Best Practices for Upholding Indigenous Data Sovereignty:

Insights and Recommendations for Funding Entities, Government Agencies, Philanthropic Institutions, and Researchers

Developed through an NPRB-funded partnership between the Aleut Community of St. Paul Island Ecosystem Conservation Office and Axiom Data Science

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Executive Summary

There is a clear need to describe and standardize the practices of scientific bodies and funding organizations that support Indigenous data sovereignty. At the core of this emerging paradigm is a mutual understanding of the historical inequities of colonial science and a recognition of the importance of improving ethics and ways of producing (and co-producing) knowledge. The data systems that evolve from this work are rooted in both interpersonal relationships and technological solutions, which must be understood as holistic and interconnected. Metadata, we assert, can serve as the bridge between the diverse qualitative and quantitative knowledge systems needed to properly understand environmental change. Long-term accountabilities, such as data labeling systems, can underwrite and contextualize emerging technical solutions. For example, the “Local Context” labels use metadata and novel database management practices to support transparency, equity, and scientific rigor. In all, achieving Indigenous data sovereignty is a collective task, requiring technical and legal expertise rooted in community values, science-based decision-making, and equitable partnerships.

Background

This document was written in a collaborative process between Axiom Data Science (Axiom) and the Indigenous Sentinels Network (ISN). Axiom Data Science is a cyberinfrastructure and data management business based in Anchorage, Alaska. The Indigenous Sentinels Network (ISN) is an Indigenous-led and community-driven Network coordinated by the Tribal Government of St. Paul Island. Functioning as an environmental monitoring Network, ISN provides a specialized technology database and comprehensive toolkits, strategically designed to enhance community-driven monitoring and data collection initiatives.

This practical contribution to data management science grew from a project titled *“Conceptualizing Indigenous-led observation and monitoring in the Bering Sea”* which was funded by the North Pacific Research Board (NPRB). The project began during a historic time for Tribes and Indigenous communities and their relationship with funding entities, government agencies, philanthropic institutions, and researchers (Kawerak et al., 2020, 2021). Indigenous communities have been increasingly calling for equitable participation, Indigenous leadership, and co-production methodologies to be applied to large- scale and coordinated environmental monitoring of the Arctic marine

environment (Raymond-Yakoubian and Daniel 2018, Huntington et al. 2019, Ellam Yua et al. 2022, Gleason et al. 2023). Additionally, Indigenous, traditional, and local knowledge (ITLK) has been increasingly recognized by Western institutions for its valuable contributions to ecology and climate science. However, there remain procedural and methodological gaps in understanding how ITLK or Indigenous-led stewardship efforts can be respectfully accommodated in environmental research and resource governance.

Tribal communities have deep and legitimate concerns about research and data pertaining to and/or derived from Indigenous and Traditional knowledge, including specific locations of subsistence harvest efforts, and believe such knowledge and data should be treated as their intellectual and cultural property (Carroll et al. 2019). Indigenous Data Sovereignty (IDS) is a crucial aspect of fostering a respectful relationship between Indigenous communities in Alaska and the broader funding and research groups. Upholding IDS becomes especially vital when enhancing databases and data sharing agreements to be inclusive, adaptive, and responsive to the real-time needs of local communities and Tribes grappling with food security issues or climate change impacts. By prioritizing IDS, entities ensure that data related to Indigenous Peoples, lands, and cultures is managed, controlled, and utilized in a manner that respects their Tribal Sovereignty.

To ensure equitable participation by Indigenous communities and leadership, and using co-production tools, the project that led to the drafting of this best practices guide aimed to explore how to implement Indigenous-led and community-driven monitoring programs in the northern Bering Sea that would address local priorities and needs while still scaling up in a coordinated large-scale monitoring framework.

Axiom was brought into the NPRB project as a key collaborator with ISN because of the long-term relationships Axiom has had with scientific research and monitoring groups in Alaska, including web-portal hosting for the Alaska Ocean Observing System (AOOS). Throughout the course of the project, ISN and Axiom have participated in a series of dialogues to identify and define opportunities for knowledge sharing on ISN's and Axiom's data management systems. These discussions occurred alongside and in parallel to dialogues ISN facilitated with Tribal leaders from the Northern and Central Bering Sea, who have come to compose an ISN advisory board called the Indigenous Sentinels Advisory Assembly (ISAA).

The dialogues between Axiom and ISN focused on creating technical recommendations for how to support and implement IDS for community-driven and Indigenous-led monitoring in the Northern Bering Sea region. These dialogues addressed key topics and needs expressed by community members participating in the ISAA.

The original questions that guided conversations between Axiom and ISN were formulated prior to the dialogues, and focused on improving data sovereignty practices and identifying challenges that Indigenous communities or tribal governments often face when collaborating on data collection, data sharing, or planning to implement environmental monitoring programs. These questions were:

- How can scientific research funders set themselves up to best support data requests and contributions from Indigenous communities and interactions with Indigenous-owned data and knowledge?
- What is the current relationship between funders and existing Indigenous observing platforms/networks/data portals?
- How do funders currently support data sovereignty practices? What, if anything, is planned for future support?
- How does Axiom currently support data sovereignty practices? What, if anything, is planned future support?
- Can we conduct a review of both funders and Axiom data sharing agreements and data use procedures? What is in place, what is possible, and finally, what kind of future arrangements would need to be explored?

Reflections on the questions above led to several important recommendations on how to better support IDS practices at the funder level for future research projects taking place in Alaska. After identifying recommendations, we sought to identify next steps to enact identified best practices at all levels. CARE (Collective benefit, Authority to control, Responsibility, and Ethics) and FAIR (Findability, Accessibility, Interoperability, and Reuse of digital assets) principle frameworks, as well as the innovative work on data labeling by the Local Context organization, were used to start these conversations

and generate next steps.[12] We share the recommendations and elaborate on these frameworks and tools below.

Recommendations

Considering the emerging confluence of interests in environmental health, knowledge, and management between Indigenous communities and scientific practitioners, the following best practices envision a scenario where equity, collaboration, and decolonial ethics guide programmatic research from inception to development, execution to dissemination and beyond. This scenario adheres to and exemplifies co-production of knowledge, as described in Ellam Yua et al. (2020).[3]

The paradigm shift that is necessary to address the "wicked problems" of the 21st century will not happen organically. It necessitates active involvement and equitable engagement of those directly affected by adverse impacts, such as climate change and food insecurity. Genuine progress will only occur when communities that are impacted by climate change collaborate seamlessly with well-resourced institutions that assert care and change-oriented leadership in addressing these critical issues. The recommendations outlined in this document rest on a recognition of the known harms of unilateral management and exclusionary environmental decision-making and insist on bridging governmental entities, grassroots and community-centered initiatives, and scientific institutions.

A foundational tenet for scientists, managers, and funders to adopt as a best practice is to **acknowledge and actively support the communities independently engaged in data collection as the primary owners of the data**. Decisions around how and what data to share are for communities to determine based on community-identified priorities, needs, concerns and questions, and not those of the funders or research partners receiving the funding.

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[1] Anderson, J. & Christen, K. 'Chuck a copyright on it': Dilemmas of digital return and the possibilities for Traditional Knowledge licenses and labels. Museum Anthropology Review. 7, 105–26 (2013).
[2] Halperin, J. R. Is it possible to decolonize the Commons? An interview with Jane Anderson of Local Contexts. Creative Commons https://creativecommons.org/2019/01/30/jane-anderson/ (2019)
[3] Ellam Yua, J. Raymond-Yakoubian, R. Aluaq Daniel. and C. Behe. 2022. A framework for co-production of knowledge in the context of Arctic research. Ecology and Society 27(1):34. https://doi.org/10.5751/ES-12960-270134

Funders and supporters or collaborators (e.g., Axiom) can assume the role of advisors on the options and opportunities for data management, but must respect community and/or Tribal ownership of data, Tribal decision-making processes, and timelines regarding data sharing. The following sections detail recommendations for funders and their collaborators that could offer organizational capacity and technical solutions to better support the utilization and distribution of data collected by Indigenous-led and community-driven monitoring programs.

Enhancing responsiveness (response-ability[4]) and organizational capacity building for funders

Funders should:

- Understand that foundational funding strategies for community-driven monitoring and research engagement must align with the legal, political, and historical aspects of Tribal Sovereignty. This involves acknowledging Indigenous Peoples and their representative institutions as equal in stature, capability, and rights when compared to both state and federal governments.
- Build internal data governance protocols that are responsive to Indigenous communities' evolving needs, capabilities, and interests in the areas of data collection and analysis, natural resource management, and environmental stewardship.
    - These protocols should include data labeling, handling, and storage requirements, with named data stewards and data management personnel with these tasks related to their role.
    - Defining clear, jointly-worded visions for the final product(s) to be shared (e.g., aggregated area mapping versus wildlife sightings by time and reporter)
    - Programs such as SIKU or ISN have the sharing protocols in place and funders can look to these existing examples for guidance.
- Co-design appropriate data sharing and data use agreements with Indigenous partners that accommodate realities of partner communities' infrastructure.

[4] Haraway, Donna. (2012). Response-Ability and Sticking With Paper Borders. https://movingpedagogies.blog.torontomu.ca/2019/12/22/response-ability-and-sticking-with-paper-borders/#:~:text=Response%2Dability%2C%20for%20Haraway%2C,are%20extensive%20and%20permanently%20unfinished

    - The agreement(s) should be explicit, timebound, frequently reviewed, legally enforceable and make clear how data can be shared or published. These agreements should also provide details for ongoing communication about the stewardship of the data, any mutually agreed upon definitions or terms used, but not be excessively prescriptive.
    - Many communities, due to economic and geographic circumstances, are limited in their access to internet infrastructure or cellular data. Additionally, there may be older or informally administered computers with minimal storage capacity. Digital survey creation and other monitoring programs that require internet for scientific data collection sould account for this (i.e., platforms for Apple and Android, like the Indigenous Sentinels Network ensure widespread access through mobile, offline functionality).
    - Build long-term partnerships with existing organizations using/ operating/ supporting Indigenous-owned data sharing portals.
    - Support grassroots and community-centered efforts to enhance capacity building in the areas of environmental monitoring and data gathering.
    - Develop Memorandums of Understanding and benefit sharing arrangements that prioritize reliable, long-term support for existing Indigenous-owned data sharing portals/networks.
- Build and maintain public-facing, jargon-minimal documentation and explanatory materials that promote transparency of funders' Indigenous data use practices, values, and protocols with methods for incorporating feedback and ongoing enhancement from partners.
    - A client list should be included, as well as 'case-study' profiles of work done that demonstrate how Indigenous data sovereignty will be managed, interpreted, upheld and respected.
- Establish strong standards for process documentation, metadata, and labeling that ensure ownership, provenance, acceptable uses, and relationships to other data are explicit and in accordance with the data owner's priorities and concerns.

Enhancing responsiveness and organizational capacity for Axiom

Axiom should:

- Maintain an open-access collection of examples of appropriate data sharing and data use agreements, ideally co-designed with Indigenous partners.

    - Project-specific agreements, when signed, should be explicit and timebound, frequently reviewed, legally enforceable, make clear how data can be shared or published, and provide details for ongoing communication about the stewardship of the data.
- Axiom's data sharing and engineering (i.e., data wrangling) process should be detailed in public facing documentation to promote trust building and transparency, with feedback opportunities from partners and users.
    - A client list that are publicly available should be included, as well as 'case-study' profiles of work done that demonstrates how data sovereignty will be respected.
    - Disclosure of potential conflicts of interest relating to existing clients and Indigenous-owned data should take place at the outset of partnership development.
- Establish strong standards for metadata and labeling that ensure ownership, provenance, acceptable uses, and relationships to other data are explicit and in accordance with the data owner's priorities and concerns.

Technical strategies and enhancements for Axiom

Axiom should:

- Ensure options for importing data into the Axiom system from community-driven and Indigenous-led servers and databases are well documented and contain details available for help with partners crafting data sharing agreements.
    - For instance, will there be data obscuring or aggregation methods available? Will geospatial or mathematical visualizations be a requirement or option for all data shared from partners? Can individual communities request to embargo particular data? If so, what does that process look like?
- Generate granular and nuanced permissions structures for any technical system designed with Indigenous and community data in mind, with full administrative privileges granted to the community partners.
- Prioritize back-end data harmonization and governance protocols, which are critical for implementation of granular access, protection of sensitive data, machine-to-machine transfer of data and metadata, and transparency of data systems that house sovereign data.
    - Enabling embargo, terms agreements as browser pop-up windows, and disabling download or scrape are current functions that can be

implemented at a wider scope based on data provider input. This requires back end data design and harmonization work that would enable faceting/filtering data by select metadata elements as a requirement to administer the database.

- Assess and audit abilities for transparency and quality assurance checks from data providers
- Implementation of a labeling system that provides machine and human readable notifications about the ownership and sharing state of the data
    - Local Contexts labels are the current best resource for this: https://localcontexts.org/support/getting-started-on-the-hub/
- Developing systems that allow for data removal, both in forms that would provide reproducible data products and for complete erasure of data products that Axiom no longer has permissions to display, would be necessary.
    - This requires a transparent procedure from Axiom that can be detailed in steps for the data provider and partnering organizations.

Next Steps

Together, ISN and Axiom have provided a series of recommendations with the intent that funding agencies can take tangible next steps to improve internal and external processes regarding Indigenous data. Our recommendations are best divided into three actionable next steps:

1. Plan for updating internal structures.
2. Create and document processes for data sharing.
3. Begin to build partnerships for achieving the recommendations.

Funders with existing internal data governance should task their data/information managers/stewards with building a plan in the style of information management and documentation. Funders without the existing internal data governance should determine a position(s) or assign a rotating working group with these tasks that implements internal data governance oversight. This group should set time-bound goals for approaching partner organizations, identifying priority outreach and technical improvements, and identifying data types that are appropriate for data creation and sharing goals.

Any internal structure and plan for improved data sovereignty practices can become a starting place for public facing documentation that provides the intent, vision and feedback options to community partners that will be an on-going best practice.

There are guides in the research and data landscape for data sovereignty best practices, such as those from the Exchange for Local Observations and Knowledge of the Arctic (ELOKA), International Arctic Science Committee (IASC) and the Arctic Data Center. Funders should adapt these existing guides and governance strategies to their mission and vision for partnering with Indigenous data providers. Once this is complete, the discrete tasks and system enhancements required of the cyberinfrastructure can be scoped and implemented with clear goals and co-production methods that allow for buildup of responsive data systems to continually meet Indigenous partners' needs.

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Resources

- https://eloka-arctic.org/
- https://localcontexts.org/labels/traditional-knowledge-labels/
- https://databack.animikii.com/
- https://www.sentinelsnetwork.org/
- https://usindigenousdatanetwork.org/
- https://arcticdata.io/data-ethics/
- https://www.nature.com/articles/s41597-021-00892-0
- https://respectfulresearch.com/
- https://www.open.landscape.network/
- https://cdnsciencepub.com/doi/10.1139/as-2020-0023
- https://www.uaf.edu/irb/indigenous/
- https://indigenousdatatoolkit.ca/data-governance/data-sharing/
- https://www.go-fair.org/fair-principles/
- https://www.gida-global.org/care

Appendix A: Data Sharing Agreement Template from Local Contexts

This Indigenous Data Sovereignty Agreement (the IDSA) is between the Local Contexts HUB (the HUB) and Users.
The purpose of the IDSA is to support Indigenous Data Sovereignty and enhance Indigenous control of Indigenous data.
1. Interpretation:
In this agreement, unless the context otherwise requires, Agreement means this document.

Data includes but is not limited to records, files or other evidence, irrespective of their content or form (e.g. in print, digital, recordings, physical or other forms) that comprise research observations, findings or outcomes, including primary materials and analyzed data, transcriptions, translations, photographs, recordings collected or produced. Data can also take the form of characters such as letters, numbers, punctuation marks, mathematical operators, and control characters and includes factual information in a form that can be input to, created by, processed by, stored in, and output by a computer.

HUB (the HUB) is the Local Contexts Hub

Indigenous Peoples are distinct social and cultural groups that share collective ancestral ties to the lands and natural resources where they live, occupy or from which they have been displaced. The land and natural resources to which they relate are inextricably linked to Indigenous Peoples identities, cultures, livelihoods, as well as physical and spiritual well-being. Indigenous Peoples are inheritors and practitioners of unique cultures and have complex and embedded relationships with the environment. Indigenous Peoples have retained social, cultural, economic and political characteristics that are distinct from those of the dominant societies in which they live. Despite their cultural differences, Indigenous Peoples from around the world share common problems related to the protection of their rights and enactment of their responsibilities as distinct peoples.

Indigenous Peoples Data includes Indigenous or traditional knowledge, data of significance to Indigenous Peoples, as well as other forms of administrative, cultural, biological and/or scientific data that relates to Indigenous Peoples and their traditional and present day territories and waters. Indigenous Peoples data may or may not have been produced through consultation and engagement with Indigenous Peoples as the primary legal and cultural owners and custodians.

Indigenous Knowledge/Traditional Knowledge is knowledge, know-how, skills and practices that are developed, sustained and passed on from generation to generation within a community, often formed as part of its cultural or spiritual identity. In a general sense, traditional knowledge embraces the content of knowledge itself as well as traditional cultural practices including distinctive signs and symbols associated with traditional knowledge. Traditional knowledge can be found in a wide variety of contexts, including agricultural, scientific, technical, ecological and medicinal knowledge as well as biodiversity related knowledge. Traditional knowledge is cared for and transmitted by a community of knowledge holders who act as custodians of the knowledge.

Indigenous Data Sovereignty (IDSov) expresses a legitimate right of Indigenous Peoples to control the access, the collection, ownership, application and governance of their own data or knowledge and/or information that derives from unique cultural histories, expressions, practices, and contexts. IDSov promotes a paradigm where Indigenous Peoples can directly create, participate, govern and share benefits that arise from access and use of Indigenous Peoples data.

Intellectual Property includes all original materials produced in the course of a research project including but not limited to written materials, transcriptions, translations, photographs, recordings collected or produced by the researcher and/or funding institution pursuant to this Agreement. It further includes all copyright including future copyright, trademarks, designs, patents registered and unregistered, inventions, trade secrets and know-how, new plant varieties and registered plant breeders rights, semiconductor or circuit layouts and all other intellectual property as defined in the convention of 1967 establishing the World Intellectual Property Organisation

Intellectual Property Rights means any and all;

(a) copyrights and other rights associated with works of authorship throughout the world, including neighboring rights, moral rights, and mask works.

(b) For the avoidance of doubt, all content on the Local Contexts website is licensed generally under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. Local Contexts hold copyright in the Labels and Notice icons. Local Contexts grants a perpetual non-exclusive license for the use of the Labels by Indigenous communities. Indigenous community users of the Hub hold and retain copyright in their own Label text.

Local Contexts includes the Local Contexts website and the Local Contexts Hub at https://localcontexts.org/

Projects and/or Activities include, but are not limited to, research, publications, data collection, implementation, recording motion, visual sound whether oral, written, via multimedia or other mechanical devices discovered or yet to be discovered

Research includes, but is not exclusive to, information and/or data collected for a particular purpose, work conducted through social science, science and humanities strands, including, not limited to, ethnology, history, linguistic, biogenetic, medical, behavioral, ethnobotany, agronomy, ecology, anthropology, archaeology, and microbiology.

2. Purpose
2.1 Indigenous Data Sovereignty promotes Indigenous control and governance of Indigenous data. This IDSA describes the rights and responsibilities of the Local Contexts Hub and user communities, researchers, and/or institutions. This pertains to the data collected, stored, and shared on the Local Contexts Hub.

2.2 Indigenous Peoples retain ownership, control and governance over their unique suite of customized Traditional Knowledge (TK) and Biocultural (BC) Labels developed on the Hub. This includes exclusive decision-making and control over how and with whom the unique community customized suite of Labels is shared with.

2.4 A community customized suite of Labels is shared with institutions and individual researchers under an exclusive license for use in institutional content management systems, information infrastructures, catalog records, databases, data repositories and

publications where appropriate. Other uses will need to be approved by each community as needed.

3. Responsibilities
3.1. The role of the Local Contexts

3.1.1. The primary objectives of Local Contexts is to enhance and legitimize locally based decision-making and Indigenous governance frameworks for determining ownership, access, and culturally appropriate conditions for sharing historical, contemporary and future collections of cultural and biological heritage and Indigenous data. Local Contexts is focused on increasing Indigenous involvement in data governance through the integration of Indigenous values into data systems. Local Contexts offers digital strategies for Indigenous communities, cultural institutions and researchers through the TK (Traditional Knowledge) & BC (Biocultural) Labels and Notices. Together they function as a practical mechanism to advance aspirations for Indigenous data sovereignty and Indigenous innovation.

3.2. Responsibilities of the Local Contexts Hub

3.2.1. The responsibility of the Hub is to act as a portal that allows communities to adapt the TK and BC Labels to contextual needs and to be shared and implemented nationally and internationally. The Local Context Hub also allows researchers and institutions to generate Notices that disclose Indigenous rights and interests, and that function as a precursor to the implementation of the community customized Labels when appropriate.

3.2.2. To facilitate connection between Indigenous communities, institutions and data repositories and researchers around the world.

3.2.3 To provide human and machine readable Labels and Notices that support the practice of disclosing proper provenance of research and data derived from Indigenous peoples, knowledge, places, lands and waters.

3.2.4. The Hub seeks to promote the highest standards in the management of Indigenous data as fundamental to Indigenous sovereignty and to support both high quality research and academic integrity.

3.2.5. The Hub recognises the inherent sovereignty of Indigenous peoples over data about them or collected from them, and which pertain to indigenous peoples' knowledge systems, customs and territories.

3.2.6. The Hub is designed to provide practical mechanisms that support the expression of Indigenous rights, interests and responsibilities in Indigenous knowledge, Indigenous data, and intellectual and cultural property.

3.2.7. The Hub is not an authorizing or policing entity, and it is not the responsibility of the Hub to act in this manner.