BACKGROUND INFORMATION FOR PRESENTERS

Contents

More on Making Observations

Being a careful and attentive observer of the natural world is a characteristic shared by scientists, naturalists, and many more people across a range of professions and community roles. Observations are a key to building an intimate understanding of nature. Observations also elicit wonder and curiosity that leads to interesting questions, further exploration, and investigation. We all can improve our observation skills. As we go about our busy lives, nature and the outdoors can sometimes become a "green blur" in the background. However, when we slow down to observe something in nature—lichen, a spider web, a leaf, a bird, a pattern in sand—this can often be an invitation to start noticing more everywhere!

Slow Down, Get Down, and Look Closely

Marine biologist Todd Newberry, whose teaching has been inspirational to the BEETLES project, says, "Naming and making lists of animals and plants is 'Glance & Go' nature watching. It might be a fun sport, but it's not natural history or science." Learners can deepen their skills of observation, and skilled teachers can offer opportunities for learners to do just that. First and foremost, observers can benefit from slowing down. Most things in nature unfold slowly, and as Todd says, "There is almost never a reason not to be slow. Nature will not speed up just because you have arrived." Most animals—from beetles to bobcats to tide-pool creatures—are startled by the arrival of humans (especially a group of 20 of them) and will do their best not to be seen. If we slow down and are quiet enough for a long enough time, these

animals recover from the shock of our arrival. For most observations, it also helps to get down low. Many organisms are small and located under or behind rocks, leaves, logs, grass, etc. We can make interesting and detailed observations while on our knees, belly, or back or through touch as a direct sensory experience. Finally, observers can aim to get in close. Todd says, "I read the seashore with the lower half of my bifocals." Getting close can reveal details of structure and behavior that might be otherwise missed. Getting close can mean physically close, using a hand lens, or using a sense of touch to make observations. We can also get virtually close by using binoculars, a spotting scope, a telescope, or examining close-up photos or videos. These tools can be one way to enter the world of the organism or other natural features we are observing.

***Interview an Organism* student activity.** See the activity *Interview an Organism* for specific questions and strategies to engage learners with this approach (http://beetlesproject.org/resources/for-field-instructors/interview-an-organism/).

Question Generators. For more on Curiosity Scaffolds and Question Generators, see the book *How to Teach Nature Journaling*, pp. 89–92.

Asking Questions, Observations, and Curiosity

Intentionally asking questions can deepen observations and increase curiosity. Todd Newberry offers the idea of posing "interview" questions to which the organism or phenomenon can "answer" back (by inviting us to make observations in response to the question). Useful "interview" questions for learners to ask: *What are you doing? How many of you are there? How far apart are you? How far will you travel in 5 minutes? What else is around you? Are they the same things that are around others like you? Can I draw you?* Asking these questions or using tools such as counting and measuring can lead to unexpected and delightful observations. Thinking about "interviewing" an organism is one way to think about creatively generating questions in nature explorations. In the book *How to Teach Nature Journaling*, John Muir Laws and Emilie Lygren offer "Curiosity Scaffolds and Question Generators," or sets of prompts that invite learners to ask a range of different kinds of questions (Laws and Lygren, 2020). These are all tools that instructors can offer learners to invite them to build on using the prompt "I wonder..." to ask interesting and varied questions.

The act of asking questions can ignite curiosity. In *The Laws Guide to Nature Journaling*, John Muir Laws and Emilie Lygren write, "Curiosity has a critical role in learning. Curious investigation stimulates the reward center in your brain. It triggers the release of dopamine and activates the hippocampus, a brain region involved in forming new memories. As a result, a person in a state of heightened curiosity will learn more easily—and not only about what had caught their attention. Surprisingly, a person in an intense state of curiosity is also primed to absorb unrelated information that they were not innately curious about. Finally, curiosity makes it more likely that you will remember what you have learned (Gruber et al., 2014). Essentially, interest in one thing creates a curiosity vortex that sucks up unrelated material, making it easier to assimilate and remember" (Laws & Lygren, 2016).

Observations and Awe

Studies have shown that people who experience awe together in the outdoors are more primed for collaboration and that this state can even increase someone's capacity for critical thinking. An article from the University of California, Berkeley, Greater Good Science Center reports that "...multiple studies have found that experiencing awe may make people more kind and

generous. Research suggests that awe helps us feel more connected to the people in our lives and to humanity as a whole." These ideas, which are relatively new to science, offer support for some of the benefits of nature experiences that outdoor educators have observed informally for years. This research can also offer guidance for the structure of our outdoor science programs and experiences. If your program has a focus on team-building, consider how inviting learners into a mindset of awe and wonder through making observations can also play a role in creating a collaborative spirit. If your organization brings learners to scenic vistas to experience awe, consider how inviting learners to make close observations of their surroundings is another way for them to experience that awe.

Incorporating Nature Journaling as an Observation Tool

Nature journaling—or the process of using words, pictures, and numbers to record and document observations and ideas on paper—is a powerful practice that deepens observation and enhances memory. Learners can call on the prompts "I notice...," "I wonder...," "It reminds me of..." as a tool for making observations, asking questions, and making connections during any nature journaling experience. The book *How to Teach Nature Journaling* by John Muir Laws and Emilie Lygren offers a range of activities and ideas on how to engage learners in journaling, and the approach supports and reinforces the strategies highlighted in this session (www.howtoteachnaturejournaling.com).

Building Environmental Literacy and Connection with Nature

The North American Association for Environmental Education (NAAEE) defines environmental literacy (in part) as follows: "Those who are environmentally literate possess, to varying degrees: the knowledge and understanding of a wide range of environmental concepts, problems, and issues; a set of cognitive and affective dispositions; a set of cognitive skills and abilities; and the appropriate behavioral strategies to apply such knowledge and understanding in order to make sound and effective decisions in a range of environmental contexts. This definition treats the primary elements of environmental literacy—the cognitive (knowledge and skills), affective, and behavioral components—as both interactive and developmental in nature."

Louise Chawla, Professor Emeritus at the University of Colorado, Boulder, is a widely published author on children and nature. She defines environmental sensitivity as "a predisposition to take an interest in learning about the environment, feeling concern for it, and acting to conserve it, on the basis of formative experiences," and continues, "Contact with natural areas has emerged as one of the most significant influences in all the studies reviewed, and free encounters with the natural world are becoming inaccessible to more and more young people in the urbanized world" (Chawla, 1998, p. 19). By bringing children outdoors and offering strategies such as *I Notice, I Wonder, It Reminds Me Of*, outdoor science programs can create opportunities for learners to develop observation skills and curiosity, which are components of environmental literacy and sensitivity. These intimate experiences with nature elicit feelings of emotional connection and caring. This is a signature benefit of outdoor science that is difficult to replicate in a classroom.

Supporting Equitable, Inclusive, and Culturally Relevant Learning Experiences

BEETLES student activities and instructional materials have been intentionally designed to create an equitable, inclusive, and culturally relevant learning experience for a community of learners. BEETLES design principles (http://beetlesproject.org/about/how-do-we-approach-teaching/) ensure that each student activity is learner-centered and nature-centered. This enables all learners to access, participate, and engage in the learning experience.

These design principles are represented in the activity *I Notice, I Wonder, It Reminds Me Of* and in the general approach of focusing on making observations as a critical part of the learning experience.

How does centering expertise on learners support the development of more equitable learning experiences? "In equitable and inclusive work, an important shift is one of power and positionality—in this case, a power and authority shift from the instructor to the learner. The instructor actually gives up power and is not afraid of receiving/seeing what other ways of knowing arise from the learner and learning." —José González, founder of Latino Outdoors

"Classroom studies document the fact that underserved English learners, poor students, and students of color routinely receive less instruction in higher-order skills development than other students." (Allington and McGill-Franzen, 1989; Darling-Hammond, 2001; Oakes, 2005) —Zaretta Hammond, *Culturally Responsive Teaching & the Brain*

When learners engage directly with nature, they all have access to learning, regardless of their prior knowledge or experiences. Centering learning on learners' in-the-moment observations of nature builds an inclusive learning experience by focusing the conversation on an experience shared by every learner, as opposed to relying on learners' prior knowledge or past experiences. As learners engage with nature, instructors are in the role of the "guide on the side." This approach shifts power from the instructor to learners, challenges the typical learning situation in which the instructor is the only expert, encourages learners to share their ideas and experiences, and makes learning a more decentralized and collaborative experience.

When learners think like a scientist and practice academic language, they develop critical thinking skills that support them to become more independent learners—learners who have skills and thinking tools they use to learn, regardless of the level of support available from a teacher or instructor. Giving learners the opportunity to think like a scientist by making observations, asking questions, and constructing explanations supports students' growth as learners and offers them the opportunity to build critical thinking skills and learning behaviors they can apply in any context. Many learners in schools that have historically been under-resourced due to racist school funding policies, redlining, income inequality, and police profiling have fewer opportunities to develop as independent learners. Specifically ensuring that learners in these kinds of schools have opportunities to develop as independent learners is an issue of equity. Learning and practicing critical thinking skills in an engaging outdoor context supports learners to succeed back in their classrooms, in science, and in other academic disciplines. Offering opportunities for learners to discuss ideas with their peers and knowledgeable adults makes science more accessible by connecting it to learners' own actions and discoveries in the moment—not to knowledge they may not have or experiences they may not have had.

Through discussion, learners make connections to prior knowledge, share their lived experiences, listen to different perspectives, and have time to process the material. Centering productive discussions in which many voices are heard and the group builds off one another's ideas creates an experience in which learners see themselves and one another as sources of expertise.

This ensures that instructors don't fall back on positioning themselves as the only source of accurate or important information. Participating in discussions also supports learners to develop cognitive rigor and the ability to take on more advanced learning tasks. Discussions make learners' thinking and ideas visible to the instructor. When instructors value, appreciate, better understand, and connect to learners' lived experiences, they create a more inclusive and culturally relevant learning space. Finally, multiple opportunities for discussion provide time and space for neurodiversity—allowing learners to process information in different ways. Using discussion strategies such as *Turn & Share* or *Thought Swap* (formerly known as *Walk & Talk*) that are part of every BEETLES student activity can help ensure that learners have these kinds of opportunities for discussion.

Specifically, the model student activity *I Notice, I Wonder, It Reminds Me Of* promotes an equitable, inclusive, and culturally relevant learning experience by:

- offering curiosity tools, an inquiry mindset, and critical thinking skills that learners can use to learn in any context and by supporting learners in becoming more independent learners.
- engaging learners with commonly found parts of nature (e.g., leaves), which contrasts the exclusionary idea that nature only exists in pristine wilderness areas, requires a panoramic view or unique geographic feature to be engaging, or is otherwise a place learners need to go to as opposed to something they are always surrounded by.
- giving learners multiple opportunities to connect to and share their lived experiences and for learners and the instructor to listen to and learn from these experiences and perspectives.
- providing space for learners to come up with connections between what they are observing and prior experiences and knowledge, which supports their learning and retention.
- giving instructors an approach they can use to guide learner-centered and nature-centered exploration and learning throughout the rest of the field experience.
- focusing the group's learning on a common experience to which everyone has access.

Overall, these factors contribute to creating a learner-centered approach in which "the ultimate goal…is to help learners take over the reins of their learning" (Hammond, 2014). This approach to teaching and learning can be applied to other activities and lessons in an outdoor science program. The approach also supports learners in becoming independent learners who are able to succeed, regardless of any individual teacher or learning context. BEETLES has intentionally designed the sequence and structure of this activity, and our other curricula and instructional materials, to support learning experiences in which all learners feel capable of success and have the tools to carry that success into other domains.

Resources on unconscious bias. There are many great resources on understanding and shifting unconscious bias. Here are a few books and organizations we have looked to consistently to work on our own unconscious bias and to better understand how it can affect teaching and learning in the outdoors:

- *White Fragility: Why It's So Hard for White People to Talk About Racism* by Robin DiAngelo
- *Culturally Responsive Teaching & the Brain* by Zaretta Hammond
- *My Grandmother's Hands: Racialized Trauma and the Pathway to Mending Our Hearts and Bodies* by Resmaa Menakem
- **Youth Outside [http://www.youthoutside.org/]**
- The Avarna Group [https://theavarnagroup.com/]
- Center for Diversity & the Environment [https://www.cdeinspires.org/]

Using learner-centered and nature-centered learning approaches is just one piece of the work we can do to create equitable, inclusive, and culturally relevant learning experiences. Instructors must also work to become more aware of their own unconscious biases and triggers around culture, identity, and race that impact their interactions with learners and affect their learners' sense of inclusion.

Science as One Way of Knowing, Not the Only Way

All cultures have a deep history of observing, investigating, and living closely with the natural world that predates modern "science." Humans have always gathered knowledge about the natural world in ways that are similar to current scientific thinking and in other ways that differ from scientific thinking. The ecological knowledge that is obtained by Indigenous peoples and western science are both valid, with each having roots that are based on philosophical foundations, methods of validation, and communities of respected experts. Traditional Ecological Knowledge (TEK) refers to an evolving body of knowledge based on hundreds or thousands of years of close observations of ecosystems by Indigenous people. Indigenous Knowledge (IK) has been used to refer to the local knowledge of Indigenous peoples or to the unique, local knowledge of a particular cultural group. TEK includes Indigenous understandings of ecology, spirituality, and human relationships with living and nonliving things. The ways of constructing, organizing, using, and communicating knowledge that have been practiced by Indigenous peoples for centuries have many similarities with current science practices (Lambert, 2003).

There are many different ways of knowing. Science is one way. When teaching science, it's important for instructors to acknowledge and value the many ways that learners come to understand their world. If learners feel their religion, spirituality, or cultural knowledge are being ignored or disrespected, they might disregard scientific instruction as irrelevant or disengage from the learning experience. Often (though not always), these varied ways of knowing are complementary. One of the options in *I Notice, I Wonder, It Reminds Me Of* is for learners to discuss which of their questions are scientific—questions that can be pursued through observation and investigation (scientific practices that integrate with TEK). Learners also discuss which questions are beyond the realm of science and can only be pursued through approaches and disciplines other than science. This can also be an opportunity for learners to engage with questions that approach a holistic view of the environment and the connection human beings have within that environment. The holistic nature of TEK or IK allows for practical applications in science that are balanced with spiritual practices that encompass intellectual, physical, affective, and spiritual domains of learning.

The Venn diagram (on the next page) is an attempt to illustrate the characteristics of science and TEK that overlap and those that distinguish them from one another.

Resources for further learning on synergies and distinctions between TEK and Western science.

To begin your learning:

Books:

- *Braiding Sweetgrass* by Robin Kimmerer
- *Decolonizing Methodologies* by Linda Tuhiwai Smith
- *Wisdom Sits in Places* by Keith Basso
- *Traditional Ecological Knowledge: Learning from Indigenous Practices for Environmental Sustainability* by Melissa Nelson & Daniel Shilling

Research papers:

- "On the Role of Traditional Ecological Knowledge as a Collaborative Concept: A Philosophical Study" by Kyle Whyte
- "Local Understandings of the Land: Traditional Ecological Knowledge and Indigenous Knowledge" by Roy C. Dudgeon and Fikret Berkes
- "The Earth's Blanket: Traditional Teachings for Sustainable Living" by Nancy Turner
- "Elaborating Indigenous Knowledge in the Science Curriculum for the Cultural Sustainability" by Rif'ati Dina Handayani, Insih Wilujeng, and Zuhdan K. Prasetyo
- "Indigenous Environmental Education for Cultural Survival" by Leanne Simpson

Other resources:

- "The Onondaga Nation's Vision for a Clean Onondaga Lake: An offer of biocultural restoration." https://www.onondaganation.org/land-rights/onondaga-nations-vision-for-a-clean-onondaga-lake/

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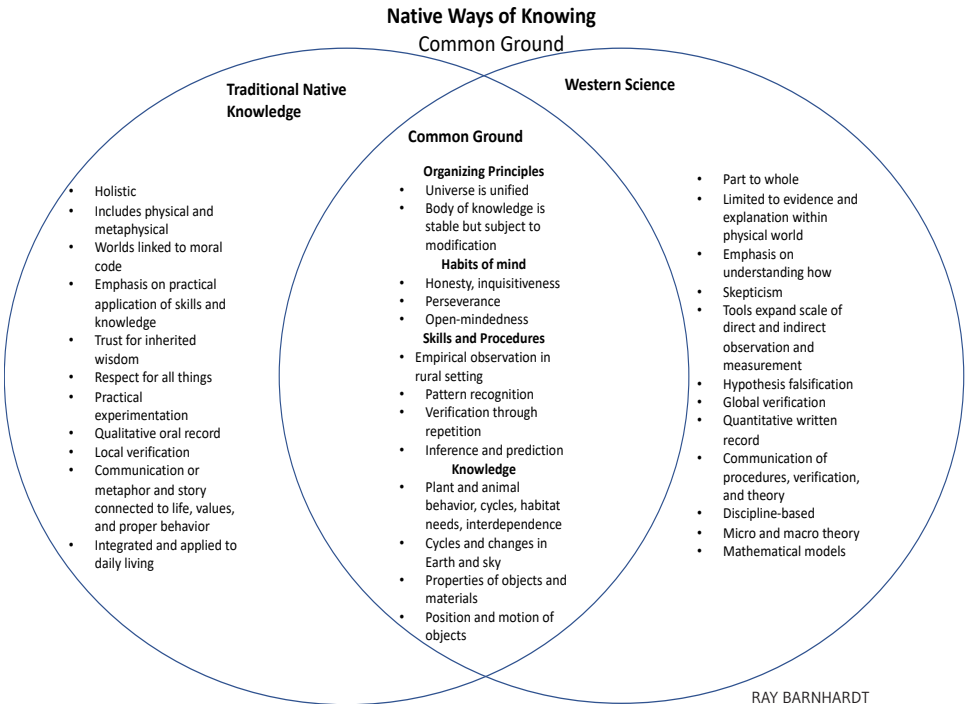

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Annie Sorrell and her cohort of graduate students from the Center for Native Peoples and the Environment (at State University of New York, College of Environmental Science and Forestry) offered these additions to the Venn diagram above:

Traditional Ecological Knowledge	Western Science
• approach nonliving relationships as relatives/kin	• approach nonliving relationships as resources
• decision-making is based on seven generations	• decision-making is guided by term limits, fiscal years, and an Individual's lifetime
• focus is on journey and process	• focus is on destination, goals, and outcome
• focus on relationships (research projects include consideration of how decisions will affect the community; involvement in a research project should consider all relationships: species, people, and land)	• focus on individuals (decisions are guided by self-interest, what a researcher might achieve individually from their participation in the activity or research)
• species/places are our relatives, they may give us gifts	• species/places are resources humans have a right to use or manage
• increase positive relationships, tend the land, consider reciprocity, re-Indigenize	• stop relationships, passive recreation (e.g., photography) vs. actively tending the land, colonizing another place to meet needs ("sacrifice zones")

For continued learning:

Books:

- *Indigenous Methodologies* by Margaret Kovach
- *Gathering Moss* by Robin Kimmerer
- *A Sand County Almanac* by Aldo Leopold
- *Tending the Wild: Native American Knowledge and the Management of California's Natural Resources* by M. K. Anderson
- *Sacred Ecology: Traditional Ecological Knowledge and Resource Management* by Fikret Berkes
- *Recovering the Sacred: The Power of Naming and Claiming* by Winona LaDuke
- *Original Instruction* by Melissa Nelson

Research papers:

- "Local Understandings of the Land: Traditional Ecological Knowledge and Indigenous Knowledge" by Roy C. Dudgeon and Fikret Berkes
- "Indian Time: Time, Seasonality, and Culture in Traditional Ecological Knowledge of Climate Change" by Samantha Chisholm Hatfield, Elizabeth Marino, Kyle Powys Whyte, Kathie D. Dello, & Philip W. Mote
- "Weaving Traditional Ecological Knowledge into Biological Education: A Call to Action" by Robin Kimmerer
- "Native Knowledge for Native Ecosystems" by Robin Kimmerer
- "Searching for Synergy: Integrating Traditional and Scientific Ecological Knowledge in Environmental Science Education" by Robin Kimmerer
- "An Emerging Decolonizing Science Education in Canada" by Glen Aikenhead and Dean Elliott
- "Discovering Indigenous Science: Implications for Science Education" by Gloria Snively and John Corsiglia
- "Coming to Know: Weaving Aboriginal and Western Science, Knowledge, Language and Literacy in the Science Classroom" by Gloria Snively and Lorna Williams
- "Western Science and Traditional Knowledge: Despite Their Variations, Different Forms of Knowledge Can Learn from Each Other" by Fulvio Mazzocchi

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Research papers (continued):

- "Beyond the 'Ecological Indian': Environmental Politics and Traditional Ecological Knowledge in Modern North America" by Gregory D. Smithers
- "Integrating Traditional Ecological Knowledge with Western Science for Optimal Natural Resource Management" by Serra Hoagland
- "Restoration and Reciprocity: The Contributions of Traditional Ecological Knowledge" by Robin Kimmerer
- "Learning as You Journey: Anishinaabe Perception of Social-Ecological Environments and Adaptive Learning" by Iain Davidson-Hunt and Fikret Berkes
- "Cultural Keystone Species: Implications for Ecological Conservation and Restoration" by Ann Garibaldi and Nancy Turner
- "Protecting Restorative Relationships and Traditional Values: American Indian Tribes, Wildlife and Wild Lands" by Linda Moon Stumpff
- "How Might Native Science Inform 'Informal Science Learning'?" by Brian McKinley Jones Brayboy and Angelina E. Castagno
- "Defining 'Science' in a Multicultural World: Implications for Science Education" by William W. Cobern and Cathleen C. Loving
- "Indigenous Knowledge in the Science Curriculum: Avoiding Neo-Colonialism" by Ann Ryan
- "Out of Place: Indigenous Knowledge in the Science Curriculum" by Elizabeth McKinley and Georgina Stewart
- "Conversations on Cultural Sustainability: Stimuli for Embedding Indigenous Knowledges and Ways of Being into Curriculum" by Renae Acton, Peta Salter, Max Lenoy, and Robert (Bob) Stevenson
- "Re-Examining the Importance of Indigenous Perspectives in the Western Environmental Education for Sustainability: From Tribal to Mainstream Education." by Doreen Vikashni Chandra

Science and Traditional Ecological Knowledge (TEK)

Robin Wall Kimmerer—scientist, author, poet, and director of the Center for Native Peoples and the Environment at the State University of New York, Environmental Science and Forestry School—compares, contrasts, and seeks out complementarity between science, TEK, and the arts in her writing and teaching. Indigenous perspectives and strategies for making observations in nature have tremendous relevance in environmental education. How can non-Indigenous environmental educators highlight TEK without engaging in cultural appropriation? Kimmerer provides guidance about this, and her approaches overlap nicely with those of marine biologist Todd Newberry (quoted several times in this session and other BEETLES resources). Newberry describes "interviewing an organism" as a way to deepen observations. Kimmerer, in her book *Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge and the Teaching of Plants*, describes the blending of TEK with scientific experiments in a similar manner, "To me, an experiment is a kind of conversation with plants: I have a question for them, but since we don't speak the same language, I can't ask them directly and they won't answer verbally... Plants answer questions by the way they live, by their responses to change; you just need to learn how to ask... Experiments are not about discovery but about listening and translating the knowledge of other beings" (Kimmerer, 2013, p. 158).

Kimmerer writes the following about science:

> *"Listening in wild places, we are audience to conversations in a language not our own. I think now that it was a longing to comprehend this language I hear in the woods that led me to science, to learn over the years to speak fluent botany. A tongue that should not, by the way, be mistaken for the language of plants. I did learn another language in science, though, one of careful observation, an intimate vocabulary that names each little part. To name and describe you must first see, and science polishes the gift of seeing. I honor the strength of the language that has become a second tongue to me. But beneath the richness of its vocabulary and its descriptive power, something is missing, the same something that swells around you and in you when you listen to the world. Science can be a language of distance which reduces a being to its working parts; it is a language of objects. The language scientists speak, however precise, is based on a profound error in grammar, an omission, a grave loss in translation from the native languages of these shores"* (pp. 48–49).

Kimmerer also refers to Indigenous lore about trees talking to one another and how that idea has long been dismissed by scientists. Yet she points out, "There is now compelling evidence that our elders were right—the trees *are* talking to one another. They communicate via pheromones, hormonelike compounds that are wafted on the breeze, laden with meaning" (pp. 19–20). She goes on to describe how scientists are learning about how fungal networks connect trees and "redistribute the wealth of carbohydrates from tree to tree" (p. 20).

The idea of communication between trees was understood by Indigenous peoples long before science managed to "discover" it. Integrating TEK with

scientific knowledge allows for a holistic understanding of the environment that improves existing processes and management. TEK can also add to the understandings built through science, validating what is known about the natural world in a different way. It's a lovely example of the complementarity between science and TEK and how we can see the world more fully when we use both.

In her blending of science with TEK, Kimmerer describes the importance of gratitude, the practice of reciprocity, and the use of language that is not "othering" when describing and addressing nature. These perspectives can be common to science and TEK and can help learners of all identities develop their own relationship with nature. These perspectives can be shared and encouraged with learners in ways that are respectful to Indigenous cultures and authentic to the instructor. This can look like genuinely and respectfully sharing practices of gratitude, reciprocity, and not othering parts of nature (universal values of Indigenous people) without using or appropriating the language or ceremonies of specific Indigenous cultures.

Cultural appropriation. When aspects of a culture are copied by members of another culture, particularly if those doing the copying are members of the dominant white culture, this may be considered to be harmful and a form of colonialism. In environmental education, aspects of Indigenous culture have at times been incorporated into programs and instruction, which is often harmful to Indigenous people. Nature instruction that ignores Indigenous values, such as when learners act disrespectfully toward nature, can also be harmful. Embodying Indigenous values and wisdom without appropriating Indigenous culture is a way of honoring Indigenous people without contributing to the harm they have already experienced through genocide and the taking of their land.

Article 31.1 of the United Nations *Declaration on the Rights of Indigenous Peoples* (https://en.wikipedia.org/wiki/Declaration_on_the_Rights_of_Indigenous_Peoples) states:

> Indigenous peoples have the right to maintain, control, protect and develop their cultural heritage, traditional knowledge and traditional cultural expressions, as well as the manifestations of their sciences, technologies and cultures, including human and genetic resources, seeds, medicines, knowledge of the properties of fauna and flora, oral traditions, literatures, designs, sports and traditional games and visual and performing arts. They also have the right to maintain, control, protect and develop their intellectual property over such cultural heritage, traditional knowledge, and traditional cultural expressions.

There is no clear cut set of rules for what does or does not constitute appropriation; while this will vary from tribe to tribe and culture to culture, the specific ideas of what is appropriative should always be determined by the people whose culture the practice arises from, not people from a dominant culture who wish to take up that practice. Some general ideas we'd like to offer for avoiding cultural appropriation of Indigenous cultures in the context of environmental education (for non-native instructors):

- Do not wear traditional costumes or appropriate rituals.
- If you're going to use language, talk about medicinal uses of plants, or share about how a piece of land was or is used by a local tribe, talk to a cultural committee or tribal council first.
- Whenever possible, strive to share quotes from local Indigenous tribal leaders in your area, instead of relying on often overused quotes from well-known tribal leaders such as Chief Seattle or Chief Joseph, who are not from your area.

This short list is just a starting point. To learn more, search online for the many lists of behaviors that could fall into the category of cultural appropriation.

"There are many ways of how you can incorporate traditional values without saying they're traditional values." –Annie Sorrell, Center for Native Peoples and the Environment (at State University of New York, College of Environmental Science and Forestry)

Considering Intellectual Property Rights in working with Indigenous thought partners. Intellectual Property Rights (IPR) are the notion that ideas, innovations, and inventions, expressed through various material forms, can be owned and that individuals have distinct property rights to these forms of creative expressions and products.

"IPR and the knowledge of seven generations as IPR is the main reason that many Indigenous people struggle with sharing knowledge with nontribal members. Considering seven generations is a fundamental value for intergenerational knowledge being passed down." –Annie Sorrell, Center for Native Peoples and the Environment

"When we were given these instructions, among many of them, one was that when you sit in council for the welfare of the people, you counsel for the welfare of that seventh generation to come. They should be foremost in your mind–not even your generation, not even yourself, but those that are unborn so that when their time comes here, they may enjoy the same thing that you are enjoying now." –Chief Oren Lyons

"Indigenous people argue that western intellectual property laws are fundamentally incompatible with Indigenous cultural systems and ignore the complexities of such Indigenous systems." –Michael Davis, Consultant, Social Policy Group

To learn more: https://www.aph.gov.au/about_parliament/parliamentary_departments/parliamentary_library/pubs/rp/rp9697/97rp20#CRITIQUES

Gratitude

Kimmerer speaks of seeing nature as offering an abundance of gifts. Field instructors can incorporate gratitude into their instruction. Instructors might thank a salamander after learners have spent time gently observing it. They might regularly describe aspects of nature they are grateful for and encourage learners to share what they are grateful for, too. Kimmerer asks, "What would it be like…to live with that heightened sensitivity to the lives given for ours? To consider the tree in the Kleenex, the algae in the toothpaste, the oaks in the floor, the grapes in the wine; to follow back the thread of life in everything and pay it respect? Once you start, it's hard to stop, and you begin to feel yourself awash in gifts" (p. 154).

Reciprocity

Kimmerer describes how the perspective of gratitude invites us to develop a relationship with nature. "The essence of the gift is that it creates a set of relationships (p. 28). …Gifts from the earth or from each other establish a particular relationship, an obligation of sorts to give, to receive, and to reciprocate" (p. 25). But how can we reciprocate? How can we give back to Earth? Kimmerer asks, "What else can you offer the earth, which has everything?" (p. 38). We can give back to Earth by treating Earth respectfully. In *Making Observations*, we ask participants, before they begin, to think about how their actions may affect the living and nonliving things they interact with, how they will be respectful as they observe and interact with the environment, what kind of relationship they want to have with this place during their stay, how they will ensure this place is there for future generations, and how they will choose to give back to nature.

Kimmerer writes, "I've heard it said that sometimes, in return for the gifts of the earth, gratitude is enough… But I think we are called to go beyond cultures of gratitude, to once again become cultures of reciprocity" (p. 189). There are many forms of reciprocity Kimmerer suggests, most of which pertain to environmental responsibility. She also underscores the importance of making nature observations as a form of reciprocity, "…the least we can do in return is to pay attention" (Kimmerer, 2014, p. 9).

Avoiding "Othering" Language

Kimmerer shares that how we address nature can influence our perspectives: "In English, we never refer to a member of our family, or indeed to any person, as *it*. That would be a profound act of disrespect. *It* robs a person of selfhood and kinship, reducing a person to a mere thing. So it is that in Potawatomi and most other Indigenous languages, we use the same words to address the living world as we use for our family. Because they are our family" (p. 55). She writes about how the English language, by describing other living things as *it*, tends to imply that nonhuman organisms are things, and it's easier for us to harm what we consider to be things, as opposed to beings. Kimmerer offers the idea that this perspective can be subtly disrupted in English by using terms such as *someone* (not *something*) to describe other organisms. A similar approach can also be seen among some field instructors who, when they come across other organisms, may greet them using terms such as, *Hey*

friend or *Hey there buddy*. For terms that acknowledge our interrelatedness, one might use *Hey cuz* or *Hey there my whiskered relative* (or substitute another descriptor such as *four-legged*, *feathered*, etc.). Some instructors may also choose to substitute the terms *he*, *she*, or *they* for the term *it*.

Developing a Relationship with Nature

Newberry describes how asking questions can encourage our curiosity and inspire us to observe nature. Kimmerer suggests that combining science, TEK, art, and other lenses can increase the fullness of how we see the world. Learning to make careful observations and to ask questions that lead to more detailed observations is key to science and to science education. It also establishes indelible relationships between learners and the bits of nature on which they focus their attention. Kimmerer states, "My natural inclination was to see relationships, to seek the threads that connect the world..." (p. 42). Naturalist E. O. Wilson writes extensively about empathy with other organisms and uses the term *biophilia* to describe "the connections that human beings subconsciously seek with the rest of life," arguing that it is rooted in our biology. Environmental literacy includes affective dispositions—the feelings we have about nature. Environmental education helps learners increase their understanding of nature and helps them develop their own relationship with nature by allowing them to directly engage with nature. This engagement can be facilitated by educators by providing learners with opportunities to make their own careful observations of different aspects of nature. Kimmerer states, "Science can be a way of forming intimacy and respect with other species that is rivaled only by the observations of traditional knowledge holders. It can be a path to kinship" (p. 252).

I Notice, I Wonder, It Reminds Me Of engages learners directly with some aspect of nature, invites them to notice what is around them, and welcomes any and all observations they make. It welcomes any questions learners come up with, including those that are beyond the realm of science. It invites learners to share what it reminds them of, providing them with opportunities to connect what they are observing with any aspect of their own lived experience and to come up with their own metaphors. Giving sustained compassionate attention to a leaf, an insect, a bush leads to what John Muir Laws calls love and what the NAAEE Environmental Literacy Framework calls "caring and positive feelings toward the environment." These feelings can be further enhanced through BEETLES focused explorations such as *Lichen Exploration*, *Spider Exploration*, or *Case of the Disappearing Log*. When learners get opportunities to "fall in love" with a variety of aspects of nature, these can lead to a relationship with nature as a whole.

Integrating Territorial Acknowledgements Into Outdoor Science Programs

As environmental and outdoor science educators, we have the opportunity to engage youth meaningfully with nature. This comes with a responsibility to examine our own relationship with the place where we live and teach and to learn and share the relationship between the local Indigenous people and the place. One way to do this is to include a territorial acknowledgment in our

programming. Territorial acknowledgments name the Indigenous people who first lived on the land and call attention to their enduring presence.

What Are Territorial Acknowledgments and Why Are They Important?

We all live, teach, and work on land stolen from Indigenous peoples. It is easy to forget about this as we move through our daily lives, focusing on our families, communities, and work. This reality is often glossed over in educational settings where local Indigenous people are frequently unacknowledged or are talked and taught about only in the past tense. Learning about Indigenous peoples in classrooms and outdoor programs is often focused on traditional Indigenous practices, not the significant impacts of colonization on Indigenous communities, where and how those communities currently engage with the land, and how they continue to be marginalized today.

More on creating territorial acknowledgements. See the BEETLES resource Territorial Acknowledgements for more information on how to create and use them (http://beetlesproject.org/resources/territorialacknowledgment/).

Territorial acknowledgements (also called land acknowledgments), or statements that acknowledge the Indigenous communities who originally lived on the land where an event takes place, are a way to guard against making Indigenous people invisible. They're also a way to introduce some discomfort and awareness into our daily lives, reminding non-Indigenous people to consider the historic and current impacts of colonization on Indigenous communities and to be in thoughtful relationship with the land. Including territorial acknowledgments toward the beginning of a program or event (and putting them on your organization's website) can be one step toward deepening understanding of the impacts of colonization on Indigenous communities.

"People generally see what they look for, and hear what they listen for." –Harper Lee

Anthropomorphism, Observations, Explanations, and Empathy

Anthropomorphism is when people project human characteristics or values onto organisms and things that are not human. Anthropomorphism can influence the observations we make of organisms. When making scientific observations, we're trying to capture with accuracy what we can detect with our senses. To do that, we need to do our best to avoid bias. Anthropomorphism can bias our observations in ways we may not be conscious of. For example:

> Male scientists observed and described male elephant seals aggressively fighting for dominance. The scientists also observed and described the female elephant seals as being passive. From their observations, the scientists made the assumption that the seals had a male-dominated social system, which became a widely accepted perspective. Then, a female graduate student observed and inferred a different social system, one in which female elephant seals incite male aggression as a way to mate with the stronger males. The graduate student published a paper describing this framework for elephant seal social systems, and since then this perspective has been widely accepted. The observations by the male scientists were inaccurate because they were biased by their anthropomorphic assumptions. They didn't observe things they didn't expect to see.

Some nature educators use anthropomorphism to encourage empathy for organisms that are not human. Empathy is the ability to understand and share the feelings of another. Anthropomorphism can sometimes lead to inaccurate empathy. Inaccurate empathy is when someone *misunderstands* the feelings or actions of another or assumes that someone else feels or will react the same way they would in a specific situation. When we are observing nature and trying to gain accurate understanding of organisms' perspectives and perceptions, we are striving for accurate empathy. Striving for accurate empathy is a common characteristic of both science and TEK. Striving for accurate empathy helps us understand the lives and worlds of other organisms. Note that it's described here as *striving* for accurate empathy, to represent that there is always some uncertainty involved in this pursuit. It's valuable to attempt to understand the perspectives of other organisms, but it's also important to remember that we can't ever fully understand the perspective and life experience of another being (including humans!), and the more different from us they are, the less we can understand.

Observations and explanations. It takes effort and intention to be accurate when observing anything, and it also takes intention to avoid confusing our inferences and explanations for observations.

> "What do you notice about the ants?"
>
> "I notice that they're playing."
>
> "That's actually an explanation you're making, but what do you actually see happening?"
>
> "I see that they're moving fast and touching each other."
>
> "Okay, *that's* your observation! Playing is one possible explanation for your observations. What's another possible explanation for your observations?"

It's not that inferences and explanations are bad—far from it! It's that they are not observations, and they should be recognized for what they are. Evidence-based explanations for the natural world are actually the primary goal of science (see the BEETLES professional learning session *Evidence and Explanations*). They're also very useful in daily life. However, a solid explanation needs to be clearly based on solid evidence/observations, so making accurate observations is a foundational skill. When we make careful observations, we can have more certainty about our observations than about our explanations—although even careful observations can sometimes be inaccurate. When making an explanation, it's important to be clear about what the observation is that's being used as evidence in the explanation. We want our inferences and explanations to be as directly connected to our observations as possible, and we want the observations they're based on to be as accurate as possible.

Often, anthropomorphism is a form of making an explanation about an organism. When a person notices that a lizard has been on a rock for a long time, they might say, "The lizard likes the rock." In this case, they are making an *explanation* that the lizard "likes" the rock based on the observation that the lizard has been on the rock for a while. An explanation is not an observation—although explanations are very valuable (see box above). Explanations and observations are often confused with each other, so when guiding learners in making observations, it's important to invite them to tease apart observation and explanation and see the distinction. It's another reason to avoid anthropomorphism when the goal is making observations, because anthropomorphism tends to be an explanation, not an observation.

Definitions for *empathy* and *accurate empathy*. "*Empathy* is a stimulated emotional state that relies on the ability to perceive, understand and care about the experiences or perspectives of another person or animal...*Accurate empathy* is an empathic response that is based in substantive knowledge of an animal's natural history, not projected assumptions." (Young, A., Khalil, K., & Wharton, J. 2018)

"Human beings have a strong, strong, strong tendency that if we see an animal do something that's analogous to what we do, like use a tool or answer an arithmetic question, we assume that the animal is doing it and understands the situation in the same way we do...And sometimes that's true but more often it's false." –Alan Kamil, Center for Avian Intelligence at the University of Nebraska

Even when we are paying attention to which things we say are observations and which are explanations, anthropomorphism can bias the explanations we make. This is where awareness of anthropomorphic tendencies is particularly important. A human perspective comes very naturally to humans, but the perspective of a barnacle, fungus, or earwig is more challenging to understand. To make accurate explanations, we need to try as best as we can to consider the perspective of the organism we're observing and to avoid projecting our own perspectives onto it.

Anthropomorphism can be fun, imaginative, and playful and is common in stories and humor. However, when attempting to make accurate observations and/or explanations in outdoor science, it should be avoided. If you invite learners to use anthropomorphism when you have different learning goals than making scientific observations, also invite them to hold awareness that it is anthropomorphism. Ask learners to reflect on how anthropomorphism is based on a human perspective, not the perspectives of the actual organisms that are not human. In making an anthropomorphic statement, we are imagining what a human might experience, not what the organism actually experiences. Without awareness, anthropomorphism may result in misunderstanding other organisms and act as a barrier to accurate empathy.

Researchers at the Seattle Aquarium write: "Incorrect empathy occurs often. At an aquarium, one might hear, 'The octopus must be so lonely!' Here, guests are projecting their own social needs, not knowing octopuses do not live in groups. Inaccurate empathy can also lead to negative consequences: "People will come across baby deer curled up and alone, assume that it is abandoned, and bring it to an animal rescue not understanding that the mother has left the baby there purposefully and will be back to collect it. Also, there are the accounts of people believing they can communicate with wolves or bears and end up dying or becoming seriously injured due to their incorrect empathy" (Young, A., Khalil, K., & Wharton, J., 2018, p. 9).

Fiction vs nonfiction books used in teaching. Fictional texts that include anthropomorphism are often used by science educators to engage learners, based on a common belief that learners find fiction more engaging than nonfiction. But a study comparing nonfiction informational text with fiction found that learners did not express a clear preference for one type of text over the other. In addition, comprehension of the nonfiction text was much higher, and twice as many learners who read fiction showed misconceptions than those who read nonfiction, even though the fiction used in the study was carefully based on scientific information (Cervetti, Bravo, Hiebert, Pearson & Jaynes, 2009).

It's common for learners, particularly young learners, to develop concern for organisms that are not human through anthropomorphism (Young, A., Khalil, K., & Wharton, J., 2018, p. 9), and some educators deliberately use anthropomorphism when teaching, with the intent of increasing concern and engagement. Simply spending time making careful observations of an organism—"sustained compassionate attention"—tends to lead toward emotional connection with the organism (Blizard and Schuster, 2007; Chawla, 2007, 2009; Chen-Hsuan Cheng & Monroe, 2012; Kals et al., 1999; Matteo et al., 2014). Without using anthropomorphism, observation activities such as *I Notice, I Wonder, It Reminds Me Of* engage learners directly with nature and help learners build accurate empathy, as well as accurate understanding of organisms that learners are observing.

Outdoor science instructors can help learners make observations while striving for humility, open-mindedness, and accurate empathy—focusing on the goal of making observations and trying to understand what the organism is actually experiencing, rather than imagining what it would be like to be a human in that organism's position. To help guide learners toward more

accurate observations and empathy, instructors can note to the group when learners say things such as, "The lizard likes that rock" or "It's scared," which are anthropomorphic interpretations or explanations of what they are observing. Instructors can invite learners to identify the observations their interpretations are based on: "What observations did you make that led you to think the lizard likes the rock?" "What observations make you say that it's scared?" Instructors can encourage learners to be aware of what they are actually observing and to avoid making inferences when working on making accurate observations. An instructor might say, "We might try to imagine what the lizard is thinking or feeling, but we can't know that. We can be much more certain of our observations, such as that since we've been here, the lizard has spent more time on the rock than off the rock."

Imagining the perspectives of other organisms is almost second nature within cultures that place high value on empathizing with living and nonliving things that are not human. This ability can be a tremendous asset in understanding the perspectives of organisms through accurate empathy; this empathy may sometimes take the form of anthropomorphism. Anthropomorphism is common among all cultures and will tend to come up when learners make observations of nature, especially when working with young children. It can come across as offensive if an instructor cuts off anthropomorphism abruptly and critically, especially if it's integral to a learner's culture. Instead, instructors can "meet them where they are at and work to develop a more accurate understanding or deeper emotional response...anthropomorphism could be the initial point of engagement for educators to activate learners towards a more accurate understanding" (Young, A., Khalil, K., & Wharton, J., 2018, p. 10). A "Yes, and..." approach can be effective at respecting the perspective as valid, while also focusing in on what's observable. For example, if a learner says that sea otters holding hands shows that they love each other, an instructor might say, "That may be true, and we've also found that it helps keep them from drifting apart as they sleep" (Khalil, K., 2018).

Background on Influential Leaders Cited in This Session

George Washington Carver was a renowned agricultural scientist, inventor, professor, and leader in promoting environmentalism. He received a master's degree in agricultural sciences from Iowa State University and was a prominent professor and researcher at Tuskegee University.

José González is a member of the BEETLES team. He is the founder of Latino Outdoors and is an experienced educator in formal and informal education settings with an array of associated interests in the arts, education, conservation, and the environment. He serves as an advisor for many organizations seeking to bring equity to their outdoor and environmental education programs.

Zaretta Hammond is the author of *Culturally Responsive Teaching & the Brain*. She is a self-described "former writing teacher turned equity freedom fighter." As a classroom writing teacher, she "started to understand how important literacy was to equity, and how neuroscience and culture should inform our instructional practice." She is a teacher, writer, anti-bias facilitator, curriculum designer, professional developer, speaker, and college instructor.

Dr. Robin Wall Kimmerer is Professor of Environmental and Forest Biology at the State University of New York College of Environmental Science and Forestry (SUNY-ESF). She is the author of the award-winning books *Gathering Moss: A Natural and Cultural History of Mosses* (2003) and *Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge and the Teachings of Plants* (2013), as well as many scientific articles. She is the director of the Center for Native Peoples and the Environment at SUNY. She teaches classes on Land and Culture, Traditional Ecological Knowledge, Ethnobotany, Ecology of Mosses, Disturbance Ecology, and General Botany.

John Muir Laws is a wildlife biologist, naturalist, educator, author, artist, and "field-journaling evangelist." He is co-author of the book *How to Teach Nature Journaling* and the curriculum *Opening the World Through Nature Journaling*. His many other publications include the books *The Laws Guide to the Sierra Nevada* and *The Laws Guide to Nature Drawing and Journaling*. He teaches workshops on nature journaling, conservation biology, natural history, scientific illustration, and field sketching.

Emilie Lygren is a member of the BEETLES team. She is a poet, author, nature-journaling expert, and outdoor educator. She is co-author of *How to Teach Nature Journaling* and *Opening the World through Nature Journaling* and a collaborator on *The Laws Guide to Nature Drawing and Journaling*.

Dr. Todd Newberry is a founding faculty member in biology at the University of California, Santa Cruz. He is as renowned for his inspirational teaching as he is for his marine biology research. He has written many articles about teaching and observing as well as his book *The Ardent Birder* on his approach to helping learners explore the natural world by slowing down, looking closely, and asking questions.

Mary Oliver was a prolific and popular poet. "The gift of Oliver's poetry is that she communicates the beauty she finds in the world and makes it unforgettable." —*Miami Herald*. Oliver had an exceptional ability for capturing keen nature observations through poetry and for finding wonder in small, ordinary things.

John Okute Sica was a farmer, historian, and writer. He is the author of many stories through which he describes and shares the lives of his Lakota ancestors.

Annie Sorrell is a member of the Confederated Salish and Kootenai tribes. She is currently pursuing a master's degree in Conservation Biology at SUNY-ESF and works with the Center for Native Peoples and the Environment. In her work, Annie focuses on reconnecting people to land and healing intergenerational traumas through culture and science. Her current research is designed to better understand the traditional knowledge of Bitterroot Salish aromatic plants within the community living on the Flathead Nation reservation in Montana.

Dr. Ashley Young, Dr. Kathayoon Khalil, and Dr. Jim Wharton, of the Seattle Aquarium, have conducted research into the role of empathy in fostering conservation behavior. They are the authors of *Best Practices in Developing Empathy Toward Wildlife* and *Empathy for Animals: A Review of the Existing Literature*. Ashley Young is the Education Coordinator at the Gardens on Spring Creek

in Fort Collins, Colorado. She has also authored and illustrated *The Curious Little Snail*, a children's book encouraging exploration and curiosity for our natural world. Kathayoon A. Khalil is the Principal Evaluator at the Seattle Aquarium. She is interested in the social science of conservation and educating for behavior change. Jim Wharton is the Director of Conservation Engagement and Learning at the Seattle Aquarium. He also works with zoos and aquariums to develop messaging for shark conservation.

The following influential leaders are not named in the session but influenced the section on sensory activities (pages 9–13):

Tom Brown, Jr. is a naturalist, tracker, and author. He grew up in New Jersey and says that he was taught the skills of tracking, wilderness survival, and awareness by his adopted grandfather until he was 17. He became a professional tracker and for decades has taught these skills through his Tom Brown Jr.'s Tracker School. He's the author of many books, including *Tom Brown's Field Guide to Nature Observation and Tracking*, *The Tracker*, *The Search*, *Field Guide to Living With the Earth*. We recognize the controversy in the field about Tom Brown's claims that he was taught by Stalking Wolf of the Lipan Apache tribe. We don't take a position on this controversy. We refer to his activities and writing because they are useful resources for making observations in nature.

Joseph Bharat Cornell is a nature educator in the United States. He wrote the influential book *Sharing Nature with Children* in 1979 to promote outdoor learning. He has since published: *Sharing the Joy of Nature: Nature Activities for All Ages*, *Sharing Nature With Children II*, *John Muir: My Life With Nature*, *Sharing Nature Pocket Guide*, *With Beauty Before Me: An Inspirational Guide for Nature Walks*, *Listening to Nature: How to Deepen Your Awareness of Nature*, *Journey to the Heart of Nature: A Guided Exploration*, *Ocean Animals Clue Game*, *Rainforest Animals Clue Game*, *Listening to Nature: How to Deepen Your Awareness of Nature*, *The Sky and Earth Touched Me: Sharing Nature® Wellness Exercises*, and *Sharing Nature: Nature Awareness Activities for All Ages*. Cornell founded the Sharing Nature Foundation in 1979.

"Solar Steve" Van Zandt is a naturalist, director of a residential outdoor science school, credentialed teacher, activity designer, singer-songwriter, and longtime environmental educator. He is a founder and active member of the Banana Slug String Band, which records and performs children's music about science, nature, and the environment. He has mentored hundreds of interns at the San Mateo Outdoor Education program and leads workshops on Keeping the Magic Alive at California environmental education conferences.

Jon Young was inspired by his childhood mentor—tracker and author Tom Brown, Jr. In his work, Young has blended Indigenous mentoring techniques from around the world with the tools of modern field ecology. Under his guidance, Wilderness Awareness School reaches learners all around the world with its programs that help people reconnect with nature. With Ellen Haas and Evan McGown, he is co-author of the curriculum *Coyote's Guide to Connecting with Nature for Kids of All Ages and Their Mentors* and is also the author of *What the Robin Knows*.

Connections to Other BEETLES Sessions

Making Observations introduces many foundational ideas that are further elaborated in other BEETLES sessions. Following are a few suggestions for connecting this session to other BEETLES professional learning sessions:

- *Field Journaling with Students* includes practical activities to encourage learners to make better observations and explanations through journaling.
- *Evidence and Explanations* encourages learners to build on their observations and questions by using them to form explanations supported by evidence.
- *Questioning Strategies* explores how different kinds of questions can impact student learning and what kinds of questions encourage or discourage exploration, discussion, and meaning-making.
- *Constructing Understanding* builds on the practical approaches for learner-centered practices shared in *Making Observations* by introducing more theoretical, research-based conceptual frameworks about how we learn.
- *Teaching and Learning* provides a practical "learning cycle" model for structuring learning experiences based on what is known from research about teaching and learning.

Many program leaders have found *Questioning Strategies* to be an effective session to do after *Making Observations*.