artificial pesticides, the growers made sacrifices to the insect god, the tea God, etc., and also trapped insect using sticky paper and other methods, but with limited success. However, they noticed that although the insects ate the tea leaves, they did not harm the tea shrub itself. In fact, they observed that the excrement of the insects was useful as a natural fertilizer for the tea plant. The Blang people then developed a kind of 'tea' made of the insect excrement, which contains amino acids, protein, fat, sugar, tannin and other nutrients. Through making and selling this insect tea, the Blang people developed a new income source.

Figure 10. A Blang family gathering tea leaves.
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Objective 3: What changes to ICH are required for adaptation to climate change?

Based on the responses to the interviews, the researchers recommend that stakeholders take the following four actions:

- At the national level, as China is a party to the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD), the central government should actively translate international regulations on biodiversity conservation and climate change co-governance into action through legislation and regulations. This includes achieving the "dual carbon" goals. Additionally, the central government should strengthen its communication with the local government of Pu'er City, Yunnan Province, to ensure the implementation of legal policies and raise awareness among the local public. Financial support should be provided to encourage relevant research and to encourage local residents to act in a sustainable manner, thereby garnering national-level support for local initiatives.

- At the local level, while local governments should continue promoting tea culture and supporting the tea industry, they should also consider biodiversity conservation within the Mangjing Mountain Ancient Tea Forest Ecological Protection Area. Relevant units should develop and implement biodiversity monitoring plans and improve related infrastructure construction and technological development accordingly. Local governments should delegate responsibilities to specific staff and forest rangers, strengthen the daily patrols and monitoring within the protection area, and promote the protection of plant biodiversity. Local governments should also continue to support research and education related to climate change and biodiversity, cultivate more scientific research talents, conduct community outreach, increase villagers' awareness of ecological protection and prevent over-planting of tea shrubs to maintain biodiversity. Based on scientific research from academia, local governments should develop educational programmes to help tourists understand the local culture and protect biodiversity. In protecting the local ecosystems and adapting to climate change, collaboration with the local communities is essential. It is recommended that local governments listen to the advice of local communities, which is based on traditional knowledge, regarding protecting the tea ecosystem, and respect local traditions and ecological perspectives. They should also encourage the application of traditional knowledge in research and education processes and the transmission of that knowledge to future generations.

- In the academic field, nutritionists can help to analyse the nutrients in local ingredients, develop recipes, promote the consumption of local ingredients and advocate for the necessity of diverse ingredients for health, thereby increasing awareness of the Blang people's traditional knowledge of wild plants. Botanists, environmentalists and agronomists can conduct in-depth investigations relating to biodiversity and climate change in Jingmai Mountain. In cooperation with local village committees and tribal elders, they can determine the most suitable scale for tea planting to prevent the pursuit of short-term profits from affecting long-term sustainable development. Anthropologists and artists can record local traditional culture, organize co-creation and enhance the social impact of their work. Researchers can collaborate on interdisciplinary research, mutually influence and complement each other and support local ecological protection work to enhance resilience to climate change.

- From an international perspective, international organizations should collect cases from different ecosystems in various countries and regions to obtain possible solutions that may be applied elsewhere. International organizations should

Figure 11. Eating lunch together. The food includes wild fish, wild vegetables and red rice
© Zeyuan Wang

also provide channels for local residents to voice their concerns, promote communication and exchange between communities and garner more international attention.

Conclusions

The Mangjing Blang Ethnic Ecological and Cultural Protection Area was recognized as World Heritage due to its unique tea ecological system and Blang ethnic culture. Our study demonstrates the importance of the Mangjing Blang Ethnic Ecological and Cultural Protection Area, along with its ecosystems, cultural beliefs and tea economy in alleviating the livelihood impacts of climate change on the local people.

We believe that efforts should be made by national governments, local authorities, researchers and international organizations to mitigate the impacts of climate change, including by enhancing regulations, implementing enforcement, fostering interdisciplinary collaboration, strengthening the public impact of academic research, advocating for the transmission of traditional knowledge and cultural beliefs, preventing overplanting of tea, and protecting and rationally using local resources and the diverse food ingredients to sustain livelihoods. Such efforts would reduce the impact of climate change on local communities, leading to mutual human and natural health, promoting sustainable development and safeguarding ICH. This case brings a new paradigm to local research and holds significant reference value for other tea planting areas experiencing the impacts of climate change, including in China, Myanmar and India.

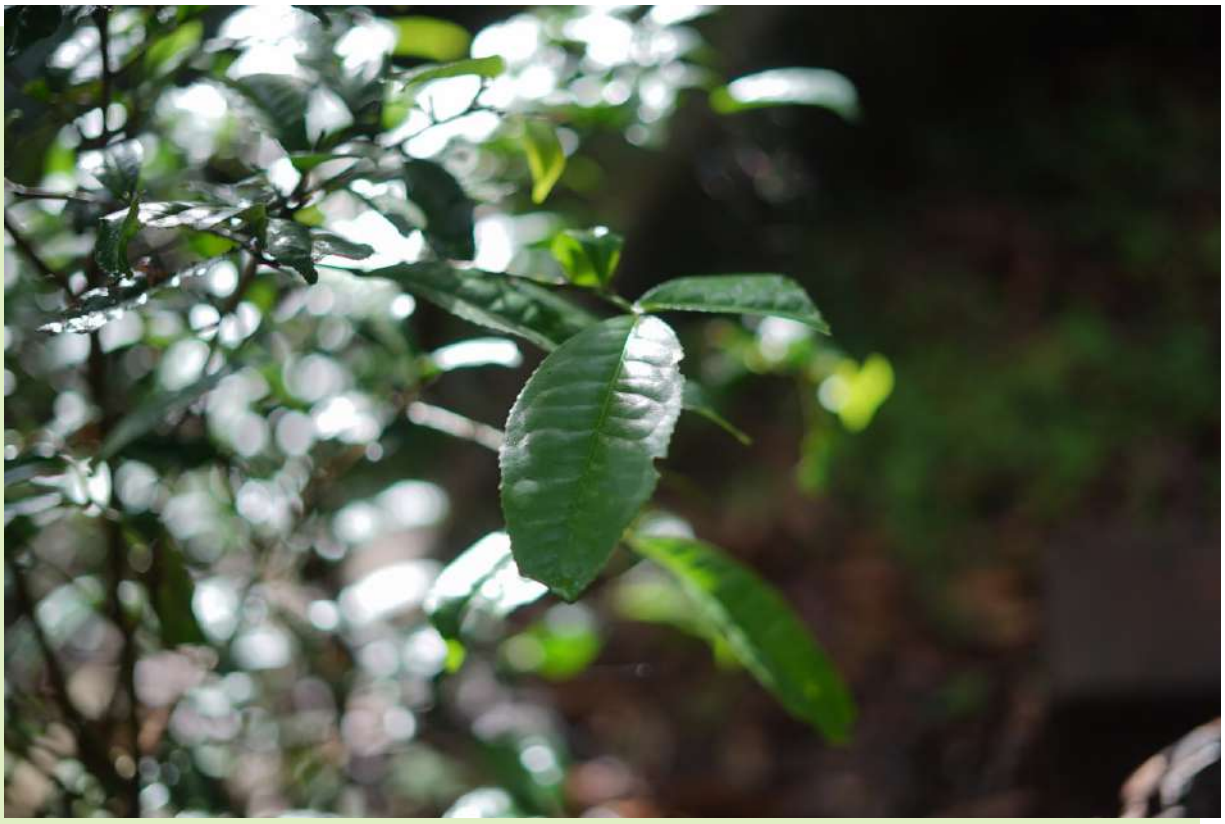

Figure 12. Tea in the Ancient Tea Forest

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Chapter 4

Community-based Strategies for Climate Action

Applying the Koyori Concept to Traditional Weaving as an Adaptation to Climate Change: A Case Study of Baan Phayao Woven Fabric Group

Naruemon Saewang, Preeyanuch Wangngio, Nikorn Palangrith, Nattawut Auttawong, Matas Waiviriya, Haruyuki Maruyama, Narucha Chiewsakon, Luxmee Srisomphetch, Suraphon Chaiwongsar

Naruemon Saewang is affiliated with the Faculty of Science and Agricultural Technology at Rajamangala University of Technology Lanna, Lampang, Thailand. She is a researcher who contributes to applied research in agricultural innovation. Her scholarly work focuses on integrating traditional knowledge with scientific approaches to promote sustainable development. In 2024, she received two Gold Medals as a co-inventor at the International Innovation & Invention Competition (IIIC) for innovations in sustainable health and household products.

Preeyanuch Wangngio is an Education Officer at Rajamangala University of Technology Lanna, Lampang, Thailand. With a background in academic research, she has worked extensively on the development and promotion of artisans and craft entrepreneurs. Her work focuses on enhancing the potential of local handicraft communities by facilitating collaboration between artisans and experts. Through strategic coordination and knowledge exchange, she supports the integration of traditional craftsmanship with modern practices. Her efforts contribute to the sustainable development and cultural preservation of local crafts, while also strengthening the capacity of community-based creative enterprises in northern Thailand.

Nikorn Palangrith is the Founder of the Ban Phayao Weaving Group in Nan Province, Thailand, established in 2019 to revive and sustain the fading tradition of handwoven textiles in his hometown. With a deep respect for cultural heritage, he brought together local artisans to form a weaving collective that blends traditional knowledge with refined craftsmanship. The group, now OTOP-certified, is known for its natural materials, distinctive patterns, and meticulous techniques. Beyond production, Nikorn leads the group as a community learning center, nurturing younger generations and promoting sustainable economic development through cultural preservation and locally rooted creative enterprise.

Nattawut Auttawong is a fourth-year undergraduate student in Interior Architecture from Lampang Province, Thailand. With no prior background in the field, he was introduced to the Koyori Project through his faculty and was inspired to join as a way to challenge himself and develop his design portfolio. Through the project, he had the opportunity to collaborate with master craftsmen, Thai and Japanese advisors, and professional designers from Japan. This experience not only deepened his appreciation for traditional craftsmanship but also strengthened his design skills, cultural understanding, and creative confidence through hands-on, cross-cultural collaboration.

Matas Waiwiriya is a Thai product designer known for his innovative and experimental approach to design, blending cultural insight with contemporary aesthetics. A graduate of Silpakorn University in Product Design, he has worked across R&D, creative direction, and consultancy with major design firms and cultural institutions. He is the founder of KHOR, which explores sustainable waste management. His work has received numerous awards, including the Good Design Award and the ELLE Decoration Prize. He has showcased internationally in Tokyo and London and served as a Thai design consultant for the Koyori Project and other cross-cultural collaborations.

Haruyuki Maruyama is an Associate Professor in the Department of Design at the Fukui University of Technology (Japan) and Principal of HYAKKA Co., Ltd. He is specialized in architectural design, focusing on branding through architectural design, social development leveraging architecture as a resource, and wood-based design. He has received numerous awards, including six Good Design Awards.

Narucha Chiewsakon is an Industrial Product Designer and Treasurer of the Lanna Culture & Crafts Association (LCCA). A graduate of Rajamangala University of Technology Lanna, Thailand, she has extensive experience in community-based design, cultural product development, and creative entrepreneurship. Her research focuses on enhancing the identity and value of OTOP handicrafts through innovation and participatory methods. She has led multiple projects aimed at linking craft, cultural tourism, and local economic development. Narucha has also contributed to international design exchange programs in Japan and Europe, and continues to empower local artisans through workshops, training programs, and ongoing collaborative publications.

Luxmee Srisomphetch is a highly accomplished leader in arts, culture, and public service. She holds degrees in Law, Arts, Business Administration, and Political Science from leading Thai universities. As President and founding member of the Lanna Culture and Crafts Association, she has championed cultural preservation and creative industries. She has served on multiple national reform committees and advisory boards, including the National Reform Council and Chiang Mai Chamber of Commerce. Recognized by the Consul General of Japan and honoured with the Royal “Thepthong” Award, she continues to drive cross-cultural relations and grassroots development across northern Thailand.

Suraphon Chaiwongsar is a multidiscipline Researcher at the Rajamangala University of Technology Lanna Lampang, Thailand. His research explores the intersection of sustainability, agricultural innovation, and cultural heritage. He specializes in community-based projects that enhance the value of traditional crafts, local textiles, and indigenous crops through scientific and technological innovation. His work promotes eco-friendly production, circular economy models, and participatory development. His interdisciplinary approach aims to empower local communities while preserving cultural identity and fostering sustainable rural transformation. He has received multiple international awards for innovations, reflecting his commitment to bridging traditional knowledge with innovation and technology to promote sustainable regional development.

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Introduction

Studies indicate that climate change is likely to lead to the deterioration of both tangible and intangible cultural assets, including cultural practices, customs, cultural identity and the feeling of place (Pearson et al., 2023; Aktürk and Lerski, 2021). Efforts are being made to mitigate the impact, including by integrating indigenous knowledge into the production of low carbon textiles, such as traditional textiles, and through the use of sustainable fibres. In a study conducted by Pargai (2024), the use of Himalayan nettle in textiles was found to be beneficial in reducing environmental impacts. This was achieved by reducing dependence on synthetic materials, capturing carbon dioxide in nettle plants and promoting sustainable economic opportunities for local residents.

The textile sector has shown interest in adopting low-carbon manufacturing techniques, including by using renewable energy sources, and modifying production procedures to minimize negative impacts on the environment (Connell and LeHew, 2020; Pimenov et al., 2022). To safeguard intangible cultural heritage, however, it is important that textile businesses involved in traditional textiles modify their production processes in a way that also preserves the cultural significance of those textiles.

Indigenous People, including the Tai Lue ethnic group in Nan Province of Thailand, have been producing traditional textiles for generations. The Tai Lue hand-woven fabric, including their Nam Lhai pattern, holds profound cultural importance as a legacy of indigenous knowledge. Today, however, many young people have limited awareness of this ancient wisdom. This can be partly attributed to the patterns and designs not meeting the needs and preferences of young people and also to the fabric's unsuitability for increasingly hot conditions due to climate change.

In 2023 a project was initiated with the aim of promoting traditional Thai handicrafts and of adapting them to changing social, economic and climatic conditions, in particular through addressing issues related to aesthetic preferences and thermal comfort. The project involved thirty textile makers in Nan Province of Thailand. This project sought to implement the Koyori concept, which aims to enhance creative and problem-solving abilities of groups

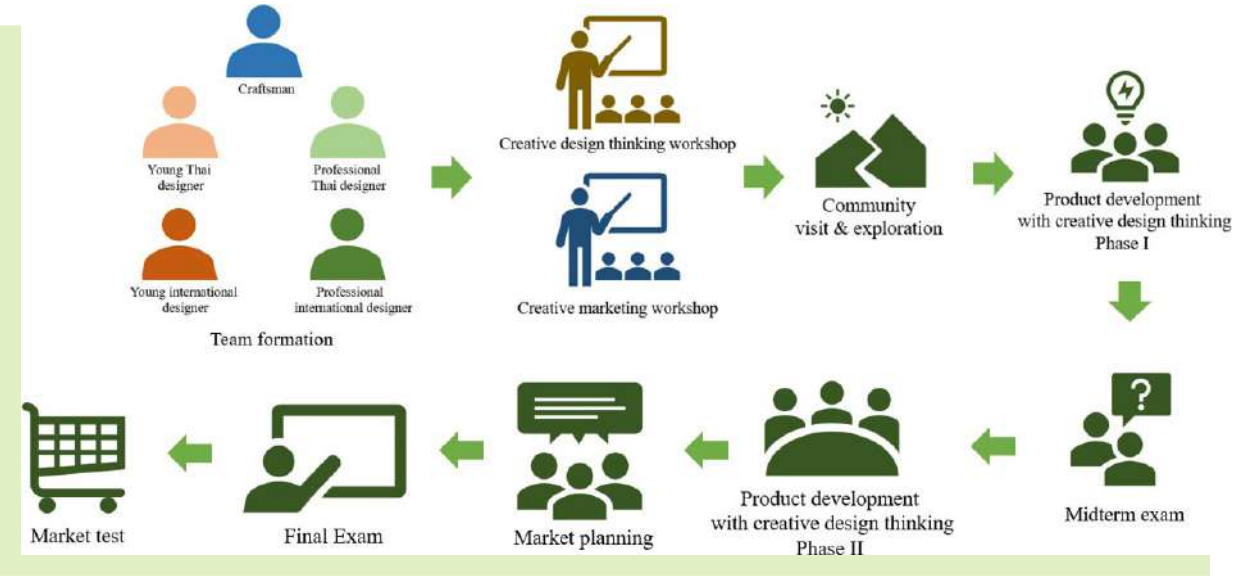

Figure 1. The project stages, using the Koyori concept
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through fostering collaboration. For the project, cooperation was promoted between local artisans, professional designers and university students studying design (Figure 1).

This study examined the outcomes for one of the participants in the project, Baan Phayao Woven Fabric, a local enterprise in Nan Province that specializes in Tai Lue textiles.[1] In this case, the project team consisted of a skilled Tai Lue artisan, a professional designer from Thailand, a professional international designer, a young Thai student of design and a young international student of design.

The project team merged traditional knowledge with knowledge of contemporary design to develop a novel weaving technique and transform the traditional Nam Lhai pattern to make it more contemporary, light and airy. This new product has the potential to increase the popularity of Nam Lhai fabric and sustain this intangible cultural heritage for future generations.

Background

The Tai Lue people are an ancient community known for their distinct cultural heritage. This ethnic group originated in Yunnan, China (also known as Sibsongpanna or Xishuangbanna), and expanded to other regions including Myanmar, Lao PDR and northern Thailand. The highest density of Tai Lue people in Thailand is located in the provinces of Nan, Chiang Rai and Phayao (Ketsuwan et al., 2022; Sarasuk, 2018). As well as being home to Tai Lue, Nan Province is also home to other ethnic groups, including Hmong, Mien, Khmer, Mumlabri, Muser, Tai Phuan and Tai Yuan. The Tai Lue people reside predominantly in Pua, Tha Wang Pha, Song Khwae, Chiang Klang, Thung Chang and Chaloem Phra Kiat districts.

The culture of the Tai Lue ethnic group is expressed through their language, clothing, residential buildings mural paintings and temples. The Tai-Lue community is particularly known for its distinctive weaving patterns. One such pattern, the Nam Lhai (flowing water), was inspired by the Nan River, which was historically the primary source of sustenance for the people of Nan. A mural artwork at the temple Wat Phumin depicts women wearing sarongs with the Nam Lhai pattern (Figure 2). The design of their sarongs suggests that they were woven using the tapestry weaving technique (kor). The Tai Lue hand-woven fabric and Nam Lhai patterns have deep cultural significance, but most young people today

1 The study was approved by the Ethics committee of Rajamangala University of Technology Lanna (no. RMUTL-IRB 092/2023). Informed consent was given by the participants through written consent to the recording and use of the interview before starting the project.

Figure 2. Traditional Tai Lue hand-woven textiles and the Nam Lhai pattern, as depicted in mural paintings at Wat Phumin in Nan Province

lack awareness and appreciation for this cultural significance and the ancient wisdom it is derived from.

The hand-woven fabric created by the Tai Lue is a sustainable textile with a low carbon footprint because artisans use local materials and natural dyes made from locally-sourced products (Annaldewar et al., 2021). Demand for this traditional fabric is limited, however, because the product is not popular among young people, who are influenced by Western tastes in fashion. In addition, traditional Tai Lue garments consist of a densely woven cotton fabric, which is suitable for those residing in cool, mountainous regions, but is too hot for people living in warmer climates, particularly in the context of global warming. Without adequate support to safeguard and promote the use of Tai Lue fabric and Nam Lhai patterns, it is likely that this cultural heritage will be lost.

Research design and methods

In 2023, we conducted a project to enhance the skill and artistry of thirty local craft enterprises. For the project, we applied the Koyori concept, a framework devised by scholars from Rajamangala University of Technology Lanna and Lanna Culture and Crafts Association (Chaiwongsar et al., 2021). Koyori is a Japanese term that refers to a resilient cord formed by twisting strands together. This word symbolizes the idea of collaboration. In this case, a local artisan collaborated with professional designers from Thailand and abroad, as well as university students specializing in design and related fields. The team members shared their knowledge and expertise, and also received training in creative and design thinking and marketing.

The project involved the following steps (Figure 1):

Selection of participants

A team was selected which included an artisan specialized in Tai Lue textiles, professional designers from Thailand and abroad and university students studying design. The artisan was selected by the Baan Phayao Woven Fabric enterprise. The selection of the professional designers involved choosing individuals from a shortlist provided by the Creative Economy Agency, Thailand, and Fukui University of Technology, Japan. The selection was based on the designers' competence and experience. The selection of the university students was based on their expressed interest in the project and educational objectives. A dedicated translator, proficient in Thai, English and Japanese, was assigned to the group for the duration of the project to prevent linguistic obstacles.

Knowledge and skills development

Two workshops (creative design thinking and marketing) were conducted to enhance the knowledge and skills of the team. The creative design thinking workshop aimed to enhance the team members' creativity and problem-solving abilities. It involved facilitating collaboration in brainstorming, prototyping and testing ideas related to the given exercise topic, which focused on modernizing local fabrics. It was conducted by experts from the Rajamangala University of Technology Lanna (RMUTL), the Lanna Culture and Craft Association (LCCA), and Fukui University of Technology. The marketing workshop, facilitated by the experts from RMUTL, aimed to encourage a customer-centric approach and enhance the team members' marketing skills. The workshop covered

various topics, including generating ideas, gaining stakeholder support, branding a business and examining real-life examples to observe effective strategies in practice.

Creative execution

The team had the chance to apply their new knowledge and skills by working with the Baan Phayao Woven Fabric group. The team members observed the artisans of the Baan Phayao Woven Fabric enterprise to better understand the products made by the group and the challenges it faces. Then they visited the local artisan market in Nan Province to see the products from the viewpoint of the customers. The team then worked with one of the artisans in a design thinking process, in which the steps were: define, ideate and prototype. During these steps, the team articulated the problem faced by the weaving group and engaged in creative brainstorming and idea generation to develop a prototype that would address the identified problem. An online group was established as a key means of communication.

This phase was followed by "midterm exam" activities, when the team presented their ideas and prototypes to a group of professionals in the fields of design, product development and marketing to get their feedback and recommendations. Based on this, the team iterated and enhanced the designs, improving the products. The improved items were displayed alongside those of other local artisan collectives in a shopping mall in Chiang Mai, under the event name "Final Exam". The team then shared their products with the same panel of experts, as well as other stakeholders and the general public. The experts provided more feedback and advice, specifically regarding strategies to enhance the marketability of the products. This event also provided the team with an opportunity to assess the market acceptance of their new products. Following this event, the artisans involved in the project used their knowledge, skills and experience to enhance and modify the products as necessary, ensuring their readiness for real-world markets.

Creative marketing

The team members convened to share their ideas and knowledge and formulate a marketing plan. The plan was implemented during the Final Exam event and subsequently put in place after the newly designed products was ready for the market.

Strengths and limitations

Strengths

This study examined the outcomes for one group, Baan Phayao Woven Fabric, a local enterprise in Nan Province that specializes in Tai Lue textiles. The study also examined the implementation of the Koyori concept, which aims to promote collaboration between artisans and designers in new contexts. Instead of emphasizing craft techniques or the manner of production, this approach aims to create a bridge between groups of artisans, professional designers and students to allow sharing, reinterpretation of values for new contexts and adaption of existing knowledge and thereby promote new ways of doing and being. This not only benefited the artisans but also the designers and students who learned about handicraft techniques and gained knowledge which enhanced their skills. By learning about marketability, the group members considered concepts of usefulness and desirability, rather than limiting the design to form, materials and the manner of production.

Limitations

The project was carried out over several months, and in order to ensure clear communication between the members of the team it was necessary to hire a translator, which increased the budget of the project. Despite efforts to facilitate collaboration between the artisans, professional designers and university students, issues arose because of age disparity and cultural diversity.

Findings

Participant selection

We conducted visits to several renowned Tai Lue handloom weaving groups, and after careful consideration we selected Baan Phayao Woven Fabric enterprise as the subject of our case study. The Baan Phayao Woven Fabric enterprise is a group collective of skilled weavers of the Tai Lue ethnic group from Wiang Sa District, Nan Province. The group was established and officially recognized under the One Tambon One Product (OTOP) programme on 11 September 2020. The head of the group was Mr Nikorn Palangrith, who is also a skilled artisan.

The members of the working team included Nikorn Palangrith; Matas Waiviriya, a professional designer from Thailand affiliated with the Lanna Culture and Crafts Association; Haruyuki Maruyama, an international professional designer from Fukui University of Technology in Japan; Nattawut Auttawong, a Thai university student from Rajamangala University of Technology Lanna; Matsuri Suzuki, an international student from Fukui University of Technology in Japan; and Siripohn Sansirikul, an interpreter from the Lanna Culture and Crafts Association.

The Koyori process

The Baan Phayao Woven Fabric group's challenges were identified as follows:

- Their present products using the traditional Nam Lhai pattern do not align with the preferences of contemporary customers.
- Young people in the community appear to have little appreciation for the knowledge and skills represented by the traditional fabric and patterns.
- The fabric is thick and not appropriate for hot climates.

The team discovered that the artisan and other members of his weaving group have the capacity to develop innovative procedures for making new products using the Nam Lhai pattern that are suitable for hot environments. The concept of producing a transparent Nam Lhai pattern emerged, prompting the artisans to engage in experimentation and exploration of various weaving techniques. Subsequently, the artisan skilfully produced a transparent fabric that was named "transparent Nam Lhai". To do this, he used a blend consisting of 70 per cent polyester and 30 per cent cotton and used a new tapestry weaving process that resulted in a modern and translucent pattern (Figure 3). The pattern was created by omitting the weft yarn and leaving the gap empty, resulting in a lighter and more breathable fabric. This fabric is well-suited for making clothes for hot and humid climates. Additionally, it served as an intermediary product that could potentially rekindle enthusiasm for conventional weaving techniques.

The team received feedback during the Midterm Exam suggesting that this fabric should be developed as an eco-friendly fabric because the production process, using handlooms, has a low carbon footprint. Due to the high labour costs associated with weaving this fabric by hand and the feedback received from experts, it was necessary to reduce costs, so the team decided to switch to "100% recycled polyester" yarns, rather than incorporating cotton.

Figure 3. Cool and airy fabric incorporating the Nam Lhai pattern, but using a new weaving technique, which creates a pattern using spaces.
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The team enhanced the fabric by incorporating intricate designs and creating transparent Nam Lhai patterns on both large and small scales. The initial marketing plan involved selling the fabric by the metre, and the market response was positive.

They then collaborated to improve the transparent "Nam Lhai" motif, which was then used to create contemporary garments. They were guided by the principle of "simplicity and airiness", opting for a monochromatic palette and modern clothing designs. The completed garments underwent a thermal examination, and it was found that the transparent Nam Lhai fabric was cooler than other fabric by 1.3 degrees Fahrenheit (Figure 4). This was due to the fabric's permeability, which allows for increased air flow that carries heat away from the skin (Tamura, 2016).

Outcomes

The weaving technique used for the new transparent Nam Lhai pattern was recognized as an innovation.

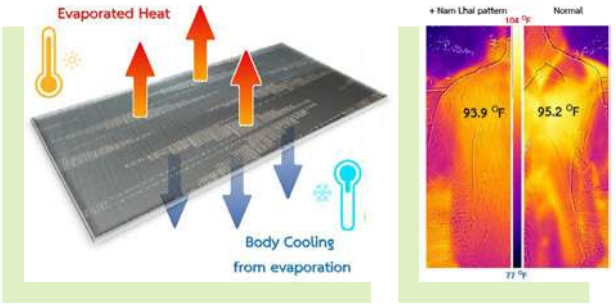

Figure 4. Cooling effect, due to the fabric's permeability, which allows for increased air flow that carries heat away from the skin
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Based on the experts' recommendation, it was entered into the 2023 IIDC Hong Kong International Invention and Design Competition, where it received two awards: a gold medal and the golden cup. These accolades were further evidence of the team's success in producing an innovative design.

In an interview with the Baan Phayao Woven Fabric group after the project, the group said that there had been a noticeable surge in sales and orders, particularly for the new designs with the transparent Nam Lhai pattern (Figure 5). The group hopes to enlist other weavers and expand production.

Figure 5. Examples of garments that are light, breezy and modern, making them appropriate for young people and warming temperatures.
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Interviews with young weavers found that their primary motivation for joining the group was the opportunity to earn a higher income compared to other occupations, such as agriculture. In addition, they expressed pride in their culture and identity, which they were able to communicate through the creation of modern and fashionable textiles using traditional knowledge. In order to meet the market's need for eco-friendly textiles, they intended to integrate additional natural fibres and natural dyes into their products as part of their ongoing efforts to improve product quality. This suggests that the innovative design thinking and creative marketing is likely to have improved the long-term viability of traditional crafts in Nan Province.

Conclusions

The Tai Lue textile weavers share similar concerns to other weaving groups, including the potential loss of cultural heritage and a lack of appeal of their products to modern customers (Chandhasa and Pattanapanithipong, 2021; Tongphet et al., 2021). This study also brought to light another significant concern, namely the impact of climate change on the long-term viability of traditional Tai Lue textiles and the need to create local hand-woven textiles that meet contemporary demand and are comfortable to wear in increasingly hot temperatures.

Through implementing the Koyori concept, the project created a collaborative platform for artisans, professional designers and young designers to share their knowledge, skills and experience, enhance local crafts and overcome the challenges faced by local weavers in Nan Province. The team improved the product design by adapting it to meet the needs of customers and be suitable for the changing climate.

According to Jaipak (2016), when redesigning or creating new products for a community, it is important to consider the capabilities and perspectives of the people in that the community, and their willingness to adapt traditional practices. Occasionally, weaving communities may reject the concept of design-led innovation, if they feel it may adversely affect traditional weaving practices and local lifestyles. The capacity and accessibility of workers, trust and long-term partnerships for business advancements are other considerations.

The project facilitated collaboration between design professionals, students and weaving communities. The goal was to identify ways to address the challenges, while also generating beneficial economic effects. The project emphasized the connection between design and marketing. Design has the potential to make a significant impact on branding, product information and presentation (such as product labels, packaging and information

sheets), distribution outlets and signage. This is only possible when marketing is integrated into the design process.

The weaving community had to adapt to the present circumstances. For instance, in the age of digital marketing, it is necessary to use modern tools and technology, such as social media (Sukamon, 2019). An effective design and marketing plan has the potential to enhance revenue for the weaving groups. The revenue generated can be allocated towards community development through employment opportunities and local material procurement. Additionally, in certain instances, it may attract visitors to the community for tourism and shopping purposes. The presence of lucrative local handicraft industries and the potential for earning income locally, would attract young people within the community to join the weaving groups and help build the businesses. This would contribute to the transfer of weaving expertise from veteran weavers to younger practitioners.

According to Nataporn Teawpanich (2013), establishing a local handicraft business requires elements such as creativity, design, traditional knowledge and community involvement. These factors play a crucial role in sustaining the business and supporting the community.

In conclusion, the Koyori concept has the potential to boost participants' creative and problem-solving skills, making it suited for application in various groups to encourage sustainable craft enterprise. The Koyori concept can be implemented in diverse contexts to promote the transmission of intangible cultural heritage and the development of sustainable crafts.

Recommendations

- Promote traditional weaving

This is advised to ensure the long-term viability of the weaving culture. The current generation can also improve weaving techniques by incorporating modern technologies.

- Assist traditional weavers to learn about marketing in order to meet consumer demand

There must be a direct channel of communication established between weavers and consumers in order to fully comprehend customer expectations. This will provide an opportunity for traditional weavers to enhance their abilities, create unique designs and directly market their products.

- Create guidelines

The government and relevant institutions involved in the production of local handicrafts should establish guidelines for the creation of product designs and patterns for ethnic handwoven fabrics that align with current economic and societal trends.

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Living Heritage and Climate Action in the Indian Sundarbans

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Sneha Bhattacharyya has completed her MPhil in Social Science and is presently pursuing a Ph.D. on demystifying the cultural identity of Chhau practitioners of Purulia district in West Bengal, India. As a Researcher in Contact Base and working in inclusive growth and sustainable development through culture, Sneha focuses on women's empowerment and uplifting indigenous and rural communities. Her work uses culture as a vehicle for development, analysing its impact on poverty alleviation, gender, wellbeing, inclusive development, climate resilience, and global cooperation. She has written many papers and presented them on various national and global platforms.

Ananya Bhattacharya is the Co-Founder and Director of Contact Base (banglanatak dot com), a Kolkata-based social enterprise promoting inclusive, sustainable development through culture. With 25+ years of experience in safeguarding living heritage, she has worked across India on grassroots creative economies and cultural tourism. An electrical engineer from Jadavpur University, she is a Commonwealth Scholar with a Master's in Sustainable Development. A member of UNESCO Global Facilitator network, she serves on international boards, including ICHCAP, the International Music Council, and ICOMOS International Cultural Tourism Committee. Ananya specialises in gender, culture and sustainability and has published extensively on community-led cultural initiatives.

Living Heritage and Climate Action in the Indian Sundarbans

Sneha Bhattacharyya
Ananya Bhattacharya

Summary

The Sundarbans, the largest mangrove forest in the world (140,000 ha), is located in the Bay of Bengal on the delta of the Ganges, Brahmaputra and Meghna rivers. This region extends across the boundary between Bangladesh and the Indian state of West Bengal. The delta belt with its exceptional biodiversity is listed as a UNESCO World Heritage Site.

The Sundarbans present a situation where human beings coexist with nature. The local communities are dependent on the natural environment for their basic needs, leisure and livelihoods, including through fishing and honey collection. This coexistence is reflected in their daily practices, knowledge and cultural activities.

The authors and their organization have been working with communities in the region for more than two decades to reduce the risk of human-wildlife conflict, safeguard cultural heritage and improve socio-economic prospects. This case study of the Indian Sundarbans reflects on how ways of living and Intangible Cultural Heritage (ICH) elements of the region reflect the socio-ecological situation.

This case study serves as a roadmap for safeguarding the living heritage of the region and for making it a vehicle to achieve climate resilience through collective action. It introduces local ways of life, living and cultural practices and shows how the ethos of climate resilience is ingrained in these processes. The study identifies cultural practices that are in dialogue with nature along with points of divergence in their interaction in the overall context of this mangrove habitat, which is highly sensitive to the impacts of climate change (Bannerji et al, 2012).

Background

The Sundarbans, the largest mangrove forest in the world (140,000 hectares), is located in the Bay of Bengal where three mighty rivers, the Ganges, Brahmaputra and Meghna converge. It covers the area from the Baleswar River in Khulna, Bangladesh, to the Hooghly River in West Bengal, India.

The Sundarban National Park in India was inscribed as a World Heritage Site in 1987 (UNESCO, n.d.(a)) while The Sundarbans mangrove forest in Bangladesh was inscribed in 1997 (UNESCO, n.d.(b)). The region's unique bioclimatic features coupled with an exceptional level of biodiversity in both the terrestrial and marine environments and mangrove forests make it a site of global importance.

The Sundarbans has an extraordinary range of flora, with 334 plant species, 165 algae and 13 orchid species. It is also rich in fauna, with 693 species of wildlife which includes: 49 mammal species, 59 reptile, 8 amphibian, 210 fish, 24 shrimp, 14 crab and 43 mollusc species. The varied birdlife of the region includes 315 species of waterfowl, raptors and forest birds, including nine species of kingfisher and the Magnificent White-bellied Sea Eagle. It is also home to the Royal Bengal Tiger and other threatened species such as the Ganges Dolphin and

Figure 1. Village in Sundarban
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Irrawaddy Dolphin, estuarine crocodiles, the critically endangered endemic river terrapin (*Batagurbaska*) and the Indian python (UNESCO, n.d.(b))

Human settlement in the region dates to at least the fourth century BCE (around 321-326 BCE) (Bandyopadhyay, 2016). Land reclamation for wet rice cultivation intensified from the thirteenth century when Islamic preachers made inroads in the region. In the eighteenth century, the East India Company resettled indigenous communities from the Chotanagpur region as labourers who converted forests into agricultural land (Sahapedia, 2018). In 1771, British Collector General Claude Russell implemented a plan to divide the Sundarbans into plots, leasing them to landlords for timber extraction and revenue collection. This move fostered further settlement in the delta, as landlords encouraged poor farming communities from Bengal and neighbouring states to settle there (Ghosh et al., 2015).

In the region, socio-ecological concerns are embedded in everyday life. From livelihood to leisure, the lives of the local communities are in constant negotiation with the surrounding environment. This exchange with nature underpins a common sense of belonging among the communities of the region. Natural and cultural heritage are intrinsically linked in community life and contribute to the well-being of the people.

The living heritage of the Sundarbans is increasingly at risk due to a number of threats. The Sundarbans is a disaster-prone region and is one of the global hotspots threatened by climate change, which is resulting in sea level rise, erosion, increased salinity (leading to biodiversity loss) and increased frequency of storms. Cyclones such as Aila, Cidr, Nargis, Hudhud, Amphan and Yash caused devastation in the region around the Bay of Bengal (Mukhopadhyay, 2020). In 2009, Cyclone Aila affected one million people in the region, through causing a breach of the 1,300-kilometre earthen embankment and the loss of homes and property, placing an enormous debt burden on the people (Ghosh, 2015).

The region is also threatened by human actions like the construction of dams and embankments, mangrove removal, aquaculture, deforestation and urban and industrial pollution. These hazards have led to the loss of land and property, and have caused food and livelihood insecurity, disease and out-migration (Dasgupta et al., 2020). Many people from the region have migrated to urban spaces in West Bengal and other adjoining regions and these people can rightly be identified as environmental refugees. Proposed climate change solutions that emphasize resettlement of the communities are likely to lead to further out-migration (Danda et al, 2020). Unsafe migration and human trafficking with false promises of jobs and marriage are realities of the region.

A recent survey, part of the international "Deltas, Vulnerability and Climate Change: Migration and Adaptation" (DECMA) series, highlights the link between climate change and migration in the Sundarbans and identifies a gender dimension. Conducted between 2014 and 2018 and covering fifty-one community development (CD) blocks in South and North 24-Parganas (the nineteen blocks that constitute the Indian Sundarbans belong to these two districts), the study reports that among those migrating, 83 per cent are men and 17 per cent women. Most are aged between 20 and30 years old. According to the DECMA study, a key reason for migration is "failed adaptation in the areas which are under stress due to climate change" (Bhattacharya, 2019).

For a climate resilient tomorrow, while climate actions in the Sundarbans must take into account modern scientific knowledge, the way forward must also acknowledge the value of local knowledge and practices in maintaining an optimum ecological balance.

Case study design, methods and ethical considerations

This case study examined the impact of climate change on the living heritage knowledge and practices of the Sundarbans and how ways of living and Intangible Cultural Heritage (ICH) elements of the region resonate socio-ecological concerns. The key objectives of this study were to highlight how knowledge of the environment is ingrained in intangible cultural heritage and to explore how climate actions can be strengthened in collaboration with local communities through leveraging their traditional knowledge, skills and practices.

While climate science and economic studies have examined loss and damage to the natural ecosystems and human property in depth, the losses pertaining to the living heritage of the area are not well researched or understood. Furthermore, there is insufficient knowledge regarding how to integrate local knowledge and intangible cultural heritage into adaptation strategies and to strengthen community resilience. Thus, it is vital that we expand the discourse around living heritage and climate change in the Sundarbans.

The authors and their organization Contact Base (trading as banglanatak dot com) have been mapping tradition bearers and traditional practitioners in the Indian Sundarbans as part of our initiatives for safeguarding intangible cultural heritage, and have been using traditional art for social and behaviour change communication. We have worked with forest protection committees to train them in using local folk theatre in communication on biodiversity conservation and reducing conflict with wildlife. We have reached out to local schools and encouraged children to learn about their unique natural and cultural heritage. Over the years we have developed a network of over 400 local folk theatre artists, folk singers and dancers as well as traditional crafts persons. Apart from capacity building, documentation and awareness initiatives, we have also worked with tourism stakeholders to include the cultural heritage of the Sundarbans in tourism offerings. We have organized the Sundarban Folk Festival since 2016 and a folk art resource centre has been constructed at Pakhiraloy. The interventions have been supported under the Rural Craft and Cultural Hub initiative of the Government of West Bengal in collaboration with UNESCO New Delhi.

Figure 2. Village women nurturing mangrove sapling
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Since the pandemic and the super cyclones Amphan and Yash, which ravaged the area 2020 and 2021, we have been working with the communities to identify ways to build their resilience. Supported by the German Consulate Kolkata, we worked with the local community to plant thousands of mangrove saplings, which is helping to prevent erosion and promotes the preservation of biodiversity. We also addressed the issue of increased salinity in ponds, which is caused by floodwaters, using calcium carbonate to reduce salt levels and support healthier aquatic life (banglanatak dot com, 2021).

This case study is based on our long experience of working in the region with tradition bearers. We conducted unstructured interviews with local community members, with a strong regard to ethical research parameters. We documented prior consent and maintained the anonymity and confidentiality of our research participants. To understand the niche aspects of the climate crisis and to come up with solutions premised on local knowledge and practices we consulted environmentalists working in the field and relevant literature regarding climate change actions in the region. The key findings were compiled under the guidance and in consultation with local community members and domain experts like environmentalists working in the field, and the data presented here have been validated by the respondents.

Key findings

The paradigm of traditional knowledge is not centralized and systematic like modern knowledge systems but rather scattered and embedded in the

socio-cultural systems of communities (Barnhardt, 2005). Local knowledge of the environment and the various types of fauna and flora in the region is indispensable. This local knowledge can rightly be identified as intangible cultural heritage (ICH) of the region, which needs to be safeguarded, documented and supported to promote climate resilience.

Knowledge of nature is the cornerstone of local livelihoods.

In the Sundarbans, local communities are dependent on the region's natural environment (ecosystems, fauna and flora) for food, shelter and key livelihoods such as fishing, honey collection and handicraft making.

The entire region of the Sundarbans is punctuated with water, and water channels are an important means of transportation for the inhabitants, who possess considerable knowledge of the waterways, weather and conditions on the water. They can predict a storm by looking at the direction of cloud movement, and this knowledge helps them to safely navigate the waterways.

The people who depend on fishing for their livelihoods in the Sundarbans can predict the seasonal inflow of fish just by observing the clarity of the river water, with clear water on the surface implying a greater number of fish. The collectors of honey likewise have particular knowledge about the local environment. In the Sundarbans, collecting honey is a competitive job. Those who can find the most bee hives are the most successful. Finding even a single beehive and extracting honey from it is a profitable venture for the locals. To find beehives, honey collectors in the Sundarbans follow the swarming pattern of the bees, so knowledge of how and why local species of bees swarm is essential.

Figure 3. Mangroves at Sundarban
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Local communities depend on mangroves for food and livelihoods. Mangrove vegetation is the backbone of the Sundarbans. This vegetation acts as a natural anchor and protects the delta from erosion. The dense root systems of mangroves support shrimp cultivation and other aquaculture practices, a key source of food and livelihoods for those who live in the region.

Dependence on and knowledge of local natural resources in the Sundarbans is also evident in the handicraft traditions of the area. People of the region extract the pith from the stalk of the Sholaplant (*Aeschynomene aspera)*, which grows in the marshlands of the Sundarbans, and use this to create traditional handicrafts, including Bengali wedding headgear, decorative pieces and items for household use. These eco-friendly and biodegradable products derived from Shola provide a sustainable livelihood for many in the Sundarbans.

Local knowledge of natural resources contributes to treating ailments and diseases. The local communities in the Sundarbans possess immense knowledge about the medicinal value of local flora and fauna. For example, they consume a locally grown plant called Brahmi Shaak to enhance memory and Shuchni Shaak to address insomnia. In addition, they have knowledge of useful bioactive compounds that can be derived from the local environment, which are used in natural remedies and insecticides (Sowah et al, 2022). For example, communities extracting curative and healing elements from local honey. In the Sundarbans, the penetration of modern medicine as a curative medium is seldom explored. Some scholars argue that modern scientific knowledge is often discordant with the social structures and practices of indigenous communities (Guto, 2020).

Local knowledge can help to foster sustainable tourism in the region.

As a World Heritage Site, the Sundarbans attract huge numbers of tourists every year (Mahmood et al, 2021). Visitors come to see the wonders of the delta region with its exceptional biodiversity but also to experience the living cultural heritage of the Sundarbans. Tourism is a major revenue generating

source, but at the current time tourism benefits local communities minimally, with profits mainly going to external investors. Moreover, tourism has led to an increase in pollution, unsustainable extraction of natural resources and the imposition of external influences that threaten the region's cultural landscape (Jamal et al., 2022). Pollution from littering and from such things as the dumping of garbage and engine oil into rivers is jeopardizing the fragile ecosystem and the region's status as a World Heritage Site (Hassan et al., 2019). The absence of a structured visitor management program exacerbates these issues, leaving conservation efforts vulnerable.

However, the region's rich intangible cultural heritage (ICH), with the deep connection to nature and conservation, offers a valuable tool to promote social and behavioural change towards more responsible tourism. Community-led cultural tourism, which emphasizes respectful and immersive experiences, can harness this heritage to encourage sustainable practices. Such tourism can support sales of sustainably harvested local produce like honey, fish and molasses by community-based businesses. Initiatives are underway to support farmer producer organisations (FPO) offering sustainably grown produce.

In this regard, a re-branding exercise for the Sundarbans highlighting cultural heritage and emphasizing sustainable tourism development is an important next step for the government to use cultural tourism to market and increase visitation to the region. World Heritage status can be mobilized to foster responsible tourism activities and encourage immediate action to increase resilience to climate change.

While community-led tourism development has immense potential make tourism in the region more sustainable, it needs to be remembered that tourism can only be a sustainable livelihood if the needs and challenges of local communities are considered and addressed.

Local knowledge of mangrove planting is being used to restore the mangroves.

The local community members have immense knowledge of the local species of mangrove, and of methods of mangrove planting. For example, they know the ideal distancing of saplings, which is critical for the survival of the plants. Drawing on this local knowledge, the community members in Sundarbans are assisting environmentalists to re-plant mangroves in areas where they were removed in the past (Ranjan, 2019).

The importance of caring for natural heritage is embedded in cultural elements.

Traditional knowledge in the Sundarbans is intricately woven into the daily lives of local communities, with rituals and practices structured to protect natural resources and ensure the sustainable use of local ecosystems. This serves as a vital pathway for maintaining ecological balance. For example, the local fishers traditionally had a strict fishing ethic. They avoided fishing in the breeding season so as to ensure that fish would be available to catch in future.

The concept of coexistence with nature is integrated into local cultural life in the Sundarbans. Songs and poems bear reference to varieties of flora and fauna. Many name the rivers and rivulets. Cultural practices manifest the everyday anxieties and desires of the local community in dialogue with the surrounding nature and reverence of nature features commonly in such traditional practices.

Figure 4. Boatmen sing Bhatiyali
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Bhatiyali, a folk music tradition innate to the region, soulfully expresses the longing, desire, agonies and concerns of those live in the region and navigate its waterways. The word *bhati* means low land, and *bhata* means low tide. Bhatiyali is a legacy of a lifestyle, where the river serves as the metaphor for life. The lyrics are inspired by life on the river, reflecting the challenges and hardships people face

in their everyday lives while out on the water. Sailors used to sing Bhatiyali songs, with the rhythmic sound of the waves hitting the oars accompanied soulful melodies. The living heritage of Bhatiyali speaks of humanity's journey of existence in the region (Grant, 2024). The number of Bhatiyali singers has dwindled as a result of out-migration, and there has been a sharp decline in the number of boats that are powered with oars, so there are limited opportunities for learning of this musical tradition by youth. Today there are only around ten known masters of Bhatiyali in the region. One renowned Bhatiyali singer from the Sundarbans, Sourav Moni, has played a significant role in safeguarding this cultural heritage. Sourav opened a school to train local youth in Bhatiyali folk music and has presented Bhatiyali in national and global platforms. He is also a community climate champion, mobilizing local communities to undertake collective action to increase resilience. In particular, Sourav has worked to mobilize local community members to plant mangroves in order to reduce riverbank erosion.

Figure 5. Jhumur dance
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Jhumur folk songs and dances of the Sundarbans bear the historical memory of the transfer of indigenous communities by the British to serve as labourers for deforestation. As well as devotional odes dedicated to the Hindu god Lord Krishna, Jhumur songs express, through everyday stories of men and women, common aspirations, happiness, sorrow, love and loss, as well as reverence for nature and survival in the wild. The Sundarbans region is home to around 250 Jhumur folk artists. Safeguarding the folk tradition of Jhumur has led to the evolution of this traditional cultural practice into a sustainable livelihood in the region. In particular,

Figure 6. Banbibir Pala
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Jhumur has become a major tourism offering in the Sundarbans. Tourism has brought Jhumur into the spotlight, and this greater visibility has contributed to brining in new sources of income.

Cultural practices in dialogue with nature are reflected in the folk theatre tradition known as Banbibir Pala. Banbibi, a local deity, is considered the supreme protector of the local people and is popularly believed to be the saviour they pray to for safe return from collecting honey or wood in the forests or from fishing. Both Hindus and Muslims venerate her with the same devotion. The play narrates the story of how Banbibi and her brother Shahjangali came to rule over the Sundarbans and how Banbibi established her supremacy over the other native godly characters such as Dakshin Ray (Tiger God) and his mother Narayani. The play emphasizes the mercy and kindness of Bonbibi and the need to maintain ecological balance and share forest resources fairly among local community members. The performances are elaborate, colourful and dramatic, full of songs, many of which are from the Jhumur and Bhatiyali traditions. This folk drama highlights how humanity's interaction with nature serves as a unifying force. The ethos of human-nature interaction ingrained in Banbibir Pala is the premise of Jungle Nama (Ghosh, 2021), a popular graphic verse novel written by author Amitav Ghosh (Ghosh, 2005; White, 2013).

When this knowledge and heritage is lost, it dismantles the cultural space where human interaction with nature is rooted in respect and regeneration and threatens biodiversity (Burman and Chatterjee,

2023). This loss erodes the Sundarbans' identity, shaped by these centuries-old traditions, leading to a breakdown in the socio-political systems that historically protected both the people and the environment. Asthis cultural framework collapses, the region becomes more vulnerable to unsustainable exploitation, undermining the delicate balance that once existed between nature and culture.

Conclusions

Indigenous communities of the Sundarbans have the knowledge that allows them to harvest natural resources like fish, honey, fibre and medicinal plants sustainably, balancing community needs with the protection of their environment. This deep-rooted understanding of living in harmony with nature offers valuable insights into how to develop livelihood strategies that mitigate human-wildlife conflict and reduce destructive practices. Indigenous knowledge systems play a key role in providing contextual solutions and fill gaps in systematic scientific knowledge.

The local knowledge and practices in the Sundarbans region also offer models for nature-based solutions for increasing resilience and adaptation to climate change. Incorporating this knowledge into climate change mitigation and adaptation efforts provides great potential to strengthen socio-ecological resilience (Vadigi, 2016). In this way, we can devise a climate resilient roadmap for the future that is in line with goals to safeguard cultural diversity.

As a way forward, we must safeguard and document these indigenous knowledge systems and practices and integrate the same in climate actions. The knowledge of local ecosystems of the fishing communities, honey collectors, handicraft makers and traditional healers, needs to be scientifically documented in further detail. Food, lifestyle, and cultural practices provide valuable insights. The oral traditions of the communities are a rich treasure trove of information on local biodiversity and physiology.

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Videos on the ICH of Sundarbans

Bhatiyali https://www.youtube.com/watch?v=tTzx-ct_Ngw

Jhumur Song and Dance https://www.youtube.com/watch?v=aj9btyPRnnc

Bonbibir Pala https://www.youtube.com/watch?v=HFPH-ezgOQo

Shola https://youtu.be/QYtH2yx-mc8?si=MxnbmNazcBJIM37m

Mangrove Plantation https://youtu.be/tVaDP0JIBhU?si=4WANRhxLHdMIytvU

Safeguarding Intangible Cultural Heritage from Disasters and Climate Change: An Ethnographic Study in Ifugao, Philippines

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Safeguarding Intangible Cultural Heritage from Disasters and Climate Change: An Ethnographic Study in Ifugao, Philippines

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Introduction

This chapter presents the findings of an ethnographic study, based on the experience of Ifugao people in the Philippines, on safeguarding intangible cultural heritage (ICH) in the context of climate change. The study identified a range of expressions of ICH, along with specific knowledge and practices related to disaster risk reduction and management (DRRM) and climate change adaptation and mitigation (CCAM). The study also identified the particular disaster and climate risks experienced in the Ifugao region and associated risks to ICH to understand how communities and managers might address these challenges. Ways to maintain ICH were also examined to advance climate action and heritage management.

Overview of ICH in the Philippines

The Philippines has between 14 million and 17 million Indigenous Peoples (IPs) belonging to 110 ethnolinguistic groups. These groups are mainly concentrated in Northern Luzon (33 per cent) and Mindanao (61 per cent), with a few groups in the Visayas area (Camacho et al., 2016; UNDP, 2010).

The IPs have intangible cultural heritage (ICH) that includes social practices, rituals, and festive events; oral traditions and expressions; performance arts; and traditional craftsmanship passed from one generation to the next. It is essential to safeguard ICH, which serves as living heritage.

In August 2006, the National Commission for Culture and the Arts (NCCA) ratified the 2003 Convention for the Safeguarding of the Intangible Cultural Heritage. As part of the Philippine government's commitment to the Convention, it aims to identify and document ICH elements, safeguard and promote ICH, foster scientific, technical, and artistic studies, and provide technical assistance and training in the field of ICH.

As of 2024, the country had five ICH elements inscribed on the UNESCO Representative List of the Intangible Cultural Heritage of Humanity: *Hudhud* chants of the Ifugao (2001); *Darangen* epic of the Maranao people of Lake Lanao (2005); *Punnuk* tugging rituals and games of the Ifugao (2015); *Buklog* of the Subanen people (2019) and the School of Living Traditions for good safeguarding practices (2021).

In 2013, the NCCA, in collaboration with the International Information and Networking Centre for Intangible Cultural Heritage in the Asia-Pacific Region, published *Pinagmulan: Enumeration from the Philippine Inventory of Intangible Cultural Heritage* (PIICH). It contains an initial inventory of 335 ICH elements and a detailed discussion of 109 elements. The Philippines inventory is currently being updated, and results are likely to be released after the second batch of elements documentation has been studied.

The *Darangen* epic, *Punnuk,* and various traditional healing practices such as *manghihilot* and *albularyo*, the belief of *buhay na tubig* (living water), *baglan* and *mandadawak* healing practices, and stone beliefs of Itneg in Abra and *magtatawak* healing practices of Marinduque were featured between 2015 and 2017

in UNESCO's Intangible Cultural Heritage Courier of Asia and the Pacific. As of 2016, there were 367 elements listed under the Philippine Inventory of Intangible Cultural Heritage (PIICH), the official national ICH inventory. All elements are listed under the Philippine Registry of Cultural Property, the official cultural property registry of the country, including both tangible and intangible cultural heritage. As of 2024, the NCCA was working on an ongoing nomination of Aklan Piña Handloom Weaving.

Objectives and methods

The study objectives were as follows:

- Identify the various expressions of ICH in the community, including the knowledge and practices that are related to disaster risk reduction and management (DRRM) and climate change adaptation and mitigation (CCAM).

It is imperative to distinguish varieties of ICH, including the knowledge and practices of DRRM-CCAM, to promote ICH awareness about disasters and climate change. The ICH includes oral traditions and expressions, performance arts, social practices, rituals, and festive events, knowledge and practices, and traditional artisanship.

- Identify the community's disaster risks and assess associated risks to ICH.

These risks include extreme weather events such as typhoons and excessive rain, floods, droughts, and landslides. Identifying disaster risks will enable both communities and heritage managers to become aware of how to prepare, prevent, mitigate, and respond to disasters and what some recovery actions are.

- Raise awareness among community members and ICH practitioners about:
  - The disaster risks for their ICH
  - Elements of ICH that might be helpful for DRRM-CCAM

It is crucial to increase awareness among community members and ICH practitioners about disaster risks to ICH and how ICH can be useful in disaster-risk management and climate change mitigation and adaptation.

- Discuss with the community:
  - How to reduce the risk of damage to ICH
  - How to use ICH to develop action plans for the community's disaster risk reduction (DRR)

It is necessary to work closely with the community to reduce the risk of disasters damaging ICH and to use ICH for community DRR. Community members are the ones who are most familiar with the local context and are best positioned to sustain the necessary actions.

The methods and data sets (Table 1) implemented considered these objectives.

Processing of free, prior, and informed consent

In the Philippines, the National Commission on Indigenous Peoples (NCIP) requires the processing of free, prior, and informed consent (FPIC) before undertaking research with indigenous cultural communities (ICCs). This is specified in the NCIP Administrative Order No. 1, series of 2012 or "The Indigenous Knowledge Systems and Practices (IKSPs) and Customary Laws (CLs) Research Documentation Guidelines of 2012". This process is in line with the implementation of the Indigenous Peoples' Rights Act (IPRA) of 1997, also known as Republic Act 8371. The research team completed this process before gathering data in the field.

Field data gathering

The team employed the following field research methods:

- ***Key informant interviews***

The researchers conducted key informant interviews with representatives of the Save the Ifugao Terraces Movement (SITMo), the NCCA, the tourism office, and the Ifugao Intangible Heritage Performing Arts Society (IIHPAS) to identify the types of ICH in the community, including knowledge and practices that are related to DRRM-CCAM. The Municipal Disaster Risk Reduction and Management Officer (MDRRMO) and the youth and women's representatives were interviewed to identify the community's disaster and climate risks in general and assess associated risks for ICH.

Table 1. Summary of research objectives, data sets and methods

No.	Research Objective	Data Sets	Methods
1	Identification of the varieties of ICH in the community, including the knowledge and practices that are related to DRRM-CCAM	Varieties of ICH, DRRM/CCAM-related knowledge, and practices	• Secondary data collection regarding ICH • Key informant interviews with SITMo, NCCA, and IIHPAS • Focus group discussions for the identification of ICH with women, men, farmers, IPMRs and elders
2	Identification of the community's disaster and climate risks in general and assess associated risks on ICH	Disaster and climate risks and its relationship with ICH	• Secondary data collection, i.e. gathering of hazard histories, DRRM plans, Contingency Plans, Local Climate Change Adaptation Plans, and laws and policies on ICH and DRR • Key informant interviews with the Municipal Disaster Risk Reduction and Management Office, youth representative, and women's association representative • Focus group discussions with women, men, farmers, IPMRs and elders • Disaster timeline workshop with the above groups • Research outcome presentation and validation workshop with the elders, Kiangan LGU and NCIP field office
3	Raise awareness among community members and ICH practitioners on: (a) the disaster risks on their own ICH, (b) elements of ICH that are helpful for DRRM-CCAM	Compilation of disaster risks associated to ICH and good practices on ICH for DRR	• Research outcome presentation • and Validation workshop with the elders, Kiangan LGU, and NCIP field office
4	Discuss with the community: (a) how to reduce the risk of disaster damaging ICH, and (b) how to utilize ICH for the community's DRR to develop action plans.	Research Outcome	• Research outcome presentation and Validation workshop with the elders, Kiangan LGU, and NCIP field office

- ***Focus group discussions***

Focus group discussions were conducted with women, men, farmers, Indigenous Peoples' Mandatory Representatives (IPMRs), and elders to identify ICH and the community's disaster and climate risks in general and to assess the associated risks for ICH.

Research validation

The research team conducted a data validation session with the ICCs/IPs in collaboration with NCIP-Cordillera Administrative Region (CAR) and the field office to check the results of the research. This session involved presenting the research outcomes and getting feedback from the ICCs/IPs. The community members signed a certificate of validation to acknowledge that they were duly consulted by the research team.

The field site of Kiangan

The province of Ifugao is one of the six provinces in the NCIP-Cordillera Administrative Region. Ifugao Province is composed of 11 municipalities. It has an area of 251,778 ha. and lies around a latitude of 16° 35′ north and a longitude of 120° 50′ east. The highest elevation is 2,523 metres above sea level, with the rice terraces lying above 500 metres above sea level. It is bounded by the Magat River along the southeastern side, and many of the upland areas are home to gigantic dipterocarp and pine trees.

Ifugao is the only locality in the Philippines that has two ICH elements inscribed on the UNESCO intangible heritage list: the *Hudhud* chants and the *Punnuk* traditional tugging ritual. In 1995 the Rice Terraces of the Philippine Cordilleras, known also as the Ifugao Rice Terraces (IRTs), were listed as a UNESCO World Heritage site and in 2001 became one of only two (the other being the Hani Rice Terraces in China) world-renowned terraced paddy rice fields with a long history that are listed in the Globally Important Agricultural Heritage Systems (GIAHS) of the Food and Agriculture Organization (FAO) for their wonderful landscapes, farming systems and range of functions (Aguilar et al., 2020; Camacho et al., 2016; Herath et al., 2015).

One of the five clusters of rice terraces that are part of the Ifugao Rice Terraces is the Nagacadan terrace, which is located in Kiangan. The Nagacadan terrace was selected as the field site for this ethnographic research. This rice terrace was included in the GIAHS because of its continuous cultivation of traditional rice varieties using indigenous farming methods (Aguilar et al., 2020; Fao-Gef, 2014; FAO, 2017).

In 2001, the Ifugao Rice Terraces were put on the World Heritage in Danger List. This was because of the "human-induced threats to the site" (Camacho et al., 2016; UNESCO, 2008). Dizon et al. (2012) noted that the terraces' deterioration is due to the loss of biodiversity because of bio-piracy, unregulated hunting, indiscriminate use of new technologies, introduction of new species, accelerated erosion and siltation of the watershed, and reduced farm labour due to out-migration. In addition, climate change has led to changes in the ICH, such as traditional rituals and agricultural practices, of the Tuwali Ifugao Indigenous group (Table 2).

Table 2. Tuwali rice production and consumption rituals and activities

Ritual and Activity	Purpose
Lukya	A rite performed in the *alang* (granary*)* by the *mumbaki* (male religious specialist) for the family just before the working period starts in the agricultural calendar. This also marks the first time that the bundled *palay* (rice plants) in the granary are taken out for the family's consumption.
Ubaya	A ritual that is sometimes performed to support the *lukya*. It is performed in the village, preferably in the house of the family in whose granary the *lukya* rite was first performed. *Tungo* (a day of idleness) is observed the following day. People may stay home and no visitor is allowed to enter the village. After the *tungo*, other families in the village may also perform *lukya*.
Langiang	This rite is only performed when a long-abandoned ricefield is reactivated. Ten chickens are offered to the gods.
Hipngat	An offering of four chickens is performed in the granary, and done after the general cleaning of the ricefield or the *ahugabut*, when the fields are filled with vegetables planted on the *pingkol*. The purpose of the practice is to invoke the gods to bless the *palay* in the granary so that it will not be easily consumed and it will give strength to the owner/eater.
Ahiballin	This is done by turning the rice stalks and grasses that emerged from the mud.
Panal	*Panal* means laying the seeds. It is a rite performed in the granary with an offering of four chickens. The rite is done to ask the gods to bless the rice seeds so that all the sprouts will become robust seedlings. The following day is a *tungo* rest day.
Ahihopnak	After the observation of *tungo*, the following day the *binong-o* (bundles of rice seeds) are carefully laid.
Hagophop	A rite performed in the granary about a month after the *kulpi*. This marks the beginning of the *ahikagoko*.

Ahikagoko	The weeding period of the ricefield and when the dead or stunted rice plants are replaced with those taken from the *inhuj-in* or reserve seedlings.
Bodad	This rite is performed prior to *ahiloba* and *ahidalu*. Three chickens are offered to the gods, petitioning them to make the plants bear abundant grains and prevent rats from eating the *palay*.
Ahidolya	The practice is to prevent rats from infesting the rice plants or *palay*. The surroundings of the ricefield is cleaned and grasses are used as *dolnat* (to block the rat passages).
Ahi-adug	The process wherein the fields are decorated with scarecrows, cloth hangings, four or five run reeds with leaves, bundle of *runo* (cane grass) to the other, connecting the end of the vine to the post of the *allung* (a small hut for shade). When there are birds, the vine is pulled and all the bundled *runo* will move, scaring the birds away.
Paad	This rite is performed in the granary when the rice grains are about to mature. Three chickens are sacrificed to the gods petitioning them to cause the rice plants to yield plenty of grains. This is also performed to make a promise to the gods to refrain from eating aquatic foods and certain vegetables until after the harvest.
Ahi-ani	Harvest time
Ngilin	This rite is performed in the granary before the start of the actual harvest. It starts on the eve of the day of harvest in a rice field.
Inawili	A continuation of the *ngilin* which is done in the early morning. A chick is offered to the god of covetousness, the *umamo*. Half of the carcass of the chick is skewered, fastened on a *runo* with leaves. The reed is then implanted on the dike of the ricefield where the harvester will start to harvest. The other half is placed at the door of the granary. This is to plead to the god of covetousness not to covet the harvest and to ask the other gods to bestow their blessings on the harvest. On the harvest day, the ritual celebration is centered in the granary; while women harvest the grains in the ricefield, the men gather in the granary where they drink rice wine, discuss and argue over the various phases of the whole performance. The priests and priestesses perform all the various steps of the rite of *ani* and narrate the myth about Ballituk and Cabbigat from the start up to the point where the harvested rice crop was taken from Kabunyan (sky world) to the Kiyangan (earth world). If the rice owner is affluent, a pig is sacrificed as an offering. The general eating is done at mid-afternoon. But the reapers are fed earlier. During the harvest, three or four women are assigned to select seeds (*mamang-o*).
Ahiponpon	The time when the *palay* is nicely piled in the granary. This is done about a month after harvesting the *palay*.
Tuldag	In this rite, three chickens are offered to the gods to protect the *palay* in the granary. It also means that the granary is closed and there will be no removal of *palay* until the *lukya* rite is performed. The *bakle* festival is set at this time.
Ahibakle	A festival period for the villagers. The villagers grind the pounded glutinous rice into very fine powder, adding sugar cane juice, making a dough, and wrapping it with *littuku* leaves or banana leaves.
Upin	A simple ritual performed in the home after the harvest season. The *mumbaki* invoke the gods to bless the harvested *palay* and the granaries, and to keep the people safe from ailments and famine and to make them prosperous, healthy and peaceful. The following days are *tungo* and nobody must go to the field. If a person disobeys, they will be cursed with bad omens. After this is the time when women go to the field to remove the big shrubs, make a few *pingkol*, one or two in each rice paddy, and gather spiders from the rice field to make *makahiw* (the material to be used for the next ritual).
Kahiw	A rite performed in the home to remind people of the promise they made to the gods during the *paad*, that they will refrain from eating aquatic animals and legume vegetables. This rite marks the end of the Ifugao agricultural calendar.

Source: Tuwali Women, Men, Farmers, IPMRs and Elders

Table 3. Barangays of Kiangan, Ifugao

Barangays	
1. Ambabag	2. Baguinge
3. Bolog	4. Bokiawan
5. Dalligan	6. Duit
7. Hucab	8. Julongan
9. Lingay	10. Mungayang
11. Nagacadan	12. Pindongan
13. Poblacion	14. Tuplac

Kiangan: a geophysical and demographic profile

Kiangan municipality[1] is in northern Luzon, Ifugao Province. Kiangan is bounded on the east by the municipalities of Lagawe and Lamut, west by Tinoc, north by Hingyon and south by Asipulo. The municipality of Kiangan is subdivided into 14 villages, locally known as *barangay*, the smallest political unit of the Philippines. These *barangay* (as seen in Table 3) are led by elected officials such as the *barangay* captain (village chieftain) and *barangay* councillors. As of the 2020 census, the municipality of Kiangan has a population of 17,691.

Kiangan has a land area of 20,419 hectares, with 70 ha allocated for rice farming. Crops include rice and vegetables and legumes, which are grown in terraced and unterraced fields on hillsides. Other uses of the land include timber, land, grazing, and residential (Camacho et al., 2016). The people of Ifugao set categories for their land use, as noted in Table 4.

The name of the municipality is said to be derived from Kiyyangan, an ancient village near the Ibulao River across the Lagawe valley. Kiyyangan is enshrined in Ifugao mythology as the dwelling of Wigan and Bugan, the mythological ancestors of the Ifugao people.

There are three ethnolinguistic groups in Ifugao: the Tuwali, who live in the north-western part of the province; the Ayangan, who are common in the north-east and south-western areas, and the Kalanguya, who live in the outskirts of the Kiangan municipality.

Our research focused on the Tuwali group. About 72 per cent of the population are engaged in farming as a source of subsistence, livelihood and employment. The poverty incidence of the municipality is 53.90 per cent, with 1,592 out of 3,432 households having an income below the poverty threshold. There are also 973 households (32.90 per cent) with income below the food security threshold.

Kiangan: a disaster risk profile

The climate of the part of Ifugao Province where the municipality of Kiangan is located is Type 3, which is characterized by the absence of a pronounced maximum rain period, with a short dry season lasting from one to three months (from January to April) and a long wet season (from May to December).

Cyclones are a key threat between July and October, generally passing from east to west over the Cordillera region. Around half (54 per cent) of all storms qualify as typhoons or super typhoons. Typhoons occur at least once a year, with up to five per year.

1 Kiangan is a 'fourth class municipality'. Under Republic Act 11964, municipalities are classified into five classes according to their income ranges and based on average annual regular income for three fiscal years preceding a general income reclassification. Local government units (LGUs) classified as fourth class, are municipalities earning an annual average income between Php 90,000,000 and Php 130,000,000. The lowest income class is the fifth class.

Table 4. Land use categories of the Ifugao

Local Term	Land Use	Description
Magulun	Grassland	Exposed ridge and slopeland; untilled soil with low herbaceous grasses; public (in any given region); unmanaged; minimal value; source of roof thatch, game; not cultivated without new irrigation sources; usually far from densely inhabited areas
Muyong	Forest	Slopeland; undisturbed soil; naturally woody cover; public (for residents of same watershed region); unmanaged; source of firewood, forest products, game
Runo	High grassland or cane grassland	High grassland or cane grassland with secondary growth *Miscanthus* association; mostly slopeland; unworked soil covered with various stages of second-growth herbaceous and ligneous vegetation dominated by dense clumps of tall canegrass; some protection and management (canegrass much used for construction, fencing, etc.)
Muyung/Pinugū	Woodlot	Slopeland; unturned soil; covered with high tree growth (timber and fruit trees, climbing rattan, etc.); privately owned and managed (some planting of tree, vine, and bamboo types), with definite boundaries; valued for timber, other products, and protection of lower farmland from runoff and erosion
Hābal	Swidden	Slopeland, often contour-ridges; cultivated; heavily planted with sweet potatoes and moderately intercropped (including rice below 600–700 m); discrete temporary boundaries for cultivation period of several years
Linta-angan/ Aldatan	Backyard-	Levelled terrace land; surface smooth or paved but not tilled; primarily house and granary yards; workspace for grain drying and similar activities; discrete, often fenced or walled
Dolya	Sloping area	A sloping area for the planting of vegetables
Payo	Rice field	Levelled terrace farmland; bounded to retain water for shallow inundation for cultivation of wet-field rice
Pingkol	Mounded field	A mound of compostable materials carefully prepared for the cultivation of vegetables with a short span of life (e.g. pechay, string beans, cabbage, onions, garlic) within the rice field. After that, when the planting season is nearing, it is used as organic fertilizer.

Source: Tuwali Women, Men, Farmers, IPMRs and Elders, adapted from Acabado, 2013

Figure 1 summarizes the tropical cyclones' tracks that passed through CAR between 1960 and 2021, Figure 2 shows the monthly distribution of tropical cyclones in CAR between 1960 and 2021, Figure 6 shows the breakdown of categories of tropical cyclones in CAR between 1960 and 2021 and Figure 7 displays the annual number of tropical cyclones in CAR between 1960 and 2021.

According to the Department of Environment and Natural Resources (2014), the average monthly rainfall is between 15 and 18.5 mm in areas with a high elevation and between 27.43 and 30.18 mm in the lowlands. Heavy rainfall exposes the region to flooding, especially in the main river valleys. Heavy rainfall also often triggers landslides. Figure 5 details the areas affected by flooding and landslides.

The Municipal Disaster Risk Reduction and Management Office identified Kiangan as being among the municipalities of Ifugao most prone to landslides. Landslides in village areas can lead to loss of life

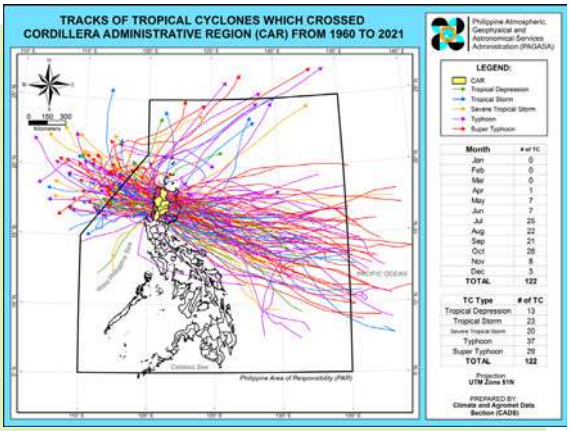

Figure 1. Tropical Cyclone Tracks in CAR from 1960 to 2021
Source: Climatology and Agrometeorology Division, Department of Science and Technology- Philippine Atmospheric, Geophysical and Astronomical Services Administration, 2023

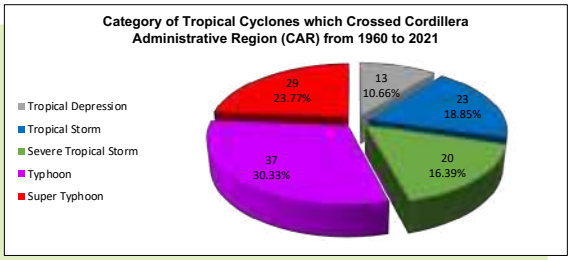

Figure 3. Categories of Tropical Cyclones in CAR, 1960 to 2021
Source: Climatology and Agrometeorology Division, Department of Science and Technology- Philippine Atmospheric, Geophysical and Astronomical Services Administration, 2023

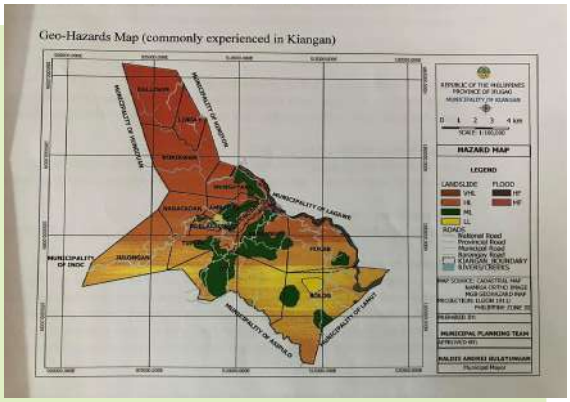

Figure 5. Map of Geo-hazards affecting the Municipality of Kiangan
Source: Municipal Planning Team, n.d.

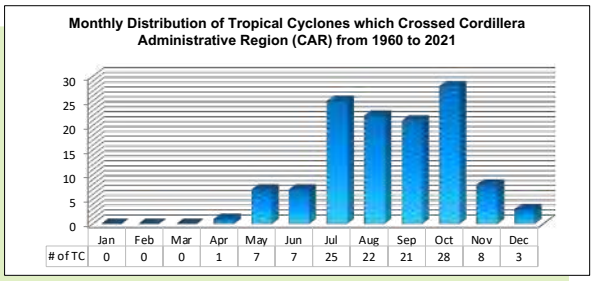

Figure 2. Monthly Distribution of Tropical Cyclones in CAR from 1960 to 2021
Source: Climatology and Agrometeorology Division, Department of Science and Technology- Philippine Atmospheric, Geophysical and Astronomical Services Administration, 2023

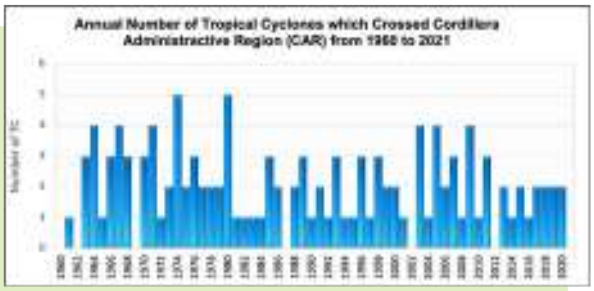

Figure 4. Annual Number of Tropical Cyclones in CAR,1960 to 2021
Source: Climatology and Agrometeorology Division, Department of Science and Technology- Philippine Atmospheric, Geophysical and Astronomical Services Administration, 2023

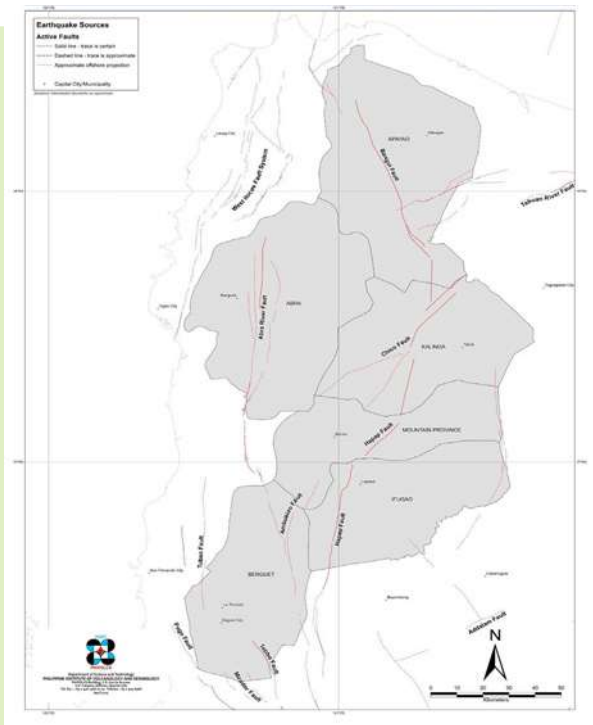

Figure 6. Map of Active Faults in CAR
Source: Philippines Institute of Volcanology and Seismology, Department of Science and Technology, April 2015

and damage to property, crops, and infrastructure. Landslides can also block access roads, especially the Ibulao-Kiangan road and the Nagacadan-Tinoc road.

Apart from hydro-meteorological hazards, the area is also prone to geological hazards such as earthquakes. During the focus group discussions, participants mentioned that their most memorable earthquake had a magnitude of 7.7. It struck the province of Ifugao and its neighbouring areas in 1990. This disaster resulted in 1,283 casualties and 2,786 injuries (Roces et al., 1992).

The Ifugao Provincial Environment and Natural Resources Officer noted during the key informant interview that the province is traversed by the Digdig fault, which particularly affects the heritage municipalities of Hungduan and Banaue. He suggested that the area should be declared as a no-build zone and be used as a planting site to cushion the possible impact of an earthquake that may occur in the area. Figure 6 shows the distribution of active faults in the region.

The province of Ifugao is ranked third among the provinces of the Philippines at most risk of climate change impacts and weather-related risks, which include intensifying typhoons, rainfall change, temperature rise, and El Niño effects (Ducusin et al., 2019; 2022; Martin et al., 2024). Climate change impacts are being experienced in the municipality of Kiangan, and these include increased temperature, more frequent occurrence of droughts, reduction of water flow in streams, shifting of the timing of rainy and dry seasons, and stronger typhoons and thunderstorms (Soriano et al., 2017). These impacts were reflected in the responses of the focus group discussions conducted under this study, with reports of hazards such as typhoons, drought, and El Niño being exacerbated by climate change, as shown in Table 5.

According to Martin et al. (2024), the province of Ifugao is projected to experience a hotter and drier climate, accompanied by more intense and extreme rainfall events and stronger tropical cyclones, as a result of climate change (see Table 6). Rain-induced landslides and drought risk are also likely to increase, coupled with further land and forest degradation and loss of biodiversity, particularly due to wildfires, low rate of seedling survival, heat stress, and water shortages under a hotter and drier climate.

Table 5. Community Hazard Experiences and ICH Used, 1956-2009

Year	Hazard/ Disaster	Impact	ICH used
1956	Mt. Atade Landslide	- Displaced families - Damaged forest trees and banana plants - Death of livestock and poultry animals - Soil erosion - Evacuation of four families	*Baddang* *Opah* *Honga*
1964	Five days of heavy rains	- Landslide - Damaged roads - Damaged houses and rice fields	*Baddang* *Opah* *Honga*
1967	Drought	- Dried rice plants - Cracked rice fields - Soil erosion (after the rain came) - Famine	*Baddang* *Opah* *Honga* *Bayuhibi*
Between 1968 and 1969	Earthquake	- Evacuation of families - Landslide - Liquefaction in some areas e.g., Poblacion and Nagacadan - Slightly damaged houses - Damaged rice paddy	*Baddang* *Honga*

16 July 1990	Earthquake	- Several aftershocks - Landslide - Earthslides in some parts of Kiangan Town - Food shortages - Road closure - Disruption of livelihood and economic activities - Heavily damaged houses and rice paddies - Increase in the prices of commodities	*Baddang* *Opah* *Honga*
1991	Mt. Pinatubo Eruption	- Volcanic ashfall - Respiratory diseases e.g., asthma, pneumonia - Damaged crops and vegetation covered by ashfall	*Baddang*
1998	Drought	- Bamboo flowered, a sign of famine and hunger	*Bayuhibi*
2004	Typhoon Yoyong (International name: Nanmadol)	- Landslide - Damaged rice paddies and rice fields - Damaged vegetation and fruit - Some casualties among Kiangan residents - Death of animals e.g. pigs - Uprooted trees - Erosion of rice fields	*Baddang* *Opah* *Honga*
2005	El Niño	- Damaged rice paddies and vegetation - Absence of water - Death of livestock - Food scarcity and hunger	Prayers *Baki* *Baddang* (also received livelihood assistance from the government)
29 August 2007	Continuous heavy rain resulting to landslide in Hingyon, Ifugao	- 4 casualties - 1 injured - Road closure - 1 totally destroyed house - 2 partially damaged houses	*Baddang* - search and rescue operation Financial, material and food assistance
2008	Continuous heavy rains	- Soil erosion - 9 casualties - Landslide - Damaged rice paddies due to silt - Damaged houses - Road closure	*Baddang* *Opah* *Honga* *Inubaya/Ubaya*
7 May 2009	2 landslides at Poblacion Landslide at Dinapugan	- Road closure - Disrupted businesses	Clearing of roads
8 May 2009	Landslide at Maitab, Lagawe	- 8 casualties - 8 totally destroyed houses - Damaged roads and road closure - Disrupted businesses - Displaced families	*Baddang* - search and rescue operation Financial and material assistance Helped commuters cross over area Use of dogs to smell missing buried persons

2009	Typhoon Ondoy (International name: Ketsana) resulting in 2 landslides in Poblacion, Kiangan	- 6 casualties - 2 totally destroyed houses - Road closure - Displaced families	*Baddang* - search and rescue operation Financial, material and food assistance

Source: Tuwali Women, Men, Farmers, IPMRs and Elders

Table 6. Selected Temperature Extremes Indices in the Early-21st Century (2020-2039) for Ifugao relative to 1986-2005

	TEMPERATURE Climate Extreme Indices					**EARLY-CENTURY Projected Change**	
	CODE	**Description** (*unit*)	**Baseline**	**Scenario**	**Range**	**Projected Value**	**Projected Change**
	Col 1	Col 2	Col 3	Col 4	Col 4	Col 5	Col 6
MAGNITUDE	**TNn**	Coldest nighttime temperature (˚C)	13.9	RCP4.5	Lower Bound	14.3	0.4
					Median	14.8	1.0
					Upper Bound	15.5	1.6
				RCP8.5	Lower Bound	14.5	0.6
					Median	14.9	1.0
					Upper Bound	15.8	1.9
	TNm	Average nighttime temperature (˚C)	18.9	RCP4.5	Lower Bound	19.4	0.4
					Median	19.5	0.6
					Upper Bound	20.0	1.1
				RCP8.5	Lower Bound	19.4	0.5
					Median	19.8	0.9
					Upper Bound	20.2	1.3
	TNx	Warmest nighttime temperature (˚C)	22.0	RCP4.5	Lower Bound	22.4	0.4
					Median	22.6	0.6
					Upper Bound	23.1	1.1
				RCP8.5	Lower Bound	22.5	0.5
					Median	22.9	0.9
					Upper Bound	23.3	1.3
	TXn	Coldest daytime temperature (˚C)	22.5	RCP4.5	Lower Bound	22.6	0.1
					Median	23.0	0.5
					Upper Bound	24.0	1.6

	TXn	Coldest daytime temperature (˚C)	22.5	RCP8.5	Lower Bound	22.7	0.2
					Median	23.0	0.6
					Upper Bound	23.9	1.4
MAGNITUDE	**TXm**	Average daytime temperature (˚C)	27.7	RCP4.5	Lower Bound	28.0	0.3
					Median	28.4	0.6
					Upper Bound	28.7	1.0
				RCP8.5	Lower Bound	28.4	0.6
					Median	28.6	0.9
					Upper Bound	28.9	1.2
	TXx	Warmest daytime temperature (˚C)	32.0	RCP4.5	Lower Bound	32.1	0.1
					Median	32.6	0.6
					Upper Bound	33.1	1.1
				RCP8.5	Lower Bound	32.7	0.7
					Median	32.8	0.8
					Upper Bound	33.3	1.3
	DTR	Daily Temperature Range (˚C)	8.8	RCP4.5	Lower Bound	8.7	-0.1
					Median	8.8	0.0
					Upper Bound	8.9	0.1
				RCP8.5	Lower Bound	8.7	-0.1
					Median	8.8	0.0
					Upper Bound	8.9	0.1
FREQUENCY	**TN10p**	Fraction of cold nights (%)	11.6	RCP4.5	Lower Bound	3.3	-8.3
					Median	5.5	-6.1
					Upper Bound	6.9	-4.6
				RCP8.5	Lower Bound	3.0	-8.5
					Median	4.5	-7.0
					Upper Bound	5.7	-5.8
	TN90p	Fraction of warm nights (%)	11.6	RCP4.5	Lower Bound	21.2	9.8
					Median	29.2	17.7
					Upper Bound	36.7	25.3
				RCP8.5	Lower Bound	27.4	16.0
					Median	39.0	27.5
					Upper Bound	49.5	38.1

FREQUENCY	**TX10p**	Fraction of cool days (%)	11.5	RCP4.5	Lower Bound	5.1	-6.5
					Median	6.6	-5.0
					Upper Bound	7.9	-3.7
				RCP8.5	Lower Bound	4.0	-7.5
					Median	5.5	-6.1
					Upper Bound	6.9	-4.6
	TX90p	Fraction of hot days (%)	11.6	RCP4.5	Lower Bound	14.6	3.0
					Median	19.6	8.1
					Upper Bound	28.2	16.7
				RCP8.5	Lower Bound	22.5	11.0
					Median	23.6	12.0
					Upper Bound	33.6	22.1
DURATION	**WSDI**	Number of days contributing to a warm period (*days*)	6.8	RCP4.5	Lower Bound	24.8	17.9
					Median	35.7	28.9
					Upper Bound	80.2	73.4
				RCP8.5	Lower Bound	44.0	37.2
					Median	84.6	77.7
					Upper Bound	177.4	170.5

Source: Department of Science and Technology- Philippine Atmospheric, Geophysical and Astronomical Services Administration, 2024

These hazards and the deterioration of the rice terraces pose a threat to the continuity of ICH practices, exacerbated by the limited awareness of ICH across different sectors in the country and low appreciation of traditional artisanship and materials. Changes include greater access to modern technologies, the changing context of hazards, out-migration, loss/damage/replacement of traditional materials of place and tools associated with the ICH, and the death of key cultural bearers, resulting in a less intergenerational knowledge transfer.

ICH in Kiangan

Understanding of ICH in the Philippines is relatively well-developed. One ICH element in the province of Ifugao that is practiced in Kiangan is Hudhud (ACCU, 2002; Batin, 2014). Hudhud are historical narrative chants performed by Ifugao community members during the rice sowing season, funerals and rituals (Blench and Campos, 2010; Moore, 2015; Royeca and Molina, 2018). They relate at least 40 historical tales for three to seven days (Moore, 2015; Peralta, 2008; Royeca and Molina, 2018). The Ifugao epic Hudhud was proclaimed by UNESCO in 2001 as one of nineteen masterpieces of the oral and intangible heritage of humanity and was inscribed on the Representative List of the Intangible Cultural Heritage of Humanity in 2008.

ICH in disaster risk reduction and management and climate change adaptation and mitigation

Ifugao has several ICH practices that are used to address the impacts of disasters, and thus have a bearing on future strategies for climate change adaptation.

During the fieldwork, researchers consulted the community members (women, men, farmers, IPMRs, and elders) about the natural hazards and climate change impacts they have experienced, along with the ICH they used to cope with and recover from the situations. Table 5 presents their cumulative experience.

Based on the interlocutors' sharing and discussions, several forms of ICH concerning natural hazards and disasters were identified.

Baddang

According to the Institute for Climate and Sustainable Cities, *baddang* is a form of the *bayanihan*[2] system that is key to community adaptation, along with cooperative labour groups of Ifugao. As a post-disaster intervention, *baddang* is when the whole community helps its affected members. It can be in the form of clearing blocked roads, repairing destroyed houses and rehabilitating eroded farmlands. According to community members who participated in the study, in earlier times they helped move the houses of their fellow community members as the need arose, and if rice paddies were destroyed, they assisted in the reconstruction. This could be the reason why to this day the rice terraces that were identified as UNESCO World Heritage sites in Kiangan are still intact and managed well.

Baddang is also manifested in the conduct of search and rescue operations after a disaster event. It also covers helping others to prepare for, prevent, mitigate, respond to and recover from any hazard or disaster event. In addition, it is the simple gesture of helping travellers cross over a particular area.

The practice of *baddang* among the people of Kiangan is important in disaster risk reduction and management (DRRM), for it covers all aspects of the four phases of the disaster management cycle: preparedness, prevention and mitigation, response, and rehabilitation and recovery. *Baddang* is a multi-stakeholder partnership and engagement that fosters a collective process of DRRM.

Honga

Another frequently mentioned ICH among the study participants was the performance of the *honga* ritual. Among the Tuwali, this ritual is performed to cure a sick person. It can be practiced for kinds of sickness, including post-traumatic stress disorder, which may be experienced after a disaster.

Honga can also be performed to gain prestige and express gratitude. The gratitude form has two types: *hongah di kitaguwan,* which happens inside a house, and *hongah de page,* which takes place in the rice field. In *hongah di kitaguwan*, the household conducts a thanksgiving ceremony to express gratefulness for the good life and favourable status of the family and to wish for continuous abundance and wellness of the family. For *hongah de page,* thanksgiving is done twelve times, following the agricultural calendar. This ritual is done to ensure good yields in the coming harvest season.

Honga is performed by a *mumbaki,* a male Ifugao religious specialist or 'shaman'. The process of *honga* involves a prayer (in accordance with the religion of the family) and the butchering of pigs. The number of pigs depends on the economic status of the family leading it.

Opah

Opah is a ritual performed when somebody dies. It is practiced seven to nine days after the body is buried, with the aim of sending the soul of the deceased person to the place where their ancestors dwell. It is a ritual that calls for the spirit of the dead to come down from the sky, since it is believed that when the mortal body dies violently, its spirit wanders up to the sky.

Tuguinay (2009) notes that *opah* is also performed after the bone cleansing ritual called *bogwa* when the family is ready to bring home the bones of a deceased person. A pig is butchered in the practice of *bogwa*. The *opah* ritual is done in the morning before the bones are brought in the afternoon.

The *opah* ritual involves calling out the names of

2 An ancient Filipino custom, symbolic of the Filipino way of group work, also known as *tulongan* or *damayan* (*tulong*- help; *damay*- aid), a system of mutual help and concern which has become the backbone of family and village life throughout the Philippine archipelago (Ang, 1979).

the living persons who helped or handled the victim after the incident. A pig is butchered during the process. A cluster of red *dongla* leaves is tied to the hilt of the spear, which is raised towards the sky in the direction of the sun by the *mumbaki,* who shouts the name of the dead person. The spear is abruptly reversed with the blade towards the *liga-u* (rice winnowing tray), shaking it briskly.

Bayuhibi

This ritual is performed to request rain from the gods during drought. The word *bayuhibi* means rain shower (Ananayo, 2009). It is one of the types of rains experienced in Ifugao, along with *dondonyag*, which features sunshine while it is raining, and *dumalallu* when hail accompanies heavy rainfall.

Inubaya

A *munhaw-e* (lead chanter) and *mumbaki* lead the *inubaya*, which is a ritual for rice and is also performed to drive away evil spirits to protect people. The *inubaya* ritual is a special practice that is no longer performed often, but was performed after nine people in Kiangan died due to heavy rains in 2008.

According to the CEO of the Save the Ifugao Terraces Movement (SITMo), "Disasters lead to the remembrance of old practices that are no longer popular in today's generation. Disasters also help the people realize and recognize our ICH that is already forgotten by the younger people".

Baki

According to Dulawan (1989), *baki* is a sacrificial ritual performed on important occasions. *Baki* is divided into "rituals for people" and "rituals for rice culture". For the rituals for people, some examples are rituals for childbirth, diagnosis of an illness, healing, epidemics, and protection of health and wealth. As for the rice culture, it includes rituals performed at various points in the agricultural cycle: sowing, before transplanting, after transplanting, when rice plants grow new leaves, when rice grains form, harvest time, stacking rice in the granary, and the removal of the first rice bundles from the granary.

Most rituals follow a general pattern beginning with an invocation to ancestors, messengers, cultural heroes, and gods; followed by an offering and divination; then chanting (usually of myths or legends); and finally a repeat of the invocation and conclusion. A chicken is usually sacrificed, and its gall bladder is read to determine the efficacy of the ritual. Aside from chickens, pigs are also sacrificed in *baki*.

Safeguarding ICH for the continuity of heritage and disaster-risk reduction

The participants in the study made recommendations regarding actions to safeguard and promote ICH, as described below.

Leadership and partnership

The tourism officer who participated in the study identified the importance of local government leadership — Local Government Units (LGU) — and partnership with stakeholders in safeguarding ICH:

> *The LGU must take a lead role in preserving [our] intangible heritage because we see this as our identity. We are trying to partner with private institutions like the Save the Ifugao Terraces Movement or other groups that are involved in cultural conservation. The reason why we must do this is because we see so many changes and adaptation(s) coming from young generations. Once we do not do something to protect our culture, there might come a time when we will lose this identity. We are going to mainstream the culture, which means our identity as Indigenous people will stay as long as it can. So, the LGU must take a major role in these initiatives. … We are partnering with some other organizations that have involved themselves in cultural conservation. But we also have our [own] initiatives, like hosting a cultural festival. We try to fund as much as we can the existing traditions that are still here.*

This view was also supported by the municipal disaster-risk reduction and management officer. She noted that:

> *It is important to involve the LGU as the focal agency in leading and fostering partnerships, not just for ICH safeguarding but also for the overall framework of disaster risk reduction and management.*

In the validation session of the research, the participants noted that the National Commission on Indigenous Peoples (NCIP), along with the Indigenous Peoples Mandatory Representatives

(IPMRs) and Indigenous Peoples Organizations (IPOs), have a huge role to play in the safeguarding of the ICH since they are the practitioners on the frontline. Without them, no one will continue to conduct and promote the full range of the ICH of the Ifugao people.

Festivals to commemorate ICH

Participants in the study recommended that traditional festivals continue to be held. One of the community celebrations that helps to ensure the continuity and passing on of ICH is the *Gotad Ad Kiangan*, the annual town festival of the municipality of Kiangan. This festival is celebrated between April and May. It is a festival of traditional Ifugao performing arts of dancing and chanting.

It was inspired by the *uya-uy,* an Ifugao prestige ritual that is one of the steps required for a couple to be elevated to the *kadangyan* (noble) status. It is also for invoking the deities for more children, if couples only have one child or if they are childless. It involves several days and may even reach a month of performance of *naba* nights filled with the beating of the gong, announcing to the community that a couple is undergoing the prestige ritual. Critical to the *uya-uy* is the observance of *holyat,* which culminates in the long nights of observing the *naba*.

The *holyat* then is a prelude and the start of the celebration of *gotad*, when the whole community joins in the festivity with the beating of gongs, butchering of animals, drinking of rice wine and dancing.

In addition to this festival, the municipality also sponsors a post-harvest festival. Other than that, an ordinance for the *Kalanguya* and *Ayangan* festivals was authored by the current local chief executive when he was still a councillor.

Indigenous Peoples' education

Since 2004 the municipality of Kiangan has implemented an Indigenous Peoples' Education (IPEd) programme through the Department of Education, institutionalized through DepEd Order 62, s. 2011 or the National Indigenous Peoples Education Policy Framework. The policy adopts a rights-based approach and directs the implementation of an education that is anchored in the social and cultural context of IP learners. The curriculum of IPEd includes Indigenous Knowledge Systems and Practice (IKSP) modules, along with Mathematics, Science, and English. Table 7 summarizes its timeline in the Philippines based on the laws and policies enacted in the country.

Table 7. Indigenous Peoples Education Timeline in the Philippines

Year	Law/ Policy	Implication
1997	Republic Act 8371: Indigenous Peoples Rights Act	Recognition and protection of the rights of indigenous cultural communities /IPs
2004	Department of Education (DepEd) Order 42 series 2004	Permit to operate Primary Schools for IPs and cultural communities
2010	DepEd Order 101 series 2010	The Alternative Learning System for IPs
2011	DepEd Order 62 series 2011	Adopting the National Indigenous Peoples Education Policy Framework
2013	Republic Act 10533	The Enhanced Basic Education Curriculum Act of 2013
2016	DepEd Order 22 series 2016	Indigenous Peoples Education Program Support Fund
2019	Commission on Higher Education (CHED) Memorandum Order (CMO) 2 series 2019	Integration of IP studies in the relevant higher education institutions

Source: IIHPAS President, n.d.

One of the key groups that supported establishing IPEd in Kiangan is the Save the Ifugao Terraces Movement (SITMo), a non-governmental organization that advocates for the exposure of community members and youth to Ifugao culture through education in schools. SITMo believes that there is a need to change the way youth and children are being taught. In 2006, it partnered with Ifugao State University and the Department of Education (DepEd) in the mainstreaming of indigenous knowledge in education through developing modules on Ifugao indigenous knowledge that localized and contextualized education. SITMo also led the development of the IPEd Center, which includes a library and museum of textiles and artifacts. It also collaborated with the NCIP for the line agency to teach indigenous knowledge to the Ifugao people.

Before SITMo, a national office called the Ifugao Terraces Commission (ITC) advocated for indigenous education in Ifugao Province. This is a presidential commission that formulates short- and long-term plans for the restoration and preservation of the Ifugao rice terraces in the municipalities of Banaue, Hungduan, Mayoyao and Kiangan. It was created through Executive Order (EO) No. 158 on 18 February 1994, under the term of President Fidel V. Ramos. In 1999, it was replaced by the Banaue Rice Terraces Task Force (BRTTF) through E.O. No. 77, which was mandated to restore and preserve the Ifugao Rice Terraces (IRT) and to prepare a development plan. In 2002, the BRTTF functions were transferred to the Provincial Government of Ifugao. This resulted in the development of the Ifugao Rice Terraces Cultural and Heritage Office (IRTCHO) under the Office of the Provincial Governor, which was later replaced by the Ifugao Cultural Heritage Office (ICHO).

Ifugao Intangible Heritage Performing Arts Society

To safeguard ICH, it is crucial to establish and support groups that value and practice ICH because such groups pave the way for intergenerational knowledge transfer and for the popularization of the heritage outside of their area. The Ifugao Intangible Heritage Performing Arts Society (IIHPAS) is an example of such a group. Originally known as the Ifugao Performing Arts group, it was established in partnership with SITMo, and the head of the Ifugao Museum serves as its president. She explained that the organization was established to "get to know more about our culture and promote our heritage in today's generation".

To become a member of IIHPAS, one must be willing to learn performing arts such as musical instruments and dances of the Ifugao. The annual membership is 50 PHP (roughly 1 USD), while lifetime membership is 300 PHP (about 6 USD).

As of 2024, the IIHPAS had 60 members. Half were affiliated with the Tuwali IP group, which comes from the 14 barangays of Kiangan, and the other half were affiliated with the Ayangan IP group, which comes from the Municipality of Lagawe. These members include elementary and high school students, cultural advocates and retirees.

Restoration of the rice terraces

Imperative to the safeguarding of ICH is the restoration of the rice terraces, which also involves forest management and natural resource management.

The practice of many rituals in Ifugao is closely tied to traditional farming practices. But when farmers start to plant new rice cultivars and use modern agricultural techniques, rituals associated with agriculture are no longer performed. As a general rule, only traditional rice varieties are allowed to be used for rice rituals. According to the SITMo CEO and the tourism officer, since the Department of Agriculture (DA) introduced modern agricultural techniques and new rice cultivars (which are dependent on pesticides and fertilizers), it has been a challenge to continue agricultural rituals.

The municipal disaster risk reduction and management officer noted that another factor that threatens agricultural rituals associated with rice growing is that many farmers have shifted to cash crops rather than planting rice, as cash crops generate more income and farmers want to be more financially stable.

According to the IPMRs, the conversion of rice terraces to gardens and residential areas has led to water scarcity, and a further decline in rice planting and associated rituals. Only those who have water sources can perform traditional farming practices.

To address these concerns, the local government of

Kiangan subsidizes farmers who perform traditional farming practices, and the Office of Municipal Tourism organizes a harvest festival, which is similar to the *Punnuk* tugging rituals and games, to revitalize and promote the rice terraces of Kiangan. Such festivals depend on government funding, however.

The School of Living Traditions

An effective tool that is worth replicating is the School of Living Traditions (SLT), whereby participants are taught the art of *hudhud* chanting, gong beating, Ifugao dance, proper use of attire and other performing arts that children and adults alike have forgotten (Dulnuan, 2014). The SLT was organized through the efforts of the NCCA. According to an interview with the representative of the NCCA, the production of e-learning documents and the publication of learning guides continued to be carried out despite the COVID-19 pandemic. The formal educational sector has started to introduce indigenous knowledge and systems into their curriculum.

Strengthening bearers of knowledge

To promote and safeguard ICH, there is a need to strengthen the Indigenous Peoples Mandatory Representatives (IPMRs) and Indigenous Peoples Organizations (IPOs) since they are the bearers of knowledge that can validate research studies being conducted about Ifugao culture. The IPMRs and IPOs were set up through the promulgation of NCIP Administrative Order No. 3, series of 2018, otherwise known as the Revised National Guidelines for the Mandatory Representation of the Indigenous Peoples in Local Legislative Councils and Policy Making Bodies.

Conclusions

Despite many efforts so far, there is still a need to invest further in the promotion and safeguarding of ICH in communities. This is because of the hazards affecting rice terraces, disasters and economic challenges that drive people to shift away from traditional farming. And because all rituals and practices are tied to the *mumbaki,* there is also a need to help the *mumbaki* pass on the knowledge of the Ifugao culture since most of them are now elderly.

Despite the presence of the School of Living Traditions (SLT) and the practice of Indigenous Education (IPEd), there are still youth in the community who have limited awareness of their cultural heritage due to limited transmission of knowledge from older generations and a lack of education about heritage in schools. Most schools and colleges do not cover the Indigenous Knowledge Systems and Practices (IKSP). Given this situation, it is crucial to sustain the funding support for SLT and IPEd in the municipality and across the country. IKSP must be mainstreamed not just in elementary and primary education but also in secondary education and universities. It is critical to educate the youth who will be our future leaders and educators and, consequently, cultural ambassadors.

It is also necessary to continue the interventions of the NCCA through training workshops in safeguarding and mobilizing ICH in the context of climate change. According to the NCCA representative, they have conducted training on three islands: Luzon, Visayas, and Mindanao. The research team supports such training and recommends that the capacity building be sustained and should be cascaded to the community level by capitalizing on the Disaster-Risk-Reduction and Management Fund (DRRMF). As per section 21 of the Republic Act 10121 (the Philippines DRRM Act of 2010), 70 per cent of the DRRMF can be used for disaster preparedness, and this includes capacity-building activities.

Awareness can also be in the form of tourism education. Dulnuan (2014) highlights the need to have sustainable and balanced tourism to preserve the living culture. She notes that:

> *Tourism education is what distinguishes the new forms of tourism (ecotourism, heritage tourism, green tourism, etc.) from mass tourism. Both guests and hosts interact and learn from each other. The host community and tourism enterprise are also educated about the nature of tourism, especially its impact, benefits, and damages, as well as the tools that could be used to mitigate damages and harness benefits. Thus, farmers and businessmen should know more about carrying capacities, ecological footprints, zoning, and other such tools that they could employ in tourism management.*

Sustainable tourism could also be a means to increase appreciation for traditional culture,

environmental protection, biodiversity conservation, income generation, and empowerment of the community.

SITMo advocates for the preservation of the living rice culture since there would be no tourism if the rice culture disappeared (Dulnuan, 2014; SITMo, 2008). To preserve the living rice culture, consideration must be given to all the practices, rituals, and processes that accompany and result in the living rice culture, and this knowledge can be conveyed through tourism education (Dulnuan, 2014).

As suggested by the NCCA representative, it is also imperative to integrate ICH in the context of DRR and CCAM plans, policies and programmes, and these must be implemented and supported with sufficient budget allocation across different levels, including the national, regional, provincial, city/municipal, and *barangay*/village levels.

Acknowledgments

The research team would like to extend its heartfelt gratitude to IRCI for making this research possible through technical and funding support. Many thanks also go to the following individuals who provided their insights and expertise in the conduct of this research: Remedios D. Allaga (IPO of Brgy. Poblacion), Phyllis C. Anudon (IPMR of Brgy. Poblacion), Jaime T. Bandao (IPMR of Brgy. Bolog), Julia T. Binyuca (Elder), Romeo C. Buyayo (IPMR of Brgy. Duit), Marcela G. Cortez (IPMR of Brgy. Pindongan), Mary T. Dimacje (IPO of Brgy. Poblacion), Maria B. Galeon (Farmer), Mercelita N. Gobway (IPO President of Brgy. Tuplac), Marilyn B. Guimbatan (Elder), Roehl Guinid (IPO of Brgy. Ambabag), Albert G. Indunan (IPMR of Brgy. Tuplac), Francis Jerome Y. Licyayo (IPO of Brgy. Baguinge), Juan M. Malanta (IPMR of Brgy. Baguinge), and Christopher Pedrosa (IPMR of Brgy. Hucab).

The team would also like to thank the National Commission on Indigenous Peoples (NCIP)-Cordillera Administrative Region, NCIP-Tinoc Service Center, NCIP-Ifugao Provincial Office, the Municipal Government of Kiangan, Save the Ifugao Terraces Movement members and Fides Anne J. Molina for their invaluable support in the research coordination, planning and process.

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Seasonal Migration Practices of the Gujjar and Bakarwal Communities: A Case Study of Intangible Cultural Heritage and Climate Change Adaptation from the Upper Himalayas

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Seasonal Migration Practices of the Gujjar and Bakarwal Communities: A Case Study of Intangible Cultural Heritage and Climate Change Adaptation from the Upper Himalayas

Shahzad Ahmed Malik
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Introduction

The Himalayas were a cradle for civilizations and for centuries have been a source of sustenance for millions. However, the Himalayan region is experiencing significant warming, with temperatures rising faster than the global average. This is impacting the inhabitants of the region in many ways.

The Indigenous communities in the Himalayas, including the Gujjars and Bakarwals of Jammu and Kashmir, have developed resilience practices over centuries, but the rapid pace of climate change is challenging their traditional adaptation strategies. These communities, known for their rich intangible cultural heritage, have traditionally relied on seasonal migration between the upper and lower Himalayas as a way of coping with the harsh conditions of the region. This practice is a means of livelihood, but is also a means of transmitting the communities' repository of extensive knowledge about the Himalayan ecosystem to younger generations.

Supporting the resilience of the inhabitants of the Himalayas is crucial for the well-being of millions of people who depend on its resources. Addressing the impacts of climate change on these communities requires a multifaceted approach that includes legal protection, support for sustainable livelihoods and the preservation of their cultural heritage. As the IPCC Working Group II Report (2022) explains, climate, ecosystems and human societies are interrelated, and it is therefore necessary to adopt comprehensive adaptation and mitigation strategies.

Background

The impacts of climate change on the Himalayan region include the following:

- **Melting glaciers**: Glaciers are crucial for storing the water that eventually flows into rivers like the Indus, Ganges, and Brahmaputra. The melting glaciers and changing weather patterns are increasing the risk of floods, disrupting water supplies and having a detrimental impact on agriculture and livestock herding.
- **Stronger and more frequent extreme weather events:** These include storms, floods and droughts.
- **Changing weather patterns**: Unusual and unpredictable weather, including unseasonal snowfall and severe cold, makes it difficult for Himalayan communities to follow traditional migration routes.
- **Biodiversity loss**: Changes in vegetation and wildlife patterns impact the availability of pasture for grazing of livestock and increase the risk of wild animal attacks on livestock.

These climate change impacts adversely affect built structures, food systems, livelihoods and human health. Climate change-induced disasters are also

causing irreversible damage to cultural heritage, both tangible and intangible, and in the process some Indigenous knowledge and practices are being lost (Brabec et al., 2019). Indeed, climate change poses a threat to the ways of life of communities, resulting in the loss of languages, oral traditions and beliefs (Atalan, 2018). For example, when built heritage, including homes and temples, are destroyed by extreme weather and other disasters, the oral narratives and practices associated with these sites also disappear. Likewise, relocation of communities to safer places results in those communities parting ways with important cultural sites such as places of worship, sacred places and cemeteries, that are specific to that community and are important for cultural continuity (Ferris, 2017). The community's deep-rooted connection to their land is lost, and associated cultural practices rituals, customs and other intangible cultural heritage become endangered (Iyer, 2020).

Disasters like storms and floods can lead to the erosion of the nutrient-rich topsoil leaving behind infertile soil, making it difficult for communities to grow traditional food crops and the plants that are used in traditional rituals (Priyadarshini, 2024), therefore impacting the local traditions related to food, medicine and spirituality. Floods, in particular, have led to the loss of land, which in turn leads to a reduction in crop yields and livestock production. Moreover, loss of the indigenous fauna and flora results in the discontinuation of cultural knowledge, and folkloric practices associated with that fauna and flora (Aktürk and Lerski, 2021).

The Hindu Kush region (HKR) is an area where communities are facing a crisis due to the impacts of climate change (Rusk et al., 2022). The people living in the Hindu Kush region of the western Himalayas, located in Jammu and Kashmir, Himachal Pradesh and Uttarakhand have rich knowledge systems dating back thousands of years relating to local landscapes, seasonal variation, waterways, agriculture, herding and crafts (Bhasin, 2011). Some of these communities are nomadic and practice seasonal migration between the upper and middle altitude Himalayan ranges as a condition of their lifestyle.

The present study focused on the Gujjars and Bakarwals, nomadic communities of the Jammu region in the union territory of Jammu and Kashmir, India. According to official statistics, there are over 1.5 million Gujjars and Bakarwals in Jammu and Kashmir. This includes 500,000 nomads who rear buffalo, sheep, cows, goats and horses. Mainly followers of Islam, these communities are largely concentrated in Poonch, Rajouri, Udhampur, Anantnag, Reasi, Doda and Kupwara districts.

Gujjars and Bakarwals are migration-based hill tribes, protected under the "Scheduled Tribes and Other Traditional Forest Dwellers" (Recognition of Forest Rights Act 2006). The Act sought to protect the landholding rights of tribes such as Gujjars and Bakarwals (Mohd Ashraf Wani and Kumar, 2019). Although these groups' land holding rights and ability to stay on land owned by the government is fully documented, these rights are not always respected.

The Gujjar and Bakarwal communities are made up of around 84 clans (*gotra).* The most prominent clans are Khattana, Bajjar, Kohli, Awan, Phamra and Mandar.

The herding of livestock such as buffalo, sheep and goats by Gujjar and Bakarwal communities is based on the free range of the animals. Historically, the livelihoods of the Gujjars and Bakarwals largely depended on their livestock (Iqbal et al., 2018). Their food, arts, crafts, medicines and sources of entertainment also traditionally revolved around rearing livestock. Today livestock herding is still the main livelihood, but some depend on agriculture. The Gujjars with agriculture as their main occupation (cultivating maize and wheat and staying in one place) are called Muqami. They live in houses called *kotha / bandi.* The Gujjars who make their living by rearing buffalo and selling milk products are called Dodhi. Bakarwals, high-altitude goat herders and shepherds, are divided into Kunhari and Illahiwal. This division is due to the difference in the dialects they speak, having moved from different areas into the region. Kunhari Bakarwals came from the valleys of Kunha, Bogadmung and Konish, all lying to the north of Hazara. The Illahiwal came from the western areas of Alai, Nandhar, Rajdnari, Kaladhaka Kohistan and Swat.

In response to the harsh local conditions, the Gujjar and Bakarwal communities have developed resilience

practices over centuries. As pastoralists, their lives are largely determined by livestock and the search for pastures, and they practice seasonal migration, which involves moving between summer and winter pastures. The transhumant migrations of the Gujjars and Bakarwals sustain their livestock (Sharma et al., 2003) and to protect them from the snow and cold in winter. Seasonal migration takes place from the upper Himalayas during the winter season towards medium or low-altitude areas of Jammu and Kashmir. Winter pastures are at low altitudes and are used during the colder months when the high-altitude areas are covered in snow. Summer pastures (*dhoks),* are used during the warmer months when the snow has melted, providing fresh grazing grounds. Middle pastures are used during the transitional periods of spring and autumn when pastoralists are moving between their winter and summer pastures. The practice of migration enables the regeneration of grassland and other natural resources. This creates a sustainable cycle of regenerative resources which is a solution to the overconsumption of natural resources in conventional sedentary lifestyles.

The intangible heritage of the migrating Gujjar and Bakarwal communities results from the combination of the natural migration routes and landscapes, livestock herding livelihoods and food (Bhasin, 2011). These communities possess a wealth of knowledge about the environment and climate of the Himalayas. Their folklore, songs and rituals reflect their deep connection with the environment. Studies suggest that these groups manage their livestock based on an understanding of the ecological balance of the region (Roy and Singh, 2013).

The cultural practices of livestock herding present a unique experience of understanding the natural landscape (Tufail, 2014). Intangible cultural heritage is more important than tangible heritage for migratory pastoral communities because the nomadic nature of their lives means that they do not have permanent structures. Pastoral communities around the world rely largely on livestock rearing to generate economic resources, and their intangible cultural practices are closely linked with this activity. For example, the act of singing folk songs, and offering ceremonial prayers to trees and water bodies is an act of thanksgiving to Mother Nature for bestowing food and fresh water during the migration journey. Their intangible heritage practices are linked with the seasonal movements of humans and livestock (Tufail, 2014). The relationships with the species, landscape and water bodies along the migratory routes of the Gujjar and Bakarwal communities are important in shaping their cultural heritage practices.

The health, lives and journey from the upper to the lower Himalayas of both humans and livestock are underwritten by the intangible cultural practices which are only transmitted to younger generations when the migration journey actually takes place (Rizwan Jeelani and Khandi, 2015). Historically, the male youth members of the Gujjar and Bakarwal communities did not learn in a formal school setting. Rather, the elders of the pastoral community would teach via the journey of migration. Moving with the livestock was a living classroom where the inter-generational transfer of knowledge and wisdom took place. Storytelling narratives are imparted to youths. The transfer of knowledge and intangible heritage between the generations happened during the movement from one location to other.

Today, too, this transfer of knowledge in its original form can happen only when the groups migrate from one place to another following the regular routes. The communities use folk songs, and rituals based on natural elements during migration to involve the youth, and transfer knowledge to them. This is a kind of informal education of the young generation of the pastoral community that passes on intangible traditions of livestock rearing and migration routes. It is at risk of being lost with the passing of older people of the tribes. Climate change and other factors are leading to changes in lifestyles, putting their intangible cultural practices at risk.

Pastoral communities in the state of Jammu and Kashmir are considered "marginalized": poor and underprivileged (Iqbal et al., 2018). Studies undertaken by Ganie et al. (2020) show that Gujjar and Bakarwal communities are living with high socioeconomic inequalities reducing them to high levels of poverty and illiteracy, unable to secure access to basic amenities. The impact on the health of the community, particularly on that of women and children, is a growing concern. Issues such as addiction to smoking are resulting in negative health implications.

Although there are numerous passes in the Pir Panchal Range, the Gujjars and Bakarwals largely follow either the Pir Panchal Route or the Banihal Pass Route. Routes are allocated to different groups to prevent over-exploitation of pasture land.

The routes taken by the Gujjars and Bakarwals from where they are residing in winter are as follows:

- R.S Pura (ChakRoi) - Banihal (Jammu-Srinagar Road) - Ganerbal-Sonmarg
- Reasi-Bodal-PirPanjal-Shopian-SrinagarKangan- Sonmarg
- Rajouri-Thanamandi-Mohra-Shopian-Wayil-Sonmarg
- Poonch-Shopian-Wayil-Kangan-Sonmarg
- Nagrota-Kalakot-Shopian-Kangan-Sonmarg
- Katra -Reasi- Rajouri-Shopian- Ganderbal-Sonmarg
- Rajouri-Thanamarg-Sathri-Pampore-Shalimar-Ganderbal-Sonmarg
- Rajouri-Thanamandi-Shopian-Anantnag-Pahalgam
- Reasi-Kalakot-Rajouri-Shopian-Pahalgam
- Nagrota-Galai-Rajouri-Shopian-Pahalgam
- Udhampur-Patnitop-Banihal-Anantnag-Pahalgam
- Reasi-Katra-Udhampur-Ramban-Banihal-Anantnag-Pahalgam
- Udhampur-Doda-Kishtwar-Kokernag-Anantnag-Pahalgam
- Katra-Ramban-Verinag-Anantnag-Pahalgam

Those who camp at Pahalgam further move to Chandanwari and Sukhnala, and assist in the Amarnath Yatra annual pilgrimage which takes place between June and August.

Objectives of the case study

This case study considers how these migrations, the intangible cultural heritage and other associated practices of the Gujjar and Bakarwal communities are being impacted by climate change and other factors. The case study is focused on the Gujjars

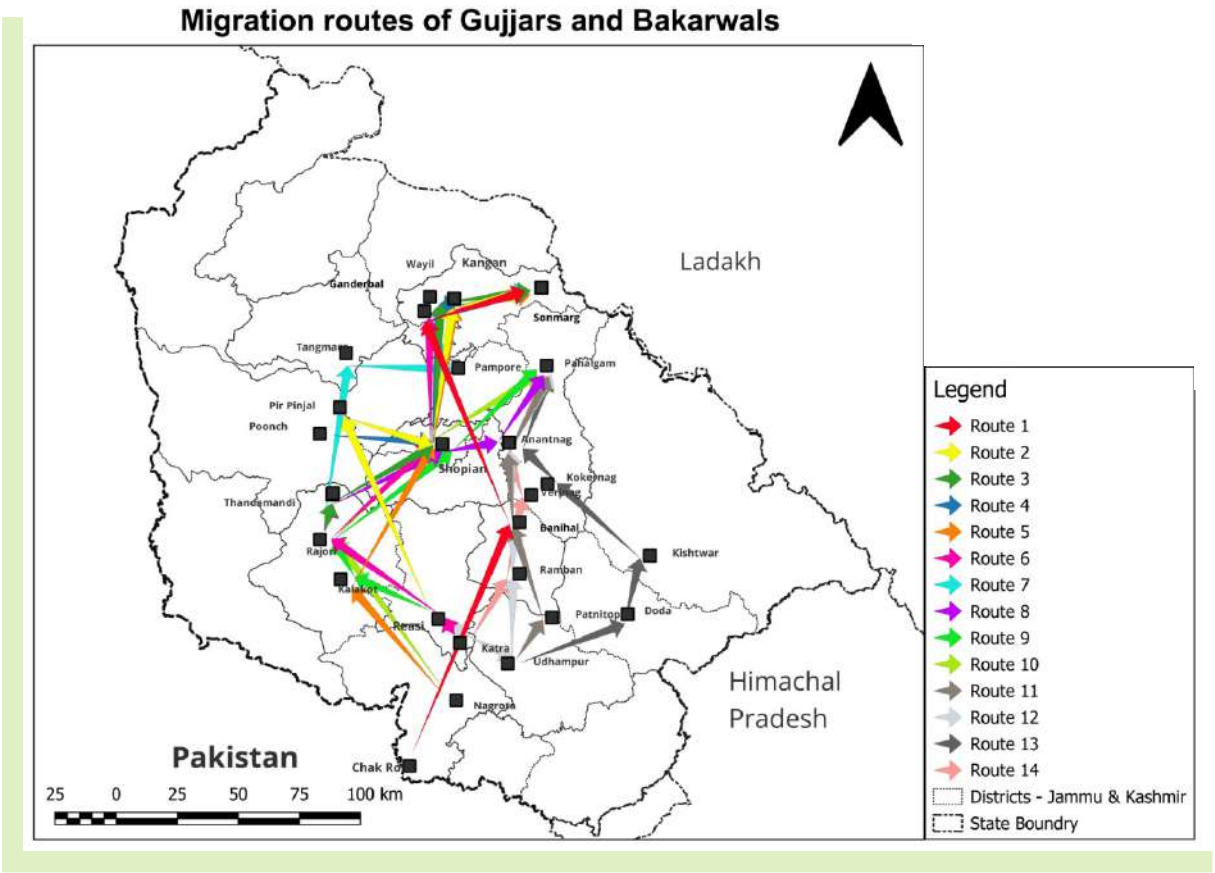

Figure 1 Migration routes of Gujjars and Bakarwals
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and Bakarwals who follow the Banihal Route (Route #1 in the list above). During winter they camp at the villages of Jagti, Nagrota, Samba, Manasar, Surinsar and RS Pura areas in Jammu. Interviews were conducted with Gujjars and Bakarwals camped in the Jagti and Nagrota areas.

The key objectives of this case study were as follows:

- To document the changes emerging in migratory practices and associated lifestyle changes, due to increased natural hazards in Jammu and Kashmir.
- To highlight specific intangible cultural heritage practices of Gujjars and Bakarwals, who use natural resources in the course of their migration.
- To document the direct and indirect risks from the impacts of climate change faced by Gujjars and Bakarwals and their ways of life in Jammu and Kashmir.
- To share local strategies as best-case practices to safeguard the intangible cultural heritage of the Gujjars and Bakarwals in future.

Research design, methods and ethical considerations

The study took place at two sites: Jagti village in Jammu Tehsil (winter stay) and Sanasar hill area in Ramban District in Jammu (summer stay).

The study involved interactions with the community members through open group discussions, which were based on a structured questionnaire with 15 questions designed to gather information about the risks from climate change and other challenges, such as modernization, as well as the responses the communities have made to the challenges. The researchers also examined the cultural underpinnings of the selected communities of the Gujjars and Bakarwals in the Jammu and Kashmir region in India and their experience of climate change and disasters.

The case study also considers the impact of urbanization on the Gujjars and Bakarwals, which is a pressing issue, and the impact of the government using vehicles to transport the community members to upper mountain pastures. Another issue is the loss of traditional migratory routes, which disrupts their way of life and also threatens their intangible cultural heritage and sustainability. These impacts have brought immense changes in practices of the community members, and hinder the transfer of intangible cultural heritage to younger generations. The discussions with the communities centred around recording details about intangible cultural heritage, the sources of cultural practices, methods of transfer of knowledge between community members, profiling the bearers of the unwritten knowledge of cultural heritage, and the detailed experiences of those undertaking the migration journey in the summer and winter seasons.

The researchers asked questions about the challenges people face during the migration, changes in the migration routes, and the problematic efforts by the government to keep the practice of migration alive by offering transport and the risks from the various human and natural hazards. The discussion with the women and girls focused on understanding the intangible cultural practices that are only practised by the women during the migration journey. Gender-specific recreational games, folklore and songs were some of the intangible cultural heritage identified during the discussions.

Separate discussions were conducted with the male and female members of the community. Thus, the researchers heard the stories of the male and female members of the community separately. The segregation of male and female community members was motivated by the religious beliefs of the communities and the separate working realms of men and women.

Responses were collected from fifty respondents. The ages of the respondents ranged between 16 and 71. Five of the fifty respondents were leaders in the community and known as the heads of clans. The Gujjars and Bakarwals have a male-dominated social structure, but widows were presumed to be the heads of families, under the guidance of clan heads, with responsibility for livelihoods and children.

In the process of data collection and interactions with the communities, the researchers duly respected ethical and human rights considerations.

Verbal permission to conduct the group discussions and interactions was obtained from the heads of the Gujjar and Bakarwal communities. Traditional protocols were respected during conversations with women and young girls of the communities. The names and identities of the community members, are not disclosed, in accordance with the wishes of most of the community members. The researchers respected the wish of women respondents to not be shown in photographs and to be covered. The researchers acknowledge the guidance of Dr Javed Rahi who is a pioneering figure in the historical and anthropological study of the pastoral community. The authors of this case study are thankful to Dr Rahi for shaping our understanding of the risks faced by Gujjars and Bakarwals and supporting the interactions with community members.

Strengths and limitations of the case study

An important strength of the case study is that it studies how indigenous intangible cultural heritage is used in adapting to the Himalayan ecosystem. The case of the Gujjars and Bakarwals of Jammu and Kashmir is not a unique case of a pastoral community in India. Studying the particular intangible cultural heritage and practices of Gujjars and Bakarwals offers insights into the practices of peoples and strategies living in the Western Himalayas in India. The intangible cultural heritage practised by the Gujjars and Bakarwals still needs to be documented fully in terms of its interaction with the environment and from a climate change perspective, however. An understanding of the intangible cultural heritage associated with the Gujjar and Bakarwal communities in the highly vulnerable Himalayan region presents an opportunity to look into ways to support these communities (Tugjamba et al., 2023).

Findings

The literature on the impact of climate change and other factors on the livelihoods of nomadic herders, including the Gujjars and Bakarwals in Jammu and Kashmir, notes that these communities, for example the Bakarwals of the Pir Panjal area in Rajouri-Poonch, are facing both economic and non-economic losses (Goswami and Rajput, 2024), with climate change impacting livelihoods and their day-to-day life (Ahmed et al., 2023). According to Das and Ahmad Dar (2023), the Bakarwals in the Kashmir valley tribe have used various survival strategies in the face of challenges in recent years. According to Mir and Batool (2022), who conducted a micro-study on the impact of climate change on the livelihood of the Gujjar Bakarwals tribe of Thanala village of Bhaderah tehsil in Doda District of Jammu and Kashmir, modernization is an issue. These communities are sensitive towards changes in climatic conditions and how they influence the regenerative abilities of the Himalayan grasslands and other natural resources and affect their livestock (Bisht et al., 2016). Over the years, many areas of their lives have been affected by issues such as climate change, urbanisation and excessive tourism. These have profoundly impacted their ways of life. Also, the younger generation is increasingly opting for a more sedentary lifestyle with better socio-cultural and economic prospects. This is reducing the trans-generational transfer of knowledge and cultural practices. In reviewing these previous studies, it appears that few studies have examined the traditional knowledge of the Gujjars and Bakarwals, which they use to meet challenges and adapt to climate change.

Climate change and related natural hazards pose a significant risk to these vulnerable communities of Jammu and Kashmir. Over the last two decades, these communities have grappled with more frequent and intense disasters, which have negatively influenced their traditional migration patterns. Community members noted that because of erratic patterns of rainfall and snowfall as a result of climate change, fodder and water are scarcer than before, resulting in the loss of newborn goats and sheep and making livestock care difficult. In addition, traditional water sources along migration routes are drying out, which poses a threat to people and livestock during the migration. Moreover, unplanned urbanization in their region has forced the community to change their migration routes, which has increased the risks to them from floods and other threats. These communities also face eviction. Despite being protected under the Indian constitution, some groups have been given eviction notices, and their temporary shelters have been demolished. The community members noted that intangible cultural heritage practices are assisting them to tackle the challenges posed by climate change, however.

The necessary knowledge and wisdom are already

present in the communities that have been living in the Himalayan region for centuries. The traditional approaches and knowledge of the terrain and knowledge of grasslands and climatic variations are based on evidence-based practices. These pastoral communities and their knowledge of livestock management in the Himalayan region represent a sustainable mode of life a unique case of a balanced approach to living in harmony with the fragile ecosystems of the Himalaya region that enables the communities to earn a living while remaining deeply rooted in their core cultural values, which centred around caring for their livestock (Ahmed et al., 2023). The knowledge of the Gujjar and Bakarwal of flora and fauna that fall within their migration journey and the ability to procure food and medicine from nature without waste makes their livelihood-based migration system one of the most sustainable in the world. The migration journey taken by the Gujjar and Bakarwal communities reflects their rich knowledge of the local climate, landscape and vegetation. Their traditional lifestyle offers valuable lessons on how to practice sustainable livelihoods, and their ability to live without getting into the trap of a consumption-based economy is a significant lesson that the Gujjars and Bakarwals can teach to the world. Moreover, their knowledge of local climatic conditions and their traditional approach to living with the available materials and conditions can help others adapt to climate change impacts (Khanyari et al., 2022).

During the group discussions, the elders of the Gujjar and Bakarwal communities explained that their communities have extensive knowledge of local species of plants, including plants that are edible and plants that have medicinal properties, as well as plants that can cause harm to humans and livestock (Singh et al., 2020). The pastoral community's knowledge of the local vegetation and grasslands is a key aspect of their survival (Roy and Singh, 2013). This knowledge is transferred to youth by the elders and leaders of the community during the migration journey, thereby making the journey

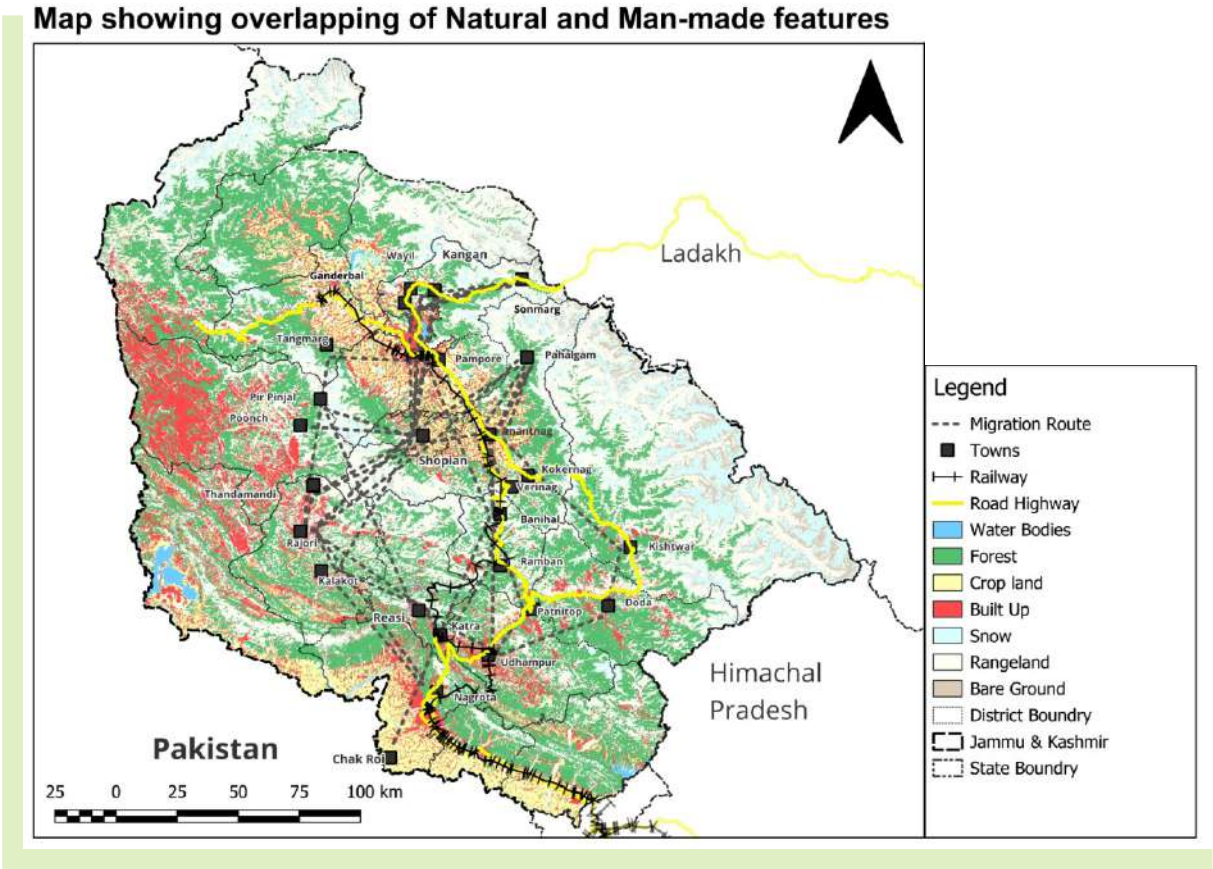

Figure 2 Map showing overlapping of natural and human-made features, with migration routes

a vital part of the education of younger generations.

The post-disaster developmental approach of the government has further impacted these communities. Moreover, urbanization along the traditional routes has forced these communities to alter their paths. This prompted the government to use vehicles to transport the communities and their livestock along roadways. As a result, the communities no longer practise the intangible cultural heritage linked with the migration routes. The decision of the government to use lorries and trucks to transfer the Gujjar and Bakarwal along national highways and other transport routes presents a serious threat to the traditional process of learning. Road transport has serious implications for all of these pastoral communities. The inability to carry out the travel journey from designated routes hinders the transfer of knowledge from the elders and more experienced community leaders to the youth of the community.

In the discussions, community leaders remarked that they felt that migration routes would soon cease to be open to them, which threatens not only to their cultural heritage but also their lives. Moreover, if cultural heritage is not practised, the new generation will not learn it and will increasingly drift away from the customary livestock rearing and develop new livelihoods. This will end the wisdom and knowledge that is so vital to keeping the vulnerable Himalayan ecosystem safe.

Discussion

The intangible cultural heritage of the Gujjars and Bakarwals in Jammu and Kashmir, India is practiced and maintained in a context of significant hazards. Over the last two decades the valley of Jammu and Kashmir has been subjected to frequent and high-intensity disasters such as the Kashmir Earthquake in 2005, the 2010 Ladakh floods, the 2012 Himalayan flash floods, and floods in 2014 that resulted in heavy loss of livestock which had little protection from sudden downpours as well as cold snaps.

The natural and human hazards in the Himalayan region are a cause of huge loss of livestock further accelerated by climate change impacts (Borunda, 2019). The risks in the upper Himalayan region, such as a sudden rainstorm that has the potential to trigger flooding results in washing away the livestock and causing injuries to family members are growing for both Gujjars and Bakarwals. One of the respondents during the discussion narrated the story of a Gujjar family that migrated in April, with 400 sheep and goats, to avoid the intense heat of the lower regions. This family lost half of their livestock travelling 186 miles due to the heavy rains, flooding and unseasonal snowstorms.

According to the president of the Gujjar Bakarwal Youth Welfare Conference (JKGBYWC), pastoral communities in the state are losing their livestock due to extreme weather conditions, which are setting new records with each passing year. The president claims that "If climate change conditions worsen year by year, the Gujjars and Bakarwals will be left with no option but to end the traditionally rooted centuries-old migratory lifestyle". This is a potential risk to the knowledge and value systems practised by these communities with heavy implications for the state's economy and the well-being of the people.

The current socio-economic and socio-cultural conditions of the Gujjars and Bakarwals are insufficient as a base on which to further improve their resilience towards these hazards. The increased exposure to risk comes with the temporary nature of their residential settlements and the limited availability of building materials.

The pastoral community and its rights to use land are protected under the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 (FRA) enabling them to use the arid land for their temporary settlements. However, despite having legal protection, demolition of Gujjar houses is a constant risk. Development authorities have demolished houses in Gujjar community hamlets in both Jammu and Kashmir without any prior warning.

An increasing number of youths from the Gujjar and Bakarwal communities are shifting away from pastoral life. With the government providing housing and other facilities, this is increasingly popular among youth, but the shift to other livelihoods, away from livestock herding, risks the complete loss of these communities' intangible cultural heritage practices. There is therefore an immediate need to document their intangible cultural heritage practices before they are lost.

Knowledge about local conditions and livestock management is currently at risk due to changing rainfall patterns, droughts, regular occurrence of urban flash floods and urbanization (Banerji and Basu, 2010). Likewise, rituals based on knowledge of plants, trees and water bodies and the folklore, songs and prayers which were offered to the trees and water bodies during the migration are also at risk.

Recommendations

The intangible cultural value system of the pastoral community in general and that of the Gujjar and Bakarwal communities, in particular, must be safeguarded. Their intangible cultural heritage of Gujjar and Bakarwal has lived for centuries, but with the impacts of climate change and with issues such as urbanization, it is at risk. The Gujjar and Bakarwal communities are at risk of losing the central focus of their culture and livelihoods which is their livestock and their customary transhumant migration routes. Action must be taken to preserve the living system of livestock herding and migration and the associated knowledge system.

The following recommendations are offered here:

- Provide disaster relief

The provision of financial assistance through disaster relief funds as per the legal mandate in India will allow pastoral communities to recover from disasters faster and continue their practice of migration, which will conserve their intangible cultural heritage.

- Build the capacity of youth in disaster-risk reduction

Efforts are required to train the youths of pastoral communities in disaster-risk reduction, to help their communities prepare for disasters and respond to them effectively so that they can minimize losses of livestock and continue their intangible cultural practices.

- Provide support for education and health care

The Gujjar and Bakarwal pastoral communities need support to maintain their engagement in education and retain access to health facilities.

- Record the intangible cultural heritage practices of these communities

In view of the threats posed by climate change and other hazards to their intangible cultural heritage, there is an urgent and immediate need to record the knowledge and value systems of the Gujjar and Bakarwal communities. Without documentation there is a chance of losing this intangible cultural heritage completely.

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Figures

Figure 1. Meeting with the community people.
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Figure 5. Settlement hut called "Kotha" (summer temporary house) made using vernacular materials.
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Figure 6. Temporary settlement using tarpaulins at Camp Site Sanasar during the summer migration.
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Cyclone Houses, Living Heritage and Climate Change in Vanuatu

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Introduction

Vanuatu presents a paradox because it is more exposed than most countries in the world to natural hazard disasters, and especially to extreme meteorological events, and yet experiences much lower loss of life than might be expected. The national impact from the largest cyclones can be considerable, with single events leading to the loss of as much as 64% of Vanuatu's GDP (CSIRO 2023), and yet the country's human population is often largely spared (Handmer and Iveson 2017). From 2011, Vanuatu was identified annually by the World Risk Report as the country most at risk from natural hazards (e.g. Bündnis Entwicklung Hilft 2021) but reconsideration by the Report's publishers of the contrast between exposure to risk and actual loss of life led to Vanuatu being "demoted" to 49th place in 2022 and subsequently (Bündnis Entwicklung Hilft 2022). How are we to understand Vanuatu's extraordinary exposure to meteorological risk and climate change, together with its capacity to limit losses to human life?

As a Pacific Islands nation composed of an archipelago of islands of greatly varying sizes and vertical profiles, Vanuatu is also particularly exposed to the current and anticipated effects of climate change, which include local changes to the frequency and intensity of cyclones. On a global scale, the IPCC's Assessment Report 6 forecasts a distinct increase in the frequency of higher-intensity cyclone events, even though overall event numbers may show no sign of increase (Seneviratne et al. 2021). In the recent experience of Vanuatu, a seemingly exceptional series of devastating cyclones over the past 10 years has elevated awareness of the perils of climate change. Consequently, Vanuatu's national government has led moves to push the international community towards acknowledgment of the consequences for the world's most vulnerable countries of the global failure to reduce carbon emissions (Wewerinke-Singh and Salili 2020).

One of the key reasons for Vanuatu's relative success in managing the impacts of an exceptional range of natural hazard threats is the continued functioning of its traditional knowledge systems or intangible cultural heritage relating to the management of natural hazards and reduction of disaster risk. In this chapter, we address the role of a particular form of this living heritage that relates to cyclones: the cyclone houses, traditional or vernacular architectural forms in Vanuatu that serve both as spaces for the transmission of living heritage, and as communal shelters from damaging cyclone events. These houses are found throughout Vanuatu, because the entire archipelago is exposed to the effects of cyclones (Siméoni 2009), but they vary considerably in size, form and construction, even though they recognisably meet the same basic needs. To some extent, this variability amongst cyclone houses reflects Vanuatu's exceptional cultural and linguistic variation: with an estimated 138 languages spoken amongst a population of just 330,000, Vanuatu has the highest linguistic diversity per capita of any country in the world (François, Franjieh, Lacrampe and Schnell 2015).

Here, we explore what this cultural specificity looks like on the ground through focus on a case study

from just one island, the *nimo norop* houses of the island of Erromango in the southern Vanuatu province of Tafea. A detailed description not just of the materials and design of *nimo norop* houses but also of the broader social and cultural contexts for their construction and use, including the role of local customary governance, illustrates Vanuatu's use of traditional cyclone houses as a critical adaptation to a cyclonic environment, and as a platform for further innovation in the face of climate change.

Cyclone knowledge and cyclone houses in Vanuatu

Cyclones have been a feature of life in Vanuatu for the entirety of its 3,000-year human history, and the country's many cultures have been profoundly formed by their experience of cyclones. Vanuatu typically experiences two to three cyclones every year, though not all of these make landfall (Vanuatu Meteorological Service 1994). In the past, cyclones have occurred within a relatively narrow seasonal band, between December and March. Each decade, on average, some three to five cyclones cause significant damage in one part or another of the archipelago (Vanuatu Meteorological and Geohazards Department n.d.).

Throughout the archipelago, communities are always in a state of either planning for, experiencing, or recovering from the effects of cyclones; local knowledge systems, agricultural practices, and patterns of marriage and alliance all reflect this experience. Examples of this evolution of local culture in the context of a cyclonic climate include detailed knowledge and prediction of cyclone conditions and behaviour, preparedness measures put in place ahead of cyclone seasons such as the planting of certain durable food crops, specific methods of preparation of stored foods and management of gardens in the days before a cyclone strikes, and regional networks managed by local leaders as a form of social safety net for individual islands affected by cyclones.

Most communities in Vanuatu possess both general and specialist forms of knowledge relating to weather, including monitoring and predicting conditions, and even seeking to influence the paths and outcomes of cyclones (Rodman 2007). Forecasts can be short-term, based on observations of cloud cover, wind speed and direction, and the behaviour of animal species, or longer-term, using changes in the position of the setting sun relative to landscape features to predict the likelihood of a cyclone later in the year. Cyclone risk reduction measures range from maintaining gardens and stock of hardy species (such as wild yams) that can endure high winds or be replanted quickly, to the annual preparation of stored foods such as breadfruit placed in pits to ferment. As a cyclone approaches, houses are strengthened, and gardens are made more secure, for example by cutting off the branches of banana trees to prevent them from being blown over.

Local knowledge practices that operate over even longer time frames have included extensive inter-island support networks managed by local leaders as a form of social safety net for individual islands affected by cyclones, distributing the risk across a wider region, such as the *suque* grade system of leadership and inter-island exchange of the northern Banks Islands (Campbell 1990). A deep-time form of local knowledge relates to the positioning of settlements in locations that are not exposed to cyclones, building on centuries of experience of local conditions and topography. On Tongoa Island, in central Vanuatu, settlements were formerly positioned within deep ravines, limiting exposure to winds from most directions; however post-missionization amalgamation and relocation of all settlements onto the high plateau, exposed in all directions, has considerably increased the vulnerability of both the communities and their communal cyclone houses.

Traditional cyclone knowledge is confronted by new challenges as a result of climate change, including expansion of the cyclone season and an apparent increase in cyclone intensity (Cyclone Pam in 2015 was the most severe event ever recorded in Vanuatu). What was formerly a regular hazard that formed part of the annual cycle is also now treated by the government and aid agencies as a disaster, ignoring the wealth of traditional knowledge about risk reduction and hazard management and strip]ping communities of much of their agency (Calandra 2020). The supply by international agencies of inappropriate food aid and construction materials, along with interventions in local systems of governance and hazard management, act to undermine what have been very efficient mechanisms for risk reduction,

developed sustainably over thousands of years.

Across Vanuatu, the traditional communal meeting house, known as *nakamal* in the national language of Bislama and by a variety of terms in local languages, is significant as a central site for chiefs, customary (*kastom*) governance, the curation of tangible forms of heritage, and the performance and transmission of living heritage (Coiffier 1988, 1996). As stated by the first President of the Malvatumauri National Council of Chiefs, the late Chief Willie Bongmatur, "A chief without a *nakamal* is nothing" (Christie 2017: xi). *Nakamal* houses are central to community life, especially in the context of cyclones when they serve as communal shelters and places of refuge (Christie 2017, 2018). Construction of the *nakamal* draws on local materials; trees for posts and beams, bamboo for walls, thatching from the pandanus, wild cane or coconut leaves, and fibrous vine-ropes to bind the parts together. Tree species used in traditional construction vary widely across the islands, with *namariu* (Acacia spirorbis), whitewood (Endospermum medullosum) and *natora* (Intsia bijuga) amongst the more commonly favoured hardwoods (Wheatley 1992: 282).

In each community, specific customary protocols are observed in the construction of the *nakamal*, which in turn reinforces social codes and maintains traditional knowledge, including through song (Christie 2017: 9). A common feature of most *nakamal* is a dome-shaped roof that extends from the central ridge down to ground level, often thought of as an inverted canoe, that is able to withstand high winds. Traditional *nakamal* have continued to serve as evacuation centres during the more severe tropical cyclones, such as Cyclone Pam in 2015 (Government of Vanuatu 2015: 52). However, the availability of local plant materials for *nakamal* construction, as well as for other traditional construction, is under considerable stress due to the increased intensity of cyclones in recent years (Ahmed and Parrack 2022). Especially after Cyclone Pam in 2015, there has been a marked revival of interest in traditional *nakamal* architecture amongst many of Vanuatu's communities (Christie 2017, Plunkett and Balick 2018, Fujieda, Nishijima and Kobayashi 2021, Letman 2021).

Nimo Norop houses of Erromango Island

Knowledge of the construction and use of traditional *nimo norop* cyclone houses on Erromango Island has survived a devastating history of intense cultural disruption and depopulation over the past 150 years, precipitated by sustained European contact in the early 1800s from the sandalwood trade and followed by Christian conversion and active suppression of many cultural practices. From the mid-1800s to 1932, the population of Erromango declined by 93%, from approximately 6,000 to just 381 people (McArthur and Yaxley 1968). There was significant loss of cultural knowledge associated with this mass mortality of cultural bearers. In the 1970s, a sense of this loss prompted formation of the island community-based Erromango Cultural Association (ECA), initially to document disappearing languages, and subsequently to document, revive and promote the island's linguistic and cultural heritage before another generation of culture bearers passed on (Naupa 2011).

Erromango is one of the more remote and isolated islands in the Vanuatu archipelago due to poor transport connectivity. To ensure community disaster resilience, the people of Erromango must draw on their cultural knowledge, such as traditional food and water preservation techniques, and building resilient shelters. The increased intensity of severe cyclone damage, and fresh memories of cyclone Pam in 2015 and the twin severe cyclones of Judy and Kevin in 2023 triggered a community reawakening of the value of traditional cyclone shelters. Safeguarding traditional knowledge relating to resilient shelter is a key means of ensuring that people's homes are built to withstand severe tropical cyclones, using locally available materials.

When the ECA embarked on a project[1] to revive cultural knowledge of the *nimo norop* traditional cyclone shelters in 2023, interest from the community was initially half-hearted. Vernacular architecture is in competition today with the prestige and other drivers associated with modern buildings

1 The 'Omurep Erromango' Project (meaning 'Erromango stands up') was a partnership between the ECA, the Simanlou Natmonuk Island Council of Chiefs and the Vanuatu Department of Forestry's TAFEA Provincial Office, with generous funding assistance from the Canadian Fund for Local Initiatives.

Table 1. Different types of *nimo* (houses) on Erromango

Type of traditional shelter	Purpose
Nimo orog	Traditional meeting house of *nompunorop* (clan head, small chief) – located within a *nompunorop's* compound on their ancestral land. Sleeping quarters for young men also.
Nimo val	Traditional meeting house of *ovatmonuk* (chiefs) – for the *nompunlou* (high chief of the people). Large enough to host numerous vistors
Nimo pat / nimo ilvuc	Housing for a husband and wife only. It is forbidden for anyone else to enter this house.
Nimo netortor	Temporary shelter used post-cyclone as well as during yam planting season in food gardens.
Nimo norop	Traditional cyclone shelter, sturdy build.
Nimo itcovki	Dedicated women-only house, used during seclusion.

Source: Helen Naupa, February 2024

and materials. However, the Erromango Natmonuk Simanlou (Island Council of Chiefs) was very supportive, recognising that revival of vernacular architectural knowledge served two purposes: the inter-generational knowledge transfer of traditional technologies that will enhance climate resilience; and the safeguarding of traditional resource management through ensuring that the local tree and plant species used in building materials are sustainably replanted. *Nimo norop* is one of a range of *nimo* (housing structures) found in traditional Erromangan culture (Table 1), all of which face challenges of continued cultural practice.

Planting for resilience

As one of the largest islands in Vanuatu, Erromango has a rich forest environment comprising native and endemic tree and plant species alongside introduced forest species that have become increasingly invasive. Over 30 types of hardwood, palm, cane and vine species are used in building *nimo norop* (see Table 2). However, the project found that it is becoming harder to find sufficient stocks due to a combination of deforestation and climate change impacts; this was confirmed by the Forestry Department's own monitoring of forest health over a 40-year period. TAFEA Forestry Officer Simon Naupa (November 2023) observed:

There's quite a lot of species for *nimo norop* ... mostly hardwood species, some are highlands, some are coastal (*natora*)... *kwila* is a trade name, the main standpost of the *nimo norop*. It is a bit limited now... Most of the hardwoods up in the regions, up in the mountains, like the *moron* and the *noi* and other species are more limited ... Cordia [introduced in a forestry project in the 1990s] is becoming invasive and deforesting all the natural species.

The regular damage and destruction of Erromango's forests through frequent severe tropical cyclone events creates spaces in which invasive species like Cordia can thrive; in southern Erromango it now out-competes the native species. While Cordia is employed in *nimo norop* construction, the project found that increasing dependence on it may undermine traditional knowledge of the treatment of native woods in construction. Similarly, the reduced availability of wild cane, an essential thatching material in *nimo norop*, is a concern. Whereas, two to three decades prior, communities would ensure that fields of wild cane were planted near settlements, today wild cane is mainly found far from settlements due to the changing preference for modern forms of building. For this reason, under the project, the TAFEA Forestry team conducted community workshops to encourage home nurseries to also include native building materials, and for these to be sustainably planted and managed close to community settlements.

Figure 1. Mori (Acacia spirobis) tree species, before and after felling for construction of a *nimo norop*, Dillons Bay, Erromango, November 2023.
© Simon Naupa (Vanuatu Forestry for ECA)

Table 2. Some native forest species used in the construction of *nimo norop**

	Erromango name (Bislama / English)	Use in *nimo norop* construction
Hardwoods		
Acacia spirobis	Mori (Bisl. Namariu)	King posts; *norop* rafters (due to pliability)
Casuarina equisetifolia	Yorset (Bisl. Si-ok)	King posts
Callophyllum neo-ebudicum	Pocur (Bisl. Tamanu)	King posts; *movoc* beams
Agathis macrophylla	Nendu (Bisl. Kauri)	King posts; *movoc* beams
Hibiscus sp.	Renvau (Bisl. Burao)	*Norop* rafters (due to pliability)
Instia bijuga	Neiyemtau (Bisl. Kwila/Natora)	King posts
Vines		
	Nousori	Grows mainly in northern Erromango, popular in Ralifati area
Salacia aneityensis	Nousangal	Used for fastening king posts and *helnivi* centre beam
Calamus spp.	Ndru (Eng. Rattan)	Used for fastening *movoc* to *norop*
Grasses and Palms		
Miscanthus spp. (wild cane)	Nenyung / Nelesi (the latter is cleaned of leaves)	Used to weave the *netrihong* wall (end wall), and side walls. Long-lasting.
Bambusa spp. (bamboo)	Nau	Similar use to *nenyung*, increasingly popular due to easy availability
Saccharum spp. (sugar cane)	Nulpai (dried leaves)	Used as extra insulation for the *nimo norop*
Cocos nucifera (coconut)	Noki (the coconut leaves)	Can be used as both a base layer and final layer of thatch

**This is a preliminary list subject to revision through ongoing traditional naming and classification work by Vanuatu Forestry.*

Table 3. Steps in building *nimo norop*

Step	Activity Focus	Other information
1	Site selection	The location must not be too exposed to winds or too close to rivers or the coast where there may be flooding during severe weather, like a cyclone.
2	Gathering materials: Posts for structure Materials for walls and thatch	Different natural materials are used for different parts of the *nimo norop* construction, each requiring specific preparation. For the posts and beams, the bark is removed and posts are soaked in saltwater for up to 3 weeks to seal the wood against pests. Walls and thatch are crafted from bamboo, wild cane (*nelesi*) and coconut leaves. Women help to gather weaving materials and weave them in readiness for their use in the roof thatching. Men typically weave the walls of the *nimo norop*.
3	Preparing the foundation: Clearing the land Digging postholes	Clearing and leveling of the land is done by both men and women. The layout of the floor and posts is also prepared. The postholes for the king posts and main posts are dug at least 1 metre deep. The posts are anchored with coral and stones for additional strength.
4	Building the main structure Installing the king posts (*neturpum, netentu* and *neturtur*) Installing the *norop* (main posts) and *helnivi* (central beam)	The basic structure of the *nimo norop* reflects Erromango's customary governance protocols: the *neturpum* denotes the entrance to the structure, where visitors may be greeted; the *netentu* in the centre houses the fireplace, and is where cooking occurs, women occupy both this zone and the *neturpum*; the *neturtur* on the back wall of the *nimo norop* is restricted to *the npau unam* or *natmonuk* (chief) and his selected council. The structure reflects the speaking zones of the community within the *nimoval* (traditional meeting house). Erromango women have a designated space to participate in community meetings alongside a chief and his council. The *helnivi* beam symbolises the main customary "road" along which inter-clan and inter-community engagement occurs. Each *norop* represents the clans that form the council within the *nimoval.*
5	Installing the secondary structure: The *movoc* The *netan*	This step requires lots of rope* to install rafters and purlins, referred to as *netan* and *movoc. Netan* are installed in between the *norop*, or main posts, and do not reach all the way to the ground. Thatch will be attached to the *netan. Movoc* are the horizontal beams in the roof, between the top or central beam and the side walls. The *netan* and *movoc* are fastened in place by rope. Once the *netan* and *movoc* are fastened in place by the *nos*, the next stage of construction can commence.
6	Wall installation	The rear wall is installed first, with the *neturtur* post and *netan* posts providing the support structure. Men weave layers of bamboo and wild cane panels, which are anchored into the ground. Each weaving pattern is named: *nivau, nevri,* or *novar.* The side walls extend from the ground to the first *movoc* or side beam.
7	Thatching	Coconut leaves are a key roof base in thatching. Women weave the coconut leaves in preparation and dry them in the sun prior to thatching. Once the coconut leaf layer is installed and fastened to the *netan* and *movoc* with rope, the main roof thatch of *nelesi*, or wild cane, is installed. This requires *nelesi* to be cleaned of leaves and bundled prior to use. The *nelesi* is fed into the spaces of coconut leaf ribs and folded at the middle around the rib of the roofing base. The *nimo norop* also has thatching along the front side, with only a low entrance into the building.

* Erromangans use a rich variety of forest lianas and vines in construction, called *nos*. *Nos-angal* is a popular traditional rope. It is found in the deep forest and is collected on the day or one day before its use. It is heated over a fire to soften it for binding. It is important not to dry out the rope or it becomes too brittle to use.

Figure 2. Traditional master builder Nacumsu explains the significance of the *nimo norop* structure in relation to socio-political relationships within Erromango's customary governance system (at Ipota, Erromango).
© Anna Naupa (ECA)

Figure 3a. The completed *nimo norop*, Ipota, Erromango, December 2023.
Figure 3b. Interior thatching is closely woven, with additional smoking to create a seal against wind and rain.
© Jonah Molou (ECA)

Building for resilience

Construction of the *nimo norop* structure is a communal endeavour that draws extensively on traditional knowledge. The sequence of construction is summarized in Table 3, which outlines the knowledge, materials and community roles needed to advance each stage.

Conclusions

Two major lessons have emerged from community efforts on Erromango to safeguard intangible cultural heritage that has the potential to play a key role in climate change adaptation. Firstly, by facilitating an inter-generational community-based approach across all stages of construction, sustaining vernacular architecture is a critical strategy for promoting the transmission of customary governance knowledge. The structure of the *nimo norop* mirrors social-political organisation across the island landscape, a physical reminder of the cultural structures essential for customary land tenure, conflict mediation and peace-making. For many of the youth on Erromango, the revival project was their first opportunity to see and learn about *nimo norop* (see and Figure 3).

Secondly, climate-related environmental stress is both transforming the frequency and intensity of cyclone and other meteorological hazards, and compounding the challenges experienced in accessing cultural ecological resources. Regular stress from tropical cyclones and other extreme weather events (flooding, drought) constrains optimal forest growth that is already curtailed by deforestation. Invasive forest species that flourish in the harsher climatic conditions are displacing the traditionally valuable hardwoods and threatening associated traditional knowledge. The difficulty in sourcing sufficient stocks of key culturally significant species for building the *nimo norop* during the project period highlighted the importance of ecological revival efforts in safeguarding the resources for the reproduction of cultural heritage. Conservation of native and endemic species in the face of climate change is therefore also essential for safeguarding intangible cultural heritage.

The immediate challenge of climate change impacts to Vanuatu's islands underscores the critical importance of safeguarding community knowledge of cyclone preparedness, to ensure community resilience to future climate-related disasters. As the *nimo norop* project revealed, reviving traditional knowledge is more than simply safeguarding the cultural heritage of cyclone shelters, it is also about safeguarding customary governance knowledge and systems, ensuring the maintenance of inter-generational transfer and practice.

Erromango's *nimo norop* are more than just traditional cyclone shelters. Their structure embodies cyclone resilience, and their spatial organisation reflects Erromango's traditional socio-political organisation. The construction process observes specific cultural protocols that in turn underpin social order and knowledge of the traditional governance system. As sites of both tangible and intangible cultural heritage knowledge

production, enactment and transfer, preservation of *nimo norop* in the face of multiple climate change impacts and other transformational processes is key to the continuity of Erromango's culture. Contrary to expectation, however, the emergence of climate-change fuelled cyclones presents an opportunity for communities across Vanuatu to reflect on and re-engage with their intangible cultural heritage, and to harness it in adapting to these new challenges (Ballard et al. 2020).

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Reconceptualizing Socio-cultural Sustainability in the Era of Climate Change: The Case of Jeju Haenyeo Culture, UNESCO Intangible Cultural Heritage

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Introduction

It has been almost half a century since the discussion of sustainability was first formalized at the 1972 United Nations Conference on the Human Environment (UNEP, 1972). Since the publication of *Our Common Future*, the definition of sustainable development has remained consistent. It is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987).

This definition of sustainability has been criticized by some for the vague meaning of the phrase "the needs of the present". Strictly speaking, "the needs of the present" cannot be defined, because it is a concept that depends on perspective and context. The 'needs' of the present are directly linked to the selfish nature of individuals or groups. Desires can never be fully met, as Garrett Hardin explains in his article, "The Tragedy of the Commons" (1968).

A "commons" is a land or resources that belongs to a community, such as a large field where all villagers can bring their cows to graze. If the villagers consider only their own individual desires, they will allow their cows to eat as much grass as they want, resulting in cows eating all of the grass and depleting the resource completely, leaving no fodder for any of the cows. According to Hardin, when people use shared resources, they generally only consider what is best for them rather than what is best for everyone. If everyone thinks like this, the commons will be ruined. This illustrates how individual self-interest when interacting with a shared resource can deplete it and ultimately harm all parties involved. He teaches us that we need to care for and sustainably manage shared renewable resources and share them equitably so that they last for everyone (Hardin, 1968).

The present paper discusses the future of intangible cultural heritage (ICH) in the era of climate change. Since the desires of the present generation are very difficult to control, the issue of climate change is bound to persist for a long time to come, and will continue to have an impact on ICH for the foreseeable future. Current efforts to safeguard ICH in the context of climate change have their limitations. so we need a new strategy for safeguarding ICH.

This paper examines the challenges faced by the culture of Jeju Haenyeo, an element inscribed in 2016 on UNESCO's Representative List of the Intangible Cultural Heritage of Humanity. It then evaluates the proactive measures taken by the Jeju Haenyeo to safeguard their heritage. Subsequently, it outlines an innovative strategy for the preservation of their culture and examines the broader applicability of the Jeju Haenyeo experience in achieving socio-cultural sustainability.

Jeju Haenyeo culture challenged by climate change

The Jeju Haenyeo are female divers from Jeju Island in Korea. *Haenyeo* is "sea women" in Korean. They are professional divers who dive without the aid of breathing apparatus and collect seafood such as disk abalone, horned turban and sea mustard (Figure 2).

The Jeju Haenyeo live in 103 villages along the coastal region of Jeju Island, Republic of Korea (Figure 3).

Figure 1. Jeju Haenyeo diving under the sea to harvest seafood
© Haenyeo Museum, 2012

Figure 2. Jeju Haenyeo going out from the sea with her harvested seafood
© Haenyeo Museum, 2004

The traditional activities of the Jeju Haenyeo are closely related to the locations of their districts, which are coastal, situated at an elevation of less than 50 metres above sea level.

The resources collected by Jeju Haenyeo are classified into three categories: mollusca, echinodermata and marine algae. Mollusca includes horned turban, disk abalone and coloured abalone. Echinodermata includes sea urchin and sea cucumber, and marine algae include agar-agar, hijiki, ecklonia cava and sea mustard (Figure 4).

These resources live in the ocean up to 25 metres deep in a shared ecosystem. The agar-agar and sea trumpet create a habitat for the abalone, disk abalone, conch and sea urchin, which feed on hijiki and sea mustard, and their excretions are broken down into nutrition for sea mustard, agar and sea trumpet, among others. Sea cucumbers help keep the habitat clean.

The Jeju Haenyeo culture features two key pillars: the sustainable management of marine resources and the equitable operation of the *haenyeo* community. The Jeju Haenyeo have sustainably managed seafood stocks and conserved community-owned fishing grounds by designating a non-collecting season. To prevent overfishing, the divers also prohibit the use of mechanical devices by members of their group. They maintain their community through democratic consultations and strict regulations based on the values of order, equity, mutual assistance, social welfare and communal contributions.

The core cultural values of Jeju Haenyeo culture can be said to be the sustainable coexistence of human beings and species in the marine environment, which stems from the spiritual values of Jeju Haenyeo, which are those of liberal communitarianism (Song, 2019).

The Jeju Haenyeo community is a strictly meritocratic society. The *haenyeo* who work hard and excel in their endeavours get more resources, while those who don't get less. However, it is important to note that the Jeju Haenyeo community recognizes those who put in their best efforts, and takes care of them. Haenyeo who have only managed to collect a small quantity of seafood, despite their best efforts, will receive a share from those who have collected a large amount (Song and Cho, 2023). Without this sharing of resources some *haenyeo* would disobey rules and overexploit the resources to fulfil their desires, resulting in a "tragedy of the commons". By sharing resources, the marine environment is a place of coexistence rather than exploitation.

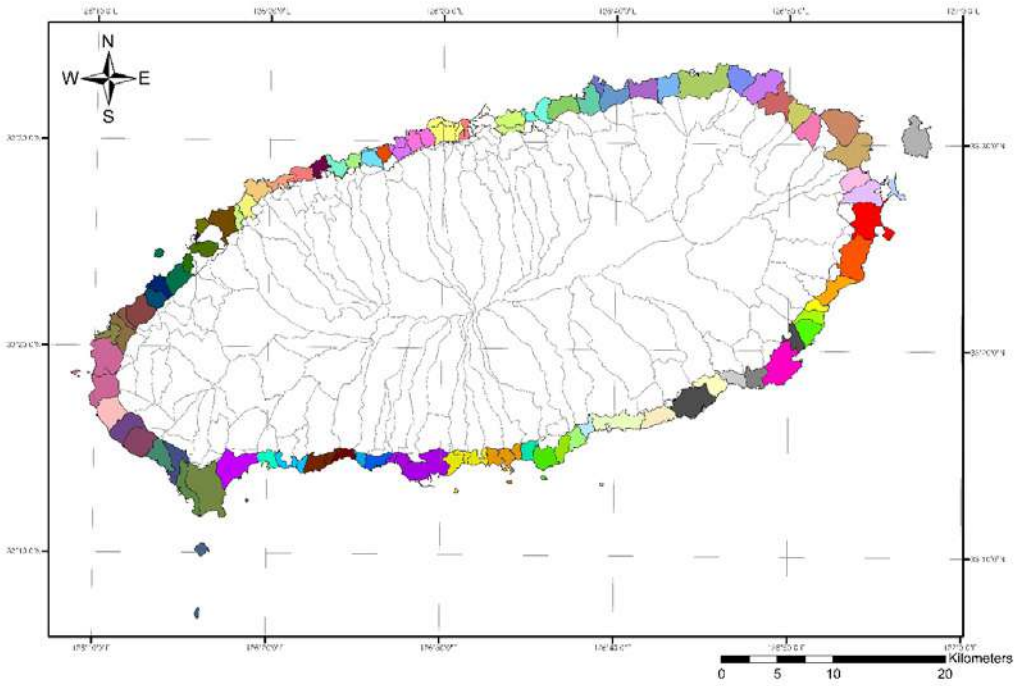

Figure 3. 103 Haenyeo communities on Jeju
Source: Song, 2023b, p. 7

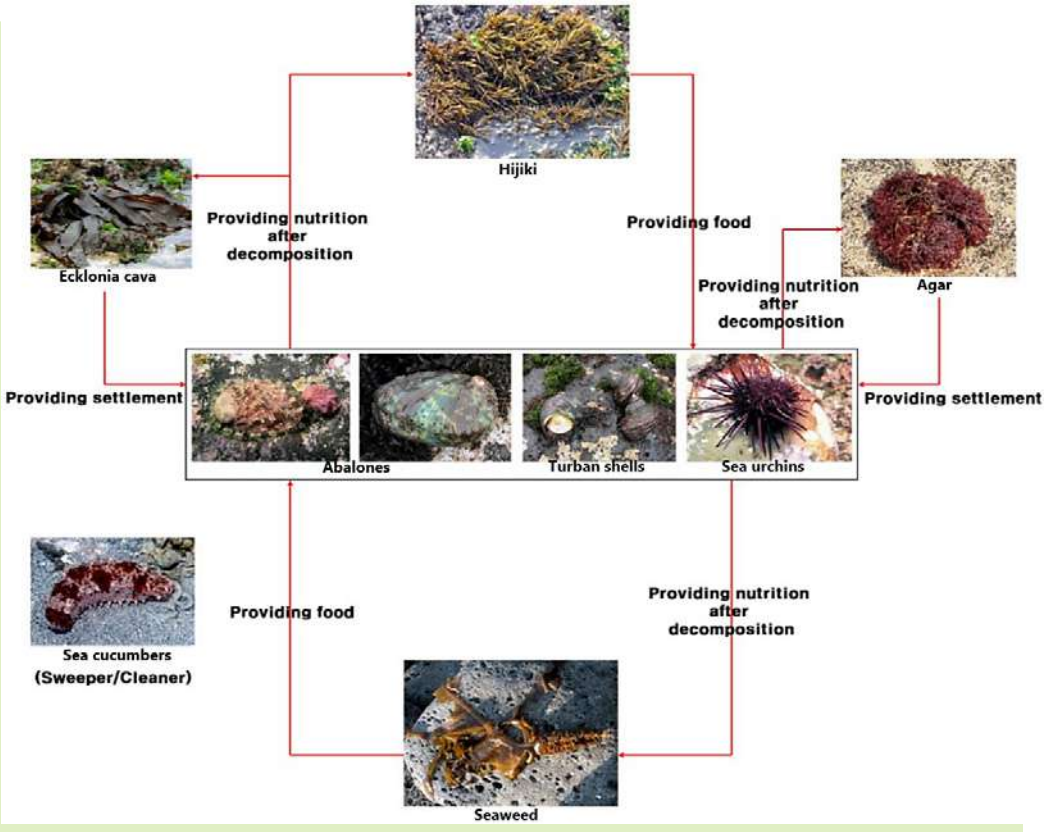

Figure 4. Ecosystem of key marine resources collected by Jeju Haenyeo
Source: Song, 2020, p. 15

This coexistence of meritocracy and welfare in the Jeju Haenyeo community is based on the value of equity. This is part of the Jeju Haenyeo goal of achieving sustainable coexistence between humans, which they hope will lead to sustainable coexistence between humans and the environment.

Key challenges

As a result of climate change, oceans are warming. Of the 52 Large Marine Ecosystems (LMEs) denoted by the United States National Oceanic and Atmospheric Administration, the East China Sea, which includes Jeju Island, is among the six most rapidly warming waters in the world, warming at over three times the rate of the average global sea surface temperature. While Jeju Island's air temperature has increased by 1.7 °C over the past fifty-eight years, ocean temperatures have increased by 2 °C over the past thirty-six years (Song, 2023a).

A particular problem is the change in the winter water temperature. The winter sea water temperature around Jeju has increased by about 4.75 °C over the past eighty-six years, which poses a serious direct threat to marine ecosystems (Korea Institute of Ocean Science and Technology, 2021), because this disrupts the food chain (see Figure 4).

Global warming makes seawater warmer and less soluble. This is dangerous because it leads to a kind of 'desertification' in the ocean. Calcium carbonate can only dissolve in water that contains carbon dioxide, and the cooler the water, the better. Calcium carbonate that doesn't dissolve ends up sticking to the rocks and seafloor. Calcium carbonate covering the rocks prevents seaweeds such as kelp and Ecklonia from growing. 'Ocean desertification' occurs when limestone algae such as coral reefs replace the dying seaweeds along the coast. This destroys the whole marine ecosystem.

A "bleaching event" is when the coral's surface turns white. Bleaching has affected more than 30 per cent of the entire coastline of Jeju Island (Korean Academy of Science and Technology, 2009). This has an impact on the marine ecosystem and biodiversity. Loss of marine biodiversity leads to marine deserts (Song, 2023a).

Jeju Haenyeo as a driving force for climate change response policies

In the midst of this crisis, the Jeju Haenyeo, recognizing the magnitude of the climate change problem, took on the role of policy advisors to actively address it.

All countries and governments have bureaucratic systems, where policies are promoted top-down, involving civil servants. Top-down policy promotion is considered by some to be more efficient than bottom-up promotion (Callahan, 1999), because it is costly to collect all the opinions of the citizens and to establish and promote policies based on them (Walters, Aydelotte and Miller, 2000; King and Stivers, 2001). However, the knowledge and resources provided by citizens are essential for the successful outcome of policies, including climate change adaptation policies (Neil Adger, Arnell and Tompkins, 2005), as responses to climate change can only be effectively maximized if they are informed by the perspectives of those who actually experience its impacts (Schipper et al., 2014).

The Jeju Island local government's policy to protect the Jeju Haenyeo culture from the threat of climate change is based on both bottom-up and top-down approaches due to the active participation of the Jeju Haenyeo in the policy. This is attributed to the non-hierarchical relationship between Jeju Haenyeo and the policy promoters like government officials.

The relationship between Jeju Haenyeo and members of the local government

The relationship between Jeju Haenyeo and Jeju local government officials is heterarchical (see Figure 5). Jeju Haenyeo have immediate access to Jeju local government officials whenever they need assistance from the local government regarding their fishing activities. They have direct access to government officials at the highest level, even the governor. This is not the norm. In normal life, there are not many societies that have a structure in place that allows citizens to immediately communicate with high-level government officials or governors when they feel uncomfortable and need government help. It is possible in this case because of the existence of the association of Jeju Haenyeo. The association has regular interactions with the local government of Jeju Island and bonds have been formed between the *haenyeo* and government officials through their regular interactions.

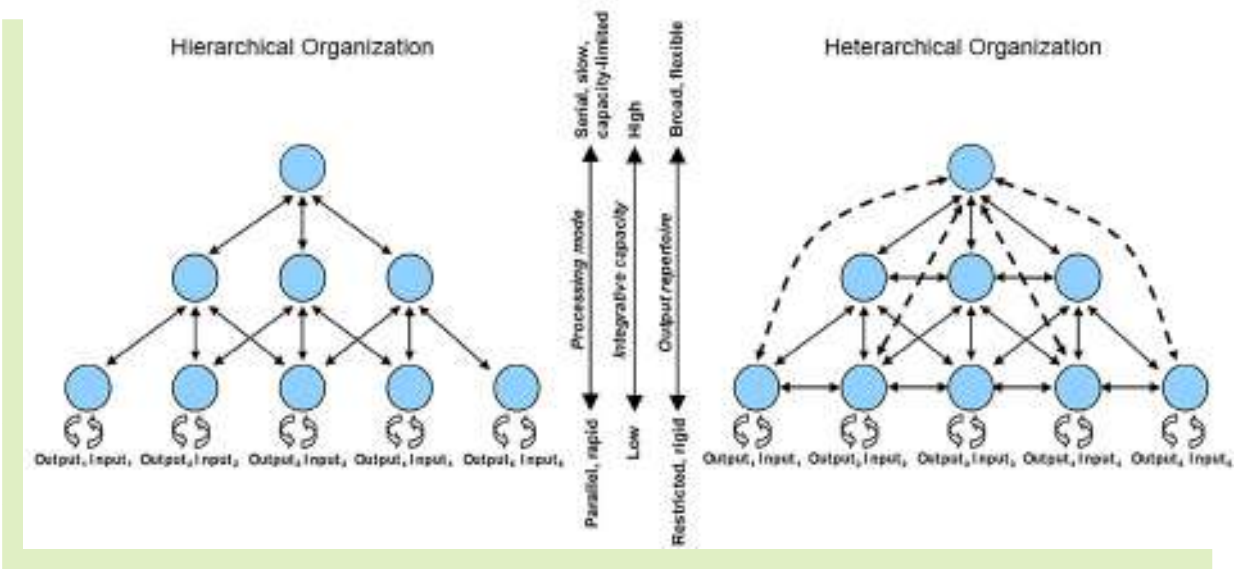

Figure 5. Hierarchical organizations follow a strict level structure, while heterarchical organizations allow direct and indirect interactions between levels, enhancing collaboration and expanding processing modes and outputs
Source: Norman et al., 2011, p. 352.

The bonds between Jeju Haenyeo and public officials serve as a foundation for facilitating the active participation of *haenyeo* in the local government's climate change response policies. Through these interactions, the Jeju Haenyeo association ensures that local governance related to climate change response policies is not static but instead evolves in response to changing social needs and conditions.

Jeju Haenyeo and climate change mitigation policies

For Jeju Haenyeo, seaweed is the most important marine species in the local ecosystem because it provides food and shelter for the marine species they collect. Without seaweed, the marine resources they collect would not exist. The Jeju Haenyeo have observed rapid changes in seaweed quantities in recent years, however, with algae decreasing dramatically. They shared their observations with the local government of Jeju Island, and based on this information the Jeju local government identified the decline of algae reported by Jeju Haenyeo as the most urgent issue that needs to be addressed to mitigate global warming.

A key way to mitigate global warming is to reduce the quantity of greenhouse gases, especially carbon dioxide, in the atmosphere. Recognizing the link between rising ocean temperatures and the decline in marine life, and understanding that seaweed can store up to 20 times more carbon per acre than terrestrial forests, the local government implemented large-scale seaweed plantings along the entire coast of Jeju Island (Figure 6).

The marine forests off the coast of Jeju were created by establishing artificial reefs up to 15 metres below the surface of the water and planting seaweed on them (Figure 8). These artificial reefs and seaweed serve as the ecological foundation for the habitat. The sea forest off the coast of Jeju absorbs approximately 33,525 tons of carbon dioxide (3.37 tons CO2eq/ha) annually. The national greenhouse gas reduction targets to combat the climate crisis reflect its role as a habitat and spawning ground for aquatic organisms.

The Jeju Haenyeo informed the local government that while the creation of sea forests had partially restored the amount of seaweed available, the number of key marine species they were collecting had decreased. They shared information on the specific coastal areas and locations where once abundant marine resources were declining, and Jeju local government officials used this information to launch an investigation.

The tracking survey findings indicate that the disk abalone, coloured abalone and red sea cucumber generally live well in areas with favourable topog-

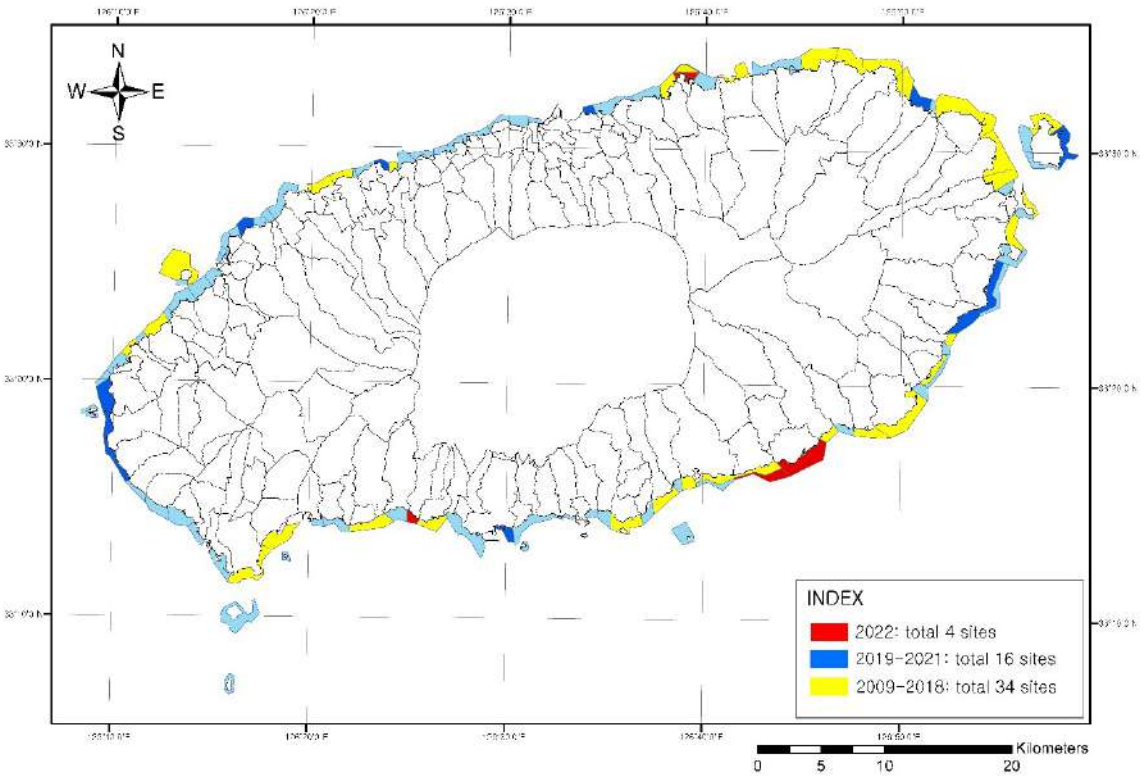

Figure 6. Distribution map of marine forest formation location
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Figure 7. The process of forming a marine forest under the sea
© Song, 2023a, p. 23

raphy. The survey identified the need for additional policies to foster the growth of marine algae because the bleaching events have caused the marine algae that once inhabited Jeju's littoral seas to disappear, with crustose coralline algae colonizing the area in their absence. This has rapidly reduced the biodiversity and populations of species on the seabed, devastating the local marine environment (Korea Fisheries Resources Agency, 2022).

As a result, the local government of Jeju Island requested cooperation from the National Institute of Oceanography and Fisheries Science to study species that can thrive in high sea temperatures. The local government of Jeju prioritized abalone species that can withstand high temperatures of 31 °C, and as of 2022 they were conducting field trials in the ocean (National Institute of Fisheries Science, 2022).

In addition, since 1999 the municipal government has implemented the Fisheries Seeds Release Project that aims to manage the marine species harvested by Jeju Haenyeo. The 2021 Impact Investigation of Fisheries Seeds Release studied the effect of releasing marine seeds in five fishing grounds. A tracking survey was conducted for three disk abalone fishing grounds (Pyeongdae, Pyoseon, and Beophwan), one coloured abalone fishing ground (Hansu) and one red sea cucumber fishing ground (Gonae) (Figure 7).

Through these efforts, the Jeju local government is conserving the Jeju Haenyeo fishery. Importantly, all of these efforts were initiated at the request of the Jeju Haenyeo themselves, which means that they have played a key role in forming climate change response policies.

Moving beyond typical strategies to innovative strategies

The safeguarding of traditional knowledge and skills and other ICH has received significant attention from international organizations (Song, 2023c; UNESCO,

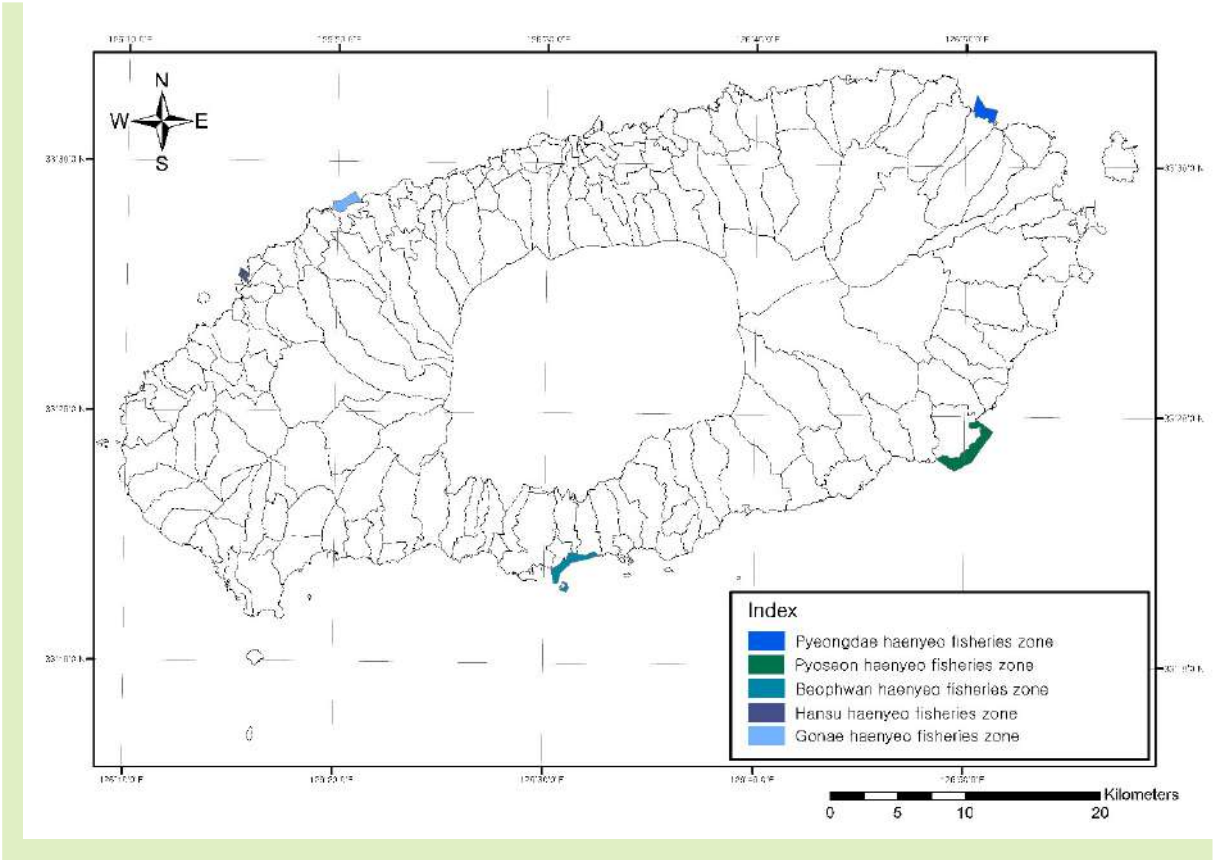

Figure 8. Areas for tracking released fisheries seeds
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2023). However, despite their commendable efforts, most micro-level efforts fall short in preparing and ensuring a stable future for ICH practitioners whose livelihoods are under threat from climate change (Dziubata-Smykowska, 2024; McDermott and Craith, 2024).

Through their inputs into government policy, the Jeju Haenyeo are doing everything they can to overcome the challenges of climate change, but these efforts must go hand in hand with preserving their intangible cultural heritage.

To safeguard Jeju Haenyeo culture, it is important to preserve their core cultural values. Faced with the impacts of climate change on Jeju Haenyeo culture, which are likely to more severe in the future, the Jeju Haenyeo have two options. The first is the typical strategy for conserving cultural heritage, which aims to preserve the traditional forms and practices despite disruptions to livelihood activities. The second option is an innovative one. It involves adapting to the current situation.

The Jeju Haenyeo know that the problem of climate change will not end in their generation. The marine ecosystem is changing rapidly and the income from their fishing activities is declining dramatically. Recognizing this crisis, the Jeju Haenyeo need to adapt their fishing methods. Identifying the ways that they can evolve is a task that academics, government officials and the Jeju Haenyeo themselves will have to figure out over time, but this paper suggests one way of evolving: a new Jeju Haenyeo fishing method that is based on eco-friendly submerged cage aquaculture.

The idea is to build eco-friendly submerged cage aquaculture farms on the coast in areas where the Jeju Haenyeo live. The technology for this type of aquaculture already exists and has been commercialized elsewhere (Kutty, 2001; Moksness, Dahl and Støttrup, 2009; Daczkowska-Kozon and Pan, 2016). Through this method of aquaculture, the Jeju Haenyeo can continue to cultivate and harvest the primary marine resources that they rely on. This, of course, requires cultivating varieties that can survive high sea temperatures.

If varieties of the species that the Jeju Haenyeo currently collect cannot survive high sea temperatures, it would be necessary for the Jeju Haenyeo to cultivate other marine resources: those that tolerate warm sea temperature. This means that Jeju Haenyeo would no longer collect the same marine resources harvested in the past. With this change, Jeju Haenyeo fishing would be different from the past. There would be a shift from collecting wild species to cultivating tolerant species via aquaculture and the marine resources they collect would be species tolerant of high sea temperatures. However, this would not disrupt their culture of diving under water to collect seafood.

Through aquaculture, Jeju Haenyeo would be able to secure their livelihoods, thus ensuring the continuation of the economic prerequisites for the sustainability of Jeju Haenyeo culture. Even though the Jeju Haenyeo fishing activity would take on a new form (aquaculture), a type of fishing activity that is completely different from the past, the values of equity and environmental and social sustainability would remain the same, as the *haenyeo* would continue to share their resources equitably.

As a sidenote, the exterior of the aquaculture farms that are visible above the sea surface, would need to be designed innovatively. When looking at the sea from the land, the appearance should remain the same as before and would need to avoid disrupting the local ecosystems.

Conclusion

Given the scale of global climate change, there is an urgent need for micro-level, macro-level and institutionalized efforts to combat the threats it poses to intangible cultural heritage. Governments and international organizations representing ICH bearers should spearhead these efforts. These efforts should focus on the preservation of cultural values, rather than on preserving an outward appearance of the past.

To achieve this, it is necessary to develop a comprehensive strategy that integrates climate resilience into ICH safeguarding. This strategy should include the development of adaptive practices that allow ICH practices to evolve in response to changing environmental conditions. It should also include the creation of support systems for ICH bearers, including financial assistance, education and resources for promoting sustainable practices that can mitigate the impacts of climate change on their

livelihoods. Education and awareness-raising are key components of a robust strategy to safeguard ICH in the context of climate change. Awareness-raising programmes should inform both the general public and policy-makers about the importance of ICH and its vulnerability to climate change, which would help build a broader base of support for policies and initiatives aimed at safeguarding ICH. Raising awareness among ICH holders about the potential impacts of climate change and the available adaptive strategies would empower them to take proactive measures to safeguard their heritage.

It is also necessary to foster collaboration between traditional knowledge holders and scientific communities. By combining empirical scientific research with traditional ecological knowledge, it will be possible to develop more effective and culturally sensitive solutions to climate-related challenges. This collaborative approach would result in innovations in sustainable resource management, disaster risk reduction and biodiversity conservation, which are crucial for the resilience of both ICH and natural environments.

In addition to these efforts, there must be a concerted push for the documentation of ICH, including through using digital tools. Digital tools are valuable means of capturing and storing knowledge, practices and cultural expressions for the benefit of future generations. Digital archives can also facilitate the sharing and dissemination of ICH across different communities, fostering greater appreciation and understanding of cultural diversity.

In the fight to safeguard ICH in the face of climate change, policy and legislation play a crucial role. Governments must enact and enforce policies that prioritize ICH safeguarding, and must allocate resources to its preservation. The UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage should be strengthened and expanded to address specific challenges posed by climate change.

While the outlook for climate change may seem grim, there is still hope for the safeguarding of ICH through proactive, multi-faceted approaches that involve all stakeholders, including ICH bearers. The voices of ICH bearers, especially those who are most vulnerable to the impacts of climate change, must be amplified in global discussions on the issue. These individuals and communities possess invaluable knowledge and experience that can contribute to more effective and equitable climate policies. Ensuring their active participation in decision-making processes is critical for developing strategies that are not only effective but also respectful of cultural heritage and rights.

By integrating traditional knowledge with modern science, fostering education and awareness, leveraging digital technologies, enacting supportive policies and amplifying the voices of ICH bearers, we can build resilience and ensure that the rich tapestry of the cultural heritage of humanity endures for generations to come.

Acknowledgement

This manuscript is based on the following author's paper, which is scheduled for publication. "Song, W. 2025. Reconceptualizing Safeguarding Intangible Cultural Heritage: The case of Jeju Haenyeo Culture, UNESCO Intangible Cultural Heritage, Vol. 37, No. 1, *Journal of Korean Cultural and Historical Geographers*, publication in progress (The page number has not yet been determined.)"

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Intangible Cultural Heritage Safeguarding and Climate Action in Asia and the Pacific

Communities across the Asia-Pacific region are responding to the increasing climate threats by introducing local knowledge and traditional practices to innovative approaches. They are proactively safeguarding their intangible cultural heritage while increasing its resilience, so future generations can continue to maintain their practices and sense of identity.

This UNESCO publication on living heritage and climate action illustrates the links between cultural diversity and environmental sustainability in the region. The case studies not only demonstrate the importance of cultural adaptation, but also provide valuable insights into the broader discourse on safeguard living heritage in the face of climate change.

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