

A call for the library community to deploy best practices toward a database for biocultural knowledge relating to climate change

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Short Title: A call for a biocultural climate database

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Abstract

Purpose – In this paper, a call to the library and information science community to support documentation and conservation of cultural and biocultural heritage has been presented.

Design/methodology/approach – Based in existing Literature, this proposal is generative and descriptive— rather than prescriptive—regarding precisely how libraries should collaborate to employ technical and ethical best practices to provide access to vital data, research and cultural narratives relating to climate.

Findings – COVID-19 and climate destruction signal urgent global challenges. Library best practices are positioned to respond to climate change. Literature indicates how libraries preserve, share and cross-link cultural and scientific knowledge. With wildfires, drought, flooding and other extreme or slow-onset weather events presenting dangers, it is imperative that libraries take joint action toward facilitating sustainable and open access to relevant information.

Practical implications – An initiative could create an easily-accessible, open, linked, curated, secure and stakeholder-respectful database for global biocultural heritage—documenting traditional knowledge, local knowledge and climate adaptation traditions.

Social implications – Ongoing stakeholder involvement from the outset should acknowledge preferences regarding whether or how much to share information. Ethical elements must be embedded from concept to granular access and metadata elements.

Originality/value – Rooted in the best practices and service orientation of library science, the proposal envisions a sustained response to a common global challenge. Stewardship would also broadly assist the global community by preserving and providing streamlined access to information of instrumental value to addressing climate change.

Keywords Libraries, Open access, Local knowledge, Stewardship, Climate change, Best practices, Repository, Database management systems, Traditional knowledge, Biocultural heritage

Paper type Conceptual paper

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Introduction

Information about adaptive cultural heritage responses to a constantly-changing natural world is dispersed. Much Local, Indigenous, and Traditional Knowledge is only discoverable through libraries' cataloging published—and publicly-inaccessible—academic journals and books.

Information and tangible and intangible heritage are vulnerable to disasters—as well as to silos that frustrate access to knowledge. In addition, some conversations, conferences, oral histories, and intangible heritage traditions are shared via ephemeral systems; those ongoing engagements associated with the development of a dynamic database are valuable information sources in themselves. Further, current open information architectures do not adequately facilitate cross searching of scientific and cultural data and research. Libraries have a special role to play in conserving, migrating, securing, and providing access to knowledge bases essential to proactively addressing what the UN Secretary General characterized as the defining challenge of our time (Sengupta, 2018).

Libraries, through a regularly-updated platform, can support collaboration among Information Science professionals and can facilitate reciprocation of knowledge-sharing with those communities which might not broadly have access to climate-relevant subscription-based information. In addition, members of the library community can support their individual communities' climate interests, which have been exhibited through worldwide marches and

protests, by supporting a professionally-structured database that could also facilitate and amplify engagement through citizen social (Kythreotis *et al.*, 2019) and citizen science.

Global challenges posed by climate changes and related risks to material and intangible culture require expertise beyond that of one individual or institution; hence this call to members of the global library and information sciences community. For instance, the United States Environmental Protection Agency Climate Change Adaptation Resource Center (EPA, 2021) effort proved unsustainable during the Trump administration because it was dependent on the wisdom, funding, and input of just one government—not a collective group with dedication to preserving data (Weiser, 2017). Distributed systems and evolving infrastructures should be considered in planning.

In addition, conceptual reorientations through the process of envisioning resources which incorporate collaborative approaches (Kalafatis *et al.* 2019a; Kalafatis *et al.* 2019b; Whyte, 2013) could illuminate additional paths towards addressing a unique and pressing global challenge demanding novel avenues and partnerships. While this paper primarily presents an argument based in scholarly literature, it opens to other developing information sources supporting action—including grey literature, conferences, and local and cross-disciplinary engagements. This paper is an analytical foundation for a call to action.

Through easily-accessible linked data, scientific information systems and Traditional and Local Knowledge can provide content and generate transdisciplinary approaches to sustainable solutions to climate challenges. This project idea acknowledges and responds to the symbiotic relationship between culture and nature, art and science, that has been understood by Native Peoples—and now increasingly understood more broadly, as discussed below. Also, as COVID home confinements have taught those of us fortunate to be able to work digitally in isolation, online platforms can facilitate that intergenerational knowledge transfer and communication so valued by Indigenous Peoples.

Literature Review and Methodology

UNESCO's extended definition of intangible cultural heritage is critical in understanding why this proposed project is worth launching: "The importance of intangible cultural heritage is not the cultural manifestation itself but rather the wealth of knowledge and skills that is transmitted through it from one generation to the next (UNESCO, n.d.b). Perspectives of Indigenous Peoples

can provide specific as well as paradigm-shifting potential paths (Roué, Césard, Yao, *et al.*, 2017)). As Daniel Wildcat argued in his keynote address at the “Climate Change and Culture in the Great Plains,” conference (2021), Native American traditions view elements and living beings of the land, water, and air as relatives, not resources—and that a relational lens brings with it a sense of responsibility rather than a perspective of extraction without considering long-term consequences.

Collaborative approaches may encounter skepticism. This conceptual article advocates for a thorough consideration of ecological approaches which may accelerate climate planning at a time when all reasonable *modus operandi* should be considered. During the Cold War, multiple academic institutions and the military worked creatively and outside of standard silos to create the Arpanet, an early distributed computing system and precursor to the internet that challenged traditional visions of information structures and organizational responsibilities (Lukasik, 2011). Looking to memory institutions, Britain’s Victoria & Albert Museum (n.d.), “founded in a time of optimistic belief in the power of industry, a point in history which we now know has had devastating consequences for our planet,” includes among its current concrete and conceptual sustainability initiatives a symposium to “explore how we can learn from other sectors to support our mutual aims” in a program titled, “Culture in Crisis: Collaborate for Climate” (Victoria & Albert Museum, 2021).

While librarians have the training to be able to uncover relevant data sets, publications, government and NGO information, and websites—global citizens without access privileges to academic libraries, interlibrary loan, or unfamiliar with efficient Boolean search strategies, are less likely to discover and access information potentially critical to preventing damage to cultural traditions—or to prevent, mitigate or adapt to climate changes. This is where library best practices come in.

Libraries should protect and utilize best practices to facilitate access to this information by a range of Indigenous cultures, global citizens, and policy planners. Libraries should do this so that communities around the world can consider historical data and approaches from Traditional and Local knowledge systems—recognizing benefits from considering a range of world views towards adapting to climate change. Librarians, archivists, and researchers can contribute professional training towards protecting original source information. Libraries should

do this to enable learning about a full range of methods—scientific and biocultural—such that across-silo studies can explore relationships between Traditional Knowledge and Science.

In the technical realm, library best practices can leverage progress made towards Open Access, accelerated during COVID's enforced global shift to online learning, and progress in linked data. Best practices regarding database management, controlled vocabularies (Harpring, 2010) and standard archival descriptions, and secure levelled access privileges for culturally-sensitive data should be introduced at the design stage. Also—from the get-go—library practices can reflect a conscious and sustained inclusiveness of diverse voices in the creation and ongoing development and maintenance of this sustainable project. Inclusion could involve deliberate recruitment of, and financial support for, MLS students representing communities whose Traditional Knowledge systems and perspectives may provide sustainable paths for climate change preventions, mitigations, adaptation, or relocation.

A broad geographical and interdisciplinary representation of studies and resources relating to managed retreat, displacement, and environmental migration may most accurately reflect populations and challenges, and therefore better inform planning and decision making (Ajibade and Siders, 2022). There is a “need for more research and a greater diversity of cases, perspectives, experiences, and voices in this field” (Siders and Ajibade, 2021). Current regions exploring multidisciplinary climate understandings range from the Center for Great Plains Studies at the University of Nebraska (2021), to South Australia (Flinders University, 2021).

UNESCO describes Local and Indigenous Knowledge as, “the understandings, skills and philosophies developed by societies with long histories of interaction with their natural surroundings,” and notes that, “These unique ways of knowing are important facets of the world's cultural diversity, and provide a foundation for locally-appropriate sustainable development” (2017).

Librarians should continue their historical collaboration with subject experts in the cultural heritage and scientific realms; these partnerships contribute to best practices relating to the documentation of both tangible and intangible heritage. UNESCO notes that, “Cultural heritage does not end at monuments and collections of objects. It also includes traditions or living expressions inherited from our ancestors and passed on to our descendants, such as oral traditions, performing arts, social practices, rituals, festive events, knowledge and practices concerning nature and the universe or the knowledge and skills to produce traditional crafts”

(2017). This calls for knowledge of how to capture, preserve, migrate and conserve video, audio, photo documentation, and text. Metadata standards for art may need to be expanded to meet these definitions (Harpring, 2010; Hou and Wang, 2019; Ziku, 2020), and to enable linking and discovery.

In addition to promoting respectful and reciprocal (Vannini, Gomez, and Newell, 2020) relationships with participating communities towards reflecting authentic heritage and knowledge, security planning and safety standards should involve stakeholders at all stages. This inclusive approach should apply to documentation and information-sharing work regarding scientific data sets, and intangible and concrete cultural artifacts. Planning should consider national and international legal safeguards against crimes that might arise as a response to openly-available information (IFLA, 2019a; Vannini, Gomez, and Newell, 2020; Thompson n.d.; Fogwill, Vivier, Engelbrecht, *et al.*, 2011).

The immediate necessity of soliciting and supporting innovative environment-oriented and information-connecting endeavors worldwide is evidenced by the inauguration of the Earthshot Prize (Royal Foundation of the Duke and Duchess of Cambridge, 2021a), which is “supported by its Global Alliance, an unprecedented network of organisations worldwide which share the ambition of the Prize to incentivise change and help to repair our planet over the next ten years” (Royal Foundation of the Duke and Duchess of Cambridge, 2021b). Among the inaugural finalists in the Protect and Restore Nature category was the Swiss organization, Restor. Its free online platform, “connects practitioners with ecological data and builds networks between activists, funders and the public. For the first time, major scientific datasets are at the fingertips of conservationists, helping local knowledge fuel global change” (Royal Foundation of the Duke and Duchess of Cambridge, 2021c).

Best practices that can protect critical cultural heritage

The best practices recommended here are rooted in practices that already exist. They offer means to collaborate towards addressing a pressing need for an easily-accessible, open, linked, curated and secure database for global knowledge documenting traditional knowledge or local traditions that supports prevention, remediation or adaptation to climate changes. Digital library infrastructures (Woodley, 2008) can support sharing, and also pairing of newly discovered juxtapositions. Open access functionalities can extend the power of digital libraries to more culturally, geographically, and ethnically diverse communities and groups. Library and

information institutions are well suited, in vision and in technical capabilities, to create and provide this service sustainably.

Through design principles and linked data, this cultural heritage resource would allow for fluid and open searching of related biodiversity and scientific data. Artese and Gagliardi in 2015 explored technical means of finding Intangible Heritage via the web and discovered that “living traditions inventories or oral traditions, practices, skills collections are not so easy to find” (Artese and Gagliardia, 2019, p. 338). This suggests that—apart from the primary importance of involving stakeholders throughout different cycles of documenting and sharing heritage information— best practices for this database/archive would include active outreach to global communities by members of the team creating, managing and maintaining the resource. Such outreach would begin with discussion about potential participants’ rights regarding whether to share/participate, or how much to share either openly or in part. Planning and training would also consider effective methods of working with stakeholders when recording community traditions (Khalala *et al.*, 2014).

Drawing upon the knowledge of potential collaborators such as Blue Shield, the European Committee for Standardization (n.d.), IFLA’s Cultural Heritage Programme Advisory Committee, and the GO FAIR (2021) and Environmental Data (n.d.) initiatives, planners could anticipate issues relating to the preservation, safeguarding, and sharing of both cultural heritage and scientific information—and design efficient infrastructures and best practices. For example, GO FAIR’s principles towards scientific data could be applied to a climate database—with implementation elements involving socio-cultural change, the involvement of stakeholders; the training of data stewards; and the designing of standards, best practices, and infrastructure elements (2021). Fogwill *et al.* explore high level architecture for Indigenous Knowledge management systems, and this includes planning for secure hardware and servers (2011).

Blue Shield’s expertise and attention to risk management preparations and trainings regarding international law (IFLA, 2019a) reflect its key goals, among them to “protect cultural and natural heritage – tangible and intangible – from the effects of conflict and environmental disaster.” The IFLA “Principles of Engagement in Library-related Activities of Disaster Risk Reduction and in Times of Conflict, Crisis or Natural Disaster,” provide guidelines for the inclusion of stakeholders, proactive measures towards protecting vulnerable cultural heritage, and outlined purposes. The latter include specifications to provide for ‘international cross-

sectorial cooperation and assistance for effective disaster preparedness,” and the facilitation of global responses to threats to library-related “movable and immovable cultural property” (IFLA, 2012).

While this paper proposes an open access database, information regarding locations of heritage need not universally include transparent geo-mapping; for instance, hunting, fishing, or archeological sites could, in instances, be noted via general or regional markers. Such precautions are similar to internal protection options for intangible heritage within data structures—such as infrastructures and metadata for sensitive or offline information. Other open access databases or data management initiatives could inform safe structuring of this proposed database; among these are: Center for Research Libraries’ Trustworthy Repositories Audit & Certification (n.d.), CCSDS (2019), DataOne (n.d.), EDGI (2021), EDI (n.d.), LOCKSS, and Open Context (Alexandria Archive Institute, n.d.). Beyond technical digital protections taken by such platforms and initiatives, the authors of “Mind the Five”: Guidelines for Data Privacy and Security in Humanitarian Work with Undocumented Migrants and Other Vulnerable Populations,” recommend: improving accountability standards and methods towards “protecting personal information and sensitive data about the vulnerable populations they serve” and committing to more robust dialogue about potential tradeoffs associated with technologies (Vannini, Gomez, and Newell, 2020, p. 936).

Making this knowledge searchable and available to many

Academic scientific and cultural knowledge about climate change is not easily accessible, as most resides in subscription journals available to few (Lund, 2019), thus the open access aspect of this proposed repository is critical. Beyond that, a repository of diverse information sources for biocultural knowledge—community, government, nonprofit and academic articles, data, websites, adaptation plans, case studies—could be inclusive of relevant information that may not otherwise be considered or discoverable. The database should provide storage space or links to a range of formats such as videos of lectures or pamphlets in local languages, for information, (Lund, 2019), including translation tools for critical academic findings.

Subject specialists, representatives from associated cultural heritage communities, and library and database professionals should be involved with developing or implementing consistent and structured relational tables, appropriate metadata schemas, controlled

vocabularies, and tags to enable efficient storage, access and crosswalk linking of a broad range of potentially related information packages. As this database would include or link to an above-mentioned range of information sources from scientific and cultural fields, communication about vocabularies and related terms would need to be thorough and ongoing to enable accessibility, cross searching and relevance in an evolving transdisciplinary endeavor. Inclusion of local information expertise can inform effective and respectful outreach (Chamunorwa, M.B., Winschiers-Theophilus, H. and Zaman, T., 2018).

[Insert Figure 1. Seeing standards metadata map. Source: Courtesy of Riley and Becker, CC-BY-NC—SA-3.0 US]

Language experts should, at a minimum, translate key metadata into designated widely-spoken languages including English, Mandarin Chinese, and Spanish. This foundational shared language documentation of included cultural heritage elements should be prioritized before extensive translation of primary content. Over time, in addition to the involvement of professional transcribers and translators, crowdsourcing—under pre-specified and regular schedules monitored by formally-enlisted language professionals—can engage members of the global community in making information widely available. An example of an existing effort is that of the Library and Archives Canada’s (LAC) Indigenous documentary heritage initiatives (2018); its portal provides a crowdsourcing application to “transcribe, tag, translate, describe, and correct inaccuracies in archival descriptions” (Library and Archives Canada, n.d.). This informal model is similar to that used by the iNaturalist or Global Biodiversity Information Facility (2021) platforms, and under more regulated systems, the New York Botanical Garden’s (n.d.) Citizen Science platform.

In this generative paper, which solicits collaboration and expertise from database specialists as well as content specialists, it is worth noting that planning and designs by information and database specialists would include the identification of efficiency-promoting and appropriate data entities that would further the description, organization, accessibility and relational searching processes regarding tangible and intangible heritage primary elements. This process would further apply to representations such as photos, recordings, and diagrams; and to multiple levels of granularity to enable precise searching, discovery and exploration of possible associations.

Preservation schemas would also be included at the outset, to facilitate lifecycle management. Provenance and provenience are among culturally-relevant categories, along with fields to enable complex documentation of time-based media. Rights metadata should be included. When determining which descriptors to list or content to enable access to openly, community representatives should decide whether to opt in to all, or to specified categories or tiered levels of access. In addition, certain technical metadata elements or geospatial coordinates could be available on a need-to-know basis.

Hou and Wang explore a knowledge ontology to support “abundant knowledge” and “internal relationships” of linked, interoperable and open Intangible Cultural Heritage data (2019). Houxilong notes top level categories including “inheritors” of knowledge, “categories,” and “place,” and expands to properties such as mentors and individuals who have influenced practitioners (2019). Mappings of metadata standards illustrate distinct requirements to adequately describe diverse cultural traditions ranging from music to fishing practices, or scientific data sets (Riley, 2010). Elements would range from performing arts movements to flora and culinary traditions.

Information is vulnerable to disasters; inadequate conservation, obsolescence or migration; political changes—as well as to silos and frustrations regarding invisible data or poorly-curated unstructured points of knowledge. Institutions such as LOCKSS practice principles already noted by Thomas Jefferson in 1791: “let us save what remains: not by vaults and locks which fence them from the public eye and use, in consigning them to the waste of time, but by such a multiplication of copies, as shall place them beyond the reach of accident” (Jefferson). However, as Stanford University brings such concerns into the 21st Century, digital or digitally-documented data demand protection, “not just by many copies but...peer-to-peer architecture, in which no network participant controls all of the copies (LOCKSS, n.d.).

Information systems must also provide tiered levels of access for culturally-sensitive information that community members wish to preserve and share among themselves, but not indiscriminately via full open access (EDGI, 2021; Fogwill *et al.*, 2011; Chakravarty and Mahajan, 2010). In addition, security measures must be planned to preserve digital data. Recent political handling of U.S. government data relating to climate change flagged the need for vigilance in protecting critical data sets (Harmon, 2017). Protections involve well-defined

policies, data management plans, as well as implementation—such as via distributed systems and lifecycle design (LOCKSS, n.d.; Solodovnik and Budroni, 2015).

Best practices for Intangible Cultural Heritage present unique challenges for metadata and linking, but specialists are doing research to address these challenges. For instance, Artese and Gagliardi (2020) report that “neither EDM nor CIDOC-CRM are suitable to describe intangible entities and the top-down model they propose is not suitable to express the meaning of the relationship between digital objects and the entities they refer to, whether tangible or intangible.” They also study how to overcome data silos using QueryLab (2019, p. 271).

Ethical and content issues and practices should guide other best practices. IFLA’s Statement on Indigenous Traditional Knowledge (IFLA, 2019b), and Code of Ethics for Librarians and Other Information Workers (IFLA, 2016), indicate best practices for policies, interactions with local communities, and valuing and making known contributions and significance of Indigenous and Local Traditional Knowledge for Indigenous and non-Indigenous people. The United Nations Declaration on the Rights of Indigenous Peoples (United Nations General Assembly, 2007) provides additional guidance. The Mukurtu content management system aims to “empower [Indigenous] communities to manage, share, and exchange their digital heritage in culturally relevant and ethically-minded ways,” prioritizing “a platform that fosters relationships of respect and trust” (n.d.).

Vision and Discussion

This proposed idea project would create a persistent OER biocultural heritage resource center, evolving along the lines of the EPA’s politically-vulnerable Climate Change Adaptation Resource Center’s (EPA, 2021) (Weiser, 2017) case studies for climate change adaptation, and the nascent Joint UNESCO- SCBD programme on links between biological and cultural diversity (CBD n.d.). Native American communities are already actively involved in preparing local adaptation plans, and their work provides another model for proactive documentation of local biocultural knowledge (Southwestern Tribal Climate Change Summit, 2017; Institute for Tribal Environmental Professionals (ITEP, 2020).

Traditional and Local Knowledge traditions such as cultural burning and sustainable fishing offer valuable stewardship models. Some elements of these knowledge systems are recognized broadly. For instance, prescribed fire management is used from Australia to the

Pacific Northwest (Williamson, 2021). Stakeholder involvement includes representation of multiple generations (National Tribal and Indigenous Climate Conference (NTICC) (2020b; Lerski, 2019), and supports community members in continuing traditions such as storytelling (Fernández- Llamazares and Cabeza, 2018).

[Insert Plate 2. Cultural Burning Courtesy of Country Fire Authority (cfa.vic.gov.au) The importance of cultural burning to CFA - CFA News and Media National Indigenous Fire Workshop Dhungala 2019]

Sustainability initiatives at 2020 conferences held by the ALA, IFLA and the Association for Information Science & Technology; and 2021 events held by ICOMOS, African Heritage Fund, and Climate Heritage Network underline a sense of urgency.

Library specialists on database design, information security, metadata, archives, cultural heritage, biodiversity, and web design could contribute their best practices towards creating, maintaining, and sustaining the project. Expertise would be required to address issues of open access as well as community-requested limitations to some types of access.

Communities documenting traditional knowledge may wish to preserve, but not widely share, information—recognizing rights not to share traditional knowledge (Climate and Traditional Knowledges Workgroup, 2014; Fernández- Llamazares and Cabeza, 2018; ITEP and Northern Arizona University, 2019; Lempert, 2010b; Roy, 2015). This caution is particularly important to include among best practices in both the design and implementation of a biocultural heritage database: embed respect for contributors’ sharing parameters within the technical design and security features.

Climate change poses threats to cultural heritage, but also provides impetus to methodically prepare for documentation and preservation of information and heritage. The service proposed here acknowledges the links between biodiversity health and the health of culture and cultural diversity (Fernandez-Llamazares and Cabeza, 2018; Jacka, 2016; National Tribal and Indigenous Climate Conference 2020b; Nazarea, 2006; Pilgrim *et al.*, 2009; Rahman and Rahman, 2015; Southwestern Tribal Climate Change Summit, 2017; Tapfuma and Hoskins, 2016; Tribal Adaptation Menu Team, 2019 UNESCO, n.d.a; Voggesser *et al.*, 2013;).

Recognizing and supporting the values reflected in Intangible Cultural Heritage has potential for adaptation planning, mitigation, migration, and climate resettlement (Aktürk and Lerski, 2021).

A 2008 UNESCO report, “Links Between Biological and Cultural Diversity-concepts, Methods and Experiences,” called for a “mechanism to link the separately evolving diversity agendas [needs] to be developed and used as the basis for connecting diversity to development issues” (p.34). Through crosswalks and links, transparent rights and permissions statements and mechanisms, and digital preservation instrumentalities to secure information in the present and the future—including elements of Traditional and Local Knowledge will be preserved, and access will be provided to current global scientific and cultural knowledge sets relating to climate change (Hiwasaki *et al.*, 2014).

Government, NGO, website and academic resources show some progress towards bridging science-culture silos. However, digitally-available resources are scattered and inefficiently-structured. A libraries-led project to create interoperable structures could facilitate information seeking on topics relating to climate change and its impacts on cultural and natural heritage.

Stakeholder involvement in actions and decisions to identify, evaluate, and share local knowledge should start from the beginning of initiatives through the lifecycle of any repository or database (Climate and Traditional Knowledges Workgroup, 2014). Stakeholder involvement is also flagged as critical in “Barriers to Reducing Climate Enhanced Disaster Risks in Least Developed Country-Small Islands Through Anticipatory Adaptation” (Kuruppu and Willie, 2015). Participation of all age groups in identifying most valued biocultural heritage elements through artistic expression provides more complete data (Lerski, 2019). Balanced gender participation of stakeholders, similar to that promoted in the work of BuildOn, should be incentivized (2021).

Lund indicates (2019) in “Barriers to Ideal Transfer of Climate Change Information in Developing Nations,” that participants should be permitted to use their local languages, rather than the language of researchers or funders, to enhance effectiveness of both research and impact on local communities. Thus, best practices would involve librarians with language skills to facilitate metadata and structuring of information from multiple languages.

Jacka (2016) presents adaptive benefits of biocultural knowledge in, “Correlating Local Knowledge with Climatic Data: Porgeran Experiences of Climate Change in Papua New Guinea.” Anthropologist and lawyer Lempert was indicating urgency a decade ago regarding a need to document highly vulnerable cultural information (Lempert, 2010a, 2010b). Nazarea (2006) published on “Local Knowledge and Memory in Biodiversity Conservation,” and Pilgrim *et al.* explored “The Intersections of Biological Diversity and Cultural Diversity: Towards Integration” (2009). Voggeser *et al.*, examined how community well-being is vulnerable to environmental damage, in “Cultural Impacts to Tribes from Climate Change Influences on Forests” (2013). Durkalec *et al.* (2015) explored, “Climate Change Influences on Environment as a Determinant of Indigenous Health: Relationships to Place, Sea Ice, and Health in an Inuit Community.

As the need for integration persists—and action stalls—future outcomes look more grim. Cultural heritage Philosopher, Matthes, mused about the lessons we will learn from delayed or destructive actions. While not endorsing a “fatalistic surrender to climate change,” he poses whether “ownership” of harm caused by humans may, in cases where we have remediated too late, be the only remedy: “Ultimately, some of the ruins of our low-lying cities could become like national monuments and memorials, sublime and poignant emblems of our environmental heritage...sites that might bring us together in opposition to the forces that engendered them, and inspire novel visions of a different future” (2020, p. 181).

In a more optimistic vein, at the pre-United Nations Summit meeting at the UN headquarters in New York, the Cultural Heritage Partnership to Enable Ambitious Climate Action explored and advocated for greater understandings of cultural heritage in addressing and planning for climate change. Agenda items included: 1) climate change impact on cultural and natural heritage; 2) cultural and natural heritage protection; and 3) partnership to support cultural heritage adaptation to climate change in countries (Cultural Heritage Partnership, 2019).

Tapfuma and Hoskins (2016) argue for “Visibility and Accessibility of Indigenous Knowledge on Open Access Institutional Repositories at Universities in Africa.” Maldonado *et al.* explore how the effects of climate change impact tribes whose cultures are tied to climate-vulnerable forests, highlighting traditional ecological knowledge and traditional tribal adaptive practices and resource management expertise. As with cultural impacts to tribes from climate change influences on forests, others describe how natural and traditional knowledge—including

strategic landscaping practices and planting of native vegetation—are employed to reduce sea level rise and flooding in coastal Bangladesh and in other climate-vulnerable locales.

(Maldonado *et al.*, 2013; Rahman and Rahman 2015; Voggesser *et al.*, 2013)

[Insert Plate 3. Mangroves. Source: Author]

Biodiversity is increasingly seen as linked to cultural diversity, as is biocultural heritage (Gavin *et al.*, 2015; Maffi and Woodley, 2010; UNESCO, 2008). “Environmental sustainability ...is intricately linked to the safeguarding of intangible heritage,” finds the working group on “Options for possible elements of work on the links between nature and culture in the post-2020 Global Biodiversity Framework” (CBD, 2019, p.6). The Convention on Biological Diversity Working Group (CBD, 2019) adopted a glossary of terms relating to “the emerging concept of biocultural diversity.” Here, the term “biocultural heritage” is understood within the context of the Convention as reflecting “the holistic approach of many indigenous peoples and local communities. *This holistic and collective conceptual approach also recognizes knowledge as “heritage”, thereby reflecting its custodial and intergenerational character [my emphasis].* Cultural landscapes...are examples of biocultural heritage” (p.3).

This work followed closely on the above-mentioned pre-summit meeting at the United Nations by the Cultural Heritage Partnership to enable ambitious climate action, at which scientific, economic, archeological as well as intangible heritage aspects such as culinary and land tenure traditions were discussed (2019). These initiatives, along with that of the emerging Climate Heritage Network (2021) reflect a growing understanding of the links between cultural health and diversity and ecological and societal sustainability.

The CBD working group explored “options for possible elements of work aimed at a reintegration of nature and culture in the post-2020 global biodiversity framework” (2019. P. 11), The creation of this database could be one of those endeavors rooted in best practices—from the Library and Information Sciences field. Further, looking to the myriad areas of expertise within the Library arena, as exemplified by American and International Library and Archives interest groups and divisions and roundtables, expertise regarding contextual cultural knowledge can be integrated from inception and throughout dynamic and ongoing execution of the proposed database.

For Tribal and Indigenous societies, the interconnectedness of culture and nature is understood—but these concepts are only recently being included in academic studies or in

nation-state plans to address climate change. At the virtual discussion group during the Dibaginjigaadeg Anishinaabe Ezhitwaad: A Tribal Climate Adaptation Menu for Indigenous-led Climate Adaptation Workshop (National Tribal and Indigenous Climate Conference (NTICC), 2020a), one particular goal stood out: consensus. Given contemporary political divisions engulfing the United States, one might genuinely wonder how consensus could be achieved. Where in the process of planning for adaptation, at which stage, did inclusion of cultural considerations enter the dialogue on addressing climate change? The answer was found in the Toolkit document which guided the workshop. There, first among action points for climate adaptation was *cultural inclusion*—the definition of which considers landscapes, spirituality, and relationships with non-human beings.

The report quotes community member, Grignon: “We recognize that we are just one part of this community and not above it” (p.8). Strategy point 1.2 considers “mindful practices of reciprocity,”(p. 18) allowing community input and the dissemination of results from endeavors. In short, this Tribal Climate Adaptation Menu provides a roadmap (Tribal Adaptation Menu Team, 2019): In order to achieve buy in and commitment towards a monumental undertaking which many might wish to ignore due its complexity and necessary strategic sacrifices, cultural knowledge and approaches must to be addressed from the outset, and sharing of information must be reciprocal.

Lest discussion about best practices take librarians away from a vision of how local communities can benefit, Ike Lawanda finds that information gained using the web and apps helps to convey cultural and environmental information across generations in the Cikarawang village in Indonesia (2019). There, globalization and societal changes strain traditional means of transferring cultural and agricultural knowledge. Librarians play a part in documenting, through digital means, traditional knowledge important for solutions to environmental issues. In other communities, where strong intergenerational ties and knowledge transfer continue, engagement of multiple stakeholders in the gathering and documenting of biocultural knowledge can cement social ties while contributing to dynamic improvement of inputs, including data and policy evolutions.

Research working with intergenerational stakeholders in Barbuda (Lerski, 2019) to identify their most valued cultural elements resulted in concrete community priorities relating to

their biocultural heritage. Soon after field research in 2017, Hurricane Irma devastated the island and resulted in a complete medium-term evacuation, after which some members of the population did not return. In a follow up visit over a year later, when many community members had returned, there was a renewed sense of urgency for documenting, protecting and utilizing local knowledge and traditions towards climate change adaptation. This database project would involve the library community in encouraging multiple communities to prioritize the protection of their knowledge systems relating to climate adaptation. It would provide access to information, to facilitate ongoing learning by global citizens.

Interoperability through crosswalking and efficient metadata structuring could result in linked data and greater access and search functionality (Korro Banuelos *et al.*,2021). Also, the very actions associated with creating this database could set in motion shared efforts towards sustainability and transdisciplinary approaches to documenting, creating pathways for, and sharing knowledge.

Discussion and Conclusion:

Summarizing, there is a growing body of literature exploring the intersection of—and possible mutual benefits from—biodiversity and cultural heritage, and this underlies the reasoning for creating and maintaining a biocultural knowledge resource. Precisely because that knowledge is dispersed and siloed, the literature and potential resources cited here are not fully representative of what may already exist in either openly-accessible or institution-specific repositories.

Librarians serve populations representing diverse cultures and knowledge systems. Creating and maintaining the proposed repository would provide these consolidated and curated resources so that even the most vulnerable—individuals, families, entire communities—could maintain their biocultural heritage traditions while remaining in place, through adaptations or even in situations of relocation. The digital repository, housed in the cloud and following LOCKSS principles, would remain as a searchable source to guide all. This dynamic project would involve Libraries and collaborating memory institutions with global communities towards facilitated and ongoing respectful engagement with, and protection of, living heritage and the environment.

The Library and Information Sciences community can apply best practices for conceptual as well as concrete know-how about sustainable storage and sharing of materials such as digital or print records. Employing life-cycle planning and appropriate technologies and controls against theft, destruction, obsolescence, and damage, best practices would include:

- Ethical guidelines regarding cultural sensitivity, information sharing, and reciprocity
- Informed design of pathways and data structures to enable sharing across subject silos
- In-discipline and cross-disciplinary cultural and scientific subject expertise
- Accurate metadata and appropriate interoperability standards
- Well-managed supporting physical systems which can adapt to, and withstand, disaster

Librarians have historically taken on challenges, from organizing paper-based records to a move towards digital records—and most recently fully embracing virtual services during the COVID-19 pandemic. This call to the Library and Information Science Community recognizes the profession’s inventiveness and dedication to serving communities. The profession is capable of creating its own blueprints while addressing emerging challenges—using Library best practices, and integrating relevant knowledge systems, as guidelines.

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Appendix

These organizations, among others, are potential partners for policymaking, content knowledge, or for designing appropriate, best-practice-guided, infrastructures:

Potential partners to begin the process:

- [African Climate and Development Initiative \(ACDI\), University of Cape Town](#)
- [African World Heritage Fund](#)
- [Biodiversity Information System for Europe](#)
- [Biodiversity Library](#)
- [Blue Shield International](#)
- [C3S and the European Centre for Medium-Range Weather Forecasts \(ECMWF\)](#)
- [Cambridge University: Centre for Environment, Energy...Governance; Centre for Climate Science; Institute for Sustainability Leadership](#)
- [Center for Climate Change Impacts and Adaptation Scripps Institution of Oceanography, UC San Diego](#)
- [Center for Climatic Research, Nelson Institute, University of Wisconsin](#)
- [Center for Research Libraries: TRAC Metrics](#)
- [Climate ADAPT](#)
- [Climate and Traditional Knowledges Workgroup](#)
- [Climate Central](#)
- [Climate Heritage Network](#)
- [Climate Policy Nationally determined contributions \(NDCs\) Country case-studies](#)
- [Columbia University: Sabin Center for Climate Change Law ; The Earth Institute](#)
- [Convention on Biological Diversity](#)
- [Copernicus](#)
- [EDGI Environmental Data & Governance Initiative](#)
- [Environmental Data Initiative](#)
- [European Committee for Standardization](#)
- [European Open Science Cloud \(EOSC\)](#)
- [European Centre for Medium-Range Weather Forecasts](#)
- [Global Biodiversity Information Center](#)
- [GO FAIR Initiative](#)
- [Grantham Research Institute on Climate Change and the Environment, London School of Economics](#)
- [Haskell Indian Nations University](#)
- [ICOMOS](#)
- [IFLA: Disaster Reconstruction Programme; Cultural Heritage Programme Advisory Committee](#)
- [Institute for Tribal Environmental Professionals, Tribes and Climate Change](#)
- [IPCC](#)
- [LOCKSS](#)
- [Millennium Seed Bank](#)
- [Mukurtu CMS](#)
- [NASA Goddard Institute for Space Sciences](#)

- [New York Botanical Garden Humanities Institute](#)
- [North Carolina Institute for Climate Studies](#)
- [Open Context](#)
- [Red List of Threatened Species International](#): Union for Conservation of Nature and Natural Resources
- [Syracuse Univ. iSchool Information Security Management](#)
- [UNDP](#)
- [UNFCCC: United Nations Framework Convention on Climate Change, National Adaptation Plans](#)
- [Union of Concerned Scientists Climate Hot Map](#)
- University of Pennsylvania: [Data Refuge Project](#) ; [Penn Program in Environmental Humanities](#)
- [University of Washington Program on Climate Change](#)
- [Water Information System for Europe](#)
- [Williams Mystic](#)
- [Woods Hole Oceanographic Institution/MIT Climate Change](#)
- [World Meteorological Organization, Projects](#)
- [World Monuments Fund](#)
- [World Resources Institute](#)

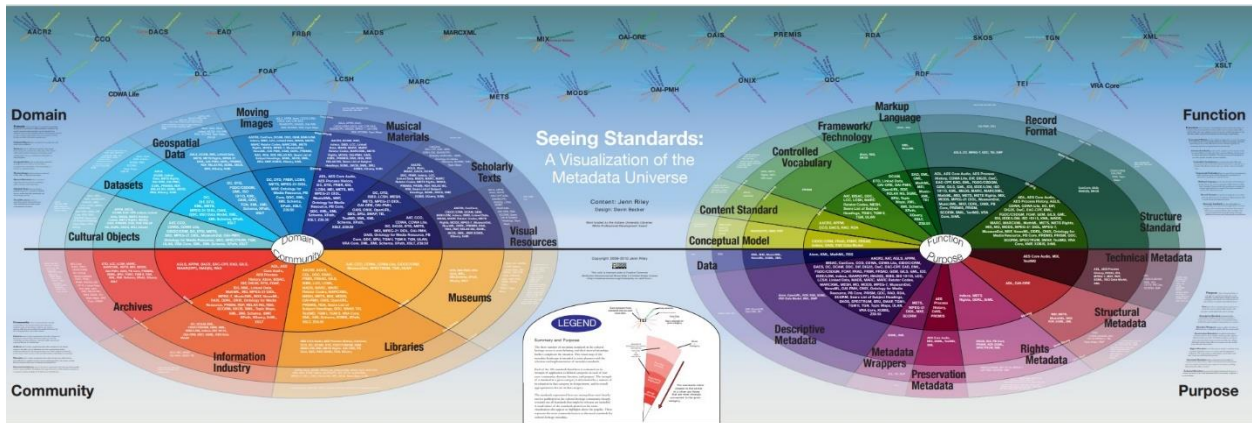


Figure 1. Seeing standards metadata map. Source: Courtesy of Riley and Becker, CC-BY-NC-SA-3.0 US



Plate 1. Cultural Burning [Courtesy of Country Fire Authority \(cfa.vic.gov.au\)](https://www.cfa.vic.gov.au) [The importance of cultural burning to CFA - CFA News and Media](#) National Indigenous Fire Workshop Dhungala 2019



Plate 2. Mangroves. Source: Author