

## Article

# The Story of 13 Moons: Developing an Environmental Health and Sustainability Curriculum Founded on Indigenous First Foods and Technologies

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**Abstract:** The Swinomish Indian Tribal Community developed an informal environmental health and sustainability (EHS) curriculum based on Swinomish beliefs and practices. EHS programs developed and implemented by Indigenous communities are extremely scarce. The mainstream view of EHS does not do justice to how many Indigenous peoples define EHS as reciprocal relationships between people, nonhuman beings, homelands, air, and waters. The curriculum provides an alternative informal educational platform for teaching science, technology, engineering, art, and mathematics (STEAM) using identification, harvest, and preparation activities of First Foods and medicines that are important to community members in order to increase awareness and understanding of local EHS issues. The curriculum, called 13 Moons, is founded on a set of guiding principles which may be useful for other Indigenous communities seeking to develop their own curricula.

**Keywords:** indigenous; environmental sustainability; environmental awareness; free-choice learning; informal learning

## 1. Introduction

*Our health comes from our culture, and our culture comes from our homelands... We have to take care of Mother Earth because there are uses for just about every bit of or environment. But you have to learn how to use it and you can only do that if you're there, listening. You can't get this from a couch, sitting there watching television.*

—wanaseah Larry Campbell, Swinomish Elder

Indigenous peoples are disproportionately impacted by environmental exposures and health disparities [1–3]. The salient impacts are widely recognized within communities and as such are considered high priorities to address [4,5]. Yet a serious disconnect exists between environmental and health agencies and Indigenous communities on how to define and operationalize environmental health and sustainability (EHS). In this paper, and via the stories of Swinomish Elders and leaders, we recount how the Swinomish Indian Tribal Community defines, addresses, and passes on knowledge about environmental health and sustainability.

In the mainstream science paradigm, environmental health (EH) is defined by individual impacts to human health from the food we eat, the water we drink, and the air we breathe [6]. The

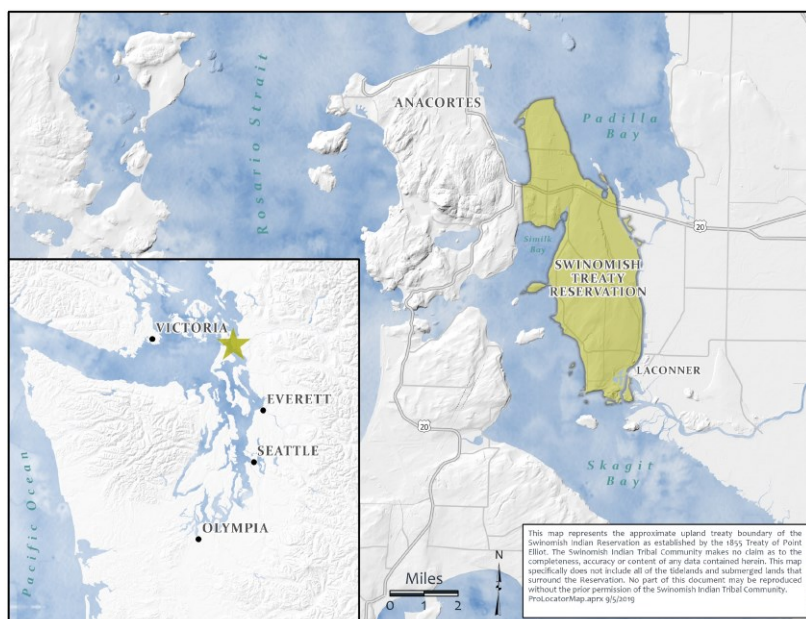
mainstream model is based on risk assessment studies—quantitative exposure assessments of contaminated foods, water, and air via dermal, inhalation, and ingestion pathways to produce probabilities of cancer and non-cancer endpoints. This model, and its subsequent assessment via quantitative probability risk equations, does not do justice to the multi-layered, nuanced, and reciprocal relationships that many Indigenous peoples have with nonhuman living beings, homelands, air, and water [1,7]. Unlike conventional EH, Indigenous knowledge recognizes the essential value of sustainability within education and the environment [8].

While each Indigenous community holds unique worldviews, and thus culturally-specific EHS definitions and priorities, there are some fundamental characteristics that are common across most communities. Indigenous EHS incorporates a combination of practices and knowledge about coexistence with human and nonhuman beings, nature and local natural resources, and spiritual beings, and focuses on familial and community scales, rather than individuals. Indigenous EHS is centered on the importance of culture and tradition, and uses a longer temporal focus that looks both backward in time and forward beyond the present (thus incorporating sustainability).

Concurrently, there are few programs that embrace Indigenous views of EHS. In conventional EHS programs, the primary educational topic (i.e., biology, chemistry, engineering), is commonly taught separately from language and culture. Consider the conventional representation of an ecosystem, which depicts a water-based or land-based food web, absent of humans [9]. In contrast, Indigenous ways of knowing recognize the interconnectedness of all living things (including humans) residing in a given ecosystem [7,9,10]. Some advances have been made in developing context-specific EH programming for a handful of Indigenous communities (i.e., lessons on air quality, non-point source pollution, or water quality in a specific geographic region). Yet these curricula typically eschew the broader and more encompassing Indigenous EHS views, such as familial or community-level impacts, nor do they acknowledge the reciprocal relationships that are the foundation of Indigenous EHS [11–13]. EHS education regarding fish advisories is a widely-cited example, wherein rivers or lakes are closed to fishing due to contaminated waters, and posted signs are used to advise would-be fishers to not fish, to eat substitution species, or to stay away from the area for the indefinite future. These fish advisories ignore and go against Indigenous EHS values and practices about human-fish-water relationships [14,15]. Citing one Swinomish elder:

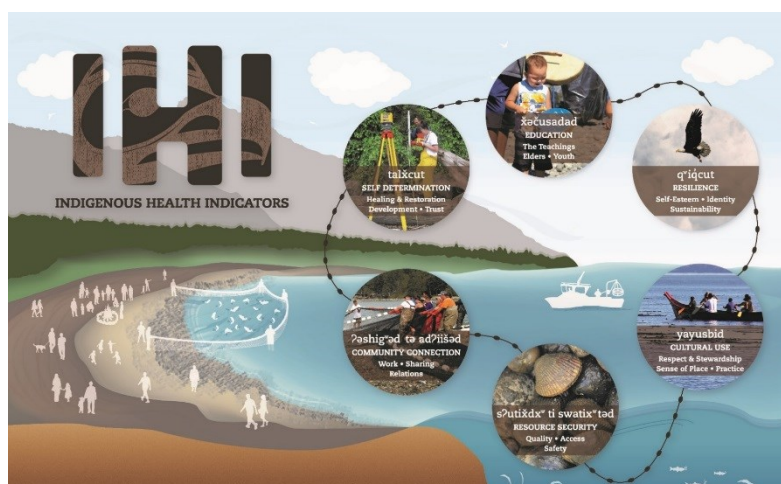
*We take care of the fish and the water and they take care of us. We will continue to have ceremonies with fish even if they are contaminated. Like we say, it's our spiritual food so it feeds our soul; so it might poison our body, but then we'd rather nourish our soul [16].*

To illustrate why conventional EHS education and intervention practices such as fish consumption advisories fail, we will talk about our experiences as staff and community members of the Swinomish Indian Tribal Community. The Swinomish Indian Tribal Community (Swinomish) is a federally recognized Indian Tribe organized under Section 16 of the Indian Reorganization Act. Today there are nearly 1000 enrolled members. The Swinomish Reservation is located on the southeastern end of Fidalgo Island in Washington State, USA. The Reservation was established by Article 2 of the Point Elliott Treaty between the federal government and Puget Sound Coast Salish communities in 1855. The current Reservation includes approximately 10,800 acres of upland area and approximately 4500 acres of wet and filled tidelands; most of the Reservation is ringed by saltwater (Figure 1). The Swinomish have been a hunting, fishing, and gathering people since time immemorial. Harvesting, preparing, and using First Foods, medicines, and resources (also called traditional foods, or “our foods” by community members) is an integral part of the social and cultural fabric in the Swinomish community.



**Figure 1.** Location of the Swinomish Indian Tribal Community in Washington State, USA.

Figure 2 illustrates the Swinomish definition of EHS. The image depicts 6 key aspects of Swinomish EHS (called Indigenous Health Indicators) in a scene where families are working together beach seining (fishing with nets from the beach), steaming shellfish in a fire pit, and crab fishing. Here, elders can be seen telling stories to Swinomish youth. Younger generations are exploring the beach and surrounding area, and learning how to harvest, cook, and preserve the catch. This image shows Swinomish people asserting their sovereignty by being on the land and water and engaging with natural resources that are abundant and accessible. In sum, the image depicts Swinomish people engaging in culturally important practices, which ‘feed the body and the spirit’ in the Swinomish way [17,18]. This clearly reflects the central importance of First Foods to Swinomish health and wellbeing broadly, and EHS specifically. First Foods can be thought of as cultural keystone species—foods that nourish the body and the spirit of both the individual and the community, while providing opportunities to pass on Indigenous knowledge about connections with nonhuman beings and the environment to the next generations [19]. Therefore, an Indigenous EHS education program taught through the lens of First Foods is a logical and natural coupling.



**Figure 2.** Swinomish Indigenous Health Indicators (IHIs) This image depicts traditional beach seining, overlaid by the Indigenous Health Indicators (listed in Lushootseed and English). Image credit: Emma Fox, Swinomish Communications Department.

In the remainder of this paper, we describe the development of an EHS education curriculum based on Swinomish beliefs and practices around First Foods. The curriculum objectives are to: increase awareness and understanding of local EHS issues among all ages of Swinomish community members; provide an informal (outside of school) educational platform for teaching science, technology, engineering, art, and mathematics (STEAM); and increase interest in healthy lifestyles and practices. We developed a set of guiding principles for the curriculum, which may be useful for other Indigenous communities wishing to develop their own curricula.

## 2. Materials and Methods

Our multi-generational curriculum development and implementation team consisted of Swinomish staff members, a Swinomish elder, a Northwest Indian College student, an EH researcher from Oregon State University, and a First Foods expert. In addition, an external advisory group of Indigenous EHS, education, and foods experts provided oversight and review of the draft curriculum. We founded the curriculum on existing Swinomish cultural frameworks, community structures, and existing community knowledge [20], to ensure lesson plans and learning methods are culturally appropriate [10,21–25].

To identify existing Indigenous EHS resources, we evaluated peer-reviewed literature, grey literature, conference proceedings, and personal recommendations. Search terms included the following: Indigenous/Tribal/Native education plus environmental, environmental health, food, nutrition, or First Foods; Indigenous curricula/curriculum; Indigenous K-12 and/or education; and traditional/First Foods curriculum/education. We used the following criteria for inclusion in the list: the resource must describe a curriculum (formal or informal), exhibit, or program (science camp, museum exhibit); the resource must be specific to Indigenous populations; and resources are specific to North America.

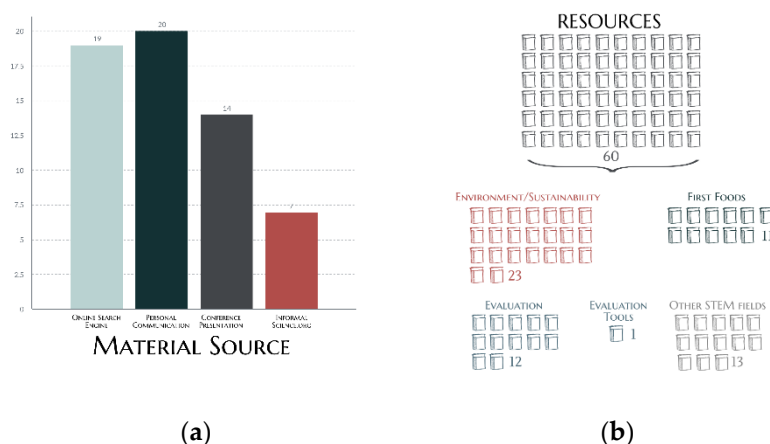
A thematic analysis identified guiding principles. The analysis included recommendations from culturally based science education [21–23,26,27], review of research and curriculum implementation notes, insights from our collated resources, and input from Tribal elders. The project team agreed on eight guiding principles, which formed the curriculum framework for developing activities.

We used an asset-based approach and free-choice learning methods to develop the curriculum. Asset-based approaches to education are more successful than deficit-based approaches as they recognize cultural knowledge sources and community strengths [28,29]. Culturally based education promotes the inclusion of cultural assets, such as native languages, traditional and cultural practices, and community-based oral history and ways of knowing [10,26]. The focus on these assets changes the orientation of the educational program from a Western perspective to an Indigenous perspective [29,30]. Free-choice learning is self-motivated learning taking place outside of a formal classroom setting. When developed and implemented through a culturally based approach, free-choice science learning outside the school system resonates with how Indigenous communities have been passing on knowledge about their environments for millennia.

The curriculum underwent multiple iterations of evaluation: internal review; Swinomish community review; external review with the advisory committee of Indigenous EHS, education and foods experts, an independent Indigenous evaluation team; and review by the Swinomish Health, Education and Social Services Committee prior to publication. Working with an independent Indigenous evaluation team, we identified and incorporated the following outcomes into the overall evaluation. The 13 Moons program was designed to increase: opportunities for informal EHS learning through a cultural lens; awareness and understanding of EHS in the Swinomish community; understanding of a healthy community that encompasses physical, mental, spiritual, and environmental health; interest or motivation to implement healthy lifestyles, traditional practices, and harvesting; youth interest and engagement with elders, traditional practices; and youth interest in STEAM fields and careers.

### 3. Results

We identified 60 curricula and resources (Figure 3). The curricula are predominantly subject-specific. For example, the *Air Toxics Under the North Star* [12] curriculum focuses on indoor air. There were several environmental curricula [11,31,32]. A full list is available (see Appendix A). Taken together, all resources fall under the umbrella of EHS, albeit to varying degrees. We did not identify curricula that provided a comprehensive Indigenous EHS overview of the complex interplay between humans, nonhuman beings, and their environments.



**Figure 3.** Description of curricula and resources related to environmental health. **(a)** Materials were sourced from online searches, personal communication, conference presentations, and InformalScience.org. Limited materials were found via traditional peer-reviewed publications. **(b)** 60 materials were identified relative to environmental health (EH).

The eight guiding principles (Figure 4) are reflected in each activity of the 13 Moons curriculum. While based on Swinomish beliefs, values, and practices, the principles are designed as an adaptable framework for other Indigenous communities. These principles are meant to help develop activities around a community's own set of culturally important First Foods, medicines, and technologies.

We named the curriculum "13 Moons," which signifies the traditional Swinomish harvest calendar. Each moon is named for an important seasonal event or harvest that takes place during that moon [33]. We designed 2–3 activities per moon that utilize a plant and an animal species (Table 1). The curriculum is designed to encourage scaffolding of knowledge; students will learn about ironwood in the spring, and then use ironwood tools to weave cattail mats in the early autumn, which are then used during community dinners during the winter season. This continuity speaks to the repetition and integration built into 13 Moons. Each activity includes a complete lesson plan which includes: background on the food, medicine, or technology; learning objectives; time to complete the activity; target age group (activities are designed to span from pre-Kindergarten to elders); materials needed; words to learn in the Swinomish language (Lushootseed), knowledge transfer goals (from elders to youth); guiding questions for discussion; identification of environmental health connections; optional additional activities; and a citation and resource list. In the four years since we began in 2016, we have piloted many, but not all, of the activities. Figure 5 depicts an activity from the curriculum to illustrate the objectives, content, and format we use.

*Late December through early January is Moon of the Sacred Time. Both the final moon of one yearly cycle and the beginning moon of the next cycle, the Moon of the Sacred Time is a time for renewal and rebirth. This is a time for learning spiritual and cultural traditions from Elders around the longhouse fire. Sea-run cutthroat trout, blackmouth salmon, and steelhead are fished during the winter months. Shellfish are collected during the night-time low tides. (Text from the 13 Moons curriculum)*





**Figure 4.** The eight Guiding Principles forming the foundation of the 13 Moons environmental sustainability and health curriculum. While the majority of the activities within the 13 Moons curriculum are Swinomish or Coast Salish specific, the overarching framework and guiding principles of the curriculum are designed to be tailored to specific seasons, resources, and harvest cycles of other Indigenous communities. The Lushootseed translation is included for each guiding principle.

**Table 1.** The 13 Moons seasonal activity calendar. Each moon is named for an important seasonal event or harvest that takes place during that moon and contains 2-3 activities.

| Moon       | Natural Resources Focus | Connection to EH and Sustainability                                                               | Description of Selected Activities   | Concepts or Principles Addressed             | Skills Learned or Gained * |
|------------|-------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------|----------------------------------------------|----------------------------|
| Windy Time | Observational learning  | Introduction to Environmental Sciences and Indigenous scientific methods of observation over time | Local Environmental Observer network | Spatial visualization of data (mapping)      | 1–3                        |
| Frog Talks | Spring Greens; Herring  | Habitat and ecological                                                                            | Spring greens harvest                | Species–habitat relationships; predator/prey | 4–6                        |

|                  |                                                                 |                                                                                                                                                                                                                  |                                                                                                  |                                                                                         |             |
|------------------|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-------------|
| Whistling Robins | Ironwood; Water                                                 | relationships/Food web interactions<br>Water quality (WQ);<br>Environmental Sustainability                                                                                                                       | Ironwood tools; Earth Day activities                                                             | relationships; numeracy<br>Conservation of natural resources; technology in tool making | 6–9         |
| Digging Time     | Camas; Bentwood Box<br>Traditional Coast Salish Foods and Tools | Sustainable agriculture; conservation of natural resources; phenology                                                                                                                                            | Harvest, prepare camas; Blessing of the Fleet                                                    | Use of fire to manage ecosystems; technology in tool making; phenology                  | 6–10        |
| Salmon-berry     | Native berries/plants; Shellfish                                | Habitat and ecological relationships/Food web interactions/coupled socio-ecological systems; phenology<br>Habitat and ecological relationships/Food web interactions/coupled socio-ecological systems; phenology | Salmonberry Soda; Clam shell dig                                                                 | Conservation of natural resources; phenology                                            | 6–11        |
| Blackberry       | Berries; Salmon                                                 | relationships/Food web interactions/coupled socio-ecological systems; phenology                                                                                                                                  | Jam workshop; Beach seining                                                                      | Conservation of natural resources; technology in tool making; phenology                 | 6–11        |
| Salal            | Marine invertebrates                                            | WQ; coupled socio-ecological systems                                                                                                                                                                             | Clam bake; Invertebrate survey; build water filters<br>Seed saving & food preservation workshops | Careers in environmental science; WQ and sampling methods                               | 12–15       |
| Silver Salmon    | Berries; Seeds                                                  | Sustainable agriculture; Phenology                                                                                                                                                                               |                                                                                                  | Environmental sustainability; phenology                                                 | 4, 6, 8     |
| Elk Mating Cry   | Riparian plants; Salmon; elk                                    | Habitat and ecological relationships/Food web interactions; WQ                                                                                                                                                   | Stream field trip, salmon habitat                                                                | Ecology; fisheries and wildlife; environmental sustainability                           | 4, 9, 14    |
| Falling Leaves   | Cattail; Elk & deer                                             | Climate change; Phenology                                                                                                                                                                                        | Cattail matt workshop; Pemmican class                                                            | Weather systems/meteorology; technology in tool making; phenology                       | 2–3, 14, 16 |
| Dog Salmon       | Bentwood Box                                                    | Sustainable agriculture; conservation of                                                                                                                                                                         | Traditional foods and resources                                                                  | Sustainability technologies in food preservation; asking questions                      | 4, 11       |

|                             |                 | natural resources;<br>phenology            | preservation<br>methods              | Conservation of<br>natural resources;<br>technology in tool<br>making;<br>phenology;<br>numeracy<br>Careers in<br>environmental<br>science; WQ and<br>sampling methods |           |
|-----------------------------|-----------------|--------------------------------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Put Your<br>Paddles<br>Away | Conifers        | Environmental<br>literacy;<br>phenology    | Medicine of<br>the Trees<br>workshop |                                                                                                                                                                        | 5–6, 8    |
| Sacred<br>Time              | Cedar;<br>Clams | WQ; coupled<br>socio-ecological<br>systems | Night-time<br>clam dig               |                                                                                                                                                                        | 12–13, 17 |

\* <sup>1</sup> Scientific Practice. <sup>2</sup> Record environmental/scientific observations. <sup>3</sup> Mapping. <sup>4</sup> Increased understanding of ecological relationships. <sup>5</sup> Weight and volume measurements/conversions. <sup>6</sup> Beneficial impact of humans on the ecosystem. <sup>7</sup> Environmental sustainability practices. <sup>8</sup> Proper harvest/care of environmentally important plants. <sup>9</sup> Active learning. <sup>10</sup> Presentation skills. <sup>11</sup> Food Safety. <sup>12</sup> Increasing understanding of water quality. <sup>13</sup> Methods for scientific/environmental testing/monitoring. <sup>14</sup> Deductive reasoning skills. <sup>15</sup> Problem solving skills. <sup>16</sup> Correlating weather patterns to animal migration/invasive plant species. <sup>17</sup> Data-driven decision making.

An external Indigenous evaluation team reviewed the curriculum based on stated project outcomes. Overall, participant feedback indicated that the program is successful [34]. The evaluation identified several foundational strategies that contributed to success, namely: the program built off existing activities (e.g., annual celebrations, Swinomish youth program, Earth day, community dinners); Swinomish community members and elders were involved in the design and implementation of activities; and community assets and resources were the focus of all activities. Swinomish community members supported the program, as they felt it sustained healthy cultural practices, promoted intergenerational learning, and increased community connection. As one community member explained, the 13 Moons activities created a place and space for learning: *“People started to speak out about what they were taught; so I think that it’s bringing knowledge together, it’s bringing teachings, and it’s bringing community thoughts together on what they were told, on what their grandparents told them.”* Another community member noted, *“As a Native people, we eat together, we gather together, it’s that sense of learning together that brings a traditional aspect...it’s a familiar setting for me.”* [34]

**Time:** Clam dig, 2 hours;  
**luncheon preparation, 1 hour**  
**Audience:** 5th–8th grade  
**Settings:** Outdoors (night-time clam dig at the beach; indoors (elder luncheon))

**Learning Objectives**  
In this activity, participants will learn:

- When to harvest shellfish
- About harmful pollutants that impact shellfish
- What a harmful algal bloom is and how they affect traditional foods
- How to make clam chowder
- About the importance of sharing and community connectedness to Indigenous health
- The importance of shellfish to Swinomish

**Lushootseed Words**

- Moon of the Sacred Time: **padika?ka?**
- Clam: **stak’ut?**
- Little neck steamer clam: **skata?**
- Butter clam: **stx’ub**
- Cockle clam: **skapab**
- Horse clam: **hufec**
- Oyster: **huk’kuk’**
- Winter: **padias**

**Materials**

- Night-time clam dig
  - Clam dig materials
  - Digging forks
  - Gloves
  - Buckets
  - Teacher or community member to lead dig
  - Headlamps and/or flashlights
- Clam chowder for elders
- Chowder ingredients
- Kitchen implements



**Activity 1: Night-time Clam Dig and Clam Chowder Luncheon**

This night-time clam dig will highlight safe harvesting of shellfish, pollution, and harmful algal blooms that affect the opening of important shellfish harvesting beaches. The harvested clams can then be used to make clam chowder for an elder’s luncheon.

Harmful algal blooms occur when colonies of algae grow rapidly and out of control. These algae produce toxins such as paralytic shellfish toxin or diarrhetic shellfish toxin. Bivalve shellfish, like clams and oysters, feed by filtering water through their bodies. While this feeds the shellfish and can clean the water, it can also result in the accumulation of various toxins that may lead to dangerous levels of toxins within the shellfish.

While harmful algal blooms can occur naturally, a process called eutrophication can trigger a bloom. Eutrophication refers to an excess of plant nutrients. These excesses can come from sewage treatment plant and septic tank discharge, storm water runoff carrying lawn fertilizer, and agricultural field fertilizer runoff.

**Activity Description**

Participants learned how to identify clam species and about the importance of clams to the Swinomish people in the Clams, Moons, and Tides Workshop held during the Moon of the Salmonberry. In this activity, participants will take the next steps of identifying, digging, and harvesting clams. They will also clean and prepare clams for an elder’s luncheon.

(a)





(b)

**Figure 5.** These panels depict a 13 Moons activity about a clam dig, demonstrating the content, style, and layout of the 13 Moons curriculum. (a) The first panel includes information on: time, audience, setting, learning objectives, Lushootseed words, materials, and activity description. (b) The second panel contains descriptions of: knowledge transfer; guiding questions and topics of discussion; trying it all together; and, digging deeper.

#### 4. Discussion

We designed the Swinomish 13 Moons curriculum to overcome environmental, cultural, and literacy barriers in EHS programming [10,35–39]. We found the approach successful within the Swinomish community, with the most common feedback being requests for more activities. The local school district has requested use of the curriculum, and other Indigenous communities have expressed interest in tailoring the curriculum for their own use. Due to the seasonality of the program, not all proposed activities could be completed in the three-year pilot phase. Future work will evaluate the success of the entire 13 Moons curriculum.

A review of published guidelines indicates that culturally based education (CBE) should situate learning within the community and cultural framework, build the curriculum on a foundation of cultural practices, and value Indigenous knowledge alongside conventional knowledge [10,21–23,26,27,40]. Specifically, Demmert and Towner (2003) published five CBE guidelines: (i) Culturally based indigenous language use; (ii) culturally based pedagogy; (iii) culturally based curriculum; (iv) culturally based patterns of participation in leadership and decision making and; (v) culturally based methods of assessing student performance [26,27]. In 13 Moons, the Lushootseed language is integrated into each activity and each activity is led or introduced by Swinomish elders and knowledge-keepers (elements *i* and *iv*). A culturally based pedagogy (element *ii*) is defined as one “that empowers students intellectually, socially, emotionally and politically using cultural references to impart knowledge, skills and attitudes” [41]. As such, culturally based pedagogy views success in the long term, focuses on cultural competency within the learner’s own culture, and highlights the socio-cultural framework of their community [42,43]. With First Foods and the lunar cycle as a foundation (element *iii*), as well as place-based activities, the curriculum explains Swinomish history, traditions, and culture; success is not measured quantitatively but qualitatively as students combine their knowledge and work with elders and instructors to complete activities. Finally, we used Indigenous evaluation methodologies (element *v*). This approach allows a holistic evaluation of participant engagement, knowledge transfer, and satisfaction with the program. While the curriculum is Swinomish specific, other Indigenous communities may find success in EHS engagement via the eight guiding principles and tailoring the First Foods, medicines, and technologies activities to their own values and practices.

#### 5. Conclusion

The Swinomish 13 Moons program was developed in response to a paucity of Indigenous environmental health and sustainability educational programs. Our program welcomes learners of all ages in an informal learning environment and highlights Swinomish culture, traditions, and concepts at the forefront. We grounded the entire curriculum in principles of culturally based education and identified additional guiding principles that represent Swinomish principles of teaching, resilience, and sustainability. The curriculum was developed by Swinomish, for Swinomish. In addition, we created the guiding principles as our own foundation, and we hope that they will help other Indigenous communities in their journeys to revitalize culture and language as foundations in their curricula. The concept of the seasonal round is shared by many Indigenous communities, and the focus on First Foods ensures that the content is culturally relevant. The adaptable module design also encourages Western educational programs to incorporate elements into formal or informal programs. Thus, the 13 Moons program demonstrates a highly relevant, culturally-based education program for learners of all ages that can be adapted by Indigenous communities throughout North America.

In closing, we share with you a quote that exemplifies how environmental health and sustainability is one integrated concept, from the Swinomish point of view:

*I fostered two teenagers... They were getting into a little bit of trouble. They wore the backwards hats and they got the Native pride, you know, "I'm Indian, I'm Indian." I said, "Well, you really want to show your people how to be Indian, here I'll show you." I just happened to be filleting fish, I had a lot of fish. And we filleted them and I made them help me...I said, "...this is how you want to be Indian is you provide food for your people. It's not standing on the corner with a Native pride hat acting tough. That's not Indian." The effect on them was just passing that on...the importance, and emphasis that we have to gather these foods, we have to provide these foods in the wintertime when we're putting food on the table for the [ceremonial] smokehouse.*

—Swinomish tribal member [44].

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## Appendix A

The full list of curricula and resources reviewed is listed below. Where available, links are provided to the content.

| Program | Citation or URL |
|---------|-----------------|
|---------|-----------------|

|    |                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----|--------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | 100 Years                                                                                                                      | Indian Pueblo Cultural Center's 100 Years of State and Federal Policy. An exhibit that reflects upon the human experience behind enacted policies and laws on Pueblo communities by other governments.<br><a href="https://web.archive.org/web/20160115085458/http://indianpueblo.org:80/100years/">https://web.archive.org/web/20160115085458/http://indianpueblo.org:80/100years/</a>                                                          |
| 2  | AIHEC Indigenous Evaluation Framework                                                                                          | The American Indian Higher Education Consortium<br><a href="https://portalcentral.aihec.org/Indigeval/Pages/Document-Collections.aspx">https://portalcentral.aihec.org/Indigeval/Pages/Document-Collections.aspx</a>                                                                                                                                                                                                                             |
| 3  | Air Toxics under the North Star                                                                                                | <a href="http://education.cehs.health.umt.edu/content/air-toxics-under-north-star">http://education.cehs.health.umt.edu/content/air-toxics-under-north-star</a>                                                                                                                                                                                                                                                                                  |
| 4  | Alaska Native Knowledge Network                                                                                                | <a href="http://ankn.uaf.edu/Curriculum/Units/">http://ankn.uaf.edu/Curriculum/Units/</a>                                                                                                                                                                                                                                                                                                                                                        |
| 5  | Aleutian Pribilof Islands Association Traditional Foods Program (The Aleut Diet Program) and Qaqamiigux Curriculum (preschool) | <a href="http://www.apiai.org/services/community-services/traditional-foods-program/">http://www.apiai.org/services/community-services/traditional-foods-program/</a><br><a href="https://www.apiai.org/services/education/head-start/qaqamiigux-head-start-traditional-foods-preschool-curriculum/#curriculum">https://www.apiai.org/services/education/head-start/qaqamiigux-head-start-traditional-foods-preschool-curriculum/#curriculum</a> |
| 6  | Building True Capacity: Indigenous Models for Indigenous Communities                                                           | Chino, M. and DeBruyn, L., 2006. Building true capacity: Indigenous models for indigenous communities. <i>American journal of public health</i> , 96(4), pp.596–599.                                                                                                                                                                                                                                                                             |
| 7  | Canadian Wildlife Federation                                                                                                   | <a href="https://cwf-fcf.org/en/resources/for-educators/?src=menu">https://cwf-fcf.org/en/resources/for-educators/?src=menu</a>                                                                                                                                                                                                                                                                                                                  |
| 8  | Cedar Box Teaching Toolkit                                                                                                     | This teaching tool was created by Elise Krohn and Valerie Segrest, and is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. It is available from the North Portland Area Indian Health Board.                                                                                                                                                                                               |
| 9  | Center for Native Peoples and the Environment                                                                                  | Center for Native Peoples and the Environment. ESF SUNY College of Environmental Science and Forestry.<br><a href="https://www.esf.edu/nativepeoples/">https://www.esf.edu/nativepeoples/</a>                                                                                                                                                                                                                                                    |
| 10 | Center for World Indigenous Scholars   Center for Traditional Medicine                                                         | <a href="https://www.cwis.org/what-we-do/">https://www.cwis.org/what-we-do/</a>                                                                                                                                                                                                                                                                                                                                                                  |
| 11 | Coastal First Nations Turning Point Initiative                                                                                 | <a href="http://www.coastalfirstnations.ca/publications-resources">http://www.coastalfirstnations.ca/publications-resources</a>                                                                                                                                                                                                                                                                                                                  |
| 12 | Community Dialogues on First Nations Holistic Lifelong Learning                                                                | Community Dialogues on First Nations Holistic Lifelong Learning: Learning as a Community for renewal and growth. Canadian Council on Learning. Aboriginal Learning Knowledge Centre. Ottawa, ON K1R 5B4. 2009                                                                                                                                                                                                                                    |
| 13 | Cosmic Serpent                                                                                                                 | Peticolas, L., Maryboy, N., Begay, D., Stein, J., Valdez, S. and Paglierani, R., 2012, August. A Place of Transformation: Lessons from the Cosmic Serpent Informal Science Education Professional Development Project. In <i>Connecting People to Science: A National Conference on Science Education and Public Outreach</i> (Vol. 457, p. 321).                                                                                                |
| 14 | CRTIFC Salmon Camp                                                                                                             | <a href="http://www.critfc.org/for-kids-home/salmon-camp/">http://www.critfc.org/for-kids-home/salmon-camp/</a>                                                                                                                                                                                                                                                                                                                                  |
| 15 | Culturally Competent Evaluation in Indian Country                                                                              | LaFrance, J., 2004. Culturally competent evaluation in Indian country. <i>New Directions for Evaluation</i> , 2004(102), pp.39–50.                                                                                                                                                                                                                                                                                                               |
| 16 | eETHICS                                                                                                                        | Pearson, C., Parker M., Fisher C. eETHICS                                                                                                                                                                                                                                                                                                                                                                                                        |

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|----|------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17 | Effective practices for creating transformative informal science education programs grounded in Native ways of knowing | Mack, E., Augare, H., Different Cloud-Jones, L. et al. Cult Stud of Sci Educ (2012) 7: 49. <a href="https://doi.org/10.1007/s11422-011-9374-y">https://doi.org/10.1007/s11422-011-9374-y</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 18 | Empowering Ramah Navajos to Eat Healthy by Using Traditional Foods                                                     | <a href="https://americanindianinstitute.wordpress.com/2012/09/05/rnc/">https://americanindianinstitute.wordpress.com/2012/09/05/rnc/</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 19 | Environmental Education and Indigenous Knowledge                                                                       | Monthly webinar series presented by NAAEE. <a href="https://naaee.org/eeopro/learning/webinars/webinar-environmental-education-and">https://naaee.org/eeopro/learning/webinars/webinar-environmental-education-and</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 20 | Environmental Protection Native American Lands: A Cultural Approach to Integrated Environmental Studies                | <a href="http://hdl.handle.net/2148/124">http://hdl.handle.net/2148/124</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 21 | Evaluating Indigenous programs: a toolkit for change                                                                   | Hudson, S., Salvatierra, C.A.M. and Andres, C., 2017. Evaluating Indigenous programs: A toolkit for change. Sydney; Australia, NSW: Centre for Independent Studies. <a href="https://www.cis.org.au/app/uploads/2017/06/rr28.pdf">https://www.cis.org.au/app/uploads/2017/06/rr28.pdf</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 22 | Fish to Schools                                                                                                        | <a href="http://www.uaf.edu/canhr/projects/fishschools/">http://www.uaf.edu/canhr/projects/fishschools/</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 23 | Fish Wars                                                                                                              | <a href="http://nmai.si.edu/nk360/pnw-fish-wars/index.cshhtml#title">http://nmai.si.edu/nk360/pnw-fish-wars/index.cshhtml#title</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 24 | Guardians of the Living Water Environmental Health Literacy Project                                                    | Simonds, V.W., Kim, F.L., LaVeaux, D., Pickett, V., Milakovich, J. and Cummins, J., 2019. Guardians of the living water: using a health literacy framework to evaluate a child as change agent intervention. Health Education & Behavior, 46(2), pp.349–359.<br>LaVeaux, D., Simonds, V.W., Pickett, V., Cummins, J. and Calkins, E., 2018. Developing a Curriculum for Change: Water & Environmental Health Literacy in a Native American Community. Progress in community health partnerships: research, education, and action, 12(4), p.441. <a href="http://www.ncai.org/policy-research-center/initiatives/MSU_Guardians_of_Living_Water.pdf">http://www.ncai.org/policy-research-center/initiatives/MSU_Guardians_of_Living_Water.pdf</a> |
| 25 | Guidelines for Considering Traditional Knowledges in Climate Change Initiatives                                        | <a href="https://climatetkw.wordpress.com/resources/">https://climatetkw.wordpress.com/resources/</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 26 | Handbook for Culturally Responsive Science Curriculum                                                                  | <a href="http://ankn.uaf.edu/publications/handbook/">http://ankn.uaf.edu/publications/handbook/</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 27 | Healthy Traditions-Confederated Tribes of Siletz                                                                       | <a href="https://www.facebook.com/Healthy-Traditions-127422657322379/info/?tab=page_info">https://www.facebook.com/Healthy-Traditions-127422657322379/info/?tab=page_info</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 28 | Help Yourself to a Healthy Home                                                                                        | Native American Housing Technical Assistance Institute, Montana State University Extension, Bozeman, Montana. <a href="https://www.epa.gov/sites/production/files/2016-08/documents/2016-08-r9-rtoc-presentation-help-yourself-to-healthy-home.pdf">https://www.epa.gov/sites/production/files/2016-08/documents/2016-08-r9-rtoc-presentation-help-yourself-to-healthy-home.pdf</a>                                                                                                                                                                                                                                                                                                                                                             |
| 29 | Impacts of a holistic place-based community internship on participant interest in science and conservation pathways    | LEMUS, Judith D. Impacts of a holistic place-based community internship on participant interest in science and conservation pathways. Journal of STEM Outreach, [S.l.], v. 1, n. 1, jan. 2018. DOI: <a href="https://doi.org/10.15695/jstem/v1i1.3">https://doi.org/10.15695/jstem/v1i1.3</a> ISSN 2576-6767.                                                                                                                                                                                                                                                                                                                                                                                                                                   |

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| 30 | INDIAN EDUCATION Utah State Office of Education                                                     | <a href="https://www.uen.org/core/socialstudies/americanindian/#lessons">https://www.uen.org/core/socialstudies/americanindian/#lessons</a>                                                                                                                                                                                        |
| 31 | Indigenous Arts and Science                                                                         | University of Wisconsin.<br><a href="https://earthpartnership.wisc.edu/indigenous-arts-and-sciences/">https://earthpartnership.wisc.edu/indigenous-arts-and-sciences/</a>                                                                                                                                                          |
| 32 | Indigenous Evaluation Toolkit                                                                       | Developed by the Great Plains Tribal Epidemiology Center. Contains 13 resources. <a href="https://gptec.gptchb.org/indigenous-evaluation-toolkit/">https://gptec.gptchb.org/indigenous-evaluation-toolkit/</a>                                                                                                                     |
| 33 | Indigenous Knowledge and Environmental Sustainability                                               | Environmental studies. Indigenous Knowledge and Environmental Sustainability. University of Montana.<br><a href="https://hs.umt.edu/evst/graduate/focus-areas/indigenous-knowledge/default.php">https://hs.umt.edu/evst/graduate/focus-areas/indigenous-knowledge/default.php</a>                                                  |
| 34 | Integrating Indigenous and Western Knowledge to Transform Learning and Discovery in the Geosciences | <a href="http://includes2017.videohall.com/presentations/845">http://includes2017.videohall.com/presentations/845</a>                                                                                                                                                                                                              |
| 35 | Inuit Holistic Lifelong Learning Model                                                              | <a href="http://katiqsugat.itk.ca/files/original/da2d254f708eaf30f4e37ee8e7e8a332.pdf">http://katiqsugat.itk.ca/files/original/da2d254f708eaf30f4e37ee8e7e8a332.pdf</a>                                                                                                                                                            |
| 36 | Lessons of our Land                                                                                 | <a href="http://www.lessonsofourland.org/lessons/traditional-use-plants">http://www.lessonsofourland.org/lessons/traditional-use-plants</a>                                                                                                                                                                                        |
| 37 | Living in Health, Harmony and Beauty: The Dine (Navajo) Hozho wellness philosophy                   | Kahn-John, M. and Koithan, M., 2015. Living in health, harmony, and beauty: the dine (navajo) hozho wellness philosophy. Global advances in health and medicine, 4(3), pp.24–30.                                                                                                                                                   |
| 38 | Living Maya Time                                                                                    | <a href="https://maya.nmai.si.edu/">https://maya.nmai.si.edu/</a>                                                                                                                                                                                                                                                                  |
| 39 | Local Environmental Observer (LEO) network                                                          | <a href="https://anthc.org/what-we-do/community-environment-and-health/leo-network/">https://anthc.org/what-we-do/community-environment-and-health/leo-network/</a>                                                                                                                                                                |
| 40 | Metis Holistic Lifelong Learning Model                                                              | <a href="http://firstnationspedagogy.ca/CCL_Learning_Model_MET.pdf">http://firstnationspedagogy.ca/CCL_Learning_Model_MET.pdf</a>                                                                                                                                                                                                  |
| 41 | Mother's Roots                                                                                      | <a href="https://cedar.wvu.edu/cgi/viewcontent.cgi?article=1569&amp;context=wwuet">https://cedar.wvu.edu/cgi/viewcontent.cgi?article=1569&amp;context=wwuet</a>                                                                                                                                                                    |
| 42 | Native Knowledge 360                                                                                | <a href="https://americanindian.si.edu/nk360">https://americanindian.si.edu/nk360</a>                                                                                                                                                                                                                                              |
| 43 | Native Science Field Center                                                                         | Augare, H.J., David-Chavez, D.M., Groenke, F.I. et al. Cult Stud of Sci Educ (2017) 12: 227.<br><a href="https://doi.org/10.1007/s11422-015-9720-6">https://doi.org/10.1007/s11422-015-9720-6</a><br><a href="http://informalscience.org/native-science-field-centers">http://informalscience.org/native-science-field-centers</a> |
| 44 | Non Point Source Pollution Education Curriculum by Wiyot Tribe, Table Bluff Reservation             | Clean Water Act §319 Non-Point Source Pollution Control Program NON-POINT SOURCE POLLUTION EDUCATION CURRICULUM Wiyot Tribe—Table Bluff Reservation<br><a href="https://www.wiyot.us/ArchiveCenter/ViewFile/Item/55">https://www.wiyot.us/ArchiveCenter/ViewFile/Item/55</a>                                                       |
| 45 | Northwest Indian Tribal College Traditional Plants and Foods Program                                | Includes the “13 Moons Community Garden Program”<br><a href="http://nwcplantsandfoods.com/">http://nwcplantsandfoods.com/</a>                                                                                                                                                                                                      |
| 46 | Qagan Tayagungin Tribe Environmental Curriculum                                                     | <a href="http://www.qtribe.org/index.asp?Type=NONE&amp;SEC={1BE73A61-68DD-49B9-BAB7-B6149094BFA0}">http://www.qtribe.org/index.asp?Type=NONE&amp;SEC={1BE73A61-68DD-49B9-BAB7-B6149094BFA0}</a>                                                                                                                                    |
| 47 | Repatriating Indigenous Technologies in an Urban Indian Community                                   | Bang, M., Marin, A., Faber, L., Suzukovich, E.S. Urban Education. (2013) 48(5): 705–733.                                                                                                                                                                                                                                           |
| 48 | Roots of Wisdom                                                                                     | <a href="http://omsi.edu/exhibitions/row/education-resources/">http://omsi.edu/exhibitions/row/education-resources/</a>                                                                                                                                                                                                            |
| 49 | Since Time Immemorial                                                                               | <a href="http://www.indian-ed.org/curriculum/">http://www.indian-ed.org/curriculum/</a>                                                                                                                                                                                                                                            |



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| 50 | SkyTellers: The Myths, the Macic and the Mysteries of the Universe                                               | <a href="https://www.lpi.usra.edu/education/skytellers/">https://www.lpi.usra.edu/education/skytellers/</a>                                                                                                                                                       |
| 51 | Spokane Tribal LifeWays Curriculum                                                                               | <a href="https://spokanetlc.com/">https://spokanetlc.com/</a>                                                                                                                                                                                                     |
| 52 | Tend, Gather, Grow                                                                                               | <a href="https://www.goodgrub.org/tend-gather-grow">https://www.goodgrub.org/tend-gather-grow</a>                                                                                                                                                                 |
| 53 | Traditions of the Sun                                                                                            | <a href="http://www.traditionsofthesun.org/">http://www.traditionsofthesun.org/</a>                                                                                                                                                                               |
| 54 | Transdisciplinary approaches to environmental science education: A Case study from Northern Saskatchewan, Canada | <a href="http://environmentalsociety.ca/programs/k-12-school-programs/water-monitoring/">http://environmentalsociety.ca/programs/k-12-school-programs/water-monitoring/</a>                                                                                       |
| 55 | Tribal Fisher's Handbook                                                                                         | <a href="https://www.firstnations.org/wp-content/uploads/publication-attachments/2013_Salmon_Marketing_Tribal_Fishers_Handbook.pdf">https://www.firstnations.org/wp-content/uploads/publication-attachments/2013_Salmon_Marketing_Tribal_Fishers_Handbook.pdf</a> |
| 56 | Turtle Island Tales                                                                                              | <a href="https://turtleislandtales.org/">https://turtleislandtales.org/</a>                                                                                                                                                                                       |
| 57 | Two-World View Environmental Education Project                                                                   | Johnson, Georgia Grady. 2001. Nez Perce Tribe Two-World View Curriculum Teaching, Learning Environmental Education project. EPA-66-951.                                                                                                                           |
| 58 | WeRNative                                                                                                        | <a href="http://www.wernative.org/">http://www.wernative.org/</a>                                                                                                                                                                                                 |
| 59 | Wild Foods and Medicines Resource Guide                                                                          | <a href="https://www.goodgrub.org/wild-foods/wild-foods-medicine-resources">https://www.goodgrub.org/wild-foods/wild-foods-medicine-resources</a>                                                                                                                 |
| 60 | Yuungnaqpiallerput The way we genuinely live                                                                     | <a href="http://www.yupikscience.org/">http://www.yupikscience.org/</a>                                                                                                                                                                                           |

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