Community Mapping for Indigenous Stewardship of Wild Salmon

Guidebook

2024

Table
of
Contents

Introduction

Who is this guidebook for?

This guide was created for Indigenous organizations and communities who are interested in using community mapping as a tool for salmon habitat monitoring and ecosystem stewardship. It provides a generalized methodology which can be adapted to suit the specific goals and needs of different users.

Background

This guide was funded by the BC Salmon Restoration and Innovation Fund as part of a larger project to enhance the capacity of First Nations to monitor and manage salmon habitat in their territories. The project is a partnership of the First Nations Fisheries Legacy Fund, Skeena Fisheries Commission, Okanagan Nation Alliance, and the University of Victoria Map Shop. The goal of the project is to integrate technologies including drones and geographic information systems (GIS) with community knowledge of salmon and salmon habitat via community mapping to create a holistic understanding of the health and restoration of salmon habitat in BC and beyond.

While some salmon habitat monitoring frameworks exist, there are few that explicitly center community knowledge and cultural values into the monitoring process. Given the importance of salmon to Indigenous communities and cultures, this guide provides a helpful roadmap for facilitating a community mapping process for salmon habitat stewardship.

Importance of Indigenous knowledge in salmon stewardship

Indigenous peoples and cultures in the Pacific Northwest are deeply intertwined with Pacific salmon. As both a cultural and ecological keystone species, salmon are critical to the survival of ecosystems, people, and cultures. For millennia, Indigenous stewardship practices have helped to sustain abundant salmon populations through sustainable harvest practices, population monitoring, habitat improvement, and stock enhancement. These practices were violently disrupted by colonization, which precipitated the collapse of many of the salmon runs in the Pacific Northwest. Despite this, many communities have retained their knowledge of salmon stewardship and have continued to practice or are in the process of reviving traditional stewardship practices. As salmon populations continue to decline in the face of multiple threats, Indigenous cultural knowledge is key to conserving and restoring salmon and their ecosystems on the coast.

"Salmon filets drying." By Brian.
[CC-BY-2.0 (https://creativecommons.org/licenses/by/2.0/)], via Flickr.

Indigenous peoples have long-standing relationships with the land, water and wildlife and have developed diverse forms of knowledge, technologies, and practices for stewarding the natural environment. In addition to intergenerational cultural knowledge held by First Nations and other Indigenous communities, individual community members who spend time out on the land and water have a wealth of experience obtained through continuous observation of environmental conditions. In this way, community members' knowledge can provide information about salmon and salmon habitat that western science practices lack. This includes information such as species presence, run timing and size, habitat condition, areas where mortality has been observed, among many others. Community mapping can be an important and useful tool to better understand these dynamics, and to identify areas that require protection and restoration efforts.

Counter-mapping and Indigenous mapping

Maps have historically been used by colonial governments to assert territorial rights, facilitate extractive industries, and dispossess Indigenous communities from their lands. Increasingly however, Indigenous communities around the world are reclaiming the mapping process to achieve their own goals – often referred to as counter-mapping. **Counter-mapping** allows for the representation of spaces and places by people and groups that have not traditionally been in control of the mapmaking process. It can be used to assert rights to traditional territories in colonial legal processes, to tell stories of places and represent community histories, to document community assets, or to highlight issues and areas of concern within communities in order to help find solutions. Counter-mapping can adopt and repurpose technologies typically used in colonial mapping processes, such as GIS or cartesian paper maps, or it can involve a radical re-envisioning of what a map can be – incorporating oral histories, community art, or any number of creative techniques. The unifying feature of counter-mapping is that communities and groups that have been historically excluded from the mapping process are in control.

Indigenous mapping refers to the process of creating maps that reflect Indigenous knowledges, values, and perspectives of the land and waters. The process is rooted in the recognition that Indigenous peoples have unique, localized knowledge and practices which contribute to sustainable stewardship of wildlife and their habitats. Indigenous mapping can take many forms and is often used to identify areas that are important for cultural, ecological, or economic reasons. Regardless of what format it might take, Indigenous mapping is an effective tool for supporting self-determination, cultural revitalization, and environmental stewardship.

What is Community Mapping?

The process of community mapping can take many forms depending on community goals, technology used, and the area of study, but essentially community mapping is a straightforward concept; **community members work together to create maps using the knowledge, skills, values, and stories held in communities**. This is a simple but powerful concept that is as much about the process as it is about the result. Coming together to create maps gives community members an opportunity to connect, share stories, have their voices and values heard, and work to create change in their communities.

Community-based Participatory Research

Community mapping is one of many methods used in **community-based participatory research (CBPR)** – a collective approach to research that is rooted in equal partnerships between researchers and communities. CBPR involves conducting research with, rather than on communities, and is guided by a set of principles, including relationality, reciprocity, trust, transparency, and mutual co-learning (Figure 1).

Researchers might be members of the communities themselves, or from external organizations, the **key defining feature is that the communities themselves are guiding the research** process. CBPR is an action-oriented and applied approach, with a goal of making change in the communities where the research is taking place. The explicit action and participatory focus differentiates CBPR from other forms of research.
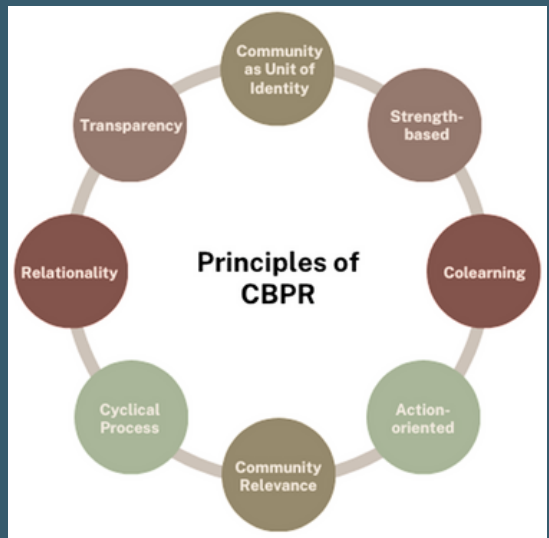

Figure 1. Principles of community-based participatory research. Adapted from Israel et al, 1998 .
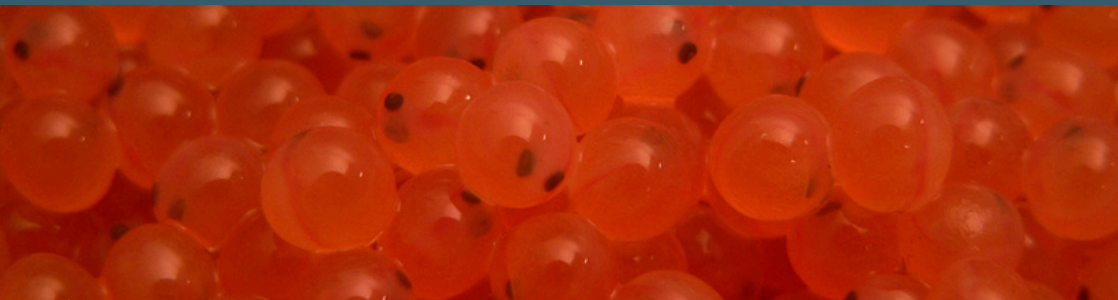
Indigenous Research Methodologies

Indigenous research methodologies (IRMs) are approaches that are informed by Indigenous worldviews and knowledge systems. These methodologies prioritize Indigenous ways of knowing and being and center Indigenous voices and lived experiences in knowledge creation and dissemination processes. There are several key principles and values that underpin Indigenous research, including relational accountability, trust, transparency and reciprocity. Acknowledging and addressing the historical and ongoing impacts of colonization on Indigenous peoples, and working to promote decolonization through research processes are central to this work.

IRMs are as diverse as Indigenous peoples and knowledge systems, and will vary depending on specific cultural and historical contexts. These often include a focus on relationships and may involve the use of Indigenous languages, storytelling and other cultural practices in the research process.

What constitutes an IRM is entirely defined by the community who is doing the research. Examples of IRMs include integrating ceremonial practices into the research process (e.g., tobacco ties), the use of storytelling, arts-based methods , and timing research to coincide with harvesting practices and seasonal cycles.

The beautiful illustration in Figure 2 comes from the *Maatookiiying gaa-miinigoowiziying (Sharing Our Gifts)* project, and outlines seven guiding principles of Indigenous research.
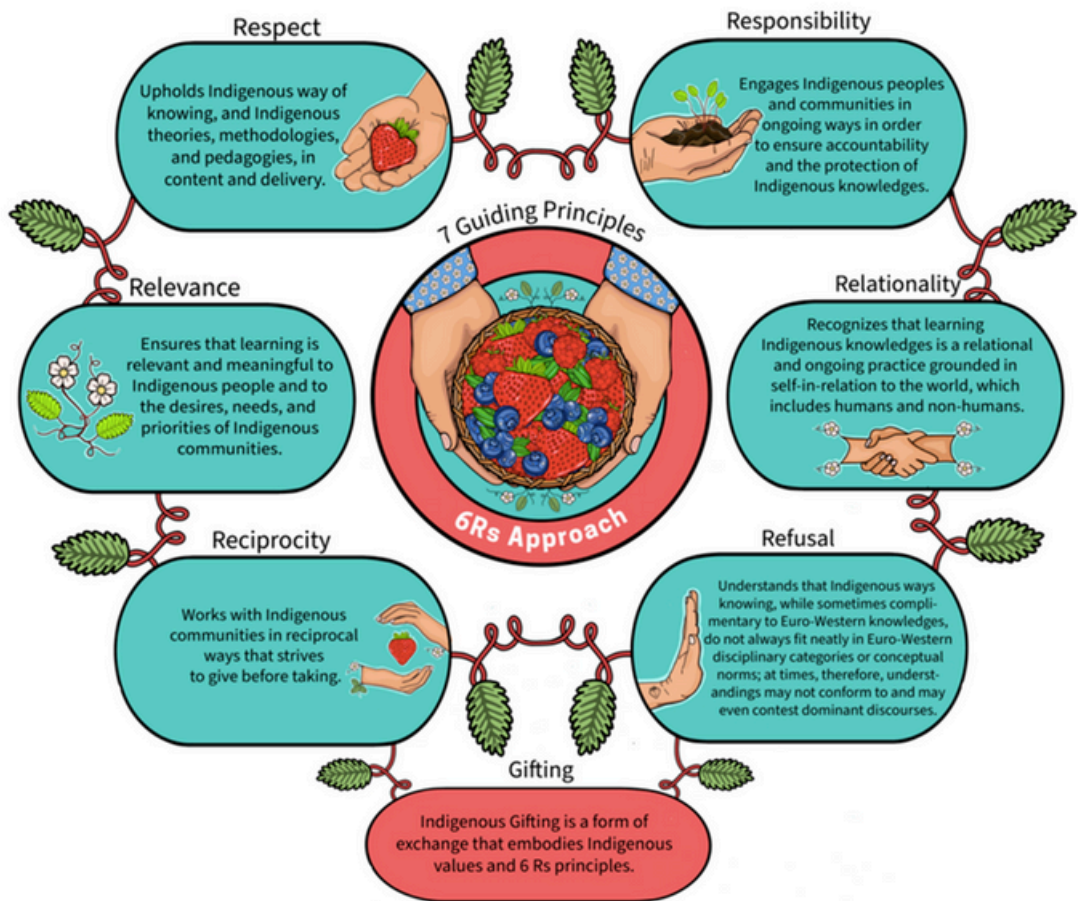
Figure 2. Guiding principles of Indigenous research (Brunette-Debassige, 2021)1

1 Brunette-Debassige, C. (2021). Maatookiiying gaa-miinigoowiziying (Sharing Our Gifts). Indigenous Learning Space. https://indigenouslearningspace.uwo.ca/Learning_Unlearning/learning/indigenous_learning_bundles.html

Community Mapping Methods

There are several tools that can be used in the community mapping process, from those that require basic materials which can be sourced from the local environment, to web-based methods that weave video and audio files, and everything in between. The following list provides some examples of commonly used tools, but is by no means an exhaustive list. These tools can also be used in combination at different stages of the project. A comparison of some different mapping platforms and methods can be found in Appendix C.

Mental Mapping

Mental mapping invites participants to draw maps from their own perception and interaction with a particular place, and may use materials from the local environment, such as sticks, to draw maps on the ground, or can use simple pencils/pens and paper. These maps are not to scale, but typically display relative locations of features important to community members.

Mapping Using Scale Maps & Images

Using this method participants document observations on scale maps or aerial images of the study area. Observations can be drawn directly on these maps, or marked out using stickers or post-it notes. Further descriptions of the observations can be detailed using capture sheets (example provided in Appendix B) with numbers and/or colors that correspond to the observations on the map to be later digitized. This method is often used in cultural land use mapping, and was applied in this project for salmon habitat mapping.

Participatory GIS

Participatory GIS involves using geographic information systems (such as ArcMap or QGIS) to represent communities' spatial knowledge. This can be facilitated directly by the community members themselves if they are familiar with the use of GIS software, or through a facilitator who places observations on a map as community members identify them. This method was used for the online community mapping sessions that helped inform the salmon habitat assessment framework in this project.
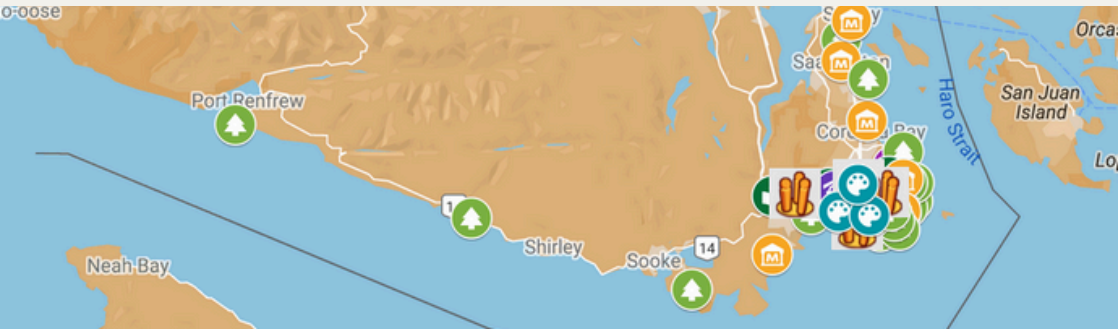
Multimedia & Web-mapping

There are many cases where communities may want to represent knowledge or information that does not fit well into typical digital or paper maps. Digital multimedia maps provide an opportunity to incorporate interviews, stories, photo or video associated with spatial information – expanding the possibilities of what maps can represent. One way to incorporate this information is via internet-based web mapping applications. Using these applications, community members can upload their observations, stories, or photographs into community maps. These maps can be 'living documents' continuously updated by community members over time. Applications like Goggle My Maps can work well for this; a great example of what this can look like can be seen in the Stz'uminus Storied Places Digital Atlas research project.

Role of Community Mapping in Salmon Stewardship

Community knowledges and participatory engagement are critical to salmon stewardship; as described above, Indigenous communities hold a wealth of knowledge that can be used to guide and inform the conservation and restoration of salmon habitat. Documenting community knowledges, concerns, and visions regarding salmon can help to inform salmon stewardship, and ultimately lead to more sustainable management plans that reflect the values and priorities of the community.

"Coho salmon young of the year." By California Sea Grant. [CC-BY-SA-2.0 (http://creativecommons.org/licenses/by-sa/2.0)], via Flickr.

Community mapping can also be used to capture information regarding community relationships with salmon habitat and how they have changed over time – this might include information about important cultural sites and practices, harvesting areas and activities, and the accessibility to and use of different sites by community members.

The process might also be used to identify place-based questions that individuals may have regarding salmon habitat and stewardship that can be used to inform research interests of the community. Additionally, it can raise awareness of and engage community members in stewardship initiatives happening within their territories, and be used as advocacy tools with external stakeholders.

Facilitating a Community Mapping process

The community mapping process will vary widely depending on the interests, goals and resources available. The following figure outlines a process which may be adapted by communities to suit their mapping needs:
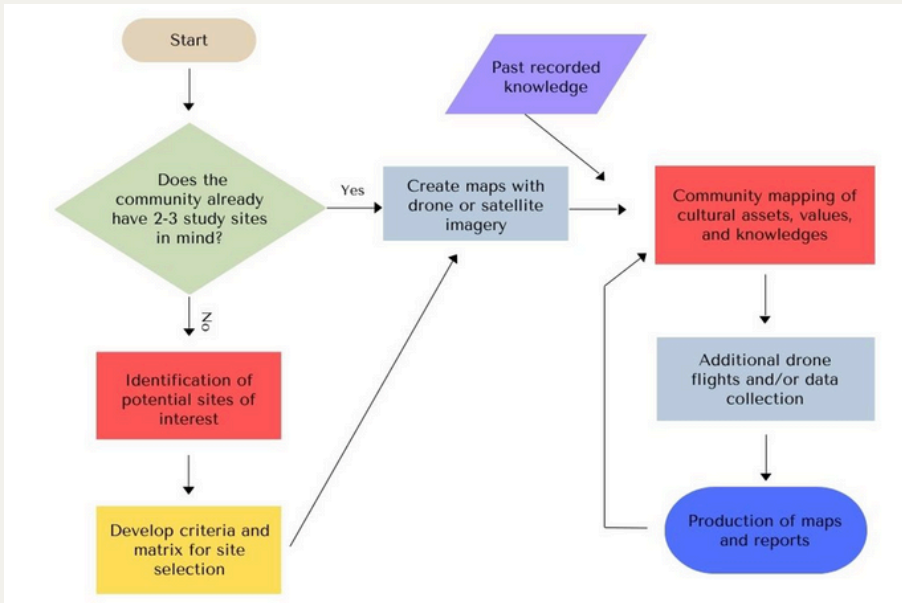

Figure 3. Suggested process for using community mapping in salmon habitat assessment.

Identification of Potential Sites of Interest

Online community mapping sessions can be effective for initial site selection as they can enhance accessibility and can cover a large area (e.g. an entire territory) while allowing for a relatively high level of detail of the map during the session. These sessions can be done either in real time over a video conferencing application (e.g., Zoom), set up so that community members can access the maps online and place points of interest on their own time, or a combination of these two approaches.

Develop Criteria and Matrix for Site Selection

Should several sites be identified in the initial site selection process, criteria may be developed to help with the prioritization of sites. In developing the criteria, you might consider the following questions:

- **Priorities**: What are the issues of concern/priority at the site? This could include habitat degradation, habitat creation/restoration projects, invasive species, etc.
- **Feasibility**: What is the operational feasibility of the site? (e.g., are there restrictions preventing drone flight? Are there community concerns about operating a drone at this location?)
- **Community preference**: Sites most identified by community, sites with particular cultural importance, important harvesting sites, etc.

Each potential site can be represented by a column in the spreadsheet, and the type of concern/consideration can be represented by a row. Coloured cells can be used to represent each of the issues of concern/consideration at the site. The sites which have the highest overlap of criteria that are also operationally feasible might be selected as priority areas (see Figure 4 below for an example).

Site	Invasives	Habitat Obstructions	Habitat Degradation	Habitat Introduction	Cultural Importance	Operational Feasibility
Site 1						Airport nearby
Site 2						Airport nearby
Site 3						Class F
Site 4						Control Zone
Site 5						Access Issues
Site 6						Control Zone
Site 7						Control Zone
Site 8						Class F
Site 9						Airport nearby
Site 10						Airport nearby

Figure 4. Example site prioritization matrix. Red rectangles indicate selected sites.

Creating Maps with Drone or Satellite Imagery

Once 2-3 sites have been selected for further study, a drone (or 'UAV') flight of the area of interest can be conducted to capture high resolution photographs of the site. Once captured, these photographs can be georeferenced (associated with physical points on the ground) in order to create a map of the site. Although georeferencing is not an absolute requirement for this phase, it is useful for placing the site in a wider environmental context, and for capturing the absolute physical locations of the points of interest that will be identified by community members in following phases of the project.

Alternatively, free high-resolution satellite imagery or orthophotos can be obtained through a number of sources, including Google Earth, Google Earth Online, or local municipal/regional government websites.

Incorporating Historical Information

Historical maps and air photos are a valuable source of information that can be incorporated into the community mapping process. They provide a historical baseline for the study area, giving insight into landscape change over time. Maps and air photos can be geo-referenced and incorporated as layers in GIS for digital map creation. UVic has a collection of digital historical maps, as well as a collection of air photos. Additionally, there are historical air photos available from the Province of BC and the National Air Photo Library which have images dating back to the 1930's.

Community Mapping of Cultural Assets, Values and Knowledges

Once the photographs have been captured and maps created, a second round of community mapping might be facilitated to collect additional knowledge of cultural and environmental assets, issues of concern, questions, and priorities relevant to the study area. This can be done either in person, online, or both depending on community preference and availability.

Online Mapping

As with the first round of community mapping, these sessions may be done either in real time over a video conferencing app (e.g., Zoom), set up so that community members may access the maps online and place points on their own time, or a combination of these two approaches. Conducting sessions over video conferencing involves having a facilitator share their screen and place observations on the map based on what is being communicated by participants in the session.
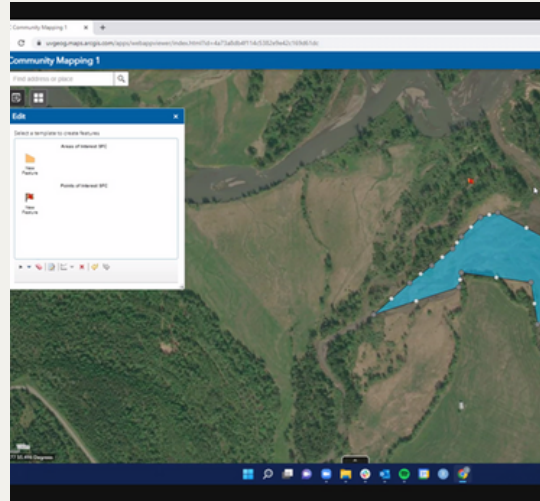

Figure 5. Screenshot taken during an online community mapping session.
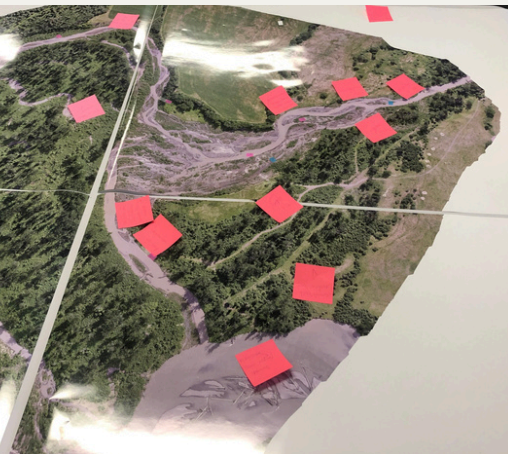

Figure 6. Map created during an in-person mapping session.

In-person Mapping

In-person sessions may be conducted using large-format, high-resolution images printed on vinyl in order to prevent tearing or water damage. In this example, we used coloured stickers that correspond to each of the five guiding questions, and invited participants to share stories and descriptions that were collected on story-capture sheets (see Appendix B).

Identify Cultural & Ecological Themes & Map Layers

After completing the community mapping sessions, data from the maps and datasheets are compiled and analyzed. In our pilot sessions, observations were georeferenced in ArcGIS online, and written observations from the data sheets were entered into an excel spreadsheet. Data was organized by site, and by the associated question of interest. Once the data was entered into the spreadsheet, researchers identified common themes in the data (e.g., invasive species, habitat restoration, cultural sites, potential sites for restoration efforts) and created additional columns to identify one-two major themes associated with each observation. This helped to identify areas of priority for communities in order to focus data collection for future drone flights.

Additional Drone Flights & Data Collection

Once data from the community mapping sessions has been analyzed and some key community questions and priorities identified, subsequent drone flights could be conducted to gather and analyze data pertaining to those questions. For example, if community members were concerned about elevated water temperatures at a site, a thermal sensor could be mounted to the drone to collect relevant information.

Production of Maps and Reports

Once drone flights have been conducted and the data analyzed, digital or physical map products can be created to display the data. Themes from the community mapping sessions can be summarized in a report and distributed to the community. Findings can also be communicated via in-person or online community meetings or video summaries. Regardless of the method used, community members should have the ability to give feedback, have their questions answered, and voice any concerns that they may have.

Suggested Materials

Materials required for community mapping will vary widely depending on the method(s) decided upon by community members. Some projects may be entirely online, some in person, or a mix of the two. Materials will also depend on the goals of the project – for example, participating communities may wish to record the information and stories being shared by community members during the sessions so that they are available to community members not present at the sessions. Therefore, the following is not a comprehensive list of materials, but a suggested starting point.
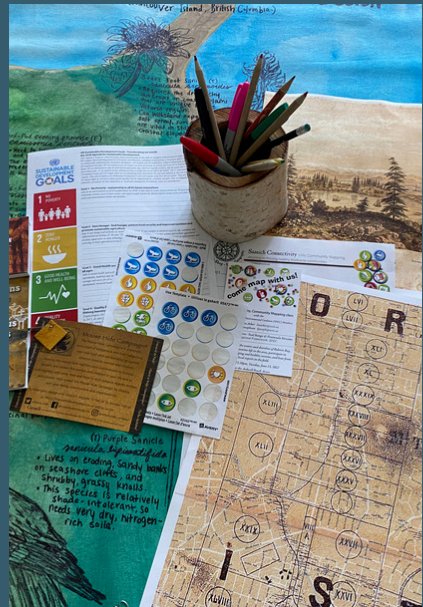
Guiding Questions

Having a list of guiding questions can be helpful for focusing a mapping session. Questions should be determined in consultation with community members in advance of the session, as this is a key aspect of the participatory community-led process. It is helpful to have questions that are narrow enough to be pertinent to the topic at hand, but broad enough to capture the breadth of community knowledge and to ensure that important information is not missed. A list of guiding questions used in our pilot project is included in Appendix A.

Material for In-person Sessions

- Large-format, printed map of the area(s) of interest (printing maps on vinyl is a great option for durability and holding gatherings outdoors)
- Sheet with pre-determined questions to help stimulate discussion and guide the process, and a story capture sheet to record information
- Coloured sticky notes which correspond to the questions on the sheets in order to keep track of information being documented
- Pencils
- A computer with mapping software (e.g., ArcGIS Online, Google MyMaps) with the maps loaded in order to digitize information collected during the session
- An audio or video recorder if communities wish to record sessions and participants have consented to being recorded
- Consent forms, if desired

Material for Online Sessions

- Online mapping software (e.g., ArcGIS Online, Google MyMaps) with recent, georeferenced imagery from the site(s) of interest
- Video conferencing application (e.g., Zoom, Microsoft Teams)
- An additional computer with the mapping application open to help record points of interest for redundancy

Best Practices for Community Mapping

The community mapping process will vary widely depending on the interests, goals and resources available. The following is a suggested process which may be adapted by communities to suit their mapping needs:

FPIC

Consent is a central pillar of community mapping, and must be centered in every stage of the research project, from project design to dissemination of results. It is a critical aspect of conducting ethical research, and is upheld by the UN Declaration on the Rights of Indigenous Peoples. The principles of free, prior and informed consent (**FPIC**) provide guidance for conducting ethical research with Indigenous communities. The FPIC principles are defined by the United Nations as follows:

- **Free**: Consent must be given voluntarily, without manipulation, intimidation, or coercion, as part of a process that is self-directed by the individual/community, and upon which external deadlines are not imposed.

- **Prior**: Consent must be sought in advance of the start of activities.

- **Informed**: The engagement with Indigenous peoples should be culturally appropriate, and the information provided to individuals should be complete, objective, clear, transparent, and accessible.

- **Consent**: As a collective decision, consent must be reached by the appropriate rights-holders through the customary decision-making processes of the Indigenous community from which consent is sought.

Some additional considerations for FPIC in a research context are:

Free
- Are there any power imbalances between community members, researchers, or others participating in the project that may influence participants' ability to freely give their consent? If so, can these can be rectified?
- Have participants been provided with all requested information in an objective and transparent way?

Prior
- Are communities and participants being given sufficient time prior to participating to make a decision about whether they would like to participate? Note that sufficient time should be decided by the individual/community in question.
- Has time been given for participant/community consideration at each stage of the research process, and in the event of any changes to the process?

Informed
- Are participants being given all the relevant information about the objectives and methods used in the study to make an informed decision about participation?
- Is the information being provided in ways that are preferred by and accessible to participants? (e.g., in their preferred language, verbal or video descriptions as well as written, in plain language that's easy to understand).
- Is the information being provided in an objective way, highlighting both the potential benefits and any potential downsides to participation?
- Is information being provided at each stage of the process and updated as things change?
- Are community protocols for engagement being properly followed?

Consent
- If consent is given with conditions, is the research process being modified to reflect those conditions?
- Is consent being continuously sought throughout the process? (i.e., not a one-time event)
- Is consent being given by the collective community, not just select individuals? Have community protocols for obtaining consent been followed?

Data Sovereignty

A key consideration in designing research is how data will be managed, stored and accessed. The First Nations Information Governance Committee has outlined the principles of Ownership, Control, Access, and Possession **(OCAP)** as a tool to support Indigenous data governance. The OCAP principles are defined as follows:

Ownership states that a community or group owns their cultural knowledge, data, and information collectively in the same way that an individual owns his or her personal information.

Control affirms that First Nations, their communities, and representative bodies are within their rights to seek control over all aspects of research and information management processes that impact them. First Nations control of research can include all stages of a particular research project–from start to finish. The principle extends to the control of resources and review processes, the planning process, management of the information, etc.

Access refers to the fact that First Nations must have access to information and data about themselves and their communities regardless of where it is held. The principle of access also refers to the right of First Nations' communities and organizations to manage and make decisions regarding access to their collective information. This may be achieved through standardized, formal protocols.

Possession. While ownership identifies the relationship between a people and their information in principle, possession or stewardship is more concrete: it refers to the physical control of data. Possession is the mechanism by which ownership can be asserted and protected.

Considerations for data control and ownership include: the governance and privacy of servers that any digital information will be stored on, protocols for information-sharing and access requests, and types of information that may be prohibited for documentation (e.g., sensitive cultural information). Protocols should be established beforehand in consultation with communities to ensure OCAP principles are respected during the research process.

Community Preparation

Prior to conducting mapping sessions with communities, it is important that community members be provided with all relevant information regarding the process. This includes the purpose of the mapping, how data will be stored and shared, how to use the tools being employed (e.g., GIS), and any potential risks or downsides associated with the process. This also gives participants a chance to voice concerns, request changes to the process, and have their questions answered. This preparation will help community members to make an informed decision about whether or not to participate.

Creating a Comfortable & Accessible Environment

Choosing a venue that is comfortable and accessible to all community members is an important step to ensuring that mapping sessions are inclusive to everyone who may be interested in attending. A list of recommended considerations when planning mapping sessions includes:

- Access for elders or those with disabilities
- If the venue is outdoors, ensuring there is shelter for attendees in case of rain
- Scheduling the event for a time when most community members can attend (e.g., outside of normal working hours)
- Ensuring there is seating for all attendees
- Providing food and beverages
- Incorporating any protocols or ceremonial practices as appropriate
- Providing honoraria to attendees

Faciliation

Having two or more people present to facilitate the session can help to keep participants engaged, and streamline the data collection process. Sessions can get very busy, with a number of people marking down observations and writing on data sheets simultaneously. Facilitators can help ensure that data stays organized, that observations are properly recorded, and engage participants by asking questions and making conversation. This can enrich the process by making the session more engaging for participants, and may stimulate observations through conservation. It also helps to streamline data analysis after the session by ensuring that observations are legible and understandable.

Appendix A – Examples of Community Mapping in Practice

Examples of how Indigenous communities are engaging in counter-mapping include documenting the impacts of resource extraction in Indigenous territories, documenting community knowledge and stories of important places on the land and water, using maps as a tool for community safety and knowledge transfer, and creating artistic pieces that communicate community perspectives and histories. Many projects incorporate multiple goals and serve many functions for community members. These maps can be intended for a range of audiences, from exclusive use by the communities who generate them, for use in engaging with colonial governments, or as materials available to the broader public.

Additional resources:

1. Native Land: This website provides an interactive map of Indigenous territories, languages, and treaties around the world. It can be a helpful resource for Indigenous communities to identify their traditional territories and understand their connections to other Indigenous communities.

2. First Peoples' Cultural Council – First Peoples' Map: This organization provides resources and support for Indigenous language and cultural revitalization in British Columbia, Canada. They offer a mapping tool called "First Peoples' Language Map of British Columbia," which shows the locations of Indigenous languages and dialects in the province.

3. Indigenous Mapping Collective: This collective is a global community of Indigenous mapping practitioners, researchers, and allies. They offer a range of resources, including case studies, webinars, and networking opportunities, to support Indigenous mapping initiatives around the world.

4. <u>Local Contexts:</u> Local Contexts is a global initiative that supports Indigenous communities with tools that attribute cultural authority of heritage and data. By focusing on Indigenous Cultural and Intellectual Property and Indigenous Data Sovereignty, Local Contexts helps Indigenous communities repatriate knowledge and gain control over how their data is collected, managed, displayed, accessed, and used in the future.

5. <u>Aboriginal Mapping Network</u>: This network was created to support Aboriginal and Indigenous peoples around the world facing common issues including land claims, treaty negotiations and resource development. By providing tools such as data sources, training resources, funding, and relevant news stories, the website aims to be a collaborative platform for Indigenous and Aboriginal peoples to support each other in their mapping efforts. The project was initiated through the leadership of the Gitxsan Nation, the Ahousaht Nation and Ecotrust Canada.

Appendix B – Question Sheets Used in Community Mapping Sessions

Community Mapping BCSRIF

Q1: Which sites have good quality/healthy salmon habitat?

01 _____

02 _____

03 _____

04 _____

05 _____

06 _____

Q2: Which sites have poor quality/unhealthy salmon habitat?
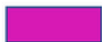
01 _____

02 _____

03 _____

04 _____

05 _____

06 _____

Q3: Which sites are a priority for salmon habitat monitoring? Why are they important to monitor?

01 _____

02 _____

03 _____

04 _____

05 _____

06 _____

Q4: Which salmon sites are of cultural importance?

01 _____

02 _____

03 _____

04 _____

05 _____

06 _____

Q5: Anything else important to include?

01 _____

02 _____

03 _____

04 _____

05 _____

06 _____

Appendix C – Comparison of Mapping Methods & Platforms

Platform/Method	Cost	Skill Required to Set up	Remote/Hybrid Options	Data privacy and security	Other considerations
ArcGIS webmap	$950/year for a basic ArcGIS Online license	Moderate – requires basic familiarity with ArcGIS Online	Yes – can be done synchronously via video calling or be used asynchronously by sharing a link.	Data stored on U.S. servers. Webmaps are publicly viewable for as long as they are made available for use.	ArcGIS webmaps offer the most customization for incorporating a range of layers into the basemap (e.g., existing datasets held by organizations). The webmaps also offer a relatively intuitive user experience to input data.
Google mymaps	Free	Minimal – many free online tutorials available. Two such tutorials can be found here and here.	Yes – can be done synchronously via video calling or be used asynchronously by sharing a link.	Data stored on U.S. servers. Maps are only available to those who have the link and data is stored on the google account the map is created with.	Requires a Google/Gmail account.
Google earth	Free	Minimal – sample tutorial can be found here.	Yes – can be done synchronously via video sharing.	If using the Google Earth web map, data is stored on U.S. servers. If using the Google Earth Pro desktop app, data are stored locally on the computer hosting the app.	Google earth offers the opportunity to view 3D views of landscapes from a ground-level perspective, which can help to orient participants.
Miro	Free	Minimal – sample tutorial can be seen here.	Yes – can also be used asynchronously	Data stored on U.S. servers. Board can be shared only with select users, or to anyone with the link.	Miro does not have any built-in maps, therefore basemaps must be added to the board as an image. The data contributed is also not georeferenced, so if a spatial dataset is the desired end product all data on the board must be input into a GIS system after the mapping exercise.
In-person mapping	Varies depending on cost of map printing and supplies	Varies depending on desired features & complexity of the printed map	No	Only those participating in the event and in possession of the map have access to the data.	Mapping in person is most conducive to making personal connections with participants, and tends to be most approachable for those who may struggle with using digital platforms.