

Are Tribal Water-Climate-Environment Nexus Databases FAIR and CARE?

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About Me

I am a Postdoctoral Research Associate at the Nelson Institute for Environmental Studies, University of Wisconsin-Madison. I started my position in July 2022, working in Dr. Grace Bulltail's research group. We study water and natural resources management and environmental justice for Indigenous communities.

I am delighted to contribute to the program "Sharing UW-Madison Postdoctoral Scholarly Research with Non-Science Audiences," sponsored by the Wisconsin Initiative on Science Literacy (WISL). This program, made possible by the dedication of the WISL staff, is instrumental in fostering connections between scientific exploration and a wider audience. My journey as a postdoctoral fellow researching water resources engineering and management is about finding practical solutions to adapt to and mitigate the impacts of global warming and anthropogenic (human-based) climate change. I firmly believe this will not happen without sharing our research and findings with our community and the public.

Background

I am sure you are familiar with the words "fair" and "care." For many, fair means justice, and care means compassion. But these words have other meanings to data scientists and data sovereignty researchers. I want to tell my research story about the guiding principles that make databases FAIR and CARE.

The story of my research started a year ago when I tried to find some technical and engineering publications on U.S. tribal water resources management. My challenge was that the more I searched, the less I found. Then I thought about why there are insufficient research publications or engineering case studies in this field. After digging into it, and talking to other researchers at scientific events and conferences, I found out why. Yes! There is a lack of

Indigenous data, along with inefficient data system management, for tribal water resources datasets. The desired datasets here refer to data collections related to water bodies and natural resources that are available and accessible on the Internet. This includes hydrological datasets, weather and climate timeseries (i.e., data over time), and environmental monitoring data. It may be hard to believe that in the information era, enough data is not accessible for doing a simple scientific project. More problematically, this lack of data and the lack of technical publications has hindered scientists' ability to face certain environmental challenges. On a larger scale, it has contributed to the environmental injustice facing Native communities, including limited access to clean and adequate water supplies in some tribes (Chief et al., 2016).

The lack of technical publications, however, motivated me to research more on tribal water-climate-environment (WCE) databases. By definition, Indigenous data include data, information, and knowledge, in any format, that impact Indigenous peoples, nations, and communities at the collective and individual levels (Carroll et al., 2013). I started to find database platforms on the Internet covering a broad range of (1) water-related data (e.g., water quality and quantity), (2) weather and climate timeseries (e.g., temperature and precipitation), and (3) environmental and ecological information (e.g., land use and biodiversity on the U.S. tribal lands). The questions I had in mind were: Do any collected Indigenous WCE databases exist at all? Are they buried in the many data collections but not well-documented and well-organized and, as a result, hard to access? How can I find them and access them on the Internet? Are they reusable through user-friendly online platforms?

In my first couple of search attempts, I could not find the exact databases or platforms that I was looking for. As I searched more, I figured out there are a few Indigenous digital platforms that contain limited WCE nexus data for research in Earth systems. By this I mean data that is related to the interconnected components of water, climate, and environment in the complex interactive networks of different parts of our Earth, including water, soil, air, living organisms, and human beings.

This lack of data made me passionate about redirecting my work to Indigenous data sovereignty and governance topics. Based on the United Nations declaration on the rights of Indigenous peoples, Indigenous data sovereignty supports the rights of Indigenous peoples to control information about their communities, lands, and resources (Carroll et al., 2021). Indigenous data governance helps support Indigenous values, cultures, equity, and interests to address

historical challenges faced by underrepresented groups (Carroll et al., 2021; Williamson et al., 2022).

In the context of my research, I am investigating the following questions:

- (1) Why are tribal WCE nexus data collections limited? and
- (2) How can we, as Earth systems researchers, overcome this barrier for the benefit of science?

I figured out that the most solid and holistic answer to question (1) is that Indigenous WCE nexus databases are not FAIR. The FAIR guiding principles, developed by Wilkinson et al. (2016), are a general framework that primarily emphasizes making scientific data discoverable and reusable for the benefit of science and researchers. In particular, they refer to making data Findable, Accessible, Interoperable (compatible for use in different systems and devices), and Reusable (See Figure 1).

On the other hand, another set of principles called CARE has been developed by Carroll et al. (2021) to encourage the Indigenous community's participation in their own data governance to benefit their communities, values, and interests. The CARE principles support Collective benefits, Authority to control, Responsibility, and Ethics in using Indigenous data to promote data sovereignty and self-determination for Native communities. By respecting and considering the CARE data principles in Earth systems science, the researchers can cultivate mutual trust and contribute to overcoming the lack of data barrier mentioned in question (2) (See Figure 1).

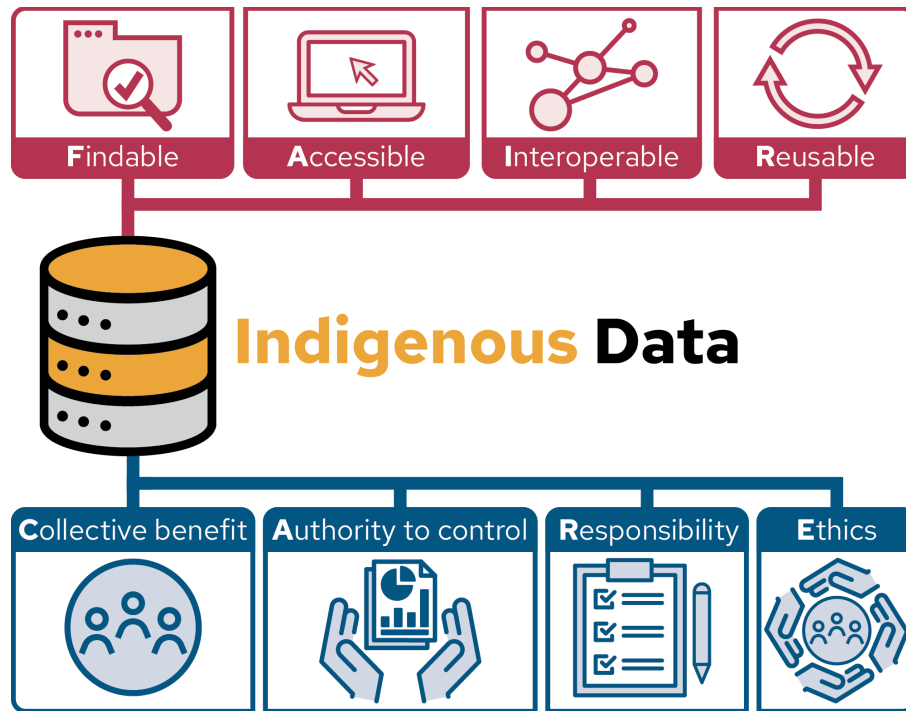


Figure 1. FAIR and CARE Data Principles

My Research

To understand the importance of my research, we need to understand the importance of the Indigenous WCE nexus data in environmental studies from (1) Indigenous and (2) non-Indigenous viewpoints. From the Indigenous perspective, the Indigenous data are required to improve Indigenous peoples' self-determination practices and welfare. Enhanced data and a more efficient data management system will advance Earth science research, while also strengthening Indigenous communities' sovereignty, environmental justice, and sustainability.

Having reliable and accessible data sources is vital to ensure that the current land and natural resources management systems are consistent with Native communities' values, and a necessary key for advancing technology for innovative management with a focus on sustainability (see Figure 2). A valid database helps scientists evaluate water quality and quantity indicators, test the water and natural resources management, assess environmental monitoring, analyze risk related to climate hazards, and recognize vulnerability factors. A valid database will also eventually help scientists make informed decisions and policies to improve Indigenous communities' well-being and decrease environmental disparities.

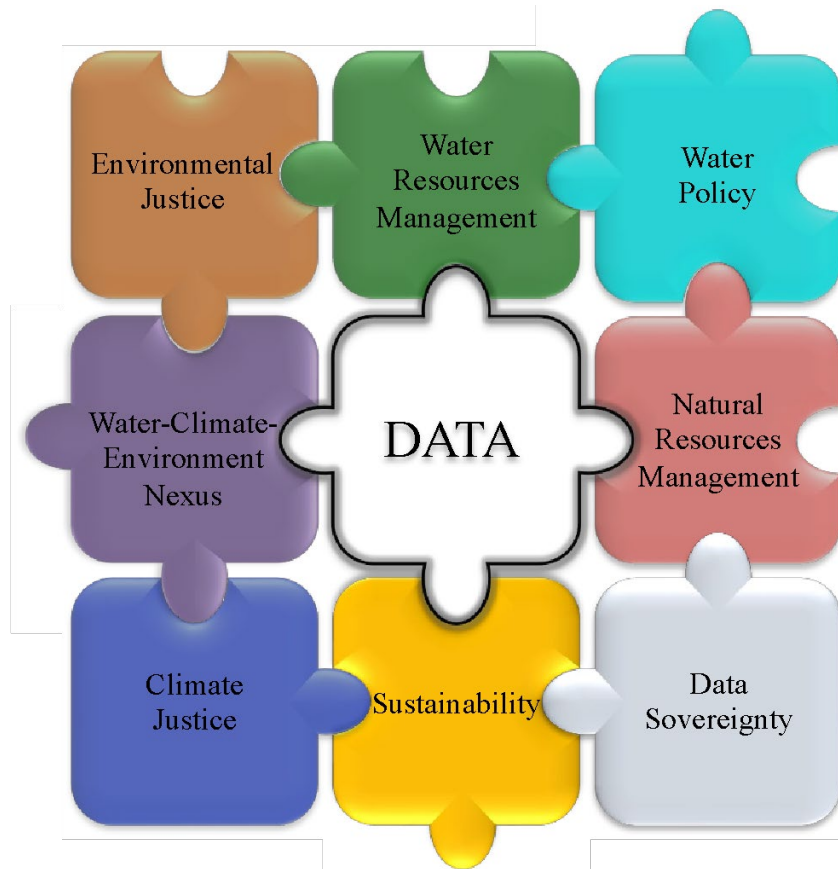


Figure 2. Data, in conjunction with efficient data management systems, is critical for Indigenous communities to effectively conserve and restore natural resources, develop and make policy and regulations, promote environmental and climate justice, and exercise data sovereignty, focusing on their territories’ environmental, social, and economic sustainability.

Furthermore, from the non-Indigenous perspective, it is worth understanding Indigenous natural resources conservation practices. According to the book "All We Can Save," Indigenous communities, which comprise a small portion of the global population (i.e., 5% of the global population), are contributing to a large, mind-blowing portion of global biodiversity (i.e., 80% of the worldwide biodiversity). Indigenous nations are also the smallest greenhouse gas generators and the largest carbon sink communities. It is valuable for non-Indigenous communities to understand Indigenous ecological knowledge, practices, and wisdom, and learn, adapt, and apply that knowledge to mitigate and adapt to global anthropogenic climate change impacts. All these procedures require valid and accessible data ecosystems that guarantee the Indigenous community's self-determination and values.

While FAIR and CARE are generic concepts for any database, in my research, I am working on extending their guiding principles to tribal WCE nexus databases. I am also working on developing access protocols to facilitate water resources scientists' access to the desired data, so that they may utilize these data for the benefit of Indigenous communities. I have found limited Indigenous WCE database platforms for public and researcher access. Most of these platforms do not support long-term datasets (that is, data that cover a long time of records), do not publish a wide range of different variables, or release informative, detailed explanations of the data. In many cases, the online platforms could be embedded in much more user-friendly systems. Examples of more user-friendly systems include: providing a search toolbar to find the desired data using some appropriate keywords, updating the data records, visualizing the data through interactive map tools, and employing a consistent data management tool for different data types. Earth systems researchers need data on spatial and temporal scales in order to conduct long and short-term geospatial (location-based) analyses, generate maps of data measurements for monitoring goals, and make real-time sustainable and climate-resilient decisions.

How to be FAIR and CARE ...

According to Carroll et al. (2021), Indigenous databases are required to be simultaneously as open as possible and as protected as necessary. While the FAIR principles encourage data availability and discoverability for the benefit of research and science, the CARE principles support data governance rights and beneficial data applications for Native communities.

In my research, I follow the FAIR guiding principles to evaluate the already limited available U.S. Indigenous WCE nexus databases. I also recommend a specified FAIRification framework to enhance the databases' accessibility and reusability by other researchers. In addition, I assess the possible opportunities for and challenges to use of CARE principles in the Indigenous WCE nexus data applications in water resources engineering. These applications can benefit Native communities and help us overcome many of the environmental issues and disparities on tribal lands (Sarzaeim and Bulltail, 2023).

Summary

Both FAIR and CARE principles are relatively new frameworks promoting data sharing and sovereignty. I believe that articulating the FAIR and CARE principles in the context of the

U.S. tribal WCE nexus databases is the first step to drawing environmental scientists' attention to minorities' rights in their own data sovereignty and governance, and encouraging the research community to enrich the scientific findings on reservation lands.

In this short article, I intended to show the big picture of the critical role of WCE nexus data in environmental justice for minority communities and how the lack of data could limit research advancement. Also, I wanted to familiarize the public with FAIR and CARE principles, and how they can enhance research outcomes for the benefit of minorities.

Then, the next time you encounter Indigenous data or information, consider whether it is FAIR and how it can be aligned with CARE.

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