BACKGROUND INFORMATION FOR PRESENTERS

Scientists and Field Journals

Field journals and notebooks are ubiquitous in nearly all disciplines of science and natural history. Lab scientists use notebooks to keep records of data and experimental procedures, and professional naturalists carry field journals everywhere and draw what they see. Recording information on paper requires focused, quality observation; practicing this makes scientists better at what they do. According to John Muir Laws, field guide artist and environmental educator, "Keeping a nature journal is [an] effective way to train yourself to be a keen observer of the natural world."

A journal offers more than just the opportunity for deep observation. Working on paper also can lead to conceptual understanding and new ideas. Bernd Heinrich, the famous bird biologist and author of *Mind of the Raven* writes, "Taking notes has always helped me zero in on the interesting questions. They have made the difference between simply observing and being able to get the meat out of science." Scientists use journals to grapple with conflicting ideas or to explore questions. A page offers a different forum than a discussion or thinking about something without journaling. Darwin famously drew a simple branching tree in a journal as he considered 34 ideas of evolution. Countless other major and minor discoveries in science were worked out on paper first.

A journal is also a record, one that is not subject to the alteration and degradation that memory is prone to. John D. Perrine and James L. Patton (*Field Notes on Science & Nature*) refer to journals as letters to the future. The journal is not only a letter to the author's future self—who can access data or information they have recorded—it is also a useful record for future generations of researchers.

For many naturalists, scientists, and thinkers, a journal is also a meaningful place to record the details of amazing experiences or to reflect on conversations and feelings. This can support learners in increasing their personal connections with nature, as well as their development of a scientific approach to understanding how nature works.

Effective Use of Printed Journals in Outdoor Science Instruction

Field journal use is most effective when it mirrors that of a professional naturalist, scientist, or thinker. A naturalist, scientist, or thinker will almost always have a purpose in mind when they begin a journal entry. We can support learners' participation and engagement in journaling activities by offering a similar kind of focusing structure. The activities in this session offer learners the tools and guidance for gathering and organizing information in their journals. The activities are sourced from the book *How to Teach Nature Journaling* by John Muir Laws and Emilie Lygren, which is a comprehensive

resource that contains information about how to use journals to support meaningful science learning experiences. The activities and much of the content in this session was generously shared by the authors, and the entire book is available at howtoteachnaturejournaling.com.

In the world of outdoor science instruction, many instructors will not need to significantly alter their approach to successfully incorporate journaling into their teaching. Journaling supports science practices such as observation, asking questions, and constructing explanations from evidence; instructors can use journals when they are leading any activities that involve science practices. In addition to using journaling during other outdoor science activities, instructors ideally would integrate activities that are specifically journaling activities into the rest of their field experience.

Learning in this way offers lively opportunities for learners to engage in practices described both in the Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science and other Technical Subjects, and in the Next Generation Science Standards (NGSS).

According to these documents, learners must: "Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately," and "Communicate scientific and/or technical information orally and/or in written formats, including various forms of media and may include tables, diagrams, and charts."

As learners journal, they gain exposure to all these skills, use other science practices, and engage with content. For more information about connecting journaling activities to the Common Core State Standards and the NGSS, see *How to Teach Nature Journaling*.

Printed journals shouldn't be used only for science instruction. A journal can also be a place for personal reflection and creative expression. A creative writing or reflective activity can enrich learners' whole experience during an outdoor science program and offer them an opportunity to process their experiences in writing. Additionally, if learners write, they are more likely to remember—not just because they'll have a record of their thoughts, but also because they took the time to intentionally choose which thoughts were important to them in the moment.

Recommendations for Structuring Printed Journals

Learners are more likely to feel ownership over a journal if it contains mostly their own thoughts and reflections. They will also be less likely to lose track of a journal if they care about the work within it. Printing journals takes time, money, and paper, so we should be judicious when creating printed journals. Classroom-style worksheets or games can distract learners from their outdoor surroundings. Pages that focus on content delivery take up space that could be filled with learners' thoughts and ideas. We suggest that printed outdoor science journals offer mostly blank pages or pages with minimal structure (such as grids, boxes, or lightly colored lines) that can be used in a variety of ways.

Many programs try to strike a balance between including resources such as field guides or keys and having blank pages. Some instructors enjoy having field guides or other informational pages in journals because learners can reference information easily on a trail and can take these resources and information home with them—resources and information they might not have access to otherwise. The field guides included in a printed journal can be more simple and site- or region-specific than most published field guides. Other instructors prefer to keep field guide pages out of journals so the journal feels more personal and so learners get practice using real field guides as tools. Make a decision based on the goals of your staff and program.

Check out the BEETLES resource Model Field Journal Pages for examples of different types of pages you might choose to include in your program's journals (http://beetlesproject.org/resources/field-journal-pages/).

There are some useful tools worth including in journals such as rulers and formulas that help learners use leg strides or arm length to make measurements. Just the presence of tools like those can offer guidance on ways learners might include numbers in their field journals. These pages can be cut out and pasted in printed journals: (https://howtoteachnaturejournaling.com/teaching_support/cut-and-paste-toolkits/).

Barriers to Learners' Engagement in Journaling and Possible Solutions

If learners and instructors have pre-existing negative associations with writing and drawing through school work, or if they think journaling might distract them from a nature experience, they may initially react negatively to field journaling. If learners are just filling out a worksheet in a journal, this might add to these sorts of perceptions. Offering blank pages in printed journals and using activities that connect learners to the environment can help overcome any such barriers. Learners' resistance to journaling may also arise if journaling prompts include too much or too little structure. Prompts that tell learners exactly what to write can be frustrating, as can directions that are so general that learners may be unsure how to begin. Instructors can use focused journaling activities, such as those modeled in this session, to support learners' participation and engagement. Instructors can also cultivate their own practice of nature journaling, which will help them gain more confidence in helping learners use journals as learning tools.

Learners' varying comfort levels with drawing, writing, or math can also affect their engagement in journaling activities. Many learners may have received messages during their school experience that they are good or bad at writing, drawing, or math. These messages can impact their identities as learners and, by extension, their engagement in journaling activities. Reminding learners that field journaling is about making observations, wondering, and communicating ideas and emphasizing that they can use words, pictures, and numbers together can help reduce any anxiety. More ideas on how mindset and messages about learning can impact learners' engagement in journaling and on how to support learners' participation in journaling can be found in *How to Teach Nature Journaling*.

Thoughtfully choosing journaling opportunities and activities that you think will be exciting for your learners can also help overcome any resistance. If learners feel successful and engaged by their first field journaling experience, they'll be more likely to be open to more field journaling experiences. If you offer learners the opportunity to journal when it seems like they have just had an experience they may want to record or have a lot to say about it, they will be more likely to engage enthusiastically.

If your program provides printed journals, come up with a simple system to ensure that learners will have their journals throughout field experiences. The simpler the system, the easier it will be for instructors to integrate journaling into their teaching.

Another logistical barrier to using journals is weather. Many programs operate where there is frequent precipitation and/or cold or hot temperatures. Some instructors and programs have found success through using materials from Rite in the Rain, a producer of waterproof paper. Other programs continue to use journals in cold, hot, or wet periods by having learners gather samples from the outdoors—such as leaves, small organisms, etc.—and bringing them to an indoor or shaded space (or an area with a roof) for journaling. Instructors have also used the strategy of handing out index cards, golf pencils, and clipboards in environments such as intertidal zones where materials often get a little wet. Later, learners can paste the index cards into their journals.

Incorporating Choice into Activities Encourages Relevance and Intrinsic Motivation

Offering learners some autonomy through choice during activities is one way to encourage intrinsic motivation and learner participation. Offering enough structure for clarity and guidance is important, but so is some learner autonomy. In general, if learners have the opportunity to have some choice in what they are going to focus on and study during journaling experiences (e.g., the specific plant or leaf they will sketch) and how they are going to record their observations and ideas, and if their individual perspectives feel welcome, they are more likely to feel some ownership of the process. Including many opportunities for learners to voice their ideas, perspectives, and lived experiences will also help center learning on what learners are interested in. Listen to your learners and allow their ideas to help guide learning experiences—in effect, allowing the group to feel that their hands are also on the rudder and that the collective choices expressed by their interests are guiding their learning.

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.

The field journaling activities in this Professional Learning session make use of some of the same design principles. Specifically:

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.

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

Focusing on learners directly engaging with nature found anywhere democratizes access and relationship to nature. Sometimes, nature is portrayed and perceived as being something that only exists and can be appreciated in established wilderness areas, which can make nature and outdoor experiences feel less accessible. Centering field journaling experiences on local and common aspects of nature (e.g., leaves, ants, rocks) is one way to share the idea that nature can be found anywhere and that engaging with nature can be part of anyone's daily experience. Direct engagement with nature also offers opportunities for learners to develop their own individual ongoing relationship with nature, independent from instructor-led experiences.

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.

"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*

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. The discussion questions featured at the end of each field journaling activity in this session can help ensure that learners have these kinds of opportunities for discussion.

Specifically, field journaling as a practice supports equitable, inclusive, and culturally relevant learning experiences by:

- scaffolding skills of scientific observation, illustration, and communication to support learners' visual literacy, language acquisition, and engagement with the activity.
- connecting how learners are learning in-the-moment to practices of working scientists—contradicting the exclusionary ideas that science is a list of facts to memorize or that only people who are good at memorizing facts can be good at science.
- using broad questions to invite learners to share their observations, prior knowledge, and experiences with one another and with the instructor.
- engaging learners with commonly found parts of nature, such as worms, contrasting 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.
- focusing the group's learning on a common experience to which everyone has access.
- providing an opportunity for instructors to have a window into how learners think and providing a genuine opportunity for instructors to learn from learners.
- providing a teaching approach in which the instructor acts as a "guide on the side" and builds a collaborative learning environment in which learners make observations, share ideas, and see themselves and one another (not just the instructor) as sources of expertise.

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 experience. 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.

Using learner-centered and nature-centered teaching 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.

Background on Authors of Model Field Journal Pages

Gargi Chugh has been a member of the Nature Journaling community in the Bay Area of California since 2018. A data analyst by profession, she enjoys the process of using data not just to answer questions but also to generate additional hypotheses and questions. Nature is her favorite setting for cultivating curiosity.

Chloé Fandel is an assistant professor at Carleton College in the Department of Geology. Her research focuses on modeling groundwater flow in alpine karst aquifers and the hydrology of working landscapes. She received a PhD and an MSc in hydrology from the University of Arizona and a BA in geological sciences from Brown University. She has also worked in environmental education, hydrologic consulting, public land management, the oil and gas industry, and land and water conservation.

Dr. Ruth Heindel is an environmental Earth scientist who conducts field research on atmospheric dust deposition, nutrient cycling in soils, and the impact of winds on landscape evolution. Ruth grew up in Vermont, attended Brown University and Dartmouth College for her undergraduate and graduate degrees, and was a postdoctoral scholar at the University of Colorado Boulder. Ruth is currently the Dorothy & Thomas Jegla Assistant Professor of Environmental Studies at Kenyon College where she teaches courses on Earth systems, climate change, and landscape evolution.

Marcelo Jost is a naturalist who sees nature as a never-ending source of wonders and challenges (depending on whether he understands what he is seeing or not). His nature journal is a place to graphically debate what he is seeing, to dialogue with nature, and to (he hopes!) produce wonder out of challenges.

Eriko Kobayashi was born in Mitaka city in the suburbs of Tokyo. She started her career as a nature artist and illustrator in 1996. Recently, she has started nature journaling and including writing in her journals. She finds that drawing and writing together lead her to observe nature more and more deeply. In 2018, Eriko started the Japan Nature Journal Club and has gathered people of all ages to look at and learn from nature. She lives in Zama, Kanagawa.

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**

Justice Outside. https://justiceoutside.org/

The Avarna Group https://theavarnagroup.com/

Center for Diversity & the Environment https://www.cdeinspires.org/

John Muir Laws is a scientist, educator, and explorer who uses nature journaling to enhance his memory, observation skills, and creative thinking.

Akshay Mahajan is a hardware engineer from Mumbai, India. He is in love with the experience of learning absolutely anything. Today he finds this in nature journaling, dancing, Mandarin, social psychology, music, and, of course, engineering!

Yvea Moore can usually be found in the field combining her two loves: habitat restoration and nature journaling. Yvea is from San Francisco.

Melinda Nakagawa is a biologist, naturalist, and educator with a passion for connecting people with nature. With an approach that bridges science, art, and heart, she guides her students to cultivate a deeper relationship with nature, slowing down to nature's pace and *being truly present* rather than just looking and labeling. Through her gentle guidance, students awaken a spark of curiosity, wonder, and genuine connection with nature.

Marley Alexander Peifer is a naturalist, educator, and artist. He longs for a reintegration of art with science and words with images, a synthesis that he develops in his journals. Nature journaling has been a fundamental practice for Marley ever since he discovered how it improved his observation and learning.

Sarah Rabkin is the author and illustrator of *What I Learned at Bug Camp: Essays on Finding a Home in the World*. A former high school biology teacher and UC Santa Cruz faculty member in writing and environmental studies, she now works as a freelance editor and oral historian. Sarah leads retreats and workshops that foster awareness of the more-than-human world and the true nature within each of us.

Kate Rutter is a nature journaler, sketchnoter, and digital designer with an experimental and rambunctious visual practice. Kate is a professor at the California College of the Arts, hosts the East Bay Sketchers Meetup group, and has illustrated three books. She holds a BA in studio art from Wellesley College.

Amaya Shreeve is 16-years-old and spends her time reading, working on her YouTube channel and her nature journaling magazine, and most importantly, nature journaling! Amaya loves nature journaling and sharing its wonder and beauty with everyone she meets.

Robert Stebbins (1915–2013) was a researcher, herpetologist, and field guide author of many popular books, including *Peterson Field Guide to Western Reptiles & Amphibians*. He was also a professor of zoology at UC Berkeley and a curator of herpetology at the Museum of Vertebrate Zoology.

Subhelic is a graphic designer and illustrator from Leyte, Philippines. He found nature journaling during the COVID-19 pandemic, and it's the most enriching hobby he's picked up so far.

Mana Hayashi Tang is a paleoethnobotanist, educator, and taiko drummer. In her research and teaching, Mana explores the intersections between plant biology, traditional knowledge, and political ecology. Her areas of interest include early food systems, human relationships with weeds, and music ethnohistory. She is a PhD candidate in anthropology at Washington University in St. Louis, Missouri, and a performing member of St. Louis Osuwa Taiko.

Connections to Other BEETLES Sessions

Field Journaling can be a nice follow up to the BEETLES Professional Learning session *Making Observations* as it offers a practice for engaging learners in making observations and builds on ideas around learner-centered and nature-centered teaching approaches that are introduced in *Making Observations.*