Cosmovisions of the Pacific

cosmovisionsofthepacific.org

PHASE I REPORT

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Eurocentric Approaches to Science: We define Eurocentric approaches to science as those that adopt a narrow framework that prioritizes Eurocentric scientific methodologies and perspectives. This approach establishes a hierarchical system of knowledge, deeming Eurocentric science as superior and relegating other knowledge systems as less relevant. Consequently, this hierarchy perpetuates colonial agendas and marginalizes Indigenous populations, whose knowledge systems are rooted in practices passed down through generations. By disregarding or devaluing Indigenous knowledge, Eurocentric science reinforces historical power dynamics and perpetuates the marginalization of Indigenous communities.

Indigenous Knowledge: We define Indigenous knowledge systems as those formed from experiential knowledge accumulated and passed down through generations within Indigenous communities. Unlike Eurocentric approaches to science, which prioritize empirical data, Indigenous knowledge systems are rooted in lived experiences and a wholistic understanding of the world. They are not driven by a motive to collect empirical evidence but rather by a synchronized way of life that emphasizes relationships with all living beings and non-living elements of the environment. These knowledge systems encompass a deep understanding of natural cycles, traditional practices, spiritual beliefs, and social structures, reflecting the interconnectedness between humans, nature, and the cosmos.

INTRODUCTION

Since the dawn of humanity, science and exploration have connected people, communities, countries, and cultures. Indigenous peoples of the world have observed the Earth and the sky above, and this Earth-sky connection has been a fundamental element in the development of their society. The sky shaped their culture and religion, helped define their temporal and spiritual perspectives, and supported their management of agriculture and livestock cultivation (Cramer, Uzzo, Catricheo, Spuck et al., 2019). Through this worldview, or cosmovision, Indigenous peoples have established connections with all that surrounds them, including the rivers, plants and animals on Earth, and the stars and planets above.

We define cosmovision as *an individual or culture's way of knowing and being, emanating from the wholistic natural cosmic processes that have led to the present state of the universe and what is yet to come* (Begay, Catricheo, Kimura, Maryboy, and Spuck, 2022). It is the lens through which we live and come to understand the universe. Through our cosmovisions, Indigenous and non-Indigenous peoples have established understanding and connections with the world that surrounds them. Cosmovisions of the Pacific brings together both Indigenous and non-Indigenous people, as Native Hawaiian Kalepa Baybayan described it before his unfortunate and sudden passing, to "walk the middle together" where both can share what is shareable.

Why the Pacific?

Studies of Indigenous populations of the Americas have found distant genetic links in common with people of Australia, Papua New Guinea, and the Andaman Islands (Skoglund et al, 2015). Research indicates that around 12,000 BCE people migrated from East Asia to Alaska over the Bering Land Bridge, then moved south through Canada, the U.S. and into Central and South America (Belshaw, 2015). There is also growing evidence that the West Coast of the Americas may have been populated by boat via the Pacific coastal route prior to the migration of individuals from Alaska (Montaigne, 2020). In focusing on Indigenous groups in the Pacific and the regions surrounding the Pacific Ocean, these populations may have close connections and Cosmovisions that may have been passed down from generations. The proposed project will look to capture connections and similarities across Cosmovisions and cultures, both Indigenous and non-Indigenous. While we will focus on the Pacific and Pacific Rim regions, we will not exclude others who may be interested in

participating. Further, once developed and implemented for the Pacific region, Cosmovisions can be implemented elsewhere across the globe as well.

Why Now?

The research community has recognized the need for, and the many benefits of, interdisciplinary and convergence approaches to STEM (Subcommittee, F.C.I.S.E., 2022; Maden, et al., 2013; Reynante, et al., 2020; National Research Council, 2014). Further, we have witnessed the impact of unsuccessful collaboration between Indigenous knowledge holders and non-Indigenous communities. Recent examples include strong protests against the construction of the Thirty-Meter Telescope in Hawaii (Rüland, 2023) and protests against the Keystone XL pipeline project (Bosworth & Chua, 2021). This moment is an opportunity to recognize that science is embedded in culture and history, and that science is best done using as wide a lens as possible. Indigenous practitioners can help Eurocentric science transition to more interdisciplinary convergent methods. However, this process requires a harmonious approach through authentic collaboration and relationship building, rather than traditional Eurocentric framing that values transactionally-framed engagement.

Background

Conversations around the Cosmovisions of the Pacific initiative started in 2018, and included Indigenous and non-Indigenous persons primarily from the Indigenous Education Institute (IEI), the ʻImiloa Astronomy Center of Hawaiʻi, and Associated Universities, Inc. (AUI). In the years that followed, the conversations worked to refine a set of strategic goals and objectives (see Appendix A). When COVID hit in 2020, it forced the team to delay plans to hold our Cosmovisions Gathering to develop the initiative more fully. Finally, in January 2023, thanks to support from the Heising-Simons Foundation, we held a small pilot program (Cosmovisions Phase 1) at Northwest Indian College on the unceded territories of the Lummi Nation. The gathering including approximately 30 Indigenous and non-Indigenous researchers, educators, students, and knowledge holders to explore the concept of Cosmovisions, and to establish a framework for a larger gathering in the future of Indigenous and non-Indigenous persons interested in establishing a more formal Cosmovisions network of collaborators.

The original goals of Cosmovisions of the Pacific Phase 1 Gathering included:

- Bringing together a group of 30 Indigenous and non-Indigenous persons to share what is sharable and explore the opportunities for future collaborations in research and education across STEM and astronomy-related disciplines,
- Advancing the strategic Goals and Objectives of the broader Cosmovisions initiative (see Appendix A),
- Production of a draft white paper that identifies rich areas of opportunities for future Indigenous/non-Indigenous collaboration on research and project implementation, and
- Production of draft guidelines that incorporate the principles of collaboration with integrity (as defined by IEI) to help guide Indigenous/non-Indigenous collaborations.

In addition to these goals, program activities also focused on:

1. Modeling collaboration with integrity as defined by the IEI (Maryboy, Begay & Peticolas, 2012),
2. Maintaining an awareness that we each "Explore" through our own unique cosmovision, and collaboration with integrity requires us to respect the cosmovision of others,
3. Maintaining an awareness of related recommendations outlined in "Pathways to Discovery in Astronomy and Astrophysics for the 2020s" (National Academies of Sciences, Engineering, and Medicine, 2021),
4. Identifying processes, opportunities, and critical steps in addressing our strategic goals (SG) and strategic objectives (SO) listed below,
5. Advancing and refining our stated SGs and SOs as needed for implementation of Cosmovisions Phase 2 which is intended to be a much larger gathering that will establish a more formal Indigenous/non-Indigenous Network of collaborators,
6. Implementing a strategy including individual presentations, panel presentations, breakout groups for small group discussion, synthesis of thought, and opportunity to pursue new ideas that emerge, and
7. Collecting key points for integration into a white paper identifying opportunities for Indigenous/non-Indigenous collaboration, and protocol for collaboration.

The Cosmovisions Phase I Venue

Cosmovisions Phase I took place January 12–15, 2024, at Northwest Indian College (NWIC) and the Silver Reef Casino Resort near Bellingham, Washington. NWIC

opened their doors to host the majority of the daytime activities and evening events were held at Silver Reef. NWIC is a public tribal land-grant community college established by the Lummi Nation, and is the only accredited tribal college or university serving reservation communities of Washington, Oregon, and Idaho.

Land Acknowledgement

"We would like to acknowledge that the Cosmovisions Gathering took place on the ancestral homelands of the Coast Salish Peoples, who have lived in the Salish Sea basin, throughout the San Juan Islands and the North Cascades watershed, from time immemorial. We express our deepest respect and gratitude to the Lummi Nation and Nooksack Tribe, for their enduring care and protection of these lands and waterways."

Acknowledgement of Historic and Cultural Context and Gathering Goals

Tim Spuck, Director of Education & Public Engagement at Associated Universities Inc. (a non-Indigenous participant), in opening comments stated, "We acknowledge the impact of Eurocentric colonization on Indigenous people. The work here is a step in healing the harm that has been done." In his presentation, Tim also highlighted several key points that we can not ignore as we work through the healing process toward collaboration. Examples of key points presented include:

- White men and women took the land, food supply, and ways of life away from Indigenous communities;
- It is estimated that European settlers killed 56 million Indigenous people over about 100 years in South, Central, and North America;
- It was not until 1924 that Native Americans in the U.S. were permitted to vote, and for decades after, many states continued to withhold or subvert voting;
- Many Native American children were forcibly taken from their homes and placed in boarding schools, where they were stripped of their names, their language, and their culture, and forced to assimilate into white, Christian society;
- These children were abused at the hands of white men and women; many died/were murdered at these boarding schools.

Following this critical acknowledgement there was further discussion on the meaning of one's cosmovision. Another's cosmovision is not something we have to

accept for ourselves, but it is something we should respect about one another as we become aware of how different people have come to perceive and understand the universe. Tim said, "We acknowledge that it is possible our cosmovision may come into conflict with others. We hope that we can be comfortable sharing our views and the context behind them."

In an attempt to better define what we mean by an individual's cosmovision, Tim volunteered to share some details of his own personal cosmovision (See Figure 1 below). Through his lens, he sees all things (living organisms and non-living, personal experiences, etc.) entering the universe at a point within the graphic, representing a level of motivation and awareness. The goal of existence is a movement toward greater understanding and a more positive motive. When something within the universe does not follow this movement up and to the left within the diagram, he asks, "Why?" What is the cause of the imbalance? For Tim, all matters are viewed through this lens and it frames his personal cosmovision and his views on the past, present, and future.

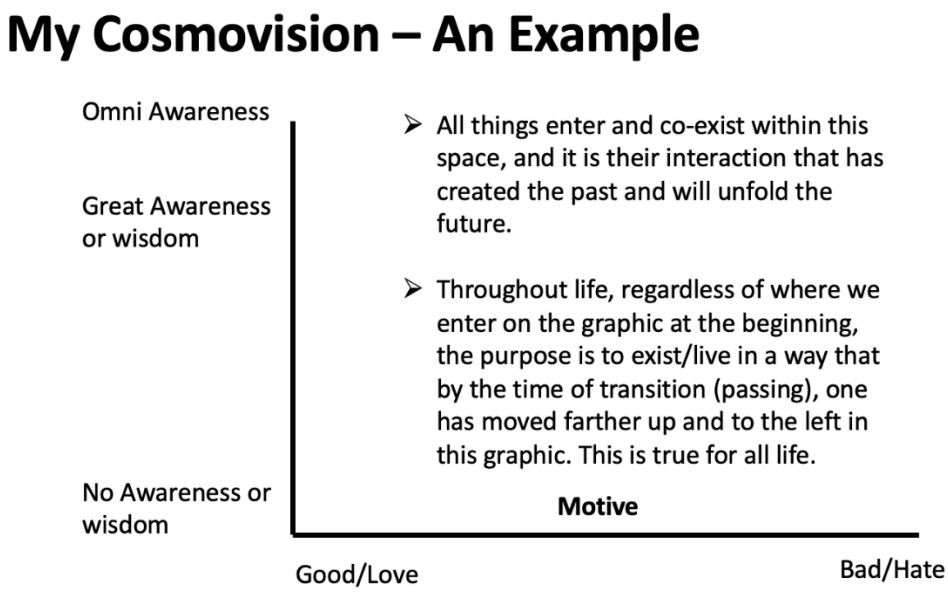


Figure 1: Example of an individual's cosmovision (Spuck, T., 2023).

The Gathering Program

The Gathering program included a variety of activities (See Appendix B: Gathering Agenda). All individuals who wanted to speak were given the opportunity to do so without interruption. The facilitators focused on letting the participants guide the

conversation and the agenda, rather than allowing the agenda to dictate time constraints on the conversations. This meant that the agenda was flexible and required ongoing revision as we progressed through the Gathering. This was intentional.

It was critical that the setting and ceremonies prepared the space for authentic dialogue. We wanted to create a space in which individuals felt comfortable sharing what they wanted, as well as holding back that which they did not want to share, without judgment or fear of what others might think. To achieve this goal, each day was opened and closed with a ceremony including prayer, song, and/or words of wisdom and thankfulness. The program also included presentations that recognized the atrocities committed by non-Indigenous on Indigenous people, and presentations sharing Mapuche, Lummi, and other Indigenous cultures.

At the core of the program were four different scenarios. For each of the four scenarios, Gathering participants were separated into Indigenous and non-Indigenous homogeneous groups to begin discussion. For approximately one hour, participants in these homogeneous groups discussed how they might approach solving the problem or answer the question. Following this discussion, the participants came together as one large group in which a representative from the Indigenous group and a representative from the non-Indigenous group provided the full gathering a summary of the discussions that took place in their homogenous group. This was followed by a full group discussion on the similarities and differences in the Indigenous and non-Indigenous approaches to the scenario, potential revisions to the Cosmovisions strategic objectives, and areas of possible Indigenous and non-Indigenous research and projects. This process was implemented for each of the four scenarios listed below:

Scenario #1. The bright star Betelguese in Orion (Western culture) begins to show signs that it is within weeks of going supernovae providing researchers with the once in a lifetime opportunity to collect rare data about the build-up to the Supernovae event. However, this event is happening during a period of time when some Indigenous cultures may not be permitted to tell stories related to this group of stars. One of the premier instruments for this supernovae research is on the land of these Indigenous people. **Break out into Indigenous and non-Indigenous groups for discussion. (How should this research opportunity be approached? What are your concerns? Other?)**

Scenario #2. Walleye and bass are not native to the Pacific Northwest. It is estimated that more than 20 million salmon smolts are eaten each year by these fish in Lake

Washington and the Columbia River. They could be classified as an invasive species. **Break out into Indigenous and non-Indigenous groups for discussion. (What should be done, if anything, about the walleye and bass in the Pacific Northwest in an effort to best steward our resources for future generations? What are your concerns? Other?)**

Scenario #3. We have an upcoming solar eclipse where the centerline will pass through both Indigenous and non-Indigenous communities. A research team would like to engage these Indigenous and non-Indigenous communities in data collection, analysis, and reporting, and ultimately in the writing of a journal article. **Break out into Indigenous and non-Indigenous groups for discussion. (How should this research opportunity be approached? What should be the protocol for data collection? How should individuals be recognized for their contribution? What are your concerns? Other?)**

Scenario #4. As science evolves and new discoveries are made, new language/vocabulary must be invented. In addition, this new vocabulary should be made accessible for those who are deaf and/or blind or visually impaired (DHH and BVI). A team would like to develop new sign language for the deaf community here in the U.S., including both Indigenous and non-Indigenous persons. The hope is that this new vocabulary to be signed will be able to be used for both Indigenous and and non-Indigenous audiences. B**reak out into Indigenous and non-Indigenous groups for discussion. (How should this opportunity be approached? What should be the protocol for working together on this collaborative project? How should individuals be recognized for their contribution? What are your concerns? Other?)**

See the additional scenario details in Appendix C: Cosmovision Phase 1 Scenarios.

In summary, the Gathering Program facilitated discussions on Indigenous perspectives, language, and worldviews, emphasizing the need for respectful collaboration and the recognition of diverse ways of knowing.

SECTION 1: A GUIDE TO RELATIONAL ACCOUNTABILITY

Introduction

Relational accountability serves as a root system, such as the mycelium network that connects all living beings (animate and inanimate), facilitating the exchange of information in order to nourish and enrich our diverse communities with relevant

knowledge, shared in an appropriate way, to support collaborative growth. Cosmovisions values the integration of Indigenous knowledge, relational accountability, and Indigenous ethics in research, emphasizing the importance of meaningful and reciprocal relationships in collaborative endeavors with Eurocentric scientific research. We acknowledge that Eurocentric approaches to science often fail to recognize and incorporate Indigenous knowledge as valid truths, and tend to appropriate insights gleaned from Indigenous knowledge, while extracting them from their context and interpreting them through inappropriate (and inaccurate) Eurocentric lenses. Eurocentric science tends to prioritize quantitative, empirical data over qualitative, experiential knowledge, dismissing Indigenous knowledge as anecdotal or unscientific. This bias can lead to the marginalization or erasure of Indigenous and local knowledge systems, despite their demonstrated effectiveness in sustainable resource management and adaptation to environmental change.

Cosmovisions understands that power dynamics inherent in Eurocentric scientific institutions can perpetuate colonial legacies, leading to the appropriation or exploitation of Indigenous knowledge without proper recognition or compensation. This further reinforces the marginalization of Indigenous voices and perpetuates inequalities in knowledge production and dissemination. We also recognize that Eurocentric science's insistence on a reductionist, compartmentalized approach to understanding the natural world can overlook the interconnectedness and holistic perspectives inherent in Indigenous knowledge systems. Traditional knowledge often integrates ecological, cultural, and spiritual dimensions, offering comprehensive understandings of ecosystems and their dynamics. The emphasis is on the relationships between beings and knowledge, and the importance of preserving and maintaining those relationships.

The modern Eurocentric scientific community's historical attitude toward Indigenous science is rooted in beliefs about intrinsic capabilities, influenced by historical concepts of racial supremacy rather than historical Indigenous knowledge as experiential evidence. These beliefs have led to the establishment of exclusionary systems that oppress Indigenous peoples, hindering the development of Indigenous science in alignment with their needs, priorities, and values. Indigenous individuals seeking to engage in Eurocentric science often face pressure to conform to systems that do not serve them, adopt values they do not endorse, sever relationships that inform them, and pursue objectives that may conflict with their values.

Contrary to the idea that humans inherently harm their environments, we contend that human systems, rather than humans themselves, bear responsibility for the negative consequences resulting from the irresponsible application of technology lacking relational accountability. Examples such as the dark earth in the Amazon Rainforest, Forest Gardens in British Columbia, and the aquaculture practices of the Coast Salish underscore humans' significant capacity to enrich the abundance, diversity, and overall well-being of ecosystems. Embedding our research, science, engineering, and activities within a framework of relational accountability can facilitate the restructuring of systems to uphold the quality, diversity, and abundance of life for all beings.

The colonial imposition of a singular truth has had a detrimental impact on the revitalization of knowledge within Indigenous populations, leading to erasure. By prioritizing and imposing Eurocentric epistemologies, colonial forces have suppressed and devalued Indigenous ways of knowing, undermining the preservation and transmission of Traditional Knowledge systems. This erasure perpetuates intergenerational trauma and impedes efforts towards cultural revitalization and self-determination among Indigenous communities.

Key ideas

Relational accountability is not a new concept within Indigenous spaces; in fact, it stands as a guiding principle that recognizes and respects Indigenous perspectives, values place-based knowledge, and ensures that any collaboration between communities is grounded in respect, integrity, deep listening, authenticity, and reciprocity. Cosmovisions of the Pacific strives to establish ethical frameworks rooted in relational accountability that honor diverse ways of knowing and foster mutually beneficial relationships between researchers and communities in order to support productive collaboration and the expansion of understanding for the benefit of all.

Collaboration with integrity entails maintaining these principles as anchors for all collaborative endeavors. The definition of these principles is not fixed, but evolves with new information, collective understanding and changing contexts. Therefore, effective collaboration involves constant reflection, evaluation, and adaptation to ensure alignment with the core values of respect, integrity, deep listening, authenticity, and reciprocity. Like a healthy ecosystem, collaboration thrives when all these values are utilized synergistically and suffers when values are selectively chosen or eliminated. See Figure 2 and descriptions:

Figure 2. Cosmovisions' Relational Accountability and values used in collaborative efforts.

Respect in the context of relational accountability reflects the understanding that other ways of being and knowing exist and are valid and that there are inviolable boundaries and rights inherent in all living beings. The Cambridge Dictionary defines respect as "admiration felt or shown for someone or something that you believe has good ideas or qualities." Respect demonstrates an understanding that all beings have value. Cross-cultural collaboration requires respect for:

- Indigenous and non-Indigenous knowledge systems and ways of knowing,
- Indigenous and non-Indigenous stewardship of knowledge,
- Rights of Indigenous and non-Indigenous communities to participate or decline to participate in knowledge sharing,
- Youth and their ways of knowing and how they interact with others,
- Our ancestors who are still in the land and our descendants who will come after us,
- New knowledge and understanding, diverse perspectives and changing values, and
- All life that makes up the universe.

What does/did respect look like at Cosmovisions Phase 1?

- We created space for everyone to share what is shareable.

- Meeting organizers did not expect attendees to give their knowledge; the information shared came from their own individual decisions.
- Indigenous leaders shared their own cosmovisions of the universe, which have the same weight and value as the cosmovision of the Eurocentric communities.

Integrity is realized when a person or persons operate in good faith and with good intentions. Collaboration with integrity can only occur when you also see and feel this in those you are collaborating with. Integrity further results from communicating honestly and matching actions with stated intentions and demonstrating benevolence toward others.

What does/did integrity look like at Cosmovisions Phase 1?

- Each day, there was space for opening with land and ancestors' acknowledgment. At the start of the program, co-facilitator Tim called out past atrocities against Indigenous persons and their communities. This honest assessment and reflection of the realities of our past and the people who committed these atrocities helped establish integrity throughout the following program. This admission of what our non-Indigenous white ancestors had done also made it possible to communicate the true intention of Cosmovisions more effectively.

Dynamic Balance between knowledge systems and ways of knowing is essential. Further, there must also be a dynamic balance between the needs of individuals and diverse communities, between ecosystems and all living things, as well as non-living resources. We specifically use the word "dynamic" in reference to balance because the universe is in a state of constant change, and so too is the point of balance. We also must ensure that marginalized or disempowered communities are represented when establishing balance.

What does/did dynamic balance look like at Cosmovisions Phase 1?

- There were opportunities throughout the gathering for both Indigenous and non-Indigenous to lead the conversation, to provide their thoughts and ideas, etc.
- There were sharing of how collaboration between Indigenous and non-Indigenous groups could lead to new ways of knowing and knowledge.

Deep listening is engaging in communication to understand the intention of each communicator—listening with openness, that is, not assuming what the other might say, but listening for the meaning of the words others say as they likely want

to convey it. Listening to the natural world as well as humans. Listening to understand, instead of listening to respond.

What does/did deep listening look like at Cosmovisions Phase 1?

- During the meeting, Indigenous leaders had their time to share their trauma in their communities of how colonialism has impacted their land, environment and culture. During these instances everyone listens in a way to understand the communicator's intention of sharing with open hearts and respect.

Authenticity means accurately representing our identities, intentions, motivations and goals. Being true to our values, aligning our thoughts, words and actions. The Cambridge Dictionary defines authenticity as “the quality of being real or true.”

What does/did authenticity look like at Cosmovisions Phase 1?

- At the beginning of the first day participants introduce themselves, sharing their identities, their intentions to be part of the meeting, their motivations to come together to share what is shareable.
- This gathering built the sharable knowledge and experiences under a core of values and thoughts that would lead words and action, like this report.

Reciprocity is acknowledging and honoring mutual interdependence among humans and between humans and the natural world.

What does/did reciprocity look like at Cosmovisions Phase 1?

- In different instances, during presentations there was a clear message that can be summarized as: we are all connected, there is only one world that connects us all in it, there is nothing that happens independently from other communities or entities.
- David Begay (Navajo/Pueblo) shared: we think of it in terms of relationship; we are related to everything and everything is interrelated.

In Nancy’s words: “Collaboration with integrity is a teaching from the Indigenous Education Institute (IEI), and we want to share about what it means in cross-cultural relationships, especially in connecting Indigenous ways of knowing with Eurocentric science. We have found that a lot of things we have learned and teach focus on these two ideas: collaboration and integrity.” We find that the values above can translate into the processes that IEI has articulated, so we summarize them below.

Building long term relationships and trust. Tribal people are hold to a different standard, in terms of relationships. It goes beyond something transactional; instead each person must include their intent, to make a relationship with someone else.

Engaging respectfully with Indigenous knowledge management. As members of an inclusive community, we learn together. If we want to learn, then we should be together and learn. Outcomes of this learning process should be shared when appropriate but not put into capitalistic spaces for profit.

Honoring the protocols of the Native Nation(s) with whom you are collaborating. Consideration should be given to which tribal nations are involved and developing awareness of the ways Indigenous protocols may differ. As a guest, one should observe protocols, one should listen to Indigenous collaborators. Jared asked: "Would you come and sit with our family and understand why we do what we do? Our approach is to go to our hereditary chief, our elders. In this case, we would always defer to the elder."

Acknowledging the trauma of colonization. It's important to recognize the damage done by colonization and allow extra time, extra space, and extra resources to allow the communities to work to make this right. Polly said: "Underline the role of trauma, both historic and contemporary, that is present for Indigenous people when we face any issue. Indigenous people don't separate ourselves from these experiences, and often non-Indigenous people want to dive right into the problem at hand and may not realize that they are stepping into the presence of that trauma."

Engage in deep listening. To underscore what is described above, this means taking the time to really listen to what people are saying. When you try to not use your own preconceived notions but really listen to what people are saying, something barely touched on might be really significant.

Develop and honor place-based knowledge. Indigenous knowledge recognizes there are many truths in many places, and what might be true in what place might be different in another. The sense of place is also so important—you must know the land you come from, the land you're living on. It's very fashionable to do land acknowledgments, which are wonderful, but land is more than a place.

Respect and uphold the treaties of the Nation(s) you are collaborating with. The role and history of treaties is not being taught in schools, and we need to hold our legislators accountable. Treaties also extend to non-human relationships—with other species, with place. In reference to discussions around walleye and bass

invasive species, Shirley said: "When we think about the 'benefits' of invasive species coming into our lands, it ends up feeling like an attack."

Honor and support Native languages. As Shirley said: "The land is so connected to our language, so if we lose our land or the environment, then our language changes and is lost as well. It's true that things change, and we have to adapt, but our language and culture connects us to the past and our ancestors, and it's important to share this worldview with other people."

Lessons Learned

This is *how* we may explore in Cosmovisions Phase 2.

Using the framework of values created by the Cosmovisions team, the following procedures for collaborations will include:

1. Establish safe and supportive environments:
    a. Create safe spaces, welcoming and conducive to open communication.
    b. Ensure confidentiality and privacy to promote trust and security.
2. Practice active listening:
    a. Listen attentively without interruption or judgment.
    b. Validate feelings and experiences expressed by the individual.
    c. Use reflective listening techniques to demonstrate understanding and empathy.
3. Prioritize consent and autonomy:
    a. Respect each individual's autonomy and agency in decision-making.
    b. Obtain informed consent before engaging in any collaborative activities or interventions.
    c. Offer choices and alternatives to empower the individual in the collaboration process.
4. Engage in self-education:
    a. Be accountable to educate oneself about individuals and communities before providing goals, processes, and potential outcomes of collaboration.
    b. Clarify roles, expectations, and boundaries to foster transparency and clarity.
5. Foster empowerment and self-efficacy:
    a. Encourage individuals to identify their strengths, resources, and goals.

    b. Support the development of coping skills and resilience.
    c. Acknowledge and celebrate achievements and progress made throughout the collaboration.
6. Practice cultural sensitivity and humility:
    a. Recognize and respect cultural diversity and individual differences.
    b. Validate and integrate cultural beliefs, practices, and traditions into the collaboration process.
    c. Continuously educate oneself about cultural competence and humility.
7. Collaborate with multidisciplinary teams:
    a. Engage with a diverse team of professionals for wholistic understanding.
    b. Coordinate efforts and share information to provide comprehensive and wholistic support.
    c. Respect the expertise and contributions of all team members.
8. Implement trauma-informed practices:
    a. Be aware of potential triggers and sensitivities related to trauma.
    b. Use trauma-informed language and approaches that prioritize safety, trust, and empowerment.
    c. Avoid re-traumatization by offering choice, flexibility, and control in the collaboration process.
9. Provide continuous support and follow-up:
    a. Collaborate with individuals to harbor strength-based relationships.
    b. Continual referral and information between all collaborators.
10. Practice self-care and reflective practice:
    a. Reflect on personal biases, assumptions, and reactions in interactions with individuals.
    b. Engage in ongoing learning and professional development to enhance trauma-informed care practices.
    c. Reflect on previous collaborations to evaluate whether outcomes are in alignment with intentions.

Areas for Future Exploration

This is *what* we may explore in Cosmovisions Phase 2.

We feel fortunate to be living in this era where we honor our traditions, practice the teachings passed down to us, and collaborate with contemporary scientists, many

of whom are present here today. Today, we'd like to share insights into our relationships with academic institutions and offer some ideas or role models for nurturing your own connections within your communities and professional circles.

Some of you may already have long standing relationships in place. Looking back, we recognize the importance of acknowledging and nurturing these relationships as they evolve. As a collective, we recognize that knowledge comes from ancestors, connections with others, and insights into the future revealed through dreams, celestial knowledge, and the wisdom shared by Mother Earth and Father Sky. Looking forward, we can create a protocol around relational accountability—how we engage and document to support future endeavors. This will look different from an individual versus an institutional perspective.

Regular reflection and dialogue with community partners throughout the research journey can help ensure that our values and ethics align with the needs and aspirations of the Indigenous tribes we collaborate with. These assessments may look like:

- Conducting follow-up surveys with Cosmovisions Phase 2 participants to gauge how well we lived into these values,
- Creating mechanisms for people to share their experiences in a Cosmovisions newsletter or blog, and
- Finding alternative ways for people to provide feedback—perhaps a liaison could travel into communities and practice deep listening to engage with people who may not engage through other means—subject to the protocols and sovereignty of the Tribes.

SECTION 2: DIFFERENT WAYS OF KNOWING AND KNOWLEDGE BUILDING

Introduction

How we build new knowledge is integral to who we are as lifeforms on planet Earth. Throughout Cosmovisions Phase 1 activities, it became apparent that Indigenous and non-Indigenous persons approach this knowledge building quite differently. While an Indigenous approach sees the "observer" in relationship with a subject or question they might be exploring, non-Indigenous approaches see the "observer" separate from the subject or question. So, it is not surprising that many Indigenous persons see Earth and all life on it as part of their family, while non-Indigenous persons objectify Earth and life on it, and see themselves as dominant over both. While this difference presents significant challenges to collaboration, it also presents unique opportunities to more fully understand the world around us.

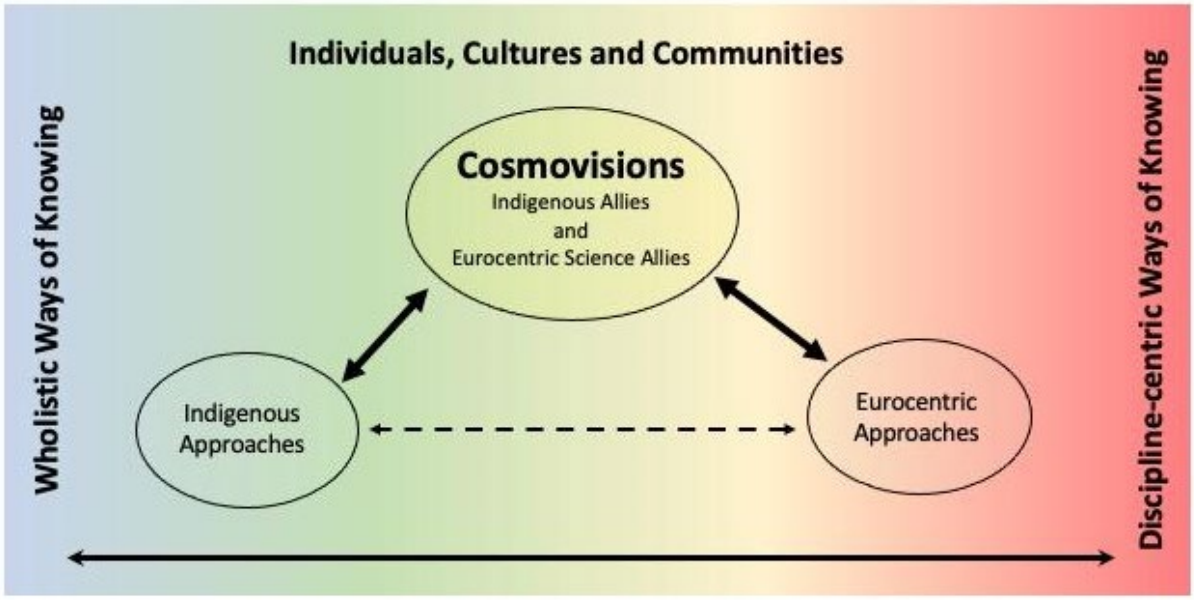


Figure 3: Ways of Knowing Spectrum (Spuck, T., Maryboy, N., Catricheo, Y., & Walker, P., 2023)

As outlined in Section 1, we can overcome these challenges through the practice of relational accountability and collaboration with integrity. Figure 3 (above) shows a spectrum of different ways of knowing from wholistic to discipline-centric knowledge building. Indigenous Allies are those who are primarily discipline-centric knowledge holders who recognize the value of Indigenous and other more wholistic

ways of knowing. Eurocentric Science Allies are those who are primarily wholistic or Indigenous knowledge holders who recognize the value of discipline-centric ways of knowing. Cosmovisions is working to create a network of Indigenous Allies and Eurocentric Science Allies who can work together to build bridges between these different ways of coming to know our universe and our relationship with it and with each other.

Further, Figure 1 is constructed in the shape of a triangle, in three dimensions we would refer to it as a cone. This is one of the strongest shapes in nature, and it was used for a variety of purposes such as housing. The commonly known "tipi" is used by tribes and people all over the world. In the diagram, both the Indigenous and Eurocentric science knowledge systems represent different sides of knowing. At the top, both systems come together representing community, relationality, and understanding of "what's up above is below, and what's below is above."

Key Ideas

It is important to note that both Indigenous approaches and Eurocentric approaches to knowledge building are evolving practices. Just because something is believed to be true does not mean that there is no longer a need to observe the phenomenon. Indigenous knowledge building is the result of continuous observation of phenomenon, and new observations can and do result in changes in beliefs and understanding. The Eurocentric perspective is well summarized by a quote attributed to Albert Einstein: "No amount of experimentation can prove me right; a single experiment can prove me wrong." While Indigenous and Eurocentric approaches to knowledge building implement different strategies that allow for changing what one believes to be true, both have a similar goal, and that is an understanding of "Truth." In the tapestry of knowledge, woven with threads of Indigenous wisdom and Eurocentric logic, there lies a common thread—Truth. Although their paths diverge, their destination is the same: a deeper understanding of existence.

Knowledge is not confined to the pages of textbooks or inside the walls of lecture halls; it transcends mere information-sharing; there is life and energy beyond technical activity where information is shared via presentations or publications. Deeper understanding of a phenomenon can result from experiencing the phenomenon through food, setting, symbolism, prayer, dance, and language. It is experienced through the senses—tasting, feeling, seeing, hearing, and smelling. It is

found in the nourishing embrace of food, the sacred dance of prayer, the lyrical language of the land.

Food is a representation of the land and people. All people need food to live. For the Lummi people, Salmon is more than sustenance; it is a symbol of interconnectedness. Rich in nutrients, it offers not just physical nourishment, but a spiritual connection to the land and its people. Within the salmon are vitamin rich and amino acids that are beneficial in giving us sustained healthy energy. The act of sharing Salmon is a gesture of welcome, of safety, of life itself. The sharing of food indicates sharing of knowledge, sense of identity, and or familiarity of the host. Historically many people and cultures come together for many reasons for nourishment. Food is understanding.

In the morning, on Day 1 of the Cosmovisions Gathering, the family of Troy Olsen and Shirley Williams shared canned salmon with all participants. The preparation of the salmon was excellent. The texture and the flavor were the result of great care, love, and gratitude, and thousands of years of practice in preparation. The sharing of the salmon and partaking in the joy of this shared food experience allowed for a deeper understanding of the importance of the salmon to the Lummi people. As more technical discussions took place about salmon populations, laws, treaties, fishing practices took place throughout the gathering, individuals were able to draw on this food experience to more fully understand the importance and consequences of the more technical matters.

The setting and symbolism too are critical to knowledge building. The log building and horseshoe arrangement of tables at NWIC provided a setting conducive to collaboration and sharing of knowledge and experience. The cedar log building was also symbolic and representative of traditional housing of the Lummi people. The home indicates safety and comfort that reflects the local environment. For the Lummi people, cedar is seen as not just a tree but also as a relative offering safety, protection, and travel. Cedar boughs are often hung on the door to ward off negative energy. In parallel, we find it interesting that cedar is used in closets and storage chests in Eurocentric cultures to ward off insects that might damage clothing. So, the voice of the cedar log cabin for Cosmovisions created a setting for meaningful discussion which is essential in establishing relationality with the host. Observing what items are in or closest to the home, how objects are placed within the home and the smell of the home. Across all people, the home or setting expresses full and true exposure of the host, family, and people.

Song, dance, and prayer are also important to knowledge building. They can be used to both prepare the mind and body to receive knowledge or to communicate knowledge itself. Each day of Cosmovisions was opened and closed with prayer and/or song. From a Eurocentric perspective, individuals might similarly engage in reflection or a form of meditation. These activities can result in relaxing and opening the mind so that it can identify new knowledge and better connect to it as the mind attempts to make meaning. As an example, YakaiYastai Gorman-Etl provided a closing song. The song expresses Navajo prayer that embodies beauty before, after, all around, and within. This song is a symbolic message of how Indigenous communities use song to connect everyday living to a way of life that is sacred.

Language and tradition too are factors that heavily influence how we come to know or build new knowledge. Cosmovisions Phase 1 highlighted both the importance and limitations of language. It was a primary consideration within the Indigenous groups discussions related to the four scenarios, "How will [this scenario] impact our language?" was consistently a point of discussion. In addition, limitations in language, and in particular in translations, make it impossible to transfer knowledge fully. Written language is an attempt to use points and lines or even pictures to communicate a thought, but there can be misinterpretations. In addition, the sounds we make when we communicate verbally can be misinterpreted as well. Further, there are Indigenous words that simply do not have a non-Indigenous equivalent. As a result, language is an important factor to consider when thinking about different ways of knowing or knowledge building.

Traditions and customs also influence knowledge building. In different cultures there may be a time and a place when it is appropriate to talk about and/or explore various topics, and some topics may be too sacred or forbidden altogether. These traditions and customs can influence how or if we come to know.

Throughout participant discussion around knowledge building, additional key themes emerged. For example, from an Indigenous perspective, the land is viewed as a member of the family, highlighting the responsibility to care for it akin to caring for another family member. Therefore, if the pursuit of new knowledge harms the land, it is the same as harming a member of your family, and that places limitations on what one can do in the pursuit of new knowledge. Indigenous (wholistic approaches) to knowledge building comes from a point of relationship. The Earth and all life on it are part of my family. I build knowledge in harmony or synergy

through my relationship with my family. I do not want to harm my family in the process of building new knowledge.

Indigenous persons often see themselves in deep relationship with the land. They see the land and life on it as part of their family, and it is their responsibility to take care of and protect their family. So, if we are putting telescopes on mountains, putting in a pipeline, or introducing a non-native species, those actions can be seen as not much different than harming one of our siblings. So, from a Eurocentric approach, how would we respond if someone were harming a member of our family? We would consider it a crime, and we would try to stop it. This is a way to contextualize an Indigenous perspective, and Polly stressed the importance of understanding this point; we can't ignore or dismiss it. This background is incredibly important, and too often Eurocentric approaches often ignore this critical context, and we can't continue to do that.

From a Eurocentric perspective, the land is objectified and seen as something one can control and has dominance over. While this attitude may result in new knowledge, it can also result in an environment where we as humans may not be able to exist. Eurocentric (discipline-centric) approaches come from a point of perceived objectivity. We are objective observers. We are not in relationship with the subject as we build knowledge. The observer sees themselves as disconnected. Because of this disconnection, we see ourselves in control and having power over the subject. We interrogate the subject, even causing harm to it, as we attempt to extract new knowledge. An Indigenous worldview includes connection to ancestors and relatives, and that humans have a responsibility to engage with the land as sacred, and that plants are our oldest teachers.

Discussions revealed diverse Indigenous perspectives on topics such as the significance of celestial events and the interconnectedness of all things. Indigenous languages were explored, showcasing unique concepts like the Navajo word "Yatkay," signifying humanity's place within the universe. The importance of Indigenous languages in shaping worldview was underscored, challenging the dominance of Eurocecntric perspectives.

Participants also reflected on their own cultural backgrounds, acknowledging the limitations of their Eurocentric worldview and recognizing the value of embracing diverse perspectives. The gathering served as a platform for cross-cultural dialogue, fostering mutual understanding and appreciation.

Areas for Future Exploration

- We need to better understand the origins (cause) of the emergence of Eurocentric (discipline-centric) approaches to building new knowledge. Why/how did this happen? A deeper understanding could help us collaborate to take appropriate corrective actions.
- What is the role language plays in different ways of knowing and knowledge building?
- "What's above is below, what's below is above" and coming to an understanding.
- How do we best facilitate the use of the relational accountability framework (or collaboration with integrity) in building new knowledge or research in Eurocentric practices?
- How do things such as food, dance, song, symbolism, and prayer enhance and lead to more meaningful knowledge-building for both Indigenous persons who have not grown up in traditional settings and those who are primarily Eurocentric in their knowledge-building practices?
- A good way to better understand a culture's way of knowing or knowledge-building is to learn their language. How can we better understand and promote this idea?
- In person teaching and learning is essential. (This can necessitate separating into groups to engage in trauma informed care and trust building.)
- Each language or form of communication carries a different understanding of the universe. Consider also the contrast between values, symbols, or plants compared to books, numbers, or technology.
- Storytelling or story sharing provides context of how we arrived where we are today.
- Both Eurocentric and Indigenous ways of knowing are needed for us to achieve understanding of who we are as human beings and the universe.
- Hands on approach and experiential learning.

SECTION 3: CURRENT STATUS OF INDIGENOUS AND NON-INDIGENOUS COLLABORATION

Introduction

Cosmovisions is all about the relationship and collaboration between Indigenous and non-Indigenous people and the understanding of their wholistic ways. Cosmovisions aims to establish a network of Eurocentric and Indigenous Allies who can collaborate to forge connections between these disparate perspectives on cosmic phenomena and our relationship with them. Indigenous and non-Indigenous mutual collaboration is important to succeed in environmental conservational terms, economics, education, and policy. Many examples of investment (time, workforce, funding, etc.) have not been successful in such projects due to the lack of effectiveness, collaboration, and participation between Indigenous and non-Indigenous communities.

Key Ideas

The knowledge exchanged throughout the meeting discussions, and the scenarios evaluated provided a more transparent understanding of how and why connections between Indigenous and non-Indigenous people are important. Acknowledgment, deference, and familiarity with Indigenous or non-Indigenous cultures can help with acceptance and build relationships.

Because non-Indigenous people may not take the time to understand or accept them, Indigenous people frequently feel alienated when they say something. Non-Indigenous people frequently lack the background knowledge necessary to properly comprehend the beliefs and practices of Indigenous people, making it difficult for them to understand many of the ideas and customs that the Indigenous people adhere to. This frequently results in hostility from either Indigenous or non-Indigenous people, which fuels the conflict or acceptance problems that persist.

Representation is a crucial aspect of scientific research and collaboration; an example of the potential consequences of poor or inaccurate representation can be found in the fish advisories issued around contamination in the Columbia River. Dozens of harmful contaminants, including dioxins, mercury, and PCBs, were discovered in the Columbia River decades ago. However, when the federal advisory panel analyzed the data for implications it had for consuming salmon from the Columbia River, the panel used a rate of consumption that was not informed by the

actual salmon consumption of Columbia River Tribes; instead, a significantly lower non-Native salmon consumption rate was used. Using this inaccurate assumption to inform their recommendations, the panel concluded that consumption of salmon from the Columbia River was below the thresholds for the contaminants and led Columbia River Tribes to believe the salmon was safe to eat. When actual Tribal consumption of salmon was taken into account, however, it revealed a level far above the "safe" threshold of consumption for these harmful pollutants (Schick & Miller, 2022), Unchecked pollution is contaminating the salmon that Pacific Northwest tribes eat). As a result of the lack of representation of Columbia River Tribes in that decision, the health of Columbia River Tribal people has been endangered, leading to elevated cancer rates from consuming a traditional food that until recently had been a pristine component of their diets. If Columbia River Tribes had been consulted, a more accurate representation of their salmon consumption would have been taken into account, and perhaps steps could have been taken to mitigate the contamination.

Understanding the values and perspectives of diverse Indigenous communities is necessary to collaborate with integrity while minimizing harm.

As a large concern, Troy stated: "Non-Natives often struggle to understand the importance of salmon to the Salmon People and Tribes of the PNW because they view salmon as a non-sentient resource, just one species among many of 'animals.' But among Coast Salish people, salmon are one of many ancient peoples with their own language, culture, history, and place in the universe. The relationship between human and salmon peoples is a sacred one that has shaped Coast Salish civilization for thousands of years, and is a critical component of Coast Salish life that fills dietary, cultural, economic and spiritual needs."

Troy asked: "Do they understand how important salmon is to 29 treaties (within the State of Washington)? Do they know that our older brother and sister are the salmon? The context of these relationships is not included in the conversation." Troy's example illustrates the need to educate non-Indigenous populations about Indigenous ways of knowing, such as considering non-human creatures to be people and kin to humans. From the viewpoint of open-mindedness, both Indigenous and non-Indigenous people can benefit from our shared awareness of each other's ideas.

Another example that highlights the importance of awareness and reciprocity is the 2020 tragic death of George Floyd, causing a very large uproar on social media. Multimedia and its large democratized speech: People who might not have had a

platform now have access to media platforms that allow them to connect and speak freely. People are now connecting across space and time. Without the use of multimedia platforms, we would not have perceived action and the inclusion of diverse communities around the world on the matter, and the policies that were followed by the government and policing agencies, making new laws or training for these types of atrocities never to happen again. Following the death of George Floyd, there was a huge shock to all communities, and it galvanized people to think of things in a different way, including what has happened to Indigenous and people of color over the years, especially in the 1960s with the "Sundown Towns" across America. Going from hearing a story online, on paper, or verbally to seeing it happen actively has changed people and their processes of thinking in many communities, which is undeniable through research and experience. Through many examples, it can be shown that without these multimedia platforms, we as a people would not have been aware or had the collaboration andmutualism we needed to be fully recognized and accepted by others worldwide.

Reconciliation for both Indigenous and non-Indigenous people can result in a solution for mutual respect and awareness. Indigenous people have not always had easy historical events, which may still be an issue. Teaching and thinking about Indigenous history more often has the potential to reopen old wounds. With more exercises and instruction, we can learn how to mend the wounds or, at the very least, bandage them.

In the past few years, with the prevalence of narratives around historical injustice in mainstream media, segments of the general public have developed increased awareness of these issues. Thus, there is increased potential for those in power to effect positive change.

Collaboration between Indigenous and non-Indigenous needs to be rooted in connections between groups. Based on Figure 3: Ways of Knowing Spectrum, every group is relevant to keep the triangular shape. All three groups are related or connected; even if there are individuals that are on the extreme end of the spectrum, we are all connected; this is why decisions or actions affect everyone; having a clear understanding of this relationship could help us to collaborate more effectively. The lack of connections hurts collaboration and trust.

To increase effective collaboration with integrity, governmental funding that is focused on building connections and trust is needed. On November 15, 2021 the White House Office of Science & Technology Policy (OSTP) committed to "elevating Indigenous knowledge in federal policy decisions." "Indigenous Knowledge should

inform Federal decision making," said the President's Science Advisor and OSTP Director Dr. Eric Lander. "This effort will give Federal agencies the tools they need to ensure Indigenous knowledge is appropriately considered and elevated." Through an executive order signed by President Biden, federal agencies were directed to develop robust plans for ensuring meaningful Tribal consultation on agency work that may affect Tribal Nations and the people they represent (Memorandum, 2021). Others initiatives across the globe has increased the numbers of programs and projects that address collaboration between Indigenous and non-Indigenous people. The problem is that if there is no trust and connection between them, the success of those initiatives is low. Government and private agencies must invest in building connections and trust; the collaboration will flow more effectively and strongly.

Over time, we can think about the total cost of any scientific endeavor that is undertaken, whether it be wind turbines or telescopes, and make sure that we are giving equal weight to the financial expenses as well as the environmental, ecological, cultural, and possibly unexpected costs that will have to be borne by future generations. We hurt ourselves when we don't appreciate connections. We are doing away with the practice of building strong connections—mentally, emotionally, and spiritually—with the environment and/or with one another. When children and adults view plants and animals on a computer or screen, the potential learning that could be there is not fully realized. A culturally significant, highly knowledgeable family member's or tribe member's combined lessons, along with firsthand, in-person encounters with the plants and animals, would enable a novice in ancient teachings to thoroughly understand the physical rather than the virtual domain of learning. Receiving potential generational teachings and experiences that would be carried on from earlier generations, preserving a tribe's "roots."

Lessons Learned

This is *how* we may explore in Cosmovisions Phase 2.

- Expressing the cultural and spiritual needs of multiple and diverse communities
- Be open to ideas of Indigenous communities
- Ask for additional support and learn from other Indigenous people
- Connections are key for collaboration with integrity

Areas for Future Exploration

This is *what* we may explore in Cosmovisions Phase 2.

- Additional Indigenous and Eurocentric Science ideas and expressions that bring people together and not apart.
- Ideas of the effects of tourism, elimination, and development on sacred lands.
- How do we find a model that will help us build the connections that are key to collaborating effectively or with integrity among our differences?
- Governmental and private agencies funding to build connections and trust among Indigenous and non-Indigenous people.

SECTION 4: AREAS OF FUTURE COLLABORATION

Introduction

To foster an inclusive and supportive environment for collaboration among allies, it is imperative to adhere to the principles outlined in Section 1, which promote relational accountability. By consciously embodying and consistently practicing values such as respect, integrity, deep listening, authenticity, and reciprocity, we can cultivate a culture of relational accountability. This culture not only encourages but also sustains meaningful collaboration among allies.

Similar to the intricate mycelium network that interconnects all living organisms in the natural world, a robust collaborative network should serve as a conduit for nourishment, communication, information exchange, resource sharing, and mutual growth among its participants.

In our efforts to establish such a network, we aim to develop culturally appropriate protocols and networks that facilitate connections between allies seeking to amplify or understand underrepresented ways of knowledge and those willing to share such knowledge. These networks will enable allies from diverse communities to engage in reciprocal knowledge-sharing and co-creation, guided by our framework of relational accountability.

Key Ideas

The main points shared from participants emphasize the importance of collaboration between Indigenous and non-Indigenous communities, acknowledging differences in worldview and cultural perspectives. To summarize the key points and recommendations for collaboration:

1. Respect for Indigenous sovereignty: Indigenous sovereignty is crucial, and respecting it is essential for collaboration. This includesdatasovereignty, to ensure that Indigenous communities maintain stewardship over any data from or involving their communities to protect against appropriation, misinterpretation or other inappropriate use. This involves acknowledging historical injustices, such as the exclusion and oppression of Indigenous people, the extraction and appropriation of Indigenous knowledge, and the devastating impact of Colonial policies on Indigenous communities, languages, cultures, and knowledge systems.

2. Understanding Ecological and Cultural Dynamics: Recognize the complex interactions between ecological changes and cultural practices. This involves understanding Indigenous stories, traditions, and the significance of natural resources and relationships within ecosystems.
3. Challenges in Cross-Cultural Communication: Cross-cultural collaboration requires overcoming language barriers and understanding the nuances of different worldviews. It's essential to approach communication with sensitivity and openness to diverse perspectives.
4. Areas for Collaboration:
    a. Treaty rights education: Supporting curriculum development to foster understanding of treaty rights around collaboration with Cosmovisions
    b. Language revitalization: Creating programs to support Indigenous language learning for both children and adults.
    c. Allyship programs: Developing initiatives to educate non-Indigenous individuals on how to be allies to Indigenous communities.
5. Co-Creation and Collaboration: Identifying stakeholders from diverse backgrounds to co-create projects and initiatives. This includes Indigenous representatives, educators, government officials, and potential funders.
6. Specific Project Ideas:
    a. Curriculum development on Native American–U.S. Treaty Rights.
    b. Language learning programs for families.
    c. Training for STEM professionals on allyship.
    d. Indigenous astronomy curriculum development.
    e. Cosmovisions conference and educational platform.
    f. Conflict resolution processes integrating Indigenous and Western approaches.
7. Incorporating Indigenous Perspectives: Acknowledging the importance of relationships and communication in collaboration. Incorporating Indigenous wisdom into training programs and materials to foster effective engagement.

Overall, the emphasis is on building respectful, inclusive partnerships that honor Indigenous knowledge, promote cultural understanding, and work towards common goals of education, preservation, and reconciliation.

Project Idea (Description)	Who do you think should be at the table to co-create?
Develop curricular resources on Native American–U.S. Treaty Rights for implementation in history and social studies courses in Indigenous and non-Indigenous schools across the U.S.	Indigenous allies from different groups, education resource developers, government officials, officials from agencies most impacted by these treaties, others
Program to support parents to learn Indigenous languages alongside their children.	Language instructors, children, parents, potential funders, others
A training or professional development program to help STEM professionals understand how they can be good allies to Indigenous communities. Indigenous allies, STEM professionals, professional facilitator and communicators	Indigenous allies, STEM professionals, professional facilitator and communicators
Bilingual early readers in Indigenous languages and programs to support distribution. “Read to Parent” program to support kids in learning the language and sharing their knowledge with parents who were prevented from learning due to residential schools & colonial education. Books can be specific about traditional ecological knowledge, native plants, constellations and star stories, etc., but should be culturally relevant to each language and co-created and owned by their communities of origin.	Indigenous language speakers, illustrators, authors, and others listed in previous suggestion

Indigenous Astronomy Textbook or Curriculum: A textbook to support potential curriculum and coursework in Indigenous ways of knowing about constellations, 13 moons, eclipses, star navigation, etc.	Indigenous allies and knowledge keepers, space scientists, space science educators, STEM curriculum creators
Annual Cosmovisions Conference to continue to educate about different ways to study and interpret the cosmos and our place within it, and expand our collective understanding. Would be great if we could perhaps publish a yearly journal or other publication summarizing each year's presentations and discussions.	All of us
Cosmovisions YouTube channel. A place to curate videos from the conference and host relevant content, to continue educating about different cosmovisions.	Video editors, sound editors, filmmakers, storytellers, space scientists
Exploring possibilities of developing Five Fingered conflict transformation processes that honor diverse approaches to peace while recentering Indigenous worldviews.	Native peacemakers, non-native mediators and others working in conflict resolution and conflict transformation
In 2021, Kelly Blumental developed a workshop aimed at professional astronomers and astronomy communicators on public engagement. The goal was to focus on relationships because doing so would naturally lead to effective engagement. The resulting workshop is fairly unique to the science	Anyone who values relationships as necessary to communication

communication world, but the approach is very Western, and entirely informed by the Eurocentric academic perspective. Materials can be found on this page. Perhaps this training program could be modified to reflect the wisdom of an Indigenous or non-Western perspective on relationship building and communication.	
Documentary around the work Cosmovisions is doing to capture the process and participants as we build a culture of relational accountability to facilitate collaborative networks between allies. Footage of the conversations, participants and process could help us reflect on and learn from the way we identify, develop and practice the values outlined in Section 1. Future efforts to build collaborative networks between diverse communities may benefit from a documentary capturing this process in action to inform their work.	Documentary filmmakers, Cosmovisions participants, allies and collaborators.
Monthly newsletter with updates about our work, surveys and questionnaires to collect and evaluate feedback, opportunities for collaboration, reflections on our efforts building relational accountability, insights on supporting and practicing DEI, results of past surveys	Cosmovisions team.

System to support Deaf and Hearing Impaired people, translation of spoken content	Sign language translators, Cosmovisions team.

Moving into Cosmovisions Phase 2

This is *what* we may explore in Cosmovisions Phase 2.

To effectively assess the effectiveness of our network in practicing the values of respect, integrity, deep listening, authenticity, and reciprocity, it is important to create assessments that specifically evaluate our adherence to these values. This can be done through surveys, interviews, and feedback sessions with members of the network to gauge how well these values are being integrated into our interactions and collaborations.

In order to develop liaisons between Cosmovisions and Indigenous communities that promote meaningful communication and productive collaboration, it is essential to establish relationships built on trust, understanding, and respect. This can be achieved through in-person, place-based listening sessions and oral surveys that prioritize the voices and perspectives of Indigenous communities. It is also crucial to include allies who may not have access to digital communications in these conversations to ensure inclusivity and representation.

It is imperative to protect sacred and sensitive information shared by Indigenous communities and to assist them in establishing and maintaining data sovereignty over their knowledge and research. This involves implementing strict protocols for handling and sharing information, as well as advocating for policies that protect Indigenous rights to their cultural and intellectual property.

Incorporating diversity, equity, and inclusion (DEI) training and education into our practices is essential for promoting relational accountability in culturally appropriate, respectful, and inclusive ways. By increasing our understanding of different cultural perspectives and histories, we can better navigate relationships with Indigenous communities and ensure that our interactions are rooted in mutual respect and understanding. This training can also help us address any biases or assumptions that may hinder effective communication and collaboration.

Overall, by prioritizing the values of respect, integrity, deep listening, authenticity, and reciprocity in our network, developing strong liaisons with Indigenous communities, protecting sacred information, and incorporating DEI training, we can work towards building more equitable and respectful relationships that honor the rights and perspectives of all involved parties.

In Phase 2, Cosmovisions plans to assess the promotion of relational accountability within a group or organization by designing an assessment tool that evaluates the

extent to which individuals and the collective embody and practice the key values mentioned in Section 1: respect, integrity, deep listening, authenticity, and reciprocity. Comprehensive list of structured assessment models:

1. Community Assessment Questionnaire: Develop a questionnaire where individuals/communities can assess adherence to the values of relational accountability. Include statements related to each value, such as:
    a. “The Cosmovisions team consistently treats others with respect, regardless of differences in opinion or background.”
    b. “The Cosmovisions team always strives to align my actions with my values and commitments.”
    c. “The Cosmovisions team actively listens to others without interrupting or judging their perspectives.”
    d. “The Cosmovisions team communicated authentically and honestly in all interactions.”
    e. “The Cosmovisions team recognizes and appreciates the contributions of others, and I am willing to give back to the community.”
2. Internal 360° Feedback: Implement a feedback mechanism where individuals receive input from peers regarding demonstrating relational accountability. Use a similar set of statements for respondents to rate the individual's behavior and interactions.
3. Surveys and Interviews: Conduct surveys or interviews to gather broader feedback on the organizational culture and the extent to which relational accountability is valued and practiced. Ask open-ended questions to capture nuanced insights and suggestions for improvement. Practices of inclusion for survey/interviews for hearing impaired, blind and vision impaired, PTSD, fdand other non-visible disabilities.
4. Quantitative Metrics: Develop quantitative metrics, such as frequency of respectful communication, adherence to ethical standards, or levels of trust within teams, to track progress over time and identify areas for development.

By combining multiple assessment methods, you can understand how well relational accountability is promoted and practiced within the group or organization. Use the findings to identify strengths, address areas for improvement, and reinforce the importance of fostering a culture of mutual respect, trust, and responsibility.

To continue the growth of embodying Section 1 values, the Cosmovisions team feels it is necessary to continue creating a comprehensive training plan for diversity, equity, inclusion, cross-cultural understanding, multicultural intersectionalities, privileges, and addressing microaggressions requires a systematic approach within collaborations. To prepare our team, we plan to implement key components:

1. Assessment and Needs Analysis:
    a. Conduct a thorough assessment to identify current knowledge levels, attitudes, and behaviors regarding diversity, equity, and inclusion (DEI).
    b. Identify specific strengths and weaknesses within the team related to cross-cultural understanding, multicultural intersectionality, privilege awareness, and addressing microaggressions.
2. Setting Objectives:
    a. Define clear and measurable learning objectives for the training program, tailored to address identified needs and gaps based on feedback from tools as mentioned earlier.
    b. Ensure objectives align with organizational goals and values regarding diversity, equity, and inclusion.
3. Curriculum Development:
    a. Develop a comprehensive curriculum covering topics such as:
        i. Understanding diversity, equity, and inclusion.
        ii. Cross-cultural communication and competence.
        iii. Intersectionality and recognizing various identities.
        iv. Power dynamics, privilege, and oppression.
        v. Identifying and addressing microaggressions.
        vi. Incorporating trauma-informed education
    b. Include interactive activities, case studies, role-plays, and multimedia resources to engage participants effectively.
4. Training Delivery Methods:
    a. Determine the most suitable delivery methods, such as:
        i. In-person workshops or seminars.
        ii. Virtual training sessions or webinars.
        iii. Self-paced online modules.

    b. Consider blending synchronous and asynchronous learning opportunities to accommodate diverse learning styles and schedules.
5. Promoting Psychological Safety:
    a. Create a supportive and non-judgmental learning environment where participants feel comfortable expressing themselves and sharing personal experiences.
    b. Establish ground rules for respectful communication and active listening.
6. Evaluation and Feedback:
    a. Implement pre-and post-training assessments to measure knowledge, attitudes, and behavior changes.
    b. Solicit participant feedback to evaluate the training program's effectiveness and identify improvement areas.
7. Integration into Organizational Culture:
    a. Ensure alignment between DEI training initiatives and broader organizational policies, practices, and initiatives.
    b. Encourage leadership buy-in and commitment to fostering a culture of diversity, equity, and inclusion.

APPENDIX A: COSMOVISIONS LONG TERM STRATEGIC GOALS AND OBJECTIVES

SG - Strategic Goal

SO - Strategic Objective

SG1: Enable Collaboration with Integrity as developed by IEI to honor and respect different ways of knowing the universe

- SO1a: Create a space where Indigenous peoples can share what is shareable (stories, knowledge, artifacts, etc.)
- SO1b - Enhance participant capacity to respect and express value for diverse perspectives.
- SO1c - Cultivate relationships among participants through sharing Indigenous skies.

SG2: Promote sharing of traditional knowledge and language of Indigenous communities to live in balance with the natural cosmic order

- SO2a: Enhance participant awareness of exemplary programs that benefit youth and future generations.
- SO2b: Transfer traditional knowledge and Indigenous language to young persons within their community.
- SO2c: Deepen participant understanding of how best to steward our resources and collective knowledge for future generations.

SG3: Explore the similarities and differences between Indigenous ways of knowing and non-Indigenous science practices in astronomy-related disciplines

- SO3a: Enhance understanding of the intersections between Indigenous ways of knowing and non-Indigenous science practices of astronomy and related disciplines.
- SO3b: Identify proper protocol for seeking approval and properly crediting Indigenous people and their knowledge.

Exploring SG4: Explore the use of astronomy and related disciplines for responsible economic and human development toward a sustainable future

- SO4a: Co-create meaningful knowledge and practices for a sustainable future.

- SO4b: Encourage, through astronomy and related disciplines, responsible stewardship of cultures, people, and the environment, both on Earth and in Space.
- SO4c: Identify topics for future exploration and research to support understanding of Indigenous cosmovisions
- SO4d: Identify and share best practices to ensure evaluation and assessment of project/program impact measures what Indigenous communities value.

NOTE: Our work in Cosmovisions Phase 1 was to begin advancing the SGs and SOs. Accomplishing the stated SGs and SOs is something that will take years.

APPENDIX B: COSMOVISIONS PHASE 1 AGENDA

Day	Time	Activity Description	Location
Thursday	~5:30 PM - 6:00 PM	People Arrive and Get Name Tags (check in)	Hotel
Thursday	~6:00 PM - 6:05 PM	Welcome and Introductions of Rena by Nancy Maryboy	Hotel
Thursday	~6:05 PM - 6:15 PM	Opening Comments by Rena Priest (Land acknowledgement and Welcome to Lummi poem)	Hotel
Thursday	~6:15 PM - 6:25 PM	**Provided by Nancy Maryboy and Tim Spuck** Recognition of all those who have contributed to Cosmovisions to date. This includes Nancy, David, Tim, Yasmin, Kaʻiu, Minoauka, Kalepa, (Also, those who were part of early planning included Aparna, Laura, Isabel Hawkins) We also thank the Heising-Simons Foundation for their support and for making Cosmovisions Possible (a BIG thank you to Cyndi Atherton, Director of Science and Gabriele Betancourt-Martinez, Program Officer).	Hotel
Thursday	~6:30 PM - 7:30 PM	Dinner	Hotel
Friday	8:30 AM	Shuttle leaves hotel for NWIC	
Friday	~8:30 AM - 9:00 AM	Coffee/Tea	NWIC
Friday	~9:00 AM - 9:10 AM	Opening - NWIC (TBD)	NWIC
Friday	~9:10 AM - 9:20 AM	Opening - Wilfred (Lummi)	NWIC
Friday	~9:20 AM - 9:30 AM	Opening Comments - Tim Spuck (AUI)	NWIC

Friday	~9:30 AM 9:40 AM		NWIC
Friday	~9:40 AM - 10:00 AM	1) Review: What do we mean by Cosmovisions and possible sharing of examples provided by participants - Yasmin; 2) What do we mean by Collaboration with Integrity - Nancy/David; 3) Overview of what we hope to accomplish during the day - Tim	NWIC
Friday	~10:00 AM - 10:45 AM	**Goal 1 / Scenario 1** - The bright star Betelguese in Orion (Western culture) begins to show signs that it is within weeks of going supernovae providing researchers with the once in a lifetime opportunity to collect rare data about the build-up to the Supernovae event. However, this event is happening during a period of time when some Indigenous cultures may not be permitted to tell stories related to this group of stars. One of the premier instruments for this supernovae research is on the land of these Indigenous people. **Break out into Indigenous and non-Indigenous groups for discussion. (How should this research opportunity be approached? What are your concerns? Other?)**	NWIC
Friday	~10:45 AM - 11:00 AM	Break: Coffee/Tea/Snack	NWIC
Friday	~11:00 AM - 11:45 AM	**Full Group** - Come together as a full group and the Scribe shares major points and results of the discussion including 1) what were the concerns and challenges, 2) What were the potential solutions (if any) to the concerns or challenges, 3) Was the group able to achieve consensus on what the best solution might be? and 4) any other key points to consider.	NWIC

Friday	~11:45 AM - 12:30 PM	**Full Group** Discussion - What are the collaborative (Indigenous/non-Indigenous) research questions and opportunities related to Goal #1 and the related objectives that could be explored further? In addition, are there recommendations for rewording Goal #1 and the related objectives? (**NOTE: this session will be recorded and transcribed** so we can use it to develop the White Paper.)	NWIC
Friday	~12:30 PM - 1:30 PM	Lunch	
Friday	~1:30 PM - 2:15 PM	**Goal 2 / Scenario 2** - Walleye and bass are not native to the Pacific Northwest. It is estimated that more than 20 million salmon smolts are eaten each year by these fish in Lake Washington and the Columbia River. They could be classified as an invasive species. **Break out into Indigenous and non-Indigenous groups for discussion (What should be done, if anything, about the walleye and bass in the Pacific Northwest in an effort to best steward our resources for future generations? What are your concerns? Other?)**	NWIC
Friday	~2:15 PM - 3:00 PM	**Full Group** - Come together as a full group and the Scribe shares major points and results of the discussion including 1) what were the concerns and challenges, 2) What were the potential solutions (if any) to the concerns or challenges, 3) Was the group able to achieve consensus on what the best solution might be? and 4) any other key points to consider.	NWIC
Friday	~3:00 PM - 3:15 PM	Break: Coffee/Tea/Snack	NWIC

Friday	~3:30 PM - 4:15 PM	**Full Group** Discussion - What are the collaborative (Indigenous/non-Indigenous) research questions and opportunities related to Goal #1 and the related objectives that could be explored further? In addition, are there recommendations for rewording Goal #1 and the related objectives? (**NOTE: this session will be recorded and transcribed** so we can use it to develop the White Paper.)	NWIC
Friday	~4:15 PM - 4:30 PM	**Full Group** Discussion - Reflections on the Day	NWIC
Friday	4:30 PM	Shuttle leaves NWIC for Hotel	
Friday	~6:00 PM - 6:30 PM	Indigenous Activity: Marganita Canio - Yasmin Catricheo: Mapuche Cosmovision of the Universe	Hotel
Friday	~6:30 PM - 7:30 PM	Dinner	Hotel
Saturday	8:30 AM	Shuttle leaves hotel for NWIC	
Saturday	~8:30 AM - 9:00 AM	Coffee/Tea	NWIC
Saturday	~9:00 AM - 9:10 AM	Opening - Polly	NWIC
Saturday	~9:10 AM 9:20 AM	Kaiu	NWIC
Saturday	~9:20 AM - 9:45	Reflections and additional comments about Scenario 1 and 2 from yesterday.	NWIC
Saturday	~9:45 AM - 10:30 AM	**Goal 3 / Scenario 3** - We have an upcoming solar eclipse where the centerline will pass through both Indigenous and non-Indigenous communities. A research team would like to engage these Indigenous and non-Indigenous communities in data collection, analysis, and reporting, and ultimately in the writing of a	NWIC

		journal article. **Break out into Indigenous and non-Indigenous groups for discussion. (How should this research opportunity be approached? What should be the protocol for data collection? How should individuals be recognized for their contribution? What are your concerns? Other?)**	
Saturday	~10:30 AM - 10:45 AM	Break: Coffee/Tea/Snack	NWIC
Saturday	~10:45 AM - 11:30 AM	**Full Group** - Come together as a full group and the Scribe shares major points and results of the discussion including 1) what were the concerns and challenges, 2) What were the potential solutions (if any) to the concerns or challenges, 3) Was the group able to achieve consensus on what the best solution might be? and 4) any other key points to consider.	NWIC
Saturday	~11:30 AM - 12:30 PM	**Full Group** Discussion - What are the collaborative (Indigenous/non-Indigenous) research questions and opportunities related to Goal #1 and the related objectives that could be explored further? In addition, are there recommendations for rewording Goal #1 and the related objectives? (**NOTE: this session will be recorded and transcribed** so we can use it to develop the White Paper.)	NWIC
Saturday	~12:30 PM - 1:30 PM	Lunch	
Saturday	1:30 PM - 2:15 PM	**Goal 4 / Scenario 4** - As science evolves and new discoveries are made, new language/vocabulary must be invented. In addition, this new vocabulary should be made accessible for those who are deaf and/or blind or visually impaired (DHH and BVI). A team would like to develop new sign language for the deaf community here in the U.S., including both Indigenous and non-Indigenous persons. The hope is that this new vocabulary to be signed will be able to be used for both Indigenous and	NWIC

		and non-Indigenous audiences. B**reak out into Indigenous and non-Indigenous groups for discussion. (How should this opportunity be approached? What should be the protocol for working together on this collaborative project? How should individuals be recognized for their contribution? What are your concerns? Other?)**	
Saturday	2:15 PM - 3:00 PM	**Full Group** - Come together as a full group and the Scribe shares major points and results of the discussion including 1) what were the concerns and challenges, 2) What were the potential solutions (if any) to the concerns or challenges, 3) Was the group able to achieve consensus on what the best solution might be? and 4) any other key points to consider.	NWIC
Saturday	3:00 PM - 3:15 PM	Break: Coffee/Tea/Snack	NWIC
Saturday	3:15 PM - 4:00 PM	**Full Group** Discussion -What are the collaborative (Indigenous/non-Indigenous) research questions and opportunities related to Goal #1 and the related objectives that could be explored further? In addition, are there recommendations for rewording Goal #1 and the related objectives? (**NOTE: this session will be recorded and transcribed** so we can use it to develop the White Paper.)	NWIC
Saturday	4:00 PM - 4:30 PM	**Full Group** Discussion - Reflections on the Day	NWIC
Saturday	4:30 PM	Shuttle leaves NWIC for Hotel	
Saturday	6:00 PM - 6:30 PM	Indigenous Activity: Voices for the Future - Indigenous Youths: Sofia Jackson (Navajo-Piute), Kyle Swimmer (Laguna-Pueblo-Cherokee) and Aydan Tomas (Navajo)	Hotel
Saturday	6:30 PM - 7:30 PM	Dinner	Hotel

APPENDIX C: COSMOVISION PHASE 1 SCENARIOS

Exploring SG1: Enable Collaboration with Integrity as developed by IEI to honor and respect different ways of knowing the universe

- SO1a: Create a space where Indigenous peoples can share what is shareable (stories, knowledge, artifacts, etc.)
- SO1b - Enhance participant capacity to respect and express value for diverse perspectives.
- SO1c - Cultivate relationships among participants through sharing Indigenous skies.

Scenario #1. The bright star Betelguese in Orion (Western culture) begins to show signs that it is within weeks of going supernovae providing researchers with the once in a lifetime opportunity to collect rare data about the build-up to the Supernovae event. However, this event is happening during a period of time when some Indigenous cultures may not be permitted to tell stories related to this group of stars. One of the premier instruments for this supernovae research is on the land of these Indigenous people. **Break out into Indigenous and non-Indigenous groups for discussion. (How should this research opportunity be approached? What are your concerns? Other?)**

What suggestions do you have for **revisions to SG1, SO1a, SO1b, SO1c** above? (Please share your thoughts below.)

NOTES/Comments: from Indigenous and Non-Indigenous Discussions (Please share your thoughts below.)

What are the differences and/or similarities between Indigenous and non-Indigenous perspectives related to Goal 1 / Scenario 1? (Please share your thoughts below.)

What are the opportunities for collaborative research and/or other projects related to Goal 1 / Scenario 1? (Please share your thoughts below.)

Exploring SG2: Promote sharing of traditional knowledge and language of Indigenous communities to live in balance with the natural cosmic order

- SO2a: Enhance participant awareness of exemplary programs that benefit youth and future generations.
- SO2b: Transfer traditional knowledge and Indigenous language to young persons within their community.

- SO2c: Deepen participant understanding of how best to steward our resources and collective knowledge for future generations.

Scenario #2. Walleye and bass are not native to the Pacific Northwest. It is estimated that more than 20 million salmon smolts are eaten each year by these fish in Lake Washington and the Columbia River. They could be classified as an invasive species. **Break out into Indigenous and non-Indigenous groups for discussion (What should be done, if anything, about the walleye and bass in the Pacific Northwest in an effort to best steward our resources for future generations? What are your concerns? Other?)**

What suggestions do you have for **revisions to SG2, SO2a, SO2b, SO2c** above? (Please share your thoughts below.)

NOTES/Comments: from Indigenous and Non-Indigenous Discussions (Please share your thoughts below.)

What are the differences and/or similarities between Indigenous and non-Indigenous perspectives related to Goal 2 / Scenario 2? (Please share your thoughts below.)

What are the opportunities for collaborative research and/or other projects related to Goal 2 / Scenario 2? (Please share your thoughts below.)

Exploring SG3: Explore the similarities and differences between Indigenous ways of knowing and non-Indigenous science practices in astronomy-related disciplines

- SO3a: Enhance understanding of the intersections between Indigenous ways of knowing and non-Indigenous science practices of astronomy and related disciplines.
- SO3b: Identify proper protocol for seeking approval and properly crediting Indigenous people and their knowledge.

Scenario #3. We have an upcoming solar eclipse where the centerline will pass through both Indigenous and non-Indigenous communities. A research team would like to engage these Indigenous and non-Indigenous communities in data collection, analysis, and reporting, and ultimately in the writing of a journal article. **Break out into Indigenous and non-Indigenous groups for discussion. (How should this research opportunity be approached? What should be the protocol for data collection? How should individuals be recognized for their contribution? What are your concerns? Other?)**

What suggestions do you have for **revisions to SG3, SO3a, SO3b** above? (Please share your thoughts below.)

NOTES/Comments: from Indigenous and Non-Indigenous Discussions (Please share your thoughts below.)

What are the differences and/or similarities between Indigenous and non-Indigenous perspectives related to Goal 3 / Scenario 3? (Please share your thoughts below.)

What are the opportunities for collaborative research and/or other projects related to Goal 3 / Scenario 3? (Please share your thoughts below.)

Exploring SG4: Explore the use of astronomy and related disciplines for responsible economic and human development toward a sustainable future

- SO4a: Co-create meaningful knowledge and practices for a sustainable future.
- SO4b: Encourage, through astronomy and related disciplines, responsible stewardship of cultures, people, and the environment, both on Earth and in Space.
- SO4c: Identify topics for future exploration and research to support understanding of Indigenous cosmovisions
- SO4d: Identify and share best practices to ensure evaluation and assessment of project/program impact measures what Indigenous communities value.

Scenario #4. As science evolves and new discoveries are made, new language/vocabulary must be invented. In addition, this new vocabulary should be made accessible for those who are deaf and/or blind or visually impaired (DHH and BVI). A team would like to develop new sign language for the deaf community here in the U.S., including both Indigenous and non-Indigenous persons. The hope is that this new vocabulary to be signed will be able to be used for both Indigenous and and non-Indigenous audiences. B**reak out into Indigenous and non-Indigenous groups for discussion. (How should this opportunity be approached? What should be the protocol for working together on this collaborative project? How should individuals be recognized for their contribution? What are your concerns? Other?)**

What suggestions do you have for **revisions to SG4, SO4a, SO4b, SO4c, SO4d** above? (Please share your thoughts below.)

NOTES/Comments: from Indigenous and Non-Indigenous Discussions (Please share your thoughts below.)

What are the differences and/or similarities between Indigenous and non-Indigenous perspectives related to Goal 4 / Scenario 4? (Please share your thoughts below.)

What are the opportunities for collaborative research and/or other projects related Goal 4 / Scenario 4? (Please share your thoughts below.)

APPENDIX C: AUTHORS - PARTICIPANTS

We owe our deepest gratitude to all participants for their valuable input throughout the workshop, and for opening themselves to share what is sharable with others. All workshop participants were active authors for this report:

Amanda Barrera – Non-Indigenous

Amanda Barrera is the EPE Administrative Assistant for Associated Universities, Inc., and is pursuing an undergraduate degree in Elementary Education with a minor in Clinical Psychology. She is interested in evidence-based Social Emotional Learning (SEL) in the K12 classroom and is looking forward to engaging and making a difference in the lives of her students. Amanda's other interests include classical literature, Greco-Roman philosophy, oil painting, and computer coding, and she adores DC comics.

David Begay – Indigenous, Navajo

David Begay, Ph.D. is currently Associate Research Professor with the University of New Mexico, Albuquerque, in the College of Pharmacy, Community Environmental Health Program working with several federal health research projects, including NIH, Environmental Health Disparities, among others. David is a former part-time faculty at Northern Arizona University, Flagstaff, in the Department of Physics and Astronomy for 20 years. He is also a former professor and academic dean for Dine' (Navajo Nation) College. He is currently VP for the Indigenous Education Institute, Friday Habor, Washington. He has also worked with NSF and other federal projects including NASA for 20 plus years, Jet Propulsion Lavatory, and Goddard Space Flight Center on space science and heliophysics educational outreach. David is considered a tribal elder and provides cultural consultant services to many organizations and corporations both in the United States and internationally.

Kelly Blumenthal – Non-Indigenous

Kelly Blumenthal (she/they) is a science communicator and astrophysicist. Kelly originally hails from the Northeast of the United States, was educated in New Jersey, Boston, and Hawai'i, and currently calls Japan home. Throughout her career as a science communicator, Kelly has endeavoured to build lasting relationships within the communities they have encountered. In their present role as the Deputy Director of the International Astronomical Union Office for Astronomy Outreach, Kelly is actively pursuing ways to better represent the world's stories, histories, and relationships with the night sky.

Margarita Canio – Indigenous, Mapuche

Margarita Canio Llanquinao lives in the Cuasco Mapuche community, Truf Truf's territory, near Temuko, south of Chile. She grew up with her relatives who never denied her the Mapuche language (mapunzugun). She is a professor of Intercultural Pedagogy at the Catholic University of Temuco (UCT), and holds a Master in American Studies from the University of Seville, Spain. She is a doctoral student in Human Sciences, Mention Speech and Culture at the Universidad Austral de Chile. She teaches classes and workshops on Mapuche culture and memory in different educational enveriemnt, institutions and organizations. Currently, she teaches at the Pedagogy in Mapuche Language and Culture (UCT).

Among her works she has published some books such as; Pu Nekulfilu ñi gülkantun engün. Mapuche oral memory in the songs of the Neculfilo family (2019); Wenumapu. Mapuche Astronomy and Cosmology (2014); Territory and Memory. Testimony and legacy of four descendants of Pascual Coña (2018), edited together with other professors; Mapuche History and Oral Knowledge. Survivors of the “Desert Campaign” and “Occupation of Araucanía” 1899–1926 (year 2013).

For a few years she has been working in the mountainous area, Pewenche territory (Andes Mountains, Chile), collecting testimonies about the process of territorial dispossession, genocide and deportations, from the experiences of Mapuche people who remember these historical events. That is why her main lines of research are Mapuche Oral Tradition and Memory.

Yasmin Catricheo – Indigenous, Mapuche

Yasmin Catricheo is a Native American woman certified in physics education, and employed by Associated Universities Inc. (AUI) in Washington D.C. as the Sr. STEM Education Specialist. At AUI she assists with and/or co-lead numerous STEM education projects as well as develop new initiatives. Examples of current projects: Network for Earth-Space Research Education and Innovation with Data, Cosmovisions of the Pacific, Big Astronomy: People, Places, Discoveries and the North American Regional Office of Astronomy for Development (NA-ROAD). She earned a Master's Degree in Education with a concentration in science from Universidad del Bío Bío in Chile, and spent seven years teaching physics and other natural sciences in middle school, high school, and college. Her research focused on science pedagogy and improving science communication and argumentation skills in high school physics students. As a member of the MAPU TRAFUN association, and being of Mapuche origins, she has been working for the past 10 years to preserve and share the Mapuche indigenous roots, knowledge and ways of knowing the universe through social and educational activities. She also serve as the current President and CEO of the Janequeo Foundation and Board Secretary for Astronomers Without Borders.

Troy Cline – Non-Indigenous

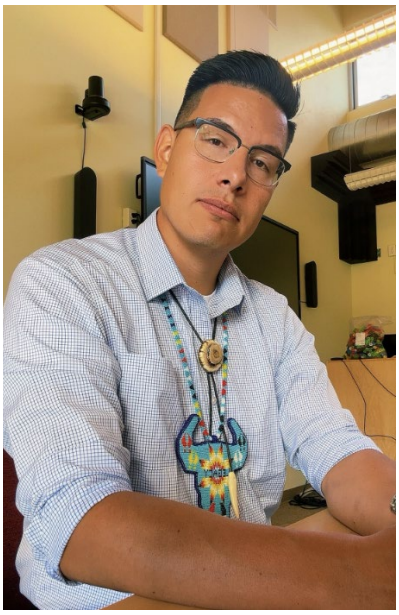
Troy Cline serves as the Public Outreach Project Manager for the Johns Hopkins University Applied Physics Laboratory (APL). In this role, he supports a variety of outreach opportunities for space science missions, including Parker Solar Probe, EZIE, DART, IMAP, and DRAGONFLY. His initiatives encompass everything from

paper models, 3D prints, AR/VR, indigenous outreach programs, to international challenges like NASA's Space Apps Challenge.

Before joining APL, Troy was the Director of the NASA STEAM Innovation Lab, providing a collaborative space for exploring and developing new ideas related to media and educational technology in STEAM activities. He also served as the Education and Public Outreach (E/PO) Lead for the Magnetospheric Multiscale Mission (MMS), overseeing mission-level public outreach activities and coordinating overall EPO efforts. Additionally, Troy organized a new NASA mission-based Indigenous MakerPlace program with the Indigenous Education Institute (IEI) to inspire indigenous youth to become thought leaders grounded in strong cultural norms and values.

Troy's career began in education, spending 11 years as a teacher in diverse locations, including the Navajo Indian Reservation and the United States Peace Corps. He also worked as an Educational Technology Coordinator at an alternative high school, focusing on 'at-risk' students. His extensive experience in education and outreach continues to inspire and engage communities worldwide in the wonders of space science.

Jared Gorman-Etl - Indigenous Lakota and Dakota



"Hau mitakuyepi, wasicu ia Jared Etl emakiya. Dakodchaze mitakin Wakinyan Sapa emakiyapi. Kangi Okute oyanke ematahan. Wanna, Lummi, WA ed oyanke ed mitawichu ka michinksi yamni kci."
Hello everyone, my name is Jared Gorman-Etl. I am Lakota and Dakota from the Crow Creek Sioux Tribe located in South Dakota. I currently reside as a guest on the Lummi reservation in Washington state with my wife and three children.
I am currently an instructor at Northwest Indian College in the Human Services department. I also instruct Lakota language at Sinte Gleska University online. I have a BA in Native Studies & Leadership. Currently working toward my MA in Human Services. My purpose

comes from my identity. Contributing to help future tribal scholar's forge new pathways through education and culture.

Yakaiyastai Gorman-Etl – Indigenous, Navajo/Cheyenne

Northwest Indian College Alumni, current student of Antioch University, Yakaiyastai Nanabah Gorman-Etl, is originally from Steamboat, Arizona, of the Navajo and Cheyenne Tribes. The first daughter of eight children to Beverly and Emerson Gorman. Yakaiyastai is a young indigenous scholar, mother, and wife who strives to learn more about preserving inherent rights for future generations through higher education. Along with learning her foundational traditional knowledge of Navajo teachings, she is self-taught in traditional herbal medicine, holistic healing, and food sovereignty. She grew up with a father known as a traditional medicine man and a mother who worked for John Hopkins Center for American Indian Health Center as a researcher. In a traditional hogan without running water or electricity, she is Navajo spoken as their first language and raised with Navajo structural influence. She learned the importance of traditional values, holistic health, and knowledge as they connect to a sense of place as well as the person, she would become to help her surrounding communities. Currently, she has worked in various capacities as a Wellness Coordinator at Northwest Indian College and an Environmental Science Instructor. Having learned the importance of healing and medicine from both Traditional and Western medicine spectrums, she utilizes her knowledge to bring equitable health initiatives on behalf of indigenous people through her work as a Behavioral Health Program Coordinator and interim Community Health Program Coordinator.

Steven Gullberg – Non-Indigenous

Steven Gullberg holds a Ph.D. in astronomy and is a Professor of Cultural Astronomy at the University of Oklahoma. He has a significant background in archaeoastronomy course development and serves as Presidentof the International Astronomical Union's (IAU) Commission C5 Cultural Astronomy. He as well is Managing Editor of the Journal of Astronomy in Culture and is the chair of a joint committee of the IAU, the Royal Astronomical Society, and the American

Astronomical Society regarding the recognition and resolution of Indigenous concerns at astronomical installations that exist, are being built, or are planned on culturally sacred sites. He has conducted extensive field research on the astronomy of the Incas in the Peruvian Andes and in addition to his books has written many research papers which he is regularly invited to present at international conferences as part of his work to globally advance the field of Cultural Astronomy.

Kwaslmut (Sadie Olsen) – Indigenous, Lummi

Kwaslmut sen ne sna'. Che Xwlemi Sen. Che Nexw Xwlemi Tengexw. Che Ch-choo-sen. My name is Kwaslmut. My English name is Sadie Olsen. I am a member and resident of the Lummi Nation. I am a Co-Founder of Whiteswan Environmental. Please visit whiteswanenvironmental.org to learn more about our Native-led, non-profit's vision, mission and work to support the restoration of our longhouses in our ancestral homelands. I am a student at Northwest Indian College, Bachelor's of Science Native Environmental Science. I am passionate about revitalization of Indigenous wisdom, specifically language revitalization. I enjoy exploring the connection between decolonizing, relationship building, place-based learning in my ancestral homelands and health. I am a recipient of the 30 Under 30 Changemakers award for Social Justice as WE are co-founders of a Washington State Public Charter School, and the first Dotty Dale Youth Peacemakers Award. I love my family, my animals and my culture as a Xwlemi Xwilmexw.

Suhunep Husmeen (Troy Olsen) - Indigenous, Lummi

Suhunep Husmeen, Troy Olsen, is the co-founder of Whiteswan Environmental (WE), a Native-led nonprofit. He is a member and resident of Lummi Nation. Troy's traditional name *Suhunep* goes 10 generations back and *Husmeen* goes 20 generations back. He is a Traditional Ecological Knowledge (TEK) keeper who cares about cultural heritage and feels blessed to be guided in a good way. He practices and shares his traditional way of life with his family and community to ensure a thriving culture and environment for future generations. Suhunep Husmeen is a

traditional weaver, working with wool and cedar to create ceremonial regalia. He spins nettle fibers into twine to weave fishnets. During the San Juan Island National Parks Service 100th Centennial Anniversary, Suhunep was humbled to be acknowledged as the reef net captain by former Chairman of the Lummi Indian Business Council (LIBC), Tim Ballew. His Native-led organization coordinated the gifting of three story boards, depicting a reef net captain, and the male and female salmon. These story boards honor the Lummi, Saanich, and Saltwater Salmon Peoples, who shared an 800-foot longhouse at the ancestral village site called Pe'pi'ow elh. The story boards were dedicated to the San Juan Island National Parks Service, English Camp/Pe'pi'ow elh. Working with the LIBC, Suhunep helped build and organize the practice of our ancestral reef net fishing during the Tribe's challenge of a coal port at *Xwe'chi'eXen*/Cherry Point. The Army Corps of Engineers upheld the Lummi Nation's Treaty Rights, blocking the proposed coal terminal. Suhunep Husmeen reminds us that our saltwater salmon people and our treaty rights and practice are the greatest level of environmental protection for all and there is a lifetime of curriculum in learning the old ways.

Yuko Kakazu – Non-Indigenous

Dr. Yuko Kakazu is Education and Outreach Scientist at TMT International Observatory and National Astronomical Observatory of Japan. Born and raised in Okinawa, Dr. Kakazu is the first astronomer from Okinawa, formerly called the Ryukyu Kingdom. She obtained her Ph.D. at the Institute for Astronomy, University of Hawai'i at Manoa and worked as a researcher at Institut d'Astrophysique de Paris, California Institute of Technology, University of Chicago, and Kavli Institute for Cosmological Physics. She joined the Subaru Telescope in Hawai'i in 2013 and led education and outreach programs. In 2021, she joined the TMT International Observatory. With new project manager and outreach team based in Hilo, Hawai'i, TMT is embarking on a new approach, listening to and learning from the communities, in particular Native Hawaiian communities who were previously left out of TMT's community engagement. Kakazu has been actively planning and

executing new educational outreach programs based on community inputs and unique needs in Hawai'i Island, integrating indigenous knowledge and philosophy into the programs, and building partnership with community organizations and schools.

Dr. Kakazu also serves as Education Committee chair for the Japanese Chamber of Commerce and Industry of Hawai'i, Trustee and Education Ambassador for the Okinawa Institute of Science and Technology (OIST) Foundation, and Council Leader for the U.S.-Japan Council. She is a mother of a 5-year-old girl.

Dr. Michael Kirk – Non-Indigenous

Dr. Michael Kirk is a research scientist in the Heliophysics Science Division at NASA's Goddard Space Flight Center. He is the Principal Investigator of NASA's Heliophysics Education Activation Team (NASA HEAT). Dr. Kirk is a Co-investigator on the SunCET CubeSat mission, launching in 2024. In addition, he is helping to lead NASA Goddard's Center for HelioAnalytics which seeks to integrate data science into heliophysics to better the physics of the sun, the causes of solar variability, and its impacts on Earth. Dr. Kirk received his Ph.D. in Astronomy from New Mexico State University, where his research focused on automated tracking of chromospheric bright points and their connection to solar eruptions. During this time, he also worked for the Air Force Research Laboratory at the National Solar Observatory in Sunspot, NM. Upon graduation, in 2013, he joined the Heliophysics division as a fellow with the NASA Postdoctoral Program (NPP). After receiving his Bachelor's degree from Whitman College and prior to entering graduate school, Dr. Kirk first worked at Goddard in 2007 researching the changing position and size of the polar coronal holes throughout the solar cycle. Dr. Kirk grew up in the Willamette Valley of Oregon.

Nancy Maryboy – Indigenous, Cherokee/Navajo

Nancy Maryboy is the President and Founder of the Indigenous Education Institute, a non-profit organization with a mission of preserving, protecting and applying indigenous knowledge. She is also President of Wohali Productions, Inc., consulting

in areas of indigenous science, indigenous astronomy, Native American education, curriculum development, film making and strategic planning. Her current work is centered around the recovery of indigenous astronomies and how that knowledge can be used in educational settings today, primarily for the benefit of native students. She gives national and international presentations on the juxtaposition of native knowledge, quantum consciousness, western science and the protocols of conducting indigenous research. She served as a faculty member and administrator at Dine College, the Navajo Tribal College, for 13 years, and Director of Curriculum and Professional Development, and Vice Principal, at a K-12 school district on the Navajo Nation for 3 years. Dr. Maryboy received her Ph.D. in Integral Studies with a focus on Indigenous Science, from the California Institute of Integral Studies. She is Cherokee/Navajo and lives in Bluff, Utah in the Four Corners area. She comes from a family of traditional and medical healers.

Tim Spuck – Non-Indigenous

Tim is the Director of Education & Public Engagement at Associated Universities, Inc. where he manages the development and implementation of innovative STEM Education efforts. Tim also leads efforts at AUI to build domestic and international partnerships to support STEM education and outreach, and workforce development. Prior to his role with AUI he taught astronomy and earth sciences at the high school and university levels and served as a K–12 Science Coordinator. He holds a doctorate in Curriculum & Instruction from West Virginia University, and a master's degree in Science Education from Clarion University of PA. Tim served as lead editor and author for the 2014 Peter Lang Publishing Book of the Year, Einstein Fellows: Best Practices in STEM Education.

Martin Storksdieck - Non-Indigenous

Martin is a professor at Oregon State University (OSU) where he directs the STEM Research Center. The center is dedicated to applied research on STEM teaching and learning in school and university settings, as well as out-of-school education and science communication, with a focus on equity and social justice. Prior to OSU, Martin directed the Board on Science Education and the Roundtable on Climate Change Education at the US National Academy of Sciences. After working on local sustainability concepts for the International Council for Local Environmental Initiatives (ICLEI), he entered the field of science communication in the mid-1990s as a producer of multimedia shows on climate change at a German Planetarium. He holds master's degrees in biology and public policy, and a Ph.D. in education.

Aydan Tomas – Indigenous, Navajo/Diné

Aydan Tomas is an Emerging Leader working toward his degree in Administration of Justice to become a Police Officer as a stepping stone to attending Law school. He is passionate about public service and helping the community. He achieved the rank of Eagle Scout in the Boy Scouts of America, the highest rank attainable, and he is proud of the leadership skills and values of citizenship, courteousness, and fitness that Scouting instilled in him. In his free time, he enjoys teaching others about Astronomy as he is passionate about technology and Science. Maternally, he is Navajo and lives in Flagstaff, Arizona. He comes from a family of Diné and uses their teachings, cultural customs, beliefs, and language. He hopes to use the knowledge and teachings of paternal modern science to help expand others' learning. He hopes to use his knowledge and skills to help others and positively impact his community. His goal-oriented and enthusiastic personality drives him to achieve his ambitions through hard work, perseverance, and a thirst for learning. He enjoys spending time outdoors, whether hiking, camping, fishing, or other outdoor activities. He views becoming an Eagle Scout as a crucial first step in a lifetime of service and leadership.

Tom Tomas – Indigenous, Navajo/Diné

Tom Tomas, a highly experienced educator with a Master's degree in Bilingual/Multicultural Education with Distinction from NAU, currently teaches 5th-6th grade, coordinates STREAM Programs (STEAM plus 'R' for reading/writing across the curriculum), serves as a lead teacher, and is a MakerPlace Outreach Specialist at Little Singer Community School. He has over 30 years of experience teaching in Navajo community schools and strongly believes that raising a child takes a collective effort.

Polly Walker – Indigenous, Cherokee

Polly O. Walker is of Cherokee ancestry, a member of the Cherokee Southwest Township, and she serves as board chair of the Indigenous Education Institute. An Associate Professor Emeritus of Peace and Conflict Studies and past Director of the Baker Institute for Peace and Conflict Studies at Juniata College, her research and practice focus on Indigenous/non-Indigenous conflict transformation, Indigenous approaches to peace, and the role of the arts and cultural work in transforming conflict.

Polly's doctoral degree is in conflict transformation from the University of Queensland, and she has worked in collaborative peacebuilding endeavors in: Vanuatu with the Malvatumauri Council of Chiefs, in the Solomon Islands with the National Council of Chiefs., and in Australia where she co-facilitated conflict transformation workshops with Aboriginal and Torres Strait Islander communities and organizations, international development and peacebuilding organizations, and people of refugee and migrant backgrounds. She is a past director of the Peace and Conflict Studies Institute of Australia and has held leadership positions in the Peace and Justice Studies Association of the US and Canada as well as in the International Peace Research Association.

Anna Graham – Indigenous, Salish

Anna Graham (Waschke) is part of the First Year Experience Science faculty at Northwest Indian College on the Lummi Nation in Washington State, co-advisor of

the NWIC Forest Garden Club and part of the solar training program. Anna has degrees in physics and mathematics from the University of Alaska Fairbanks (2002), a masters in teaching math at the secondary level (2018), and has been educating students in physics, math, environmental science, renewable energy and assemblage art since 2001. Anna's heritage is Scottish, Finnish, Coast Salish [Sto:lo (Soowahlie), Nooksack, Upper Skagit] and who knows what else. Their passion is teaching, but they also love to create (words, images, stained glass, assemblages), destroy (scotch broom, Himalayan blackberry, supremacy), and cultivate (kids, plants, friendships, community). They are fortunate to live on beautiful Birch Bay by the Canadian border, where they enjoy dancing, biking and trying not to get run over by tourists.

Shirley Williams – Indigenous, Lummi

Pacific Northwest Indigenous activist, Shirley Williams, has been a force in using the ancestral homelands of the San Juan Island National Historical Park as a site for community healing through cultural preservation of the Straits Salish people. Her collaborations with the park are part of a multi-front advocacy to bring together Indigenous and non-Indigenous from the US and Canada to support public health legislative and educational initiatives. As a registered nurse who pracitces community medicine, she combines Indigenous forms of healthcare with Western medicine. Williams has worked many years in tribal and non-tribal healthcare settings, and established the satellite medical office at the Lummi Youth Academy[1]. Today, she channels Indigenous public health efforts through her nonprofit organization, Whiteswan Environmental (WE), which she co-founded in 2015. WE's expansive organizational mission includes healing historical trauma, and partnering with state and federal governments to protect Indigenous trust responsibilities; WE also partners with academic researchers and nongovernmental organizations, opening up culturally safe spaces

[1] "Native Science Guest Speakers," Calendar and Class Schedule, Northwest Indian College, December 4, 2015. https://www.nwic.edu/event/native-science-guest-speakers/. The Lummi Youth Academy ended in 2015.

to teach tribal history, culture, governance and language. Whiteswan Environmental aims to "support community healing through the natural, cultural and historical restoration to the Salish Sea for 7th generations sustainability as a measure of ecological health protection for all. [...] WE are the vision keepers for a Coast Salish Tribal Heritage Field Institute: an Indigenous-led, 13-Moon, Mountain to Sea, Reef to Reef, K-PhD program with 7 longhouses in the San Juan Islands and 7 longhouses in the Gulf Islands." [2]

Ryan Wyatt – Non-Indigenous

Ryan Wyatt assumed his role as Senior Director of Morrison Planetarium and Science Visualization at the California Academy of Sciences in April 2007. He has written and directed the Academy's nine award-winning fulldome video planetarium programs: *Fragile Planet* (2008), *Life: A Cosmic Story* (2010), *Earthquake* (2012), *Habitat Earth* (2015), *Incoming!* (2016), *Expedition Reef* (2018), *Big Astronomy* (2020), *Living Worlds* (2021), and *Spark: The Universe in Us* (2023). All nine shows are science documentaries that rely on visualization to tell their stories, although topics range from astronomy to geology, ecosystem science, and conservation. Trained as an astronomer, Ryan has worked in the planetarium field since 1991, including six years as Science Visualizer at the American Museum of Natural History in New York City. Ryan is cofounder and vice president of Immersive Media Entertainment, Research, Science, and Art (IMERSA), a professional organization dedicated to advancing the art and technology of immersive digital experiences. He served as co-chair of the 2017 and 2019 Gordon Research Conferences on Visualization in Science and Education. He also participated in the One Sky Project as an institutional representative and as a writer and production coordinator for six planetarium short films on cultural and Indigenous astronomy.

[2] Whiteswan Environmental, *Whiteswan Enviornmental.* https://www.whiteswanenvironmental.org/

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If you want to learn more about the Heising-Simons Foundation, please visit their website at: https://www.hsfoundation.org/

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