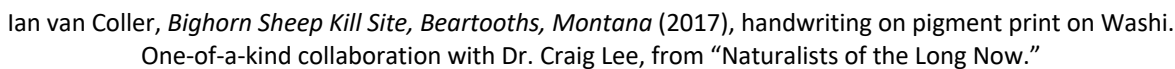


Nancy Lowe



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## Foreword

*This is the second edition of a set of guidelines for arts programs at biological field stations and marine laboratories. The first edition of the Ecotones Guide, co-authored with artist Leah Wilson, included extensive information about artist in residence programs, exhibits, and building relationships with artists and arts organizations.*

*This new edition adds a more detailed history of arts at field stations and marine labs (FSMLs). It provides guidance for arts education, with a special section on drawing as a tool for ecology education. It explores ways that arts can build relationships between field stations and indigenous communities, especially with those on whose ancestral lands the field station is built. It provides examples of arts at international field stations with a showcase of projects from outside the US. Finally, a section on creativity invites us to think about how we can use creative thinking as a tool to innovate science and advance public understanding.*

*Endeavoring to direct and facilitate interdisciplinary, cross-disciplinary, or trans-disciplinary art-science work can be frustratingly difficult. It can also be deeply rewarding. Taking the time to build arts programs at science-focused FSMLs yields very interesting work, relevant for our challenging future. I hope this guide is helpful to you, your FSMLs, and the scientists and artists who work with you.*

– Nancy Lowe, March 2026





Artist Erin Wiersma working at Konza Prairie Biological Station, KS. <https://erinwiersma.com/konza-prairie>

## I. Introduction and History of Arts at FSMLs

According to the Organization of Biological Field Stations, “Biological field stations and marine laboratories (FSMLs) provide living libraries and outdoor laboratories for students, researchers, and the general public. They vary greatly in form and purpose, and include both marine laboratories whose focus is offshore, as well as terrestrial reserves dedicated to protecting key ecosystems. Whatever form individual field stations may take, they all share the same commitment to advancing our understanding of the Earth by supporting research, teaching, and public education.” Throughout this guide, these institutions may be referred to as “field stations” or the abbreviation “FSML” (pronounced FIZ mul), which will include all types of institutions in that category, including marine labs, agricultural research stations, long term ecological research sites (LTERs), etc.

Why should field stations and marine labs invite artists? One of the most obvious reasons is that the arts can be a vehicle for public understanding of science. It can broaden participation, increase science engagement, and cultivate new donor relationships. Beyond those goals lie an even richer territory of true interdisciplinarity, a kind of no-mans-land of uncertainty, but rich with intellectual and cultural rewards. The adventure of art-science interdisciplinary exploration, whether on an individual level or in collaborative work, is often uncomfortable, hard to define, and without clear goals. But it’s in the

## Ecotones Guide for Arts at Field Stations & Marine Labs – 2nd Edition

interstices between disciplines where some of the most engaging conversations happen, and where some of the most innovative work emerges.

Artists and scientists share some common ground. Both are cultural workers, often seeking understanding or producing new knowledge. Curiosity, creativity, and risk-taking are important to engaging in the scientific process and making art. Artists and scientists blaze uncharted territory and innovate, sometimes with an adventurous sense of uncertainty about where a project is going. Artists and scientists build on past work, of their own and of others. Both often invent their own tools and techniques.

However, there are also challenging differences. Science by necessity uses analytical thinking and standardized methods, whereas art can also engage in analytic thinking and standardized methods, it is also often open-ended, spontaneous, and intuitive. Science aims for objectivity; art permits a subjective or personal point of view. Science often requires, and provides, a much greater investment of schooling, funding, and institutional support. Vast inequities exist between the socio-economic status of scientists and artists, from funding to opportunities for professional recognition to societal values of success. Aaron Ellison, former Senior Research Fellow at Harvard Forest, points out: “Most scientists are paid for their ‘process’ (and draw a steady paycheck) but most artists are paid for their ‘product’ (and don’t get paid until they complete a project or commission).”

### Roots of Arts at FSMLs and LTERs

Field stations and marine labs have been around since about the middle of the 19th century, primarily as institutions to support science research and education. The trend of inviting artists to field stations and marine labs has developed since around the year 2000. Two influential arts-at-FMSL initiatives that shaped this work are the Long Term Ecological Reflections program at HJ Andrews Experimental Forest, and ArtSci Converge at Sagehen Creek Field Station. The founding efforts of these two field stations inspired and supported other FSMLs and LTERs to welcome more artists to their sites – as visiting artists, resident artists, arts educators, and artists in other roles. This section will explore a bit of this history, opening with an interview with Fred Swanson about the arts activities at HJ Andrews, followed by a brief history of ArtSci Converge.

**Interview with Fred Swanson, a key founder of the arts programs at HJ Andrews Experimental Forest.**

***NL: HJ Andrews has been such a leader in providing opportunities for artists and scientists to work together for longer than a lot of other LTERs and field stations. Could you share a brief history of arts at Andrews, summarize how that started?***

*FS: I've been interested in this stuff vaguely for a long time, and didn't act on it until the year 2000. I got to go to Mount St. Helens, which is another powerful, charismatic landscape. That's the stuff that I work on, of these wild, charismatic landscapes. I got to go out there with the poet Gary Snyder, who had influenced me, from having read his works when I was an undergrad in geology. I'm from the East Coast, but I had this attraction to the West Coast and the landscapes out here. Anyway, we got to go spend three days out there in the blast zone. He ended up writing about it in his book, "Danger on Peaks," then one thing led to another. A scientist colleague from the Andrews, Jim Sedell, who was then working in the Washington Office of the Forest Service, got me connected with Kathleen Dean Moore. [She] was a distinguished professor at Oregon State University in philosophy, now retired. She's an amazing writer and an amazing presence, an environmental ethicist, and a great communicator. That began in 2002. She was the founding director of the Spring Creek Project for Ideas, Nature, and the Written Word; privately endowed and associated with Oregon State. The successes we have had in our Long-Term Ecological Reflections program are attributable to her early and continuing leadership and that of successor Directors of Spring Creek - Charles Goodrich and Carly Solstrom. The mission statement as it was then, was to "bring together the practical wisdom of the environmental sciences, the clarity of philosophical analysis, and the creative, expressive power of the written word and the arts, to understand and re-imagine our relation with the natural world."*

**NL: That's powerful.**

*FS So, that's our mission. And so, Jim Siddell was the scientist. He was a wild and crazy scientist, a stream ecologist who I had worked with at the Andrews Forest and Mount St. Helens in the 1970s and 1980s. He was a philosophy major as an undergrad, but he was an idea guy. He sent money from the Washington Office of the Forest Service through our Forest Service research group I was leading in a Federal lab on campus at the time (2002) over to the philosophy department. You're used to sending a lot of money over to the College of Forestry and other parts of the university for science. But this was for humanities to run a workshop on new metaphors for restoration of forests and watersheds. And so we had a gathering at the Andrews in 2002. And that was the initiating event. Kathy Moore was central in organizing that, but we had others as well. We had a number of writers and scientists, river scientists and forest scientists, like Jerry Franklin. That was the first of a series of gatherings we had over a decade and a half on topics like new metaphors or the meaning of watershed health. We had a gathering at Mount St. Helens with 20 people, including some veteran scientists and some super luminaries, like Ursula Le Guin. Camping out in the blast zone, we produced a book titled "In the Blast Zone: Catastrophe and Renewal on Mount St. Helens" with writings by both scientists and writers, including a poem from Gary Snyder from that 2000 trip. Then in 2004, we had our first writer in residence, Robert Michael Pyle. And later in 2004, our number two person was Robin Kimmerer. Number three was Alison Deming. So, because of Kathy's engagement with the Orion Society, which, back in those days, had an advisory group and a group of the superluminary nature writers, they would get together, and they would go honor people, WS. Merwin or Gary Snyder, people like that. So she was in that circle. We started out with these*

*invitations to people that we felt comfortable with, who we knew would be comfortable in the forest. And also who had a foot in both the arts humanities and in the science world. So they were cross-dressers, boundary spanners... They had no bounds, and that's the whole thing. What we're trying to do is not be interdisciplinary, but undisciplined. You know, wildly open. That's the payoff for me. I love these places, and I want them to persist as places of inquiry, deep inquiry, and communications from that inquiry. So, let's bring in the storytellers and have them work at the high end.*

"The forest has one rule: Start over, making use of what remains."

- Allison Deming, visiting writer at HJ Andrews Experimental Forest

*And that was the motivation of Mount St. Helens. Because ... I started working at St. Helens. When it blew up. And I got to go in on day 10 and made science observations that I never could have imagined. And they profoundly influence how I think about volcano ecology, and then working with the ecologists stationed there, we've now done 45 years of publishing, thinking about volcano ecology, the geo and the eco and their intimacies... And now with the Andrews, like, with the big fires of 2023, you know, it's: What do we have? What do we miss? I see a need to have the humanities involved and the arts that I did not perceive when we began over 20 years ago. And that is dealing with the grief and the loss of seeing 70% of the Andrews burn, all these old-growth forests that have been around for 500 years. But now, with the help of theologian Vince Miller, for example, and Simmons Bunton, the instigator of the online journal [Terrain.org](https://terrain.org), which is a West Coast counterpart to Orion. Those writers are helping us think about loss, grief. He did a master's with Alison Deming, and he's a writer and a tech guy. He quotes her: "The forest has one rule. Start over, making use of what remains." That's a message for all that's coming down these days, at all, at all levels.*

*We have the "Forest Log," which we had for many years. [See <https://andrewsforestlog.org/>] I made a list of books, about 3 dozen books that draw inspiration from the Andrews Forest, by all kinds of people, including Robin (see the "**Books rooted in the Andrews Forest**" section of the references at the end of this Guide). Robin Kimmerer was beginning her ascendancy in 2004, and she's bosom buddies with Kathy, and she and Alison and Bob Pyle are all senior fellows of the Spring Creek Project, so there's this nexus. So anyway, that's how we got started. We started rather fresh, but we soon learned about relevant activities at other places, like Harvard Forest and North Temperate Lakes LTER sites.*

*One thing I'd like to get at is the notion of residencies. I feel like that's a very incomplete notion for what we're trying to achieve. And a small percent of the 130 or 40 people that have come through, maybe it's like 10%, have a sustained engagement with us. It's not necessarily residence-based.*

**NL: That sustained engagement makes such a deeper experience. It's what scientists do when they work and do significant work.**

*FS: Exactly, because I didn't want us to say, okay, you can do a residency, and screen people, so we have by invitation and by application processes for people to connect. The notion of being in residence seems restrictive; in some cases creatives have sustained engagements punctuated with periodic visits. They leave, and we close the gate. There's some marvelous people with marvelous work, Leah Wilson, a painter, installations, and some photographers now with David Bayles [see <https://www.followingfire.com>], and Ian van Coller who has this project "Naturalist of the Long Now." It's a 10,000 year perspective. Leah Wilson is married to a great-grandson of H.J. Andrews... For something like 13 years, she has been doing work inspired from the forest.*

**NL: I have a question specifically about working with writers. I know that so much about the work that you did in the early days, you're talking about some people who are luminaries in writing. But what about working with emerging writers and students? People who may not have yet published a lot or made a name for themselves. What's some advice that you have for field stations and marine labs in working with writers specifically?**

*FS : Young people, up and coming people, we definitely are tuned to that. And we have now visited writers and artists by invitation. For the more senior, accomplished folks we usually partner with another entity on campus to get up enough money for an honorarium, and the travel and so forth. Through the by-application process we keep an eye out for folks earlier in the career path: And then there are people who just sort of wiggle in one way or another. We got an unexpected donation from a forestry family member and that increased our ability to host residents. I think it was because we read him some poems out in the old growth.*

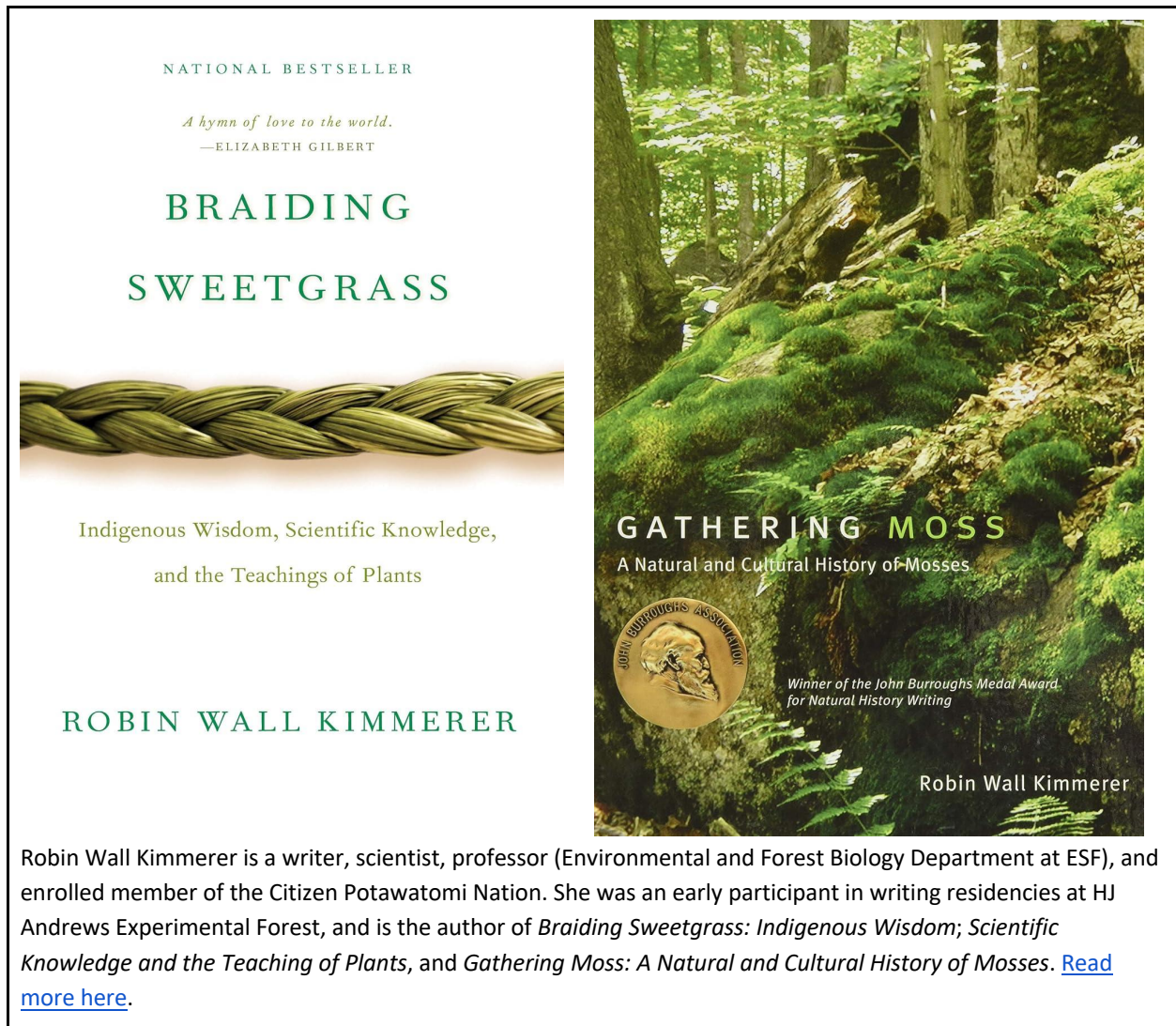
**NL: That's so generous! That is such an incredible thing. I mean, I just want to pause for a second. Obviously, I believe in the value of arts just as they are, and especially arts in these contexts, but I think that art can also be an unappreciated tool for reaching donors, reaching potential donors for field stations. Because people respond to that.**

*FS They do...It can happen. I've been out there with thousands of people on hundreds of field trips. The magnificent landscape speaks to people - opens their minds and hearts - and sometimes even their wallets.*

**NL I think you can't go into it with that as a goal. But knowing it's just another way to reach people.**

*FS Correct. We do fundraising, and we have endowment funds and current use funds in the OSU Foundation. And the PRAX Center, that is a fabulous building, and Art Sci Is a central programming theme.*





FS: Early on in our Andrews / Spring Creek partnership, we called what we were doing Long-Term Ecological Reflections. A riff off [the NSF program] LTER, but it's to make sure that we have room, we have inclusivity, for inquiry. And Kathy has always been very keen that we don't have the writers, she describes it sort of this way "trudging along behind the scientists with their notebook, writing down what the scientists are saying." This isn't about science journalism though that happens along the way. So anyway, it was natural for us to start with writing. And because of Kathy's knowledge and connections and instincts, we started right out with those ...super luminaries. The Andrews-derived stories show up in a wide variety of places and in some cases we don't know how the connection was made. For example, Andrews is a present (though not by name) in Richard Powers' "Overstory." In fact, that won the Pulitzer

*in 2019 in Fiction. And one of the three finalists in nonfiction was Elizabeth Rush's "Rising," about rising tides and climate change, and she has a chapter titled "Connecting the Dots" from her residency at Andrews. In some cases, it's only a single poem in a slim collection. Other cases, like Braiding Sweetgrass, have sold about 3 million copies in 20 languages. And it's still rolling. The world was hungry for it.*

*Overall, we never had a vision for what the Reflections program could become. It just rolls along and seems to gain momentum.*

**NL It grew organically.**

FS Yes.

**NL: So I want to follow on to your comment about writers "not just following along behind scientists taking notes." And, you know, the sort of analog to that in visual art is that often, visual artists are expected to be scientific illustrators, or to create a mural that tells a story or something, to be science communicators, essentially. I think the really powerful art-science projects that come out of field stations don't follow that model. They often defy categorization. They might include an artist who also, in some way, has some scientific background, or scientific identity, or some scientific practice, or a scientist who has an art practice. Or they sometimes can be collaborations between art individuals and science individuals. But it needs to be a kind of sharing across disciplines, where the art, whether it's writing or visual art or whatever it is, is. Really recognized as a form of inquiry on its own, and has its own practices. There's a curiosity and openness across those fields. How do you create an environment that invites that kind of, what you called it, "undisciplined." I love that. Wild, open-ended sharing across disciplines that goes beyond the "walking behind the scientist taking notes" model. How do you create ground that nurtures those kinds of projects?**

FS First, I felt like I was taught by Kathy at the get-go, about this kind of stuff. And that this is not about science journalism. And I'm very aware of the huge asymmetry. When you have a scientist who has worked in a place for decades interacting with a writer or artist who just appeared. One approach is to address questions and aspects of the world that are of interest to both - everyone has something to offer.

*In my own little science world, for example, I try to stretch my thinking by taking both geological and biological thinking. I love trying to know about the geo-eco interactions, and I say, you gotta get your geo straight. ...You can't tell your best geo story unless you are learning from all the lessons the bio has to teach you.*

*I went out with Leah Wilson, this artist, who's very articulate and very smart. Most people I'll go out with the first morning that they show up. We'll sit in the greenhouse down there at the Andrews, and I'll ask what they're about, and I'll do some homework on them in advance. And then we'll go out and we'll look*

*at some places, and we have some reflection plots we'd like them to relate to. We don't want somebody to come in with an unfinished book chapter about some place else, and not relate to the local environment. We want them to deeply indulge in the landscape. Anyway, at the end of a morning with Leah on that basis, she ...explained how disorienting my orientation was... So then I said, "Yeah, I'm worried about that," Should I stop doing that? And she said, "Oh no, it really contributes to the creative process." So we decided to call it a "disorientation."*

**NL: Oh, that's great.**

*FS I'm long retired, but I want to honor these places. They have given me such an interesting life. And I love them for their brute geophysical force. if I can go into a place that I've been to 50, or 100 times and be given a new view, there's this richness there by an artist or writer, and synergies. I love the synergies that can happen when world views meet.*

*We received a small grant from a private foundation out of Portland to, with some consultants' help, look at how we bring different kinds of people into the landscape. Some people aren't comfortable going into the forest and aren't prepared. Emotionally or physically. So anyway, we do have to address these kinds of issues, and we want to have a lot of opportunities.*

*Now through PRAX [Patricia Valian Reser Center for the Creative Arts on the Oregon State University campus], the university has five programs on art-sci themes [including Hatfield Marine Lab on the Oregon coast] The Andrews being the longest running of them. It is evolving quickly and organically to mix things up across disciplines, stages of career, and units within the institution. We don't have a master plan, but the use of arts and humanities has sort of infiltrated a lot of our faculty, including on the science side. It isn't a trinket of filigree on the periphery.*

**NL: It sounds so integrated into so many of the aspects of what's going on there. It sounds to me like there's, first of all. very serious institutional support on many levels. Secondly, it sounds like there's intention behind it. It's not, as you say, "icing on the cake," it's really part of the cake, it's baked in. And the third thing that I'm hearing is that it's really important to make room for uncertainty. Because that's where the surprises and the good stuff is gonna happen, if you don't really plan and don't know what's gonna happen out of these projects that leave room for failure, leave room for surprise, leave room for serendipity, for collaborations.**

*FS: Exactly, exactly. I got to go to Mount St. Helens on day 10 because of a connection through my undergrad time at Penn State and the U.S. Geological Survey, and I got to hook a ride on a helicopter trip. And the first little hole I dug. I saw that the little pit would look like spiderweb filaments on the side of the wall of this little pit. They were fungi, fungal mycelia. And in our landscape, because of forest fires so frequently, there are groups of fungi whose spores are triggered by heat, by fire. But in this case, it*

*was triggered by the heat of the volcanic blast. But the volcanic blasts are way too infrequent to be an evolutionary force whereas these pulses of heat at hundreds of degrees heating... [provided] what these fungal spores need. And so they were permeating these deposits that were only 10 days old. They've been blown from the mountaintop 5 miles to the south. We're on this ridge. Looking across this blasted landscape. And the volcano was still belching some ash, and it was coming down as little mud balls. That was a surprise, but the key thing is, there are winners and losers, and those fungal mycelia were winners. By day 10.*

*Biology is everywhere. It finds a way. And one discovery from those observations was that in the science of disturbance ecology it is important to consider the disturbance mechanism (in this case heat) not the specific disturbance type (e.g., wildfire vs volcanic blast). The essence of surprise is shifting thinking - art and literature do that.*

*And so...Exactly what do you want to know? What hypotheses are you going to test? So, no, I want to be surprised!*

**NL: Yeah, be open-ended.**

*FS And so, going out with the writers and the artists who are trained and encouraged from early on to keep their minds open, and to keep their senses aware...*

**NL ...and, be less goal-oriented...**

*FS Exactly.*

**NL That's a great story. So let's talk about the future. I know that you've done this work over the course of your whole career, and you've made such a mark in the world of field stations and marine labs and long-term ecological research sites, in terms of inviting artists, encouraging artists, making a space for artists, a real place that artists feel welcome to work in many ways, and that's : been huge. I know that even though you're retired, you still care about this work deeply, so I just want to ask what you think about where we need to go from here, what we need to think about in terms of the role of artists at field stations and marine labs, and especially considering the very challenging landscape that we're in now, with funding loss and skepticism towards science. I want to ask about the future, what you think is next, and what we need to do to keep this work going.**

*FS Well, number one, I think it's essential. It's sort of silly and irresponsible to close the door to anybody. Although there are times and circumstances where...there need to be limits, and in fact, a key question is, how do we get the discoveries and the reporting of surprises out to the public, because we don't want 10,000 people wandering in these places and trampling them.*

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*I've had the amazing good fortune of getting to go to many of the LTER sites because I was a principal investigator for a while, and the PIs would meet at other sites each year. And so that was extremely important. And then I work at other places around here, so I see it all, and every place is different – the leadership for every place, the institutional circumstances, the finances – they're all different, and the objectives may be different. Except for the foundation questions: how does the world work and, in the words of Robin Kimmerer, why is the world so beautiful?*

*I've worked at the Andrews for over 50 years. I see the incredible dynamism, I call it the issue environment, because we have lived in times of different dominant issues - for example, in the 1980s and 1990s we lived in the "old growth wars." The spotted owl stuff happened out of the Andrews, and the watersheds had periods of great public attention, and then quiet. The "issue environment" is constantly going like this. The old growth work went from being irrelevant In 1970, when we began. The forest science of that day was about production forestry: Should we be planting these Douglas fir seedlings at 6-foot or 9-foot spacing? Our leader at the time, Jerry Franklin, who was instrumental in setting up LTER, talked to the dean. Jerry who was a Forest Service scientist, as was I. The dean said you shouldn't spend public money, taxpayer money, or NSF money on old growth, because "tomorrow's forests are the plantations." But Jerry grew up in this region, and he loved the trees. He'd wake up in a sleeping bag and yodel to the trees in the morning. So we studied old growth with NSF money, wild money, not domesticated science. It was wild science And it went from irrelevant To pre-relevant to hyper-relevant, in 20 years. Just like the humanists went from, "Oh, that's a nice thing to do" in 2000... 2002 or 2004 to, from a science perspective, "Hey, we really need you guys [arts and humanities] to help us work through the emotional dimensions."*

***NL: All the stuff that's coming down from federal grants, but, you know, the federal grant situation is really tough. I think that's one of the things that's sort of discouraging to me, um, is that anytime you're doing anything new, you take on this risk – it's already so marginal because it's new, and that's exciting, but it's also not institutionalized yet, and it might not have support, that's the downside.***

*FS: On one hand, I agree, but we each have to find our way, personally navigate the world we're in. I'm a glass-half-full person. All of this turmoil makes me go back to poet Alison Deming's statement in reflecting on fire, eruptions, and other disturbances, "The forest has one rule, start over making use of what remains."*



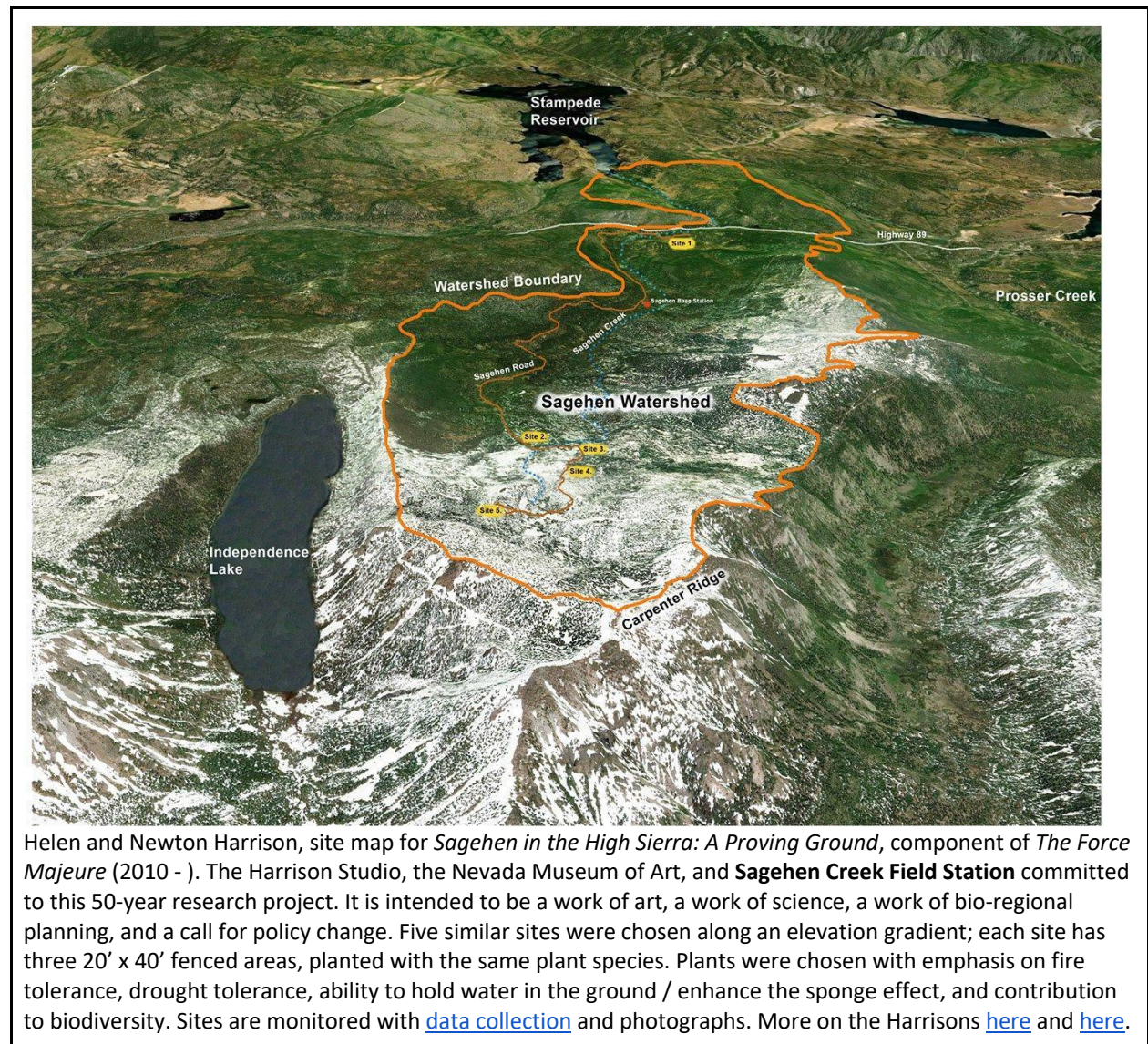


Photos from David Paul Bayles and Fred Swanson: *Following Fire: A Resilient Forest / An Uncertain Future*



## Brief History of ArtSci Converge at Sagehen Creek Field Station

In 2011, Faerthen Felix and Jeff Brown formally founded Art Sci Converge, a wide-ranging arts program at Sagehen Creek Field Station. They managed Sagehen from 2001 until their retirement in 2020. The ArtSci Converge project grew out of art projects there, including an art installation by Helen Mayer Harrison and Newton Harrison, called Sagehen: A Proving Ground, through a collaboration with the Nevada Museum of Art's Center for Art + Environment.



Helen and Newton Harrison, site map for *Sagehen in the High Sierra: A Proving Ground*, component of *The Force Majeure* (2010 - ). The Harrison Studio, the Nevada Museum of Art, and **Sagehen Creek Field Station** committed to this 50-year research project. It is intended to be a work of art, a work of science, a work of bio-regional planning, and a call for policy change. Five similar sites were chosen along an elevation gradient; each site has three 20' x 40' fenced areas, planted with the same plant species. Plants were chosen with emphasis on fire tolerance, drought tolerance, ability to hold water in the ground / enhance the sponge effect, and contribution to biodiversity. Sites are monitored with [data collection](#) and photographs. More on the Harrisons [here](#) and [here](#).

Other artists followed suit and produced a wide range of sculptural, installation, and other works. Felix and Brown cite *FOREST⇌FIRE*, an inter-disciplinary, multi-sensory installation connecting art, the humanities and science, as a pinnacle of the art conducted at Sagehen during their time there. This

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project, led by Michael and Heather Llewellyn, brought together 19 artists, 11 of which were Sagehen artists in residence, to share narratives about fire in the Sierra Nevadas, past, present, and future.

Felix and Brown contributed a chapter in JD Talasek's "Integrative Contemporary Art and Science Practices," entitled "The UC Berkeley Sagehen Creek Field Station Art Science Program: Thought Process and Experience." In this chapter, they confront the question, "Why art at field stations?" and conclude: *"...art helps us see the world from new angles, drawing new audiences and participants into field science, improving scientific creativity, detecting patterns useful as raw materials for science, and literally changing the way we see and perceive the world. This expanded thought is critical to resolving the socio-ecological challenges of the 21st century."*

ArtSci Converge not only supported artists working at Sagehen; the project grew into a network among other field stations and marine labs, through the Organization of Biological Field Stations, promoting arts and humanities efforts at other FSMLs. That collaboration resulted in an NSF-funded meeting on arts at field stations and other coalition-building activities to grow the arts-at-FSMLs movement. Influenced by the work of ArtSci Converge and others, a 2014 National Academy of Science report, "Enhancing the Value and Sustainability of Field Stations and Marine Laboratories in the 21st Century," advises, *"Field stations, either inadvertently or by design, are repositories of long-term observations and datasets of natural history necessary for documenting global changes. A greater emphasis on integrated, multidisciplinary research that includes the physical sciences, geosciences, social sciences, humanities, and arts will enhance scientists' use of historical datasets to address global challenges. The recognition of the importance of this portfolio of activities in what is now called 'convergence' is a strength of many field stations."* Felix and Brown put it more succinctly: *"Field stations and science in general must get relevant and be better at engaging society if they are to survive the current century. It's a tricky challenge: while scientists can be and usually are passionate people, the process of science itself can't be emotional: the data has to speak for itself ... but that coldness and technicality is off-putting to a public looking for yes-or-no answers."* Art is *"a good way to bridge the gap, since creating and working with emotion is in large part what art does."*

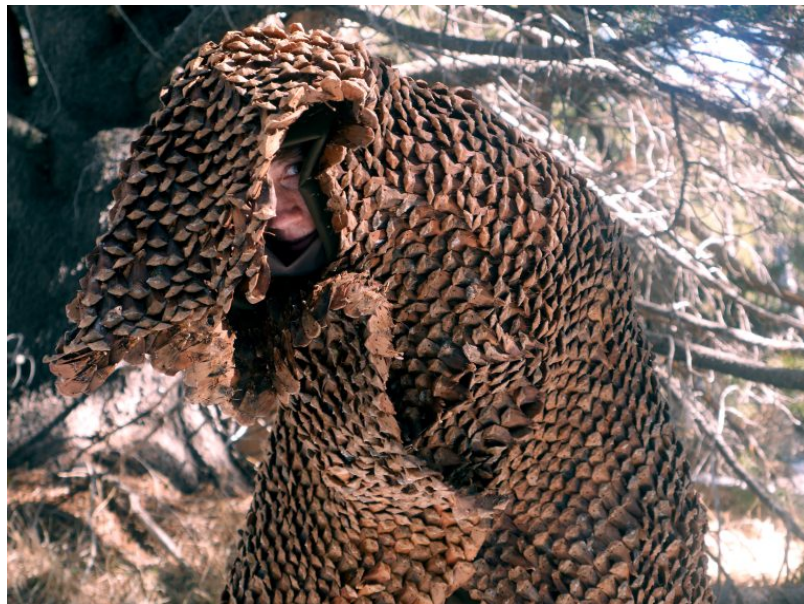
In their chapter on Sagehen, Felix and Brown compare arts at field stations to art-science in other science institutions such as MIT and CERN. They observe, *"Field science is behind the curve on effective art/science collaboration, but FSMLs are a natural place for true art/science synthesis in the service of basic discovery, since we have always been great at 'creative abrasion:' throwing scientists together at the dinner table and bunkhouse to get serendipitous discovery and interdisciplinary collaboration that seldom happened between university department silos in the past."*

For more information and inspiration, see the Cultural Programs of the National Academy of Sciences (CPNAS) interview with Faerthen Felix and Jeff Brown, Bill Fox (Director, Center for Art + Environment,



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Nevada Museum of Art), and Peter McCartney (NSF Program Director, Division of Biological Infrastructure): <https://www.youtube.com/watch?v=PKqXGAYXJCQ>



Top: stpmj Architects, *"Invisible Barn,"* photographed by Faerthen Felix, 2015;  
Bottom: Cedra Wood, *Pine Cone Cloak*.

## 2. Exploring the art-science frontier

### Out There: Current Work in Art + Science + Environment

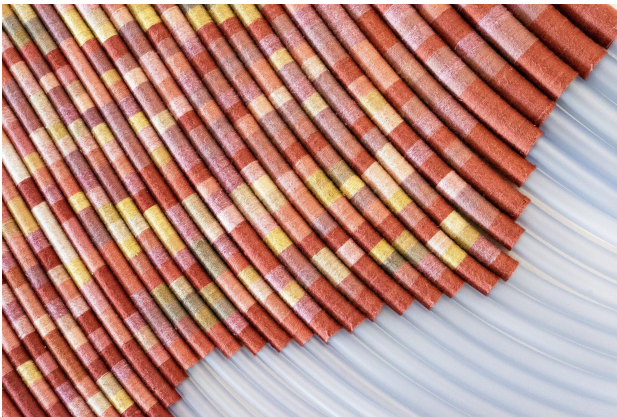
This guide includes artwork, links, and information from a small sample of artists working at the intersection of art, science, and environment. Some of the artists included have worked at FSMLs, and others have not. The inclusion of artists is not meant to be a recommendation or endorsement; many talented artists are not represented in this guide. Nor are the categories comprehensive. The guide includes an array of genres, approaches, and artistic media in this growing interdisciplinary field. You are encouraged to spend some time investigating the artists in this guide, follow the links, and take a closer look. Here are *just a few* to get started:

Representational:

- [Diane Burko](#)
- [Mollie Doctrow](#)
- [Brandon Ballengée](#)
- [Linda Gass](#)

Abstract:

- [Natalie Settles](#)
- [Rita Leduc](#)



Tali Weinberg, *Bound* (2017-19) This piece traces multiple forms of entanglement in the face of anthropogenic climate change. It materializes annual average temperature data from the National Oceanic and Atmospheric Administration for 300 places around the globe, 1500 feet of petroleum-derived medical tubing, plant fibers dyed with plant and insect-derived dyes and mineral mordants. [Read more here](#).

Creative data visualization:

- [Tali Weinberg](#)
- [Natalie Miebach](#)
- [David Buckley Borden](#)



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### Sculpture and installation:

- [Maya Lin](#)
- [Olafur Eliasson](#)

### Writing:

- [Robin Wall Kimmerer](#)
- [Drew Lanham](#)
- [Barry Lopez ed., Home Ground](#)

### Photography:

- [Camille Seaman](#)



Camille Seaman, *Tabular Iceberg at Dawn on the Solstice in the Weddell Sea, Antarctica 22 DEC 2021*. She draws on her Black and Shinnecock heritage, and strongly believes in capturing photographs that articulate that humans are not separate from nature. Her photographs have been published in National Geographic Magazine, Italian Geo, German GEO, TIME, The New York Times Sunday magazine, Newsweek, and Outside, among many others. She is a TED Senior Fellow, Stanford Knight Fellow as well as a Cinereach Filmmaker in Residence Fellow. [More here.](#)





Leilahua Lanzilotti, *On Stochastic Wave Behavior – eight voices* (2021), performed by Roomful of Teeth. Leilehua Lanzilotti is a Kanaka Maoli composer / sound artist. Wayfinding, observing nature, and respecting the ocean have been important since her childhood growing up in Hawai'i. The piece is a musical composition on geoscience, commissioned by geologist Rónadh Cox.

[Read more and listen here.](#)

Film:

- [John Akmofrah](#)
- [James Balog](#)

Sound art & music:

- [Stephen Vitiello](#)
- [Lisa Schonberg](#)
- [Leilehua Lanzelotti](#)
- [Matthew Burtner](#)
- [Matthew Suttor](#)

Dance:

- [Liz Lerman](#)
- [Dance Exchange](#)
- [Black Label Movement](#)



Matthew Burtner et al, *Listening for Coastal Futures*. The Coastal Futures Conservatory (CFC) integrates arts and humanities into the investigation of coastal change. Working with scientists at the **Virginia Coast Reserve**, the Conservatory aims to deepen understanding and stimulate imagination by opening ways to listen to the dynamics reshaping coasts. [Read more and listen here.](#)

Eco-activism as art:

- [Mary Mattingly](#)
- [Aviva Rahmani](#)
- [Mel Chin](#)
- [The Harrisons](#)



Mel Chin, *Unmoored* (2018). Developed in collaboration with Microsoft, *Unmoored* allows guests to explore a submerged Times Square in mixed reality, to use their mobile phones to access an augmented reality experience. Some models were created by Marine Microalgae Research Associates LLC, using NSF funding. [Read more here](#).

Graphic novels/ Comic art:

- [Caroline Hu](#)
- [Tessa Hulls](#)
- [Annicka Chaffey](#)

Conceptual art / experimental media:

- [Jonathon Keats](#)
- [Natalie Jeremijenko](#)
- [Hannah Jayanti and Alexander Porter](#)





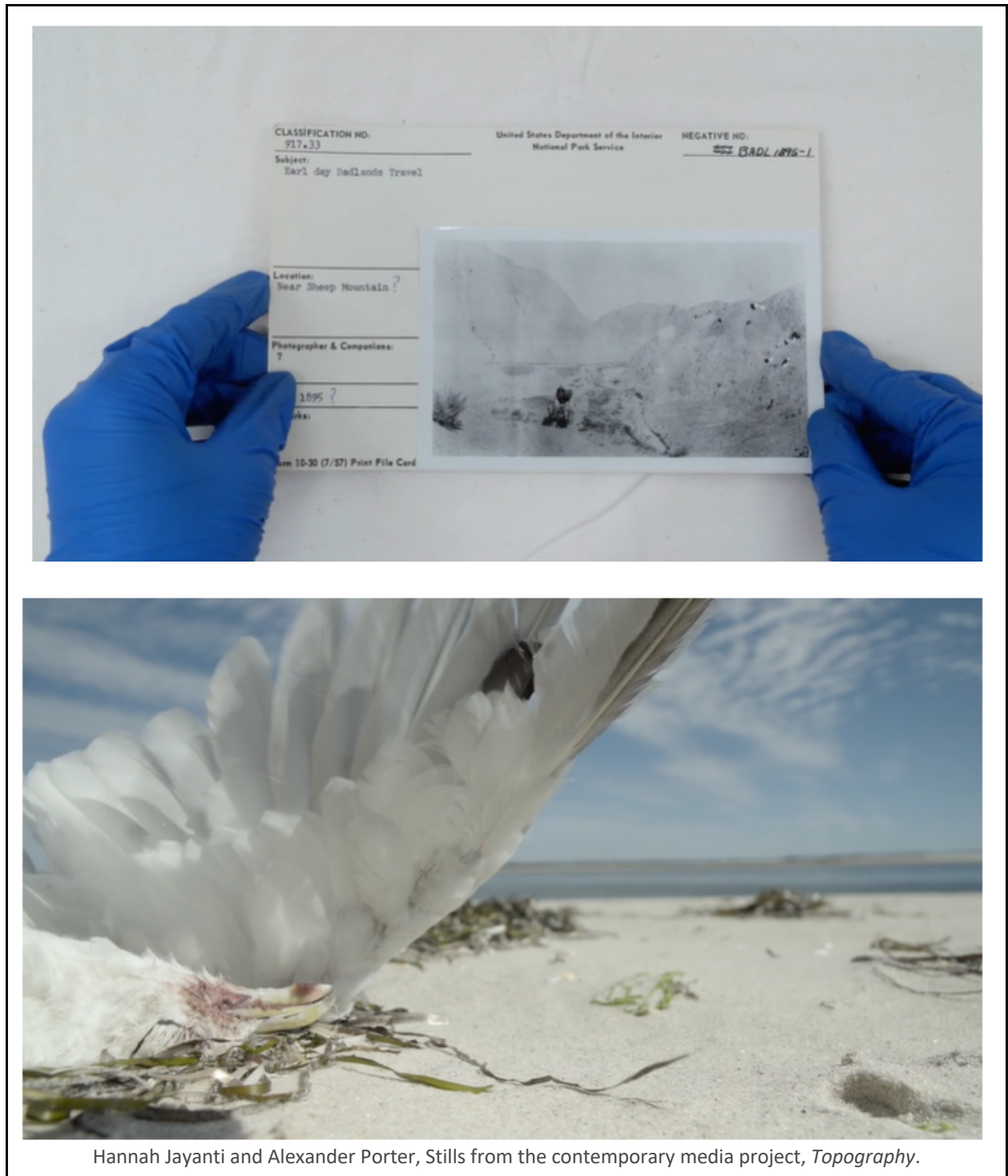
Natalie Jeremijenko, *Amphibious Architecture* (2009). The Environmental Health Clinic at New York University and the Living Architecture Lab at Columbia University created Amphibious Architecture to allow a data-driven dialogue between humans, fish and their shared environment. Installed in the East River and the Bronx River, two networks of interactive tubes contain underwater sensors monitoring water quality, presence of fish, and human interest in the river ecosystem. The buoys light up when fish swim underneath and display the water quality with a shift in color. An SMS interface allows communication with the fish, and to receive real-time information about the river, and spark conversations by contributing to a display of collective interest in the river ecosystem. [More here.](#)

#### New media:

Contemporary artists may be working in new media, and in ways that may not even feel to you like art. The works of art may be conceptual, non-linear, and may not even be made of any familiar kind of art materials that you may associate with traditional artworks. For example, Hannah Jayanti and Alexander Porter collaborate on a project called *Topography*, which uses film footage, interviews, photography – all elements that may feel familiar – but then presents them in ways that are stochastic and non-linear.



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The description of this work reads, “[Topography](#) is a multi-format documentary project that explores the histories, and futures, of land use. Set in and around North America's increasingly imperiled public lands, the project spends time in the [Badlands](#) of South Dakota, California's [Death Valley](#), and [Fire Island](#)

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[\*National Seashore\*](#) in New York. From medicinal plant experts to paleontologists, rangers to ranchers, motel workers to tourists, environmental preservation to settler colonialism, seaside communities to seemingly desolate badlands—*Topography* fragments across time, species, scales, and histories to reveal how different perspectives shape the land and its futures.

*Topography* brings together a rare combination of documentary footage, archival, and the creative misuse of emerging technologies including photogrammetry, game engines, and interactivity. The project spans documentary films, live-edited performances, immersive installations, artful video games, community publications, and interdisciplinary symposia. Formats symbiotically co-evolve in this uniquely iterative project, contributing material and learnings to each other. This allows the work to develop in community while reaching broad and varied audiences throughout the process.

Led by [\*Hannah Jayanti\*](#) and [\*Alexander Porter\*](#), *Topography* is a collaborative project that brings together a range of talented and interdisciplinary artists and ecologists working on the various formats in different capacities. More information at [www.topography.place](http://www.topography.place)."



Mary Mattingly, *Swale* A floating public food forest initiated by Mary Mattingly in 2016 in partnership with NYC Urban Field Station, *Swale* explores food as a shared civic resource and challenges laws prohibiting food production on NYC's public land. Constructed on a repurposed barge and docked at locations across the city, *Swale* invited the public to harvest edible, perennial plants for free, transforming the act of gathering food into an artwork of public imagination, ecological education, and policy advocacy.

### Language for thinking about art and artists

Labels can help us understand how artists work, what they intend, and on a more practical level what they need from a residency. However, these categories can just as easily limit the way we think about art, so it's good not to get too caught up in categorization. Art doesn't fit neatly into any kind of taxonomy. Nevertheless, here are *a few* words and ideas that may help you.

#### Broad Genres:

Sometimes art is categorized by broad disciplines such as literature, music, visual art, film, etc. These distinctions may be particularly useful for artist-in-residence (AIR) programs at FSMLs, because such categories can help you determine what kinds of facilities artists might need. For example, writers may need no more than a desk, whereas visual artists may need a studio space equipped with a work table, sink, natural light, etc.

#### Styles, or more specific genres:

Another way of categorizing art is to place the work in a style. For example, a work of literature might be fiction, poetry, or journalism. A painting might be highly representational, such as a realistic-looking landscape or scientific illustration; or highly abstract, using line, shape, color, etc. without prioritizing the immediate recognition of the subject. Abstract art can, and often is still representational in its engagement with the subject. In visual art, “figurative” means it depicts a person or people. In any genre, “narrative” suggests that the work tells a story. “Conceptual” denotes a kind of thought experiment in which the finished work may be the idea or documentation of the idea rather than realized with any physical materials.

#### Media:

Within visual art, some artists work primarily with certain kinds of materials. For example, visual art might comprise drawing, painting, printmaking, photography, and other 2-dimensional media. It might also include 3-dimensional media, described more broadly as sculpture (usually a discrete object), or more specifically as ceramic, metal, or other materials, or installation (which transforms the perception or experience of a space). Many artists who work with several kinds of media often describe their work as “mixed media” (a term that can mean almost anything, from a drawing with collage elements to a large site-based installation made of found materials).

One of the best ways to become more familiar with these terms is to expose yourself to art, talk to artists, and read about art, both written by the artists themselves and by art writers and critics. Just as in learning about science, develop curiosity, ask questions, and try it yourself.



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If looking at art is new to you, or you often feel puzzled by it, watch this 13-minute video about some ways to approach visual art in a gallery setting. It's titled "How to sound like you understand art," but if you follow the advice, it may lead to *actually* understanding more about what you are looking at:

[The Art Assignment: How to Sound Like You Understand Art](#)

The samples in this section were meant to give a flavor of some of the many ways contemporary artists work with environmental science. They are of course by no means comprehensive. The best way to learn more about art and artists is to attend performances, visit galleries, read literature, watch independent films, explore artists' websites, connect with your local and regional arts organizations... and above all, talk to artists themselves. You'll find that there are surprising parallels in the ways that artists approach their creative process, the ways they connect with the environment, and the care and dedication that goes into their work. Enjoy the journey!



Carol Schwartz, scientific illustration of rocky shore habitat. Carol has been an artist-in-residence at **Shoals Marine Lab** over multiple seasons. [Read more here.](#)

### 3. Artist in Residence Programs and Visiting Artists

#### A. Residency? Visiting artists? Informal undefined engagement?

If you're just getting started building relationships with artists and arts organizations, you might begin with inviting artists for a visit, or to engage informally at first with one of the scientists who works at your site. This has the advantage of opening the door to artists without setting up a formal residency program, and gives everyone – artists, scientists, FSML staff, community members – time to get to know each other and brainstorm projects. Such short term interactions can lead to longer term relationships and may help you more thoughtfully develop a formal residency program. Allowing relationships and programs to grow organically enables your efforts to remain relevant and balanced for all partners.

What would you like to cultivate with your residency or visiting artist program? What are you able to provide artists, and for how long? Do you expect artists to work with science or data, or do they have the freedom to freely respond to their experience at the FSML? Would you like them to engage with scientists during their residency, or are they expected to conduct their own research? Will there be an exhibition associated with the residency or visit? Is the artist expected to give a public talk about their work or a workshop?

You may wish to start by inviting artists to come for individual exploratory visits. Artist Leah Wilson began her long artistic collaboration with HJ Andrews through a series of short informal visits in which she was given the opportunity to explore the site. (See reference to Leah's work in the Fred Swanson interview in the History chapter at the beginning of this guide, and in the video interview in the Case Studies chapter at the end). You may reach out to arts faculty at your parent institution or a partnering higher education institution, and invite them to come for a visit to explore how the site could inform their creative practice. For example, see the work of Erin Wiersma at Konza Prairie:

<https://lternet.edu/stories/after-the-burn-making-art-out-of-grassland-fires/>

No two residencies are alike. Some are designed to bring a cohort of artists together, and some provide solitude for a single artist at a time. Residencies can last for a week or two, but some extend for several months to even a year or more. Some residencies provide on-site living and working space, and others, typically in urban areas, may require artists to find their own lodging. Some residencies invite artists to get away from the demands of daily life and offer time and space to work on or finish an existing body of work that has no relationship or connection with the place, but many expect artists to engage with the place. Some residencies allow open-ended engagement while other residencies may be centered on a particular theme. Some AIR programs are rural and some are urban. The [Artists Communities Alliance](#) is a good resource to learn about arts residency programs, especially their [Starting a Residency](#) page.

Just as working in a lab can sometimes look undirected to outsiders, artists working in a studio may appear to be messing around, messing up, or just making a mess. Artists will expect the autonomy to take risks, make mistakes, and wander for a while without direction. A residency can give artists time to take their work to an exciting new level, but it should also give them time and permission to fail. Often, an artist-in-residence, or AIR, program gives artists unfettered time and workspace for open-ended exploration, and artists working in an AIR program may expect to have creative freedom. If you intend a specific outcome or expect artists to work within a set of parameters, it is vital to clearly state your expectations and the scope of the residency on your AIR web page and in the application.

### B. Starting a new arts residency, or enhancing an existing one

#### Think about why

In establishing an art residency program or working to improve an existing program, a key step is to first determine what you would like the arts program to accomplish. Why are you inviting artists to your site? While there are many reasons for a FSML to offer an arts residency, we suggest a few key motivations that will likely be shared by most field research sites.

- Artists can **bring new attention to the science being conducted at your site**. While it's important not to limit artists to being simply a mouthpiece for science communication, the arts can inspire audiences and spark curiosity about the scientific research at your FSML. The work of artists may even reach new audiences, or connect with them more effectively. To achieve this successfully, take the time to find an artist(s) who can genuinely engage with your scientists, get up to speed on scientific jargon or techniques, and find the core of your stories. Ideally, artists strike a balance between maintaining scientific accuracy and context on the one hand, and exercising creative freedom and expressing an artistic vision on the other.
- Artists and scientists who are open, capable, and courageous enough can venture into the undefined territory of **interdisciplinarity / trans-disciplinarity**. This kind of work is filled with uncertainty for cultural workers on both sides of the art-science divide. Interdisciplinarity calls into question established rules and conventions, and challenges us to ask, "Why do we do it this way?" Working outside of familiar territory can be especially unsettling for those of us who have years of professional training. For both artists and scientists, interdisciplinarity can feel shaky. Because this work is often innovative, supporting artists and scientists to experiment across disciplines can elevate your institution.
- **Play**. When we dissolve barriers and work with new rules or no rules, interesting things happen. Working with others who are untrained in our professional field can lead to surprising insights. And it's just downright FUN. Play can be serious business, though – it's the root of creativity. We are facing unprecedented challenges for the future of our planet. We will need our whole selves to address these challenges, and remaining siloed is not an option. We can no more afford to



declare “I’m not a creative person” than we can shrink from critical thinking with statements like “I can’t do math” or “Science scares me, I don’t understand it.” Creating a sustainable future for other species as well as our own will require collaborating in ways that may feel uncomfortable.

There are many reasons for inviting artists to work at your science site. What are yours?

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If your program is new, it’s a good idea to plan two years ahead. In the first year, you might clarify the project’s mission, do planning, build relationships with artists and arts organizations, and engage in fundraising. In the early part of the second year, you would set up applications, publicize the residency widely, and recruit a team of jurors to select artists. Give artists at least three months between the announcement and deadline of the application, and ideally, give invited residents or visiting artists about six months between notification and the start of the residency. Here is a useful document called [Ten considerations as you start a new AIR program](#), provided by the Artists Communities Alliance (ACA), and it’s also helpful for existing programs. While this ACA document is intended for arts organizations, most of the tips will apply to arts programs at your science institution as well.

### **What do artists need at a residency? What will they expect?**

At a minimum, a residency provides time and space. It provides focused time away from day-to-day concerns, and it provides a space to work. The time might be as short as a week or two, and it might be as long as a year or even two or three. The space might be as simple as a desk or an office for a writer, or a bright, empty room with a work table and a sink for a painter.

Some AIR programs may provide more specialized spaces, such as a workshop with tools for working with wood or metal, or a large lecture hall that can convert to a performance space for dance, music, or theater.

Artists may also desire a sense of community, where residents can interact with a cohort of others working in parallel. At a field station or marine lab, this might mean opportunities for artists to interact both with other artists and with scientists. This interdisciplinary community can take many forms, from formal collaborations between artists and scientists, to inclusion in hikes and outings, to informal interaction with others over meals.

Artists also may require financial support from the FSML for their residency. Many art residencies provide room and board as well as a stipend for the artists’ time, travel, or materials. Consider that the scientists who visit your FSML are often funded by large grants, or may have generous travel budgets provided by their academic department. Artists on the other hand rarely have access to those kinds of funds, so a simple facility use fee or room & board expense may make the residency out of reach, especially for members of historically underrepresented groups.

### **What might you expect from artists?**

Revisit your reasons for inviting artists and be clear with artists in residence about what you expect from them. Are you providing open-ended interdisciplinary exploration between artists and scientists? Or are you expecting artists to interact with scientists, or use the science of your FSML as the foundation or inspiration for their work? Or would you like them to use their creativity to help you communicate the science of your site?

To help you communicate your expectations and offerings more clearly, further sections of this guide will provide tips on publicizing your AIR, recruitment of applicants, a sample AIR application, advice on jurying and selection, and some clarification about artist residencies vs. commissioned work.



Mollie Doctrow, Yucca Shrine Box. Science, art, and the natural world come together in the Wildflower Wayside Shrine Trail, a self-guided walking trail that explores pristine scrubland on the South Florida State College Highlands Campus. Developed through a partnership between the SFSC Museum of Florida Art and Culture and Archbold Biological Station, the Wildflower Wayside Shrine Trail fosters environmental preservation and education by setting aside a portion of this unique and rapidly dwindling ecosystem for scientific observation, artistic inspiration, and reflection. [More here.](#)

## C. Building relationships with artists and arts organizations

### How to connect with arts organizations

No matter what kind of arts project you hope to build, it will be enhanced by reaching out to local and regional arts college & university art departments, arts councils, nearby arts residency programs, arts organizations, etc. These organizations can broaden your pool of applicants, deepen the artwork created at your site, and strengthen your program. Further, you may find surprising allies among these organizations, as many face the same kinds of challenges you face in your own organizations – fundraising, site and facilities management, coordination of staff, faculty, participants, volunteers, board members, relationships with colleges & universities, relationships with local community members, etc. These directories can help you find residency programs near you:

- [Artist Communities Alliance Directory](#)
- [Resartis](#)
- [Rivet](#)
- [Residency Unlimited](#)

These resources can help you identify artists and arts organizations in your area, and those that share your interests:

- [State Arts Agency Directory](#)
- [Regional Arts Organizations](#)

Artist in Residence programs that often feature interdisciplinary art-science

- [Sitka Center for Art & Ecology](#)
- [Playa](#)
- [Studio in the Woods](#)
- [Djerassi](#)
- [Unseen California](#) (AIR program that engages with UC Natural Reserve Areas)

### How to Connect to Artists

#### Professional and mid-career artists

Here are some ways to find artists working at a professional level:

- Review websites of interdisciplinary art-science residencies for past residents.
- Speak with artists. Artists know other artists.
- Follow artists on social media.
- Browse the art departments of colleges and universities in the region, and look through the faculty in their departments of art, music, literature, theater, film, etc.
- Look at faculty at art schools, music schools, creative writing programs, film schools, etc.



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- Explore art museums, galleries, theaters, music venues, etc. and look at artists who have been featured in their current and past exhibitions and events.
- Search for artists who have received grants from your regional arts councils, or who have exhibited or performed at arts-council venues.

### Emerging artists, students, and underrepresented artists

Including students in art programs at your FSML builds capacity, inspires future generations, and weaves together a richer community of creative thinkers and cross-disciplinary learners. Try reaching out to students in the following ways:

- Connect with students at art departments of colleges and universities and at regional art schools.
- Use social media to promote and recruit your arts opportunities, especially those platforms used by younger viewers.
- Explore startup, smaller, cooperative, and non-profit art galleries, theaters, and other venues, which may be more likely to engage with emerging artists.

### **Recruit underrepresented artists**

Here are a few ideas to help you recruit artists from underrepresented groups:

#### Build relationships with institutions that can help recruit artist partners:

- [Institute of American Indian Arts](#)
- Art departments (faculty and students) at HBCUs, HSIs, Tribal colleges, and Community colleges
- Explore arts institutions that serve underrepresented groups such as [US Artists](#)

#### Remove barriers to participation:

- Provide support in the application process – share resources for artwork documentation and/or other application formatting/requirements
- Remove site fees, room & board expenses, and other costs
- Provide travel stipends
- Ensure that the culture of your FSML is welcoming
- Provide translation of materials
- Consider inviting cohorts, guilds, and groups
- Provide good campus signage and clear instructions for arrival
- Help visitors with safe travel routes, local places to shop, etc. (especially if you are rural)

#### Broaden the scope of your art-science to include art-environment collaborations:

- Environmental justice / climate justice for Black communities. A few artists for example:
  - [Allison Janae Hamilton](#)
  - [Tavares Strachan](#)

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- [Camille Dungy](#)
- [Article by Jaelani Turner-Williams, Composing Climate Change: The Radical Legacy of Black musicians](#)
- [Ayana Elizabeth Johnson](#)
- Indigenous perspectives of landscape and relationship to environment. A few artists:
  - [Wendy Red Star](#)
  - [Rose B. Simpson](#)
  - [Marie Watt](#)
  - [Melissa Melero-Moose](#)

### Ensure ADA compliance

- Is your campus physically accessible for people with limited mobility?
- Do you provide communication support for the hearing impaired or visually impaired?
- Are your website and printed materials designed with accessibility in mind?

### **More resources for finding artists**

Artists working with science, and sometimes but not always with the environment:

[Leonardo](#) is one of the oldest, most established organizations for art-science. The [Leonardo directory](#) provides a short list of artists; if you click “Environmental Art” it will provide a few links to artists working with the environment or land art.

The [Cultural Programs of the National Academy of Sciences \(CPNAS\)](#) hosts exhibits of art-science. Browse their current & [past exhibits](#) and current & [past events](#) to find artists who work with environmental themes.

Artists working with environment, and sometimes but not always with science:

[EcoArtSpace](#) is a wide collection of artists who work at the intersection of art and environment. However, because artists pay for membership, the list is not curated, and it can be difficult to sift through. It does provide a tremendous variety of links and is worth browsing.

The [Center for Art & Environment](#) at The Nevada Museum of Art provides an extensive [archive](#) of past work at the intersection of art and environment, including a lot of “land art.”. Because it’s an archive, some artists are no longer working or are even deceased, but the list also includes many contemporary artists working today.

### **How to publicize your residency**

Try to use as many different ways as possible to get the word out about your AIR program, so that you can broaden the pool of potential applicants. Here are some promotion strategies:

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## OBFS website

Add your entry to the [Ecotones page](#) on the OBFS website. [Use this form to add your site's info.](#)

## Artists Communities Alliance

[The Artists Communities Alliance \(ACA\)](#) has a [directory](#) that many artists use to find AIR programs. To help all our FSML members, the Ecotones: Arts at Field Stations and Marine Labs has its own [entry on the ACA directory](#), but because it represents multiple sites, that general listing can't specify things like geographical location, length of stay, art media, application processes, etc. You can find a lot of artists by listing your AIR program on the directory yourself. If you list a specific date for AIR applications, your residency will show up in the ACA monthly newsletter that goes out to artists. [Here's how to join ACA](#) to list your residency.

## Your FSML website: Template for setting up an arts page on your own FSML's website

If your artist-in-residence (AIR) program is ongoing from year to year, it's helpful to provide a dedicated AIR page on your FSML website. This is the page you will provide as a link for the OBFS website Ecotones page, so that artists can find your residency program. Here are some things that the arts page should include:

At the minimum, your website's art page should include

- Name of your AIR program
- Brief background and mission of the AIR program and its focus
- Contact name and email for artists who wish to apply
- Application summary: What is included in an application? What are deadlines?
- How long is the residency? What are dates?
- What is provided for residents? Housing and meals? Studio space? Access to scientists? Any kind of scientific orientation for artists, welcome tour? Do you provide travel funds, or any kind of stipend for artists? (The best AIR programs provide stipends and require no fees from artists – try getting grants or donors to support this. It will greatly expand the pool of artists who apply!)
- What is required of residents? Do you charge fees for housing or meals? Facility fees?
- Are there other obligations? Do artists in residence need to teach a workshop or provide a public event?

Other useful things for your AIR page include

- IMAGES! Pictures are imperative to increase interest in your site. These can include:
  - Images of past work
  - Images of artists working in a studio, field, or lab space
  - Images of the spaces artists will have access to – indoors and out in the field
- List of past residents with links to their work and website.



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- Information about how to connect with scientists, any kind of “matching program” to help artists and scientists connect.

Some sample AIR pages on FSML websites:

- [Mountain Lake Art Lab](#)
- [Shoals Marine Lab Artist In Residence Program](#)
- [H.J. Andrews Experimental Forest Long Term Ecological Reflections](#)
- [Friday Harbor Whiteley Center](#)
- Also see [Unseen California](#), a nonprofit arts residency program in partnership with the [University of California Natural Reserve System](#).

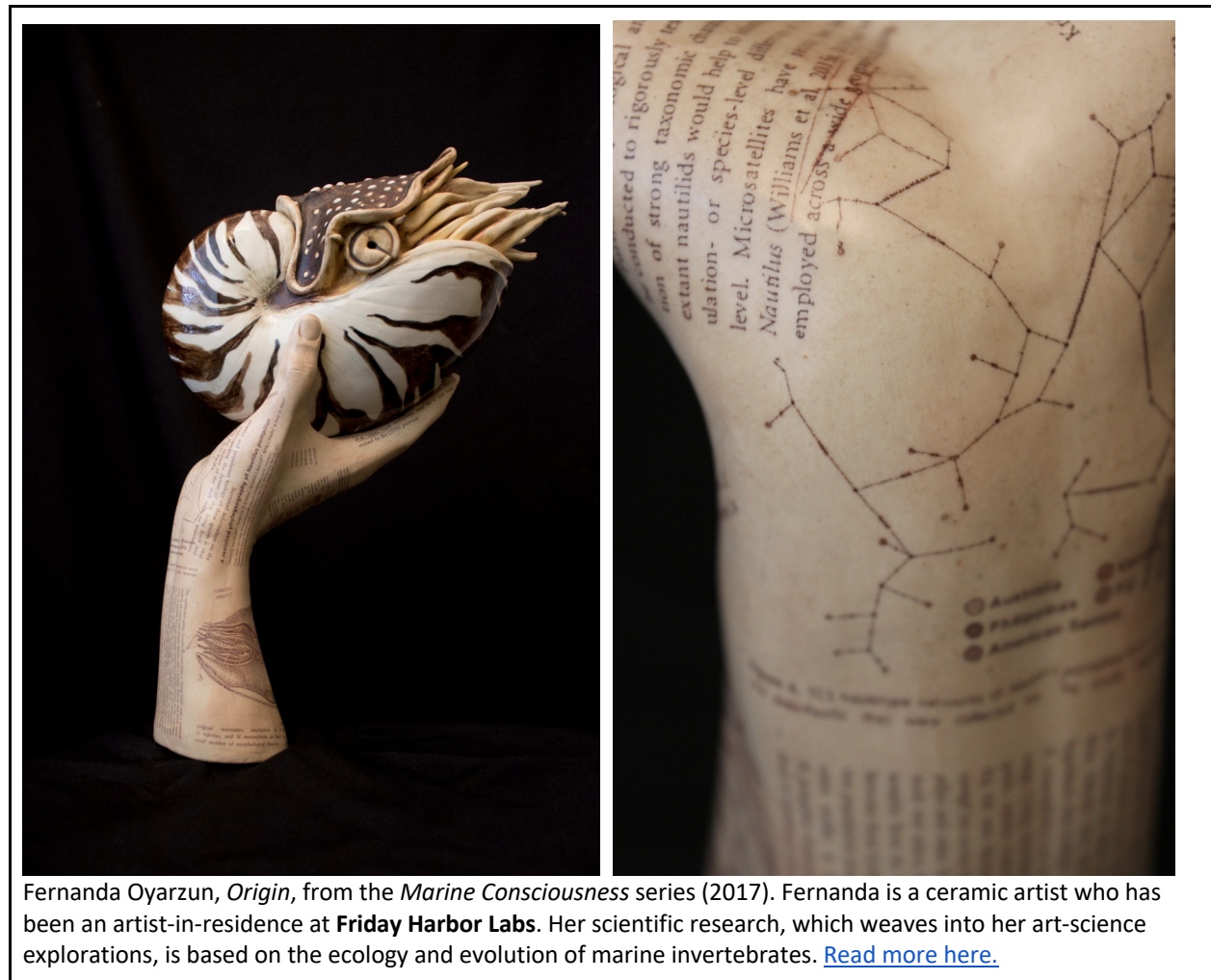


Natalie Miebach explores the intersection of art and science by translating scientific data related to meteorology, ecology and oceanography into woven sculptures and musical scores/ performances. Her main method of data translation is that of basket weaving, which functions as a simple, tactile grid through which to interpret data into 3D space. Central to this work is her desire to explore the role visual and musical aesthetics play in the translation and understanding of complex scientific systems, such as weather. She was a Lucile Walton Fellow at Art Lab at **Mountain Lake Biological Station** in 2015. [Read more here.](#)

## D. Selecting artists

### Requests for proposals

Identifying artists and scientists who are willing to work across disciplines in a respectful and curious collaboration is difficult. Because art-science is a growing interdisciplinary area, it is increasingly easier to find artists and scientists who venture across disciplinary boundaries to build genuine cross-disciplinary connections. The following section will offer some guidelines for what characteristics to look for in artist participants. \*\*Please feel free to copy this [AIR application template](#) for use at your FSML.



### Jurying teams and selection

When selecting artists-in-residence, visiting artists, or other artist participants, a committee or team of jurors representing a wide variety of experiences, backgrounds, and fields will provide a balanced approach. Ideally, a jurying team should include:

- FSML director, outreach coordinator, or other FSML staff who oversee the arts program

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- Scientists who have collaborated with artists at your own, or other, FSML
- Experienced artists who have worked at the FSML and who understand the goals and expectations
- Artists, scientists, and community members from underrepresented communities

### **Some ways to evaluate art and artists:**

Be clear about your expectations and design your application questions to reflect these.

Examples: Theme; Level of interaction and engagement with scientists, data, concepts, place, Community engagement and/or outreach

- Rank the expectations by importance and priority
- Use a rubric.
  - Use a service such as [Slideroom](#) to collect and review application materials and portfolios
  - Copy and customize this [AIR application template](#) on Jotform
- Interview/conversation with artists selected after initial application evaluation and before final selection is made to better understand and determine:
  - Is this a good fit for the artist(s) *and* the FSML?
  - Can the FSML support the artist's practice and proposed project/goals?
    - Facility/studio needs
    - Residency duration - is it sufficient for the artists' proposed project and goals?
    - Connections to scientists, artists, exhibition and speaking opportunities, community, etc.
    - Research needs
  - How do the artists plan to make the most of their on-site experience?
    - Why here? Why is this site and residency relevant to the artist(s)? How does the residency align with the artists' personal creative goals?
    - What is the artists' level of interest in engaging with scientists?
  - Do the artists intend to incorporate other disciplines besides science? For example, do they include spirituality or religion? Activism? Ask for clarity about that, and consider how well their approach fits with the mission of your FSML.

### Evaluating mid-career & established artists

- Portfolio and art experience: Demonstrated commitment to a professional studio practice (or performance, in the case of dance, music, performance art, etc.), innovative work, exhibitions, and awards or honors.
- Prior residencies
- Experience collaborating, especially with scientists
- Professional references, especially from past residencies
- Interview

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### Evaluating emerging artists and students, and underrepresented artists

- Be aware that it is easy to be seduced by slick images and a professional package. Emerging artists and underrepresented artists may not have access to the tools needed for professional-looking images and presentations.
  - Approach the application with an advocate mindset
  - References from instructors and other mentors and community members
  - Consider the impact of the residency experience for the artist. How will the experience benefit them and the trajectory of the artist's practice?



## E. Dissolving boundaries between artists and scientists

### **Interdisciplinary, cross-disciplinary, trans-disciplinary work**

While embedded in your science institution, artists may work at different levels of engagement with the science of your site, or the scientists who are working there.

- **Parallel:** Interact directly with the environment, but not with scientists. The science of your site may or may not be relevant to their work.
- **Adjacent:** Artists may not interact with scientists directly, but may draw inspiration from the scientific work that is being done or has been done at your site.
- **Embedded:** Artists may interact with scientists, asking questions, accompanying them, or assisting in the field or lab.
- **Collaborative:** Artists and scientists work together on a project of mutual benefit and interest.
- **Trans-disciplinary:** Artists and scientists collaborate in such a way that dissolves boundaries between art and science, and creates new ways of working that incorporate some art and science processes and invents a new process. This may be a merging of art and science or may be some third thing.



Carl Flink & Black Label Movement worked with University of Michigan cell biologist David Ode, in a collaborative art-science process called *Bodystorming*. Longtime art-science collaborators, they tested their ideas for physicalizing concepts of cellular processes with many collaborators, including at **Marine Biological Laboratory** in Woods Hole, MA. [Read more here.](#)

### **The element of time**

When artists establish long-term relationships with scientists at FSMLs, it greatly enhances the value and impact of their work. Several examples of artists who have established long-term collaborations with scientists are provided at the end of this guide, in the case studies section. Often these relationships start with a walk to a field site, an orientation to a lab, or a chat over a meal. When interests intersect and personalities are harmonious, these early conversations can grow in ways that are unplanned and unexpected, and can become fruitful collaborations.

In their book “The Ecology of Place,” Ian Billick and Mary V. Price emphasize the importance of long-term observation in their introduction to Part 3: Building an Understanding of Place. For science, they write, *“Long experience with a system allows one to distinguish exceptional from frequent states and to characterize slow processes – in short, to leverage knowledge out of temporal heterogeneity, and so to understand the fundamentally dynamic nature of ecological and evolutionary phenomena.”* While this is written from the standpoint of scientific research, the value of artists’ long-term relationships with place are fruitful as well. They allow time for an artist to observe seasonal changes, or differences from one year to the next as environments respond to variance in temperature and precipitation.

In chapter 4 of that book, “Ecological Invariance and the Search for Generality in Ecology,” Ronald Pulliam and Nickolas Waser write about “natural history intuition” as an important component of field work for scientists, deepening their understanding of causes and providing ecological context. This is true for artists as well. Extended time spent at a field station allows artists to develop a sense of place, maturing this “natural history intuition” as a component of their creative process.

### **Cross-training**

While artists and scientists share common ground, they work in different ways. When you have both artists and scientists at your site, encourage them to learn about each others’ working processes and vocabulary. Following are some ideas to help with that.

#### Science training for artists

Artists who work at FSMLs are in many ways entering a foreign world. They know how to work within the social and cultural rules of their art genre, but may be unfamiliar with protocols in a lab or at a field research site. Here are some ways to help artists get oriented:

Establish a main point of contact or communication facilitator for your AIR program. Communications with artists might be in-person, remotely, or both. Determine how the point of contact will interact with artists before the residency, during the residency, and after.

Encourage artists to read about scientific work being conducted at your site. They might look into a specific researcher’s publications, write an email, or request a short interview.

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Provide opportunities for artists to continue engaging with the science at your FSML by returning to the site and establishing a longer term relationship there.

Give artists opportunities to be involved in FSML community and activities, for example seminars, meetings, lightning talks, etc.

Depending on their level of understanding, you may need to provide an introduction to some science fundamentals for artists working at your site. Resources like [Science in Action: How Science Works](#) (California Academy of Sciences video) or [Understanding Science](#) from UC Berkeley may come in handy. Artists may also need an introduction to doing field science in particular. This video, [Day in the Life of a Field Biologist - Anoles](#), may be helpful as an introduction. Provide a tour of your site and explain experimental plots, instrumentation, quadrats, etc. Share the same trail maps and other orientation materials that you use for science researchers and science students, and information about permits, trail off-limits research areas, equipment, etc.

### Art training for scientists

While artists who are embedded at your FSML need to learn about the science, it's more challenging to encourage scientists to learn about the artists who are working at your site. Cross-disciplinary exploration can lead to new collaborations, or just to interesting conversations over a meal. Invite scientists to learn more about the creative process of artists they may be working with. Here are a few ways to do that:

Invite scientists to watch this 13-minute video for some quotes about art, and ways of thinking about what art is, what art does, why humans make art: [The Art Assignment: The Definition of Art](#)

For those scientists working at your site who are open to working with artists, encourage them to spend a bit of time learning about the artists' ways of working. While most artists work with fewer formal rules or codes, most artists will have particular methods. Some methods may be specific to the artist's preferred art medium, whereas others may be part of their personal creative practice. Invite scientists to follow their curiosity about the artists' creative practice. For example, some questions for an introductory conversation with an artist might be: How do you begin? To what extent is your current work connected to work you have done in the past? What influences you? What ideas are you reading/ looking at/ listening to/ exposing yourself to that inform your work? Ask the artist to share any sketches/ notes/ preliminary ideas. This is analogous to peeking in a lab notebook, field notes, or other preliminary data.

Because the mission of your FSML is probably to enable science research and/or science education, scientists who work there may not be accustomed to stepping outside of the known territory of science.

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They may regard art practices with trepidation or skepticism. By advising scientists to be genuinely curious about artists and their ways of working, you will help artists to feel valued, and lay the groundwork for richer and more equitable collaborations between artists and scientists.

How we built  
the *compositions*  
you're hearing



### 01. Listen

to insect vibrations on a wide variety of plants in the field, at different times of day and in different temperatures



### 02. Record

the vibrations using hyper-sensitive recording devices, including lasers and accelerometers



### 03. Compose

by editing, amplifying and layering sounds to create an orchestral experience of insect communication

Stephen Vitiello and Kasey Fowler-Finn: [Sound art with insects at Mountain Lake Biological Field Station](#). Also see [Too Hot to Sing](#) project on Fowler-Finn lab website. This art-science collaboration studied insect vibrations at different times of day, in different temperatures.



### **Matching artists and scientist partners**

To what degree would you like to facilitate art-science collaborations? Artists in residence may read about science at your site then work on their own. They may choose to work with particular scientists at your site and develop these collaborations in their own way. Some institutions have purposefully matched artists and scientists. Here are some examples of artist + scientist matching:

#### Art-sci Matching Example 1: Synergy

[Synergy](#), a joint project of MIT / WHOI Synergy, used a kind of “speed dating” to match artists and scientists. Synergy was co-produced by [Whitney Bernstein](#) and Lizzie Kripke. Whitney shared her matching process with us. First, she interviewed each artist. To prepare for the matchmaking day, each artist and scientist was asked to submit a very short bio including a description of their work and process. Each participant was asked to read about other participants prior to meeting them in person. Then Whitney set up a matchmaking event similar to speed dating. The artists and scientists brought to the event some small object related to their work such as an organism, a tool from the lab or studio, or a small work of art. At the event, each artist had a few short minutes to sit with each scientist. Sometimes the matchmaking event resulted in surprises – for example, an artist might discover that the scientist they had selected “on paper” turned out not to be the best match in person.

Whitney remarks, “Already knowing the scientists, their work, and their personalities, I was able to tip the scale on match day and facilitate promising introductions. Some of these ‘curated’ matches were spot on. Some matches were born from chance encounters during what I called the ‘wild card’ time slots. The meeting schedule was set in advance, so the wild card periods were blocks of time with no meetings scheduled, for random mixing and matching.”

#### Art-sci Matching Example 2: UCross

The Cross-Pollination Experiment was a partnership between the University of Wyoming and the [UCross](#) artist residency. The initial two-week partnership at the Ucross Ranch, with collaborations between scientists and artists that persisted for several years, generated a documentary film, an opera, a system for documenting low-dose pesticide effects on bees using choreographic/dance notation, a set of botanical sculptures expressing ecological principles, and three exhibitions, among other artworks and joint projects. Watch this [UCross Experiment video](#) for inspiration about artists and scientists working in partnerships and in community. Project leader [Jeff Lockwood](#) (a professor of entomology who metamorphosed into a professor of natural sciences and humanities in the departments of philosophy and creative writing) brought together four art faculty and four science faculty from the University of Wyoming, and paired them for art-science collaborations as follows:

*Day 1: Arrival and settling in; introductions and background/rules of Ucross*

*Day 2: Individuals travel to a single iconic site on the ranch within walking distance and experience the location through their own ‘lenses’.*

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*Day 3: Individuals begin to prepare their accounts of the shared site, returning to the site as needed.*

*Day 4: Individuals complete preparations of their accounts in whatever forms are most effective, comfortable and familiar to their way of expressing ideas (PowerPoint, data table, graph, conceptual model, poem, painting, improvisational performance, etc.)*

*Day 5: Individuals present what they know of the site from their perspectives (four presentations in the morning and four in the afternoon; the evening is spent in a moderated whole-group discussion about what's been learned and what questions have emerged)*

*Day 6: A day to debrief, relax, and recharge.*

*Day 7: Scientists and artists are paired in the morning, with new pairings in the afternoon, to wander the landscape together and learn how each understands the place.*

*Day 8: A repeat of the previous day with new pairings in the morning and afternoon, such that all four artists have been paired with all four scientists.*

*Day 9: Artist-scientist pairs are formed (based on mutual interests and interpersonal connections) to undertake a fully collaborative project of their own design to express their naturalistic insights in an authentically shared form.*

*Day 10: Pairs continue to co-create a single expression of the natural world.*

*Day 11: Creative collaborations continue.*

*Day 12: Presentations of collaborative works, with each team having an opportunity to share their joint project in a public program and discuss their work with the public and Ucross collaborators.*

*Day 13: Open discussion of what has been learned. Small groups of artists and scientists work on questions, problems and ideas that emerge (e.g., how to sustain the conversation).*

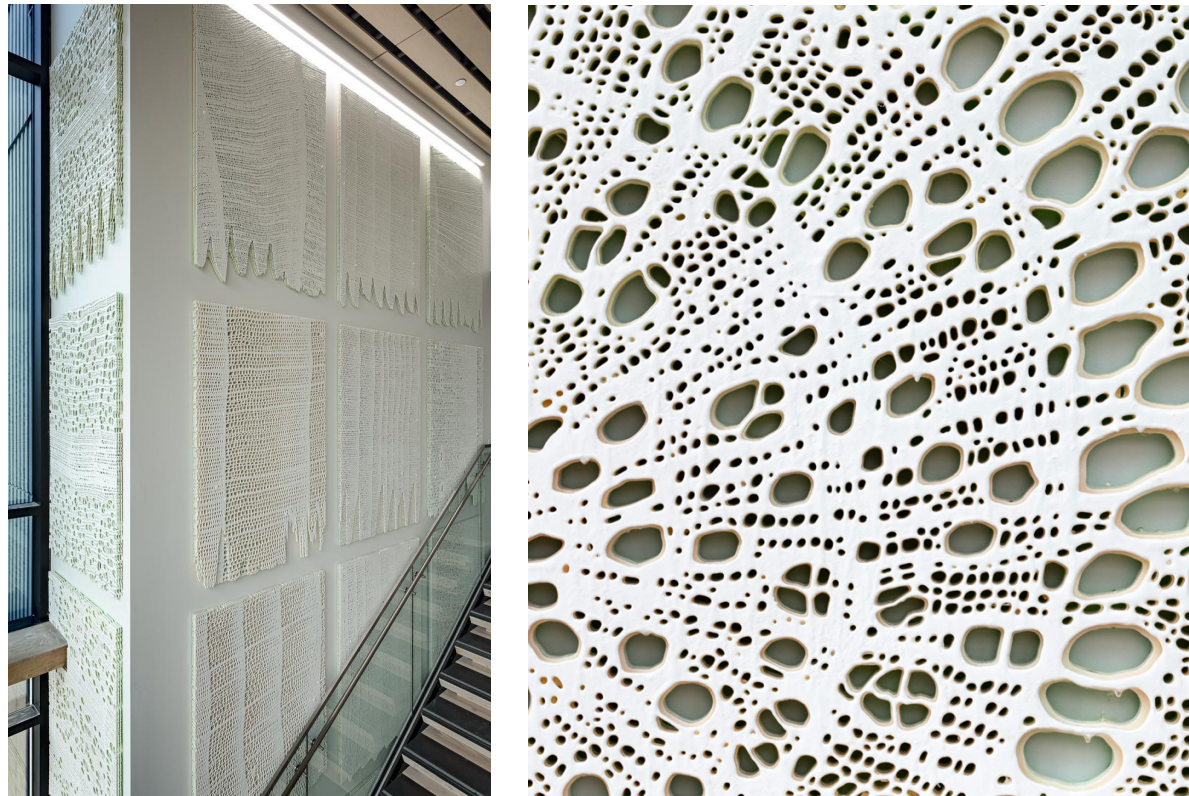
*Day 14: Debrief in the morning and depart after lunch.*

### *Art-sci Matching Example 3: SciArt Initiative The Bridge Residency*

[The Bridge](#) residency was a four-month virtual residency produced by SciArt Initiative. From their blog: "Matched based on fitness from an open call application, each pair comprised professionals in the arts, the sciences, or both. Residents were required to keep a weekly blog on their activity and projects, documenting the collaborative process over time. In four months, residents accomplished as much as was natural to their synergy; some pairs ended their work together at the conclusion of the residency, some pairs continued their work indefinitely. As a virtual residency program, collaborative potential is not limited by geography. Process and projects unfold physically where residents are located, and virtually online through resident's blogs."

## 4. Commissioned Work

Sometimes science institutions have goals for engaging with artists that have the primary expectation of finished work. For example, you might want a mural that represents species of your habitat, or creative data visualization about some scientific work from your site. Art can be a powerful means of science communication. This kind of partnership may involve an artist embedding at your site and collaborating with scientists, but it's best described as a commission rather than a residency. Artists can be wonderful partners for your science communication needs, and an artist who is already working with scientific or environmental themes may give you innovative new ways to engage audiences. It's key to keep in mind two things when working toward these goals.



Leah Wilson, *Listening to the Forest*, public art at Oregon State University, George W. Peavy Forest Science Center. *Listening to the Forest* spans the scale of an old-growth tree from the cellular level, to one growing in the forest. Four rows and four columns forming a grid of bas-relief panels were created over a one-year period. Chromatic changes and patterns of the panels follow the results of a study of light and wood anatomy at the Discovery Tree, a tree approximately 60m tall and estimated age over 300 years in an old-growth stand at the **HJ Andrews Experimental Forest**. Produced in collaboration with scientists at Andrews Forest and OSU. [Read more here.](#)

**Clarity is key.** Before engaging with artists, be clear about the scope and goals of your commission or commissioned project. When you have expectations of finished work, communicate those expectations to the artist in advance. You will work with the artist to articulate your goals. What is your core message? Who is your audience? How will the artist receive feedback and ensure scientific accuracy? What do you envision/imagine for your site? When do you expect it to be finished? Does it need to be archival? Does it need to be installed outside and withstand weather conditions? If so, are permits necessary? Are you looking for a regional artist, would you like to expand your search to state-wide or nationally?

**Ensure that you are compensating the commissioned artist not only for time and materials, but also for the value of their work.** If you are working with a specific invited artist, what have been the prices for that artist's work in the past? What costs will the artist incur in terms of materials, travel, equipment, etc.? Will the work be permanent? If so, that will generally require a much higher compensation than a temporary installation. Will you require sketches, plans, or other preliminary materials as part of the process? How will payments be made? Will you pay partially upfront and final payment upon completion/ delivery?

Whether you are putting out a call for artists or an RFP for a commission, this useful resource guide from Americans for the Arts will be helpful for your site:

[https://www.americansforthearts.org/sites/default/files/pdf/2013/by\\_program/networks\\_and\\_councils/public\\_art\\_network/CallForArtistsResourceGuide.pdf](https://www.americansforthearts.org/sites/default/files/pdf/2013/by_program/networks_and_councils/public_art_network/CallForArtistsResourceGuide.pdf)

There is not a set industry standard for artist compensation, but being aware of some guidelines is helpful.

Some compensation resources include:

- <https://wageforwork.com/fee-calculator?#top>
- <https://nmbx.newmusicusa.org/commissioning-fees-calculator/>
- <https://creative-capital.org/20Determining Your Artist Fee | Creative Capital16/01/25/determining-your-artist-fee/> <https://teachingartists.com/pay-rate-calculator/>
- <https://www.creatorresource.com/page-rates-2017/>

Depending on the nature of certain types of collaboration, at times, ownership of rights may be a factor in the project. If your project involves the creation of intellectual property between two or more parties, ownership may generally be considered shared without a collaboration agreement assigning ownership to individual parties. However, we encourage discussions about ownership rights and to execute written agreements with collaborators before beginning a project.

Some resources on ownership include:



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- <https://www.sidebarsaturdays.com/2023/01/21/httpwp-mep7vddb-oq/>
- [https://lawyersalliance.org/userFiles/uploads/legal\\_alerts/Joint\\_Collective\\_and\\_Derivative\\_Works\\_Legal\\_Alert.pdf](https://lawyersalliance.org/userFiles/uploads/legal_alerts/Joint_Collective_and_Derivative_Works_Legal_Alert.pdf)
- <https://www.creativecontractconsulting.com/c3blog/2019/4/2/a-simple-guide-to-the-artist-collaboration-agreement>

For contracts with artists, consult a qualified lawyer in your jurisdiction for all legal opinions for your residency, commission, or specific situation. Also, your FSML may already have release forms; these existing legal agreements could be adapted to include artists. Here are some resources on contracts:

<https://thecreativeindependent.com/tips/tips-for-using-contracts-as-an-artist/>  
<https://www.sidebarsaturdays.com/2023/01/21/httpwp-mep7vddb-oq/>

## 5. Exhibits, performances, and other dissemination of artworks

For visual art, the most common form of dissemination of completed work is to exhibit in a gallery or museum setting. Note that many galleries and museums book their exhibits far in advance, sometimes as much as two or three years ahead. So plan ahead and build a lot of lead time into your timeline.

However, there are many venues for visual art, such as university galleries, public libraries, community centers, cafes, and even your field station itself. If you want to share the work more broadly and set up a traveling exhibit, note that shipping costs for art are often much higher as they include special packing, handling, insurance, and other costs.



David Buckley Borden and Aaron Ellison, *Warming Warning*. Designed to immerse visitors in a three-dimensional visualization of ongoing climate change. On one side, the  $> 1.5^{\circ}\text{F}$  change (since 1880) in the average global average temperature is lined in black highlighted atop as a white-to-red heat gradient. The other side illustrated four different future scenarios of carbon dioxide emissions. This collaborative project was supported by a unique partnership between the **Harvard Forest**, Harvard University's Office for Sustainability, and Harvard Common Spaces. [Read more here.](#)

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Here are some additional tips for exhibits, performances, and other dissemination of art:

## Purchasing art for your FSML:

- [Artsy: Seven tips on buying your first piece of art](#)
- [Atelier: Seven tips on choosing the right art for your office](#)
- [Art Business: How to buy art directly from artists](#)

## Public art/ installations:

- For support with funding for public art, try searching using the terms “creative placemaking.”
- Explore other [public art opportunities at Americans for the Arts](#).
- Use [CaFÉ](#) or other similar site to set up call for artists

## Performance / time-based media:

- [Tips for planning a music event](#)
- [More tips for planning a concert](#)
- [Other event planning tips](#)

## Social media:

- [AAAS guide to social media for science communication](#)
- [Artsy: Promote art exhibit digitally](#)
- [Create virtual art gallery](#)
- [Promote art on Instagram](#)

## 6. Indigenous Artists at FSMLs

### **Two-eyed seeing**

Mi'kmaw Elders Albert Marshall and Murdena Marshall define Two-Eyed Seeing as “learning to see from one eye with the strengths of Indigenous knowledges and ways of knowing, and from the other eye with the strengths of mainstream knowledges and ways of knowing, and to use both these eyes together, for the benefit of all” (Bartlett et al., [2012](#)). In describing these collaborative, cooperative, cross-cultural processes, the word “integrate” can be misunderstood as assimilation or appropriation. Better alternative choices of words might be “use both,” “respect both,” and “learn from both.” It’s important to view Indigenous ways of knowing as sovereign, independent, and equally valid as Euro-derived scientific culture (pers. comm., Deborah Taffa, Director, MFA in Creative Writing, Institute of American Indian Arts).

This chapter includes two sections: first, notes from informal conversations with Nipmuc artist nia holley, and Harvard Forest Director of Outreach and Education Clarisse Hart, about projects at Harvard Forest; and second, excerpts of a formal interview with artist Rebecca Krinke, who has been co-developing a Two-Eyed Seeing project with Dakota artists and Cedar Creek Ecosystem Science Reserve.

### **Notes from conversations at Harvard Forest**

nia holley is an Interdisciplinary artist whose work is deeply influenced by what survival and healing look like within Black and Indigenous communities. Her work ranges from printmaking, ceramics, metalsmithing, and traditional arts to bringing tribal communities together around food justice, agroecology, land, and history. She strives to cultivate relationships across tribal borders to rebuild a more inclusive and historical process of kinship and survival. She has actively engaged with Indigenous-led grassroots organizations as an outreach and project coordinator and has participated in Nipmuc programs since before she could walk and talk. nia is co-founder of the Eastern Woodlands Rematriation Collective, and was a Bullard Fellow at Harvard Forest.

Clarisse Hart is Director of Outreach and Education at Harvard Forest. In that role, she directs the Forest's education, communications, and public outreach initiatives: I manage the Fisher Museum; communicates Harvard Forest research findings to the media and the public; oversees educational programming for K-12, university, and public groups; mentors staff and students; write grants and initiates other fundraising; and serves as liaison to the students and faculty of Harvard University. What follows is a summary of some of the wisdom that came out of my conversations with nia and Clarisse, first exploring larger concepts about relationships between FSMLs and Indigenous people, and then honing in on some arts-related projects.



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### Remembering context

Being honest with ourselves about this ongoing mission of building relationships between FSMLs and Indigenous communities is difficult work. It requires stepping back and taking an honest look at ourselves and the cultures we are immersed in. It exposes fundamental differences that may be difficult to resolve. Marine labs and field stations are predicated on the idea that they own something. That's a whole set of assumptions. On the one hand, a FSML director assumes responsibility for the site and its success. If approached by someone who reminds the FSML that "actually this is my place too and I have a say in your questions," we have to admit that they do, if we examine this in the context of long history. It's important to ask questions at every stage, even if you don't have an answer to those questions, even if you aren't prepared to change, even if there are barriers to change. Just voicing the questions is part of the work: Why can't we change this? Or why are we not changing this? Where does the history start? It's powerful to continue asking these questions, keeping a reminder of the longer narrative, and staying in the discomfort.

### Institutional support

Efforts to build relationships between FSMLs and Indigenous people are often started by one person at first – a staff member or partner at the FSML with a sense of mission who begins to ask some of these tough questions, and has the courage and persistence to build genuine connections. But for this work to be truly successful, it needs to have institutional support. People come and go, grants run out. For real commitment, it needs to be incorporated into the strategic goals of an institution.

It's also important not to rely on a single person who is a tribal member. The relationship may start that way, but one person can't represent the entire community, nor should one individual tribal member be pressured to continue a project or relationship beyond the time that is desirable for them. Sometimes, when you invite someone to be in a relationship, it doesn't make sense for them. Do they want to be in a relationship with a FSML, and what is the value of that for them? Respect that people have their own lives, their own interests, their own work-life reality to navigate. What worked for one person three years ago may not work for a different person next year. Find ways to identify intersections between your institutional goals, needs, and interests, and those of the tribe.

### Relationship building, long-term, multiple people on both sides

Take your time, be patient. As the US mainstream culture shifts and changes, tribes experience varying levels of interest in partnerships, and some kinds of outreach efforts can feel extractive and temporary. Sometimes tribes can be inundated with emails with requests for partnerships. Set aside your desire for project deliverables, and think more about building long-term relationships. Over time, with respect and patience, allowing relationships to grow organically over time, the work will feel better for both parties.

Ideally, engage with Indigenous communities through the whole life of a project, not added on at the end. Treat Indigenous artists/ Indigenous partners of a project as individuals, rather than asking them to

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represent the whole tribal group. Emphasis on asking one person to represent a whole Indigenous culture can feel extractive and doesn't take into account that this person and their family have been living immersed in US culture, speaking English, living in the same US world as their Euro-derived neighbors.

### Perfect is the enemy of the good

Just begin. It's OK to make mistakes. If you find it's difficult at first, don't just shut down, especially if it's your first time reaching out or if relationship-building is new. There is no perfection in the work. You are going to be uncomfortable and that doesn't mean you are not safe. The work is ongoing, never finished. It's important to embark, ask difficult questions even if you don't see ways to fix things. Be more creative about the way

### Toward systemic change

If we could be in a position to really make substantive organizational change about the way your FSML works with Indigenous people, what are some of the things that you would implement? What are the strategic planning components that would empower your Indigenous neighbors and move to the next step beyond just land acknowledgement?

When you make decisions about managing your lands and waters, do you ask for input from tribal members on whose land your site is based? What would that look like? Could you put tribal members on your board, or on a committee that makes those kinds of decisions? For example, what would it look like if researchers asked permission before digging holes in the ground or disturbing mycelial networks? When setting up an experiment or embarking on a new project that involves land and water, what are the perspectives of your Indigenous neighbors? If you're faced with managing invasive species, what are the opinions and wishes of the Indigenous people who may be intimately familiar with the habitat, and who may have deep cultural knowledge of the ecosystem?

Acknowledge that even the openness to inviting participation may not be sufficient. Tribes and tribal members may have a lot of demands and limited time and resources. With jobs and family obligations, people may be more willing to participate in FSML planning if there is some compensation for their time.

What are other ways to partner with tribes? Ask about their needs and goals, and consider whether your FSML may have resources that could be useful. Could your assets help them in large or small ways? For example, can you help identify historic burial sites and other sites of interest? Do you have facilities that are unused or underused that could be shared?

### Role of art in building relationships between FSMLs and Indigenous communities

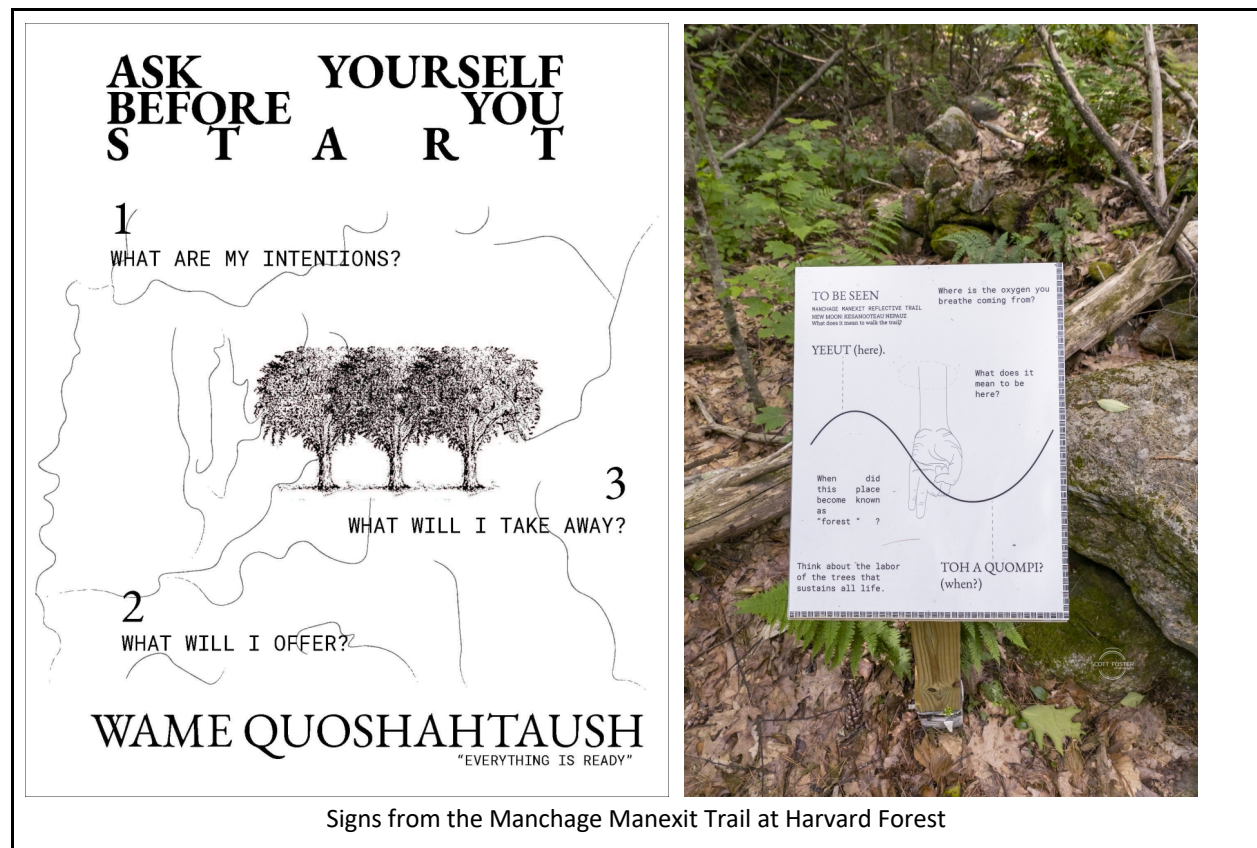
The reason that these conversations with nia and Clarisse broadened to a more general view of Indigenous people and FSMLs, not just Indigenous artists, is that the arts can be an exclusive space.

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FSMLs (and for that matter, arts organizations) can be more expansive about how art is defined, especially with regard to Indigenous people. Art is never the only work to do in the Indigenous space. Don't limit the Indigenous artist's voice to narratives to the public. It's easier to have native people come in and talk to the public, but when you have them come in and tell you about the business that you do, that's the work.

### Harvard Forest projects with Indigenous artists

The [Manchage Manexit](#) trail honors the presence of the original stewards of Harvard Forest land. The interpretive trail includes 13 powerfully insightful signs along a ½-mile trail that reflect Nipmuc language and ideas, symbols of eastern woodlands tribal knowledge systems, and questions that invite all visitors to reflect on the experiences of the land and of themselves, their intentions in visiting, and the ideas they will take back home. The trail was created by Harvard students Tyler White (Graduate School of Design) and Kashish Bastola (Harvard College '26), with research and advising by nia holley, and included input from dozens of Nipmuc community members, conservation practitioners, and Harvard University students.



The Fisher Museum is Harvard Forest's public face to the local community. It includes a series of highly detailed dioramas depicting New England forest history and forestry practices, but its omission of any

images or mention of the native Nipmuc people is a gap that needs addressing. The [Fisher Museum photographic mural](#) installed in 2021 was the culmination of a year-long collaboration between nia holley, multimedia artist [Roberto Mighty](#), and Clarisse Hart. The photographic mural spans a 24-foot wall in the museum and the east branch of the Swift River, in an area that has been known for millennia as Nicheaug. This includes Harvard Forest research land, and is also part of the unceded home territory of the Nipmuc—the Fresh Water People.

Don't limit the Indigenous artist's voice to narratives to the public. It's easier to have native people come in and talk to the public, but when you have them come in and tell you about *the business that you do*, that's the work.

A new project at the Fisher Museum continues the goal of inclusion of Nipmuc history and culture. The project is currently in the planning stages at the time of writing this guide, and includes project partners nia holley, Clarisse Hart, and Tyler White.

Clarisse: *"What they don't want to do is just fill holes in the colonial narrative. That has been really clear from the beginning, which I think a lot of museums try to do, whether or not their narrative is linear, and, you know, is missing a huge chunk of history, or is missing a certain perspective. They try to just sort of introduce words to fill that perspective. But I don't think that that's what these guys are trying to do. I think they're trying to create a new narrative where, for Tyler, it's like he's talking about liberated mobility, so thinking about diaspora and like, how does indigeneity remain? Through rupture and fragmentation. And what does reclamation look like? If you remove colonialism as the pivot, if you remove the rupture as the main story, what then is the story of continuity and like, through lines and resilience?"*

She continues: *"Beaver work is interesting because the beavers also got ruptured, right? They got hunted out, and then they got reintroduced. And there's been a synchrony, in a really odd looking-at-centuries way of removal and then return. So what's the narrative there? And artistically, where's that? So nia has a lot of time outside with beavers, and I think it's all kind of like a cocoon that's going to turn into a butterfly in her head right now. At the same time, Tyler is working on a new type of cartography. I don't know if it will end up being installed as wayfinding on the floor or something, or on the wall. I think it's going to be a different type of wayfinding to kind of transcend the rupture and erasure of the narrative that's in there now."*



nia:

[The project calls for] *“perspectives on other beings – not just Nipmuc people, but also other beings. When we think about this place, places in general, what is not seen? Looking at the research, can we redefine the narrative that comes out of that not just from a Western science perspective? For example, look at hemlock trees... Two thousand years ago, there weren’t any hemlocks. They disappeared, then they came back. We want to create different narratives from different perspectives to play on those things. We hope there will be some Nipmuc communities’ perspectives informing the work, but don’t necessarily feel like plaques or blurbs are helpful. Instead, [I am considering], What experience would people have in a museum?*

*The team is considering a few options, for example, having screens with different filmed content. Community interviews are a common thing that museums do, but they can feel flat. Perhaps a trail cam with a narrative around that, and questions: What is happening here? There is also an interest in having small installations in front of dioramas to add to the visual aspects and add interruption. Visual cues might be questions of the viewer, a blurb of what someone said, an animal’s perspective, more color, or more vibrancy. Ideally, a museum can be a space where information and materials are there, and the information is accessible to people. Co-creators are working on a map that could also be transferable to other parts of Nipmuc territory.”*

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### **Rebecca Krinke describes the evolution of the two-eyed seeing project at Cedar Creek LTER:**

*“It was about three years ago that our two-eyed seeing collaboration at Cedar Creek started. I became really interested in that place, because I’d gone there to take a photograph of a tamarack bog for an interior art installation I was making. I’d never been there before, and I fell in love with that place. It’s a University of Minnesota Field Station. It’s 5,000 acres. There are University of Minnesota researchers. Well, they’re from all over the world, actually. This is kind of a famous research station because it’s got one of the longest-running ecological experiments, continuously running for over 40 years. It’s the southernmost place where the prairie, the deciduous, and the coniferous forests come together ...It’s so ecologically rich. And it’s land where Dakota and Ojibwe homelands overlap.*

*During my sabbatical, I wanted to tap into my artist self more deeply, so I pondered: what if synchronicity is a preferred research method? So I posted a photograph of my installation that includes the massive wall-sized photo of the tamarack bog, and I tagged Cedar Creek. And Caitlin Barale Potter, now the associate director, reaches out, writing, “I just started this Instagram account. Tamaracks are my favorite tree. Let’s zoom.” And that was the start of us being really great colleagues together. The tamaracks were the catalyst, and then meeting Caitlin - I thought, I want to be in this place with her and others.*



Two-eyed seeing at Cedar Creek LTER. From the blog: *"Participants spent time with our plant relatives sage, blazing star, bergamot, beardtongue, yarrow, and Virginia Mountain Mint. We enjoyed admiring their beauty together and experiencing their textures and scents. Discussion began around the sacred and medicinal gifts of these plants. Examination of both the Latin name and the Dakota name allowed the team to further understand and connect these plants to one another. We decided to conclude our excursion by making tea from the Virginia Mountain Mint (*Pycnanthemum virginianum* or Waŋpé čheyáka in Dakota)."* For more info, see <https://www.two-eyedseeingthirdspaces.com/blog/june24>

*So I invited colleagues, and there were three native colleagues (Jewell Arcoren, Nicholas Bad Heart Bull, and Fawn Youngbear-Tibbetts) and three settlers (Dan Shaw, Caitlin Barale Potter, and myself). And so I was definitely thinking about two-eyed seeing. That was the grant proposal, two-eyed seeing. And third spaces, meeting in and finding third spaces for different kinds of conversations and questions: What is two-eyed seeing? What can we learn from each other by being with the land? Would we make a third space of our own? So the interesting thing was that the University of Minnesota's Institute for Advanced Study provided funding because it's highly interdisciplinary and innovative. The call for proposals asked for all the regular things – What are your tangible outcomes? What are your scholarly goals ... What exactly are you going to do? And I wrote, we resist these Western paradigms. We are going to become*

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*relatives with each other and the land, and then we'll find out what this is, a different worldview, a different research methodology. And beautifully, they funded it. This was funded by the University of Minnesota, an internal grant, the Institute for Advanced Study.*

*What we coalesced around was plants. Our collaborative member, Jewell Arcoren, Dakota knowledge keeper, Dakota speaker, a therapist, and very involved with healing intergenerational trauma, suggested we go down to Prairie Island Indian Community to see their cultural garden and to meet with Nicky Buck, the garden's caretaker and plant knowledge keeper. Prairie Island is Dakota, a very small reservation, because, you know, the Dakota were mostly exiled, thrown out, killed. It's very sobering to remember this. Nicky generously taught us to braid sweetgrass and she gifted us with sweetgrass seedlings. And sweetgrass doesn't grow well from a seed, but does from seedlings, so to plant a sweetgrass bed, a gift makes it possible. You (traditionally) don't buy it at a nursery. Later at lunch together, we thought, Well, with this gift, we need to make a space, a sweetgrass space, where we learn about both the cultural and scientific aspects of this plant, this medicine.*

*Caitlin looked it up in the plant registry of Cedar Creek. It had existed at one time. It wasn't there now, but that meant we could plant some. This summer, Isaac Seichen, my research assistant, and I immersed ourselves in the field station and proposed spatial locations and ideas for a "Sweetgrass Third Space for Two-Eyed Seeing". How could sweet grass thrive? It loves a sunny wet meadow, and there is an excellent site near the edge of a tamarack bog. And so we're proposing this circular, communal outdoor gathering space (including inviting the sweetgrass bed into the circle) for ecological and cultural conversations and learnings. And we are also proposing a second space, a contemplative space we are calling the "Tamarack Dreaming Place" a light screened structure to experience the bog, have a more private space of reflection, and gaze out at the tamaracks. So the Sweetgrass Space, the open air circle, will have different kinds of seating, a firepit, shade from sun...and ideas are flowing about many possibilities, frameworks or formats for Native artists to come and plant or grow or do or make, or maybe even a new residency program emerges, who knows, because station facilities are pretty close to this sweetgrass space that we're designing. What a beautiful residency that would be. We're going to meet out there later this month.*

*And I've asked a colleague of mine, Dakota artist and leader, Mona Smith, and her husband, Marty Case, who's an expert on treaties, to join us at Cedar Creek for the meeting. We should know more about all aspects of the land. This is representative of what our group does: learning from others, each other, and the land, together. And Caitlin's very invested in the two-eyed approach for Cedar Creek. Now, with the physical models (of the design ideas) that we made, we can talk with donors, and in this climate, donors may be the way forward. A lot of them are really sensitive to the current situation.*

*Here's the thing about field stations and research. I didn't realize how much I would fall in love with Cedar Creek. I didn't know that I would start to miss it. In fact, today, coming back from a campus*

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*meeting, I feel the need to go to Cedar Creek, because the tamaracks will be starting to turn yellow. And it's made me want to learn Dakota. I only know some words, but that's what folks need to realize about residencies and artists being involved with field stations. We can't predict. We need to trust the artist, or ourselves as artists, to trust the impulse. You can't really plan what the outcome is going to be before you get started - especially if you acknowledge that you are pursuing a different way right from the start!"*



## 7. Arts at international FSMLs

Art-science interdisciplinary work is a global movement, and is strong in the UK, Europe (especially northern Europe), New Zealand, and Australia. Influential art-science projects overseas include [Arts at CERN](#) (Switzerland), [SymbioticA](#) (Australia) and [BioArt Society](#) (Finland). It's no surprise, then, that there are vibrant, cutting-edge, diverse arts projects at field stations and marine labs outside of the US. The following are just a small sampling of what's happening out there:

### **Bermuda Institute of Ocean Sciences (Bermuda)**

BIOS has hosted artists working alongside oceanographers and climate scientists, producing visual art, sound works, and public exhibitions addressing reef systems, ocean circulation, and climate change. These collaborations often culminate in gallery shows in Bermuda and international venues, positioning BIOS as a marine lab that actively supports public-facing creative research. A multi-year collaboration (BIOS scientists + artists) culminated in the Bermuda National Gallery exhibition “In Dark Seas” (including works by Lesli Bell and Samm Newton, plus science videos). [Bermuda National Gallery](#)

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### **CICHAZ - Centro de Investigaciones Científicas de las Huastecas “Agazarca”**

In 2018, CICHAZ collaborated with a nonprofit interested in bringing murals to the community where we operate. They contacted CICHAZ. (<https://www.cichaz.org/murales-murals/>) CICHAZ also works with a Mexican graphic designer on infographics that we use throughout the station about our work.

Co-director Rhonda Struminger notes that , *“Partnerships can be challenging if they are not well-received locally (CICHAZ operates in a small rural Mexican town, relying heavily on the community's goodwill, so alliances really matter).”*



Mural at CICHAZ. Muralists from South America and México painted homes and establishments along 1 km of road that runs through the Aguazarca neighborhood in Calnali where CICHAZ operates.

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**La Selva Biological Station (Costa Rica)**

La Selva has hosted visual artists, writers, and performers working with tropical ecologists since the 1990s. Projects include field-based drawing, sound recording, installation, and narrative work exploring rainforest complexity, biodiversity, and conservation ethics. A public exposition, “Green in our Hands,” was installed at the La Selva Research Station Visitor Center. See

<https://www.rossellamatamoros.com/wwwweeblycomeditormainphp-881634.html>

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**Las Cruces Research Station (Costa Rica)**

Las Cruces has supported art–science courses, exhibitions, and visiting artists, particularly focused on coffee landscapes, cloud forests, and human–ecological histories in southern Costa Rica. For example, see “Open Doors” event in 2024: <https://tropicalstudies.org/open-doors-2024-lc/>



Las Cruces Open Doors Festival. Photo credit: Ramon Morales Garro

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### **Manu Learning Centre / Manu Biosphere Reserve (Peru)**

Manu has long engaged with artistic and cultural practices as part of knowledge transmission, community empowerment, and conservation education. A central feature of MLC's work is its close relationship with Indigenous communities, particularly Matsigenka and neighboring groups, whose cultural practices are inseparable from the forest ecosystem. These relationships often involve material culture—including clay work, pottery, carving, textiles, and other hand-based practices—that encode ecological understanding, seasonal rhythms, and social memory. When artists engage in this context, they typically do so through collaboration, listening, and co-making, rather than as solitary practitioners producing autonomous artworks.

MLC has also hosted visual artists, photographers, filmmakers, writers, and designers through research partnerships, NGO collaborations, and interdisciplinary initiatives. These engagements often focus on documentation, interpretation, and translation—helping make conservation science legible and meaningful to broader publics, or supporting communities in telling their own stories.

### **Mpala Research Centre (Kenya)**

Mpala has hosted international artists, composers, and performers through partnerships with universities and independent arts organizations. Artists engage with savanna ecology, wildlife tracking, soundscapes, and human–environment relationships, producing installations, concerts, and multimedia works grounded in field research.

### **Queens University Biological Station (Canada)**

Art residences at QUBS included Mexican (Puebla) biologist and artist Evaristo Hernández Fernández, who completed a series of local woodpecker paintings during residencies in 2016 and 2018 (they created greeting cards from his paintings). Canadian poet and writer Helen Humphreys spent a year (2020) visiting the Fowler Herbarium at QUBS, and completed a book titled [\*Field Study: Meditations on a Year at the Herbarium\*](#). In 2022 QUBS and the Department of English co-hosted a Creative Writing Studio, with two emerging authors (Smokii Sumac and John Elizabeth Stinzi) culminating in a successful public event, 'Reflections from the Writer's Studio', involving creative presentations by the authors, discussing their respective creative processes, inspirations, and time at QUBS. This is their [2023 writers event](#). In 2022 QUBS also had writer [Omar El Akkad](#) on site for several weeks completing his residency that had been postponed due to the COVID-19 pandemic. He interacted with and presented at the writer's studio with Smokii Sumac and John Elizabeth Stinzi.

QUBS hosted a bird illustration workshop in 2018 with Evaristo (See [poster](#) and [details](#)). There's a good article in the workshop details on his path published in 2017 here:

[https://drive.google.com/file/d/1L9EPgQ5Jyfu5JuVCdsmYGCaqD1AI\\_szZ/view?usp=sharing](https://drive.google.com/file/d/1L9EPgQ5Jyfu5JuVCdsmYGCaqD1AI_szZ/view?usp=sharing)

This relationship was through our current director, Dr. Stephen Loughheed, who has taught field courses in Mexico.



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Over the past few years QUBS Senior Manager Sonia Nobrega has been working with Sunny Kerr, a curator at the [Agnes Art Gallery](#) at Queen's University. In 2022/2023 they supported the "[Along the Way: Decolonial Ecologies Playgroup](#)", which included a dozen both indigenous and settler local artists involved plus Sonia and Sunny. It included field trips on QUBS land base, visit with artist studios at Tyendinaga, a Mohawk community near Kingston, and an on the land [art exhibition](#) at No. 9 Gardens. The Agnes gallery was undergoing a major reconstruction at the time, so many of their exhibits/activities were hosted off site and a great opportunity for hosting exhibits/artists at QUBS.

In 2025 QUBS hosted UK based artist [Iman Datoo](#) with Agnes. "[Abundant Futurities: Mapping intra-actions at the Queen's University Biological Field Station](#)" was designed with the flexibility to allow Iman to tailor their experience to their focus on language and origin stories. An excerpt of Iman Datoo's bio on the QUBS website provides details.



Iman Datoo bio from QUBS website:  
*"Iman Datoo is a multidisciplinary artist and researcher based in Devon, UK. Her practice brings together botany and cartography within the spatial environments of stories to consider forces of agency, liveness and animacy between plants, soils and people. At the heart of her practice is a desire to build relationality with our non-human counterparts and explore how forms of human agency can be mobilised through modes of listening, noticing and sensory inquiry. Iman's projects encompass installation, film, participatory performance and sculpture, with each medium carefully selected to reflect the ideas and interactions at play. Her works challenge the binaries between natural and artificial, inanimate and lively, wild and cultivated, serving as grounds for reimagining ecosystem recovery through imagination and speculation."*



### **Skukuza Research Station (South Africa)**

The Skukuza SSLI campus integrates creative practice, storytelling, and performance into leadership training for scientists working in complex socio-ecological systems. Artists contribute to workshops addressing conservation conflict, ethics, and communication. For example see this post from UCT's Human Evolution Research Institute about the HUMANITY exhibition, hosted at the Skukuza Science Leadership Initiative Campus in Kruger NP. [https://www.facebook.com/HERI.UCT/posts/our-humanity-exhibition-is-honoured-by-university-of-cape-townthrilled-to-announ/1106178631515430/?utm\\_source=chatgpt.com](https://www.facebook.com/HERI.UCT/posts/our-humanity-exhibition-is-honoured-by-university-of-cape-townthrilled-to-announ/1106178631515430/?utm_source=chatgpt.com)

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### **University of Hasselt Field Research Centre (Belgium)**

UHasselt hosted the classes for the master students of Arts College (Luca school of Arts) at FRC, with three consecutive days of classes inside and outside.

Collaborations with artists have included:

- Kristof Vrancken, a photographer who uses plant-based material and charcoal in his photography. He recently finished his PhD. Several students (architecture, art, journalists, etc.) are inspired by FRC and Ecotron research and apply to use it for their thesis.
- Miriam Rohde and Ann Mertens (artist in residence of Jester ([www.jester.be](http://www.jester.be)) who were separately inspired by the UHasselt [Ecotron](#), and were studying the effects of climate change on biodiversity in a time machine.
- Denise Peeters, who even held an exhibition in the Ecotron.
- Studio De Wilde (<https://frederik-de-wilde.com/>)

When asked how artist relationships work and how they get started, U Hasselt Field Research Project Leader Natalie Beenaerts replied, “We mostly get contacted by them. They hear from us or read about us.” They don’t currently have a real structural plan, but are thinking of collaborating more structurally with some organizations and neighbours such as park authorities.

## 8. Arts Education at FSMLs

There is a growing number of field stations that offer arts education programs, either as accredited college and university courses or parts of courses, or arts workshops for the general public. Some field stations have a mission to provide educational activities across disciplines (for example, Ada and Archibald MacLeish Field Station at Smith College, which is a liberal arts field station), and others offer arts education as supplemental offerings to their primarily science education focus (for example, Shoals Marine Laboratory). Just like artist-in-residence programs, these programs vary widely, with different goals and different relationships with the parent institution (college or university, consortium, non-profit, etc.). They vary in terms of size, mission, staffing, and faculty relationships, funding structures, resources, etc. To give a deep dive into one program, I interviewed Robyn Shea, Director of Santa Rosa Island Research Station, CSU Channel Islands <https://www.csuci.edu/> (See also Santa Rosa Island Arts Programs <https://ciartgalleries.cikeys.com/SRIRS/>)

**NL What is the CSU Channel Islands, the Santa Rosa Island program? What's your role there, and what are some of the ways that arts education happens there?**

*RS: I am now the director. I've been with the program for 10 years. I think I've held every position at some point. We're still relatively new – we were established in 2014. We partner with Channel Islands National Park. The park has had residencies, but I don't think it's something that they advertise strongly. Our program is interdisciplinary, and so we intentionally bring out groups from dance and theater, studio Arts, graphic arts, nursing, health science, math, sociology, and physical sciences, of course. Our program is the only presence our University has on the Channel Islands, so we like to say “We put the Channel Islands in CSU Channel Islands”.*

**NL When you say interdisciplinary, what do you mean by interdisciplinary? Are they co-teaching interdisciplinary classes, or might there be, for example, a dance class there while a biology class is there, and they're interacting?**

*RS: Both. It's a common misconception, or maybe one that's based on historical reference, that only biology, anthropology, and environmental science come out. So we are trying to mitigate that assumption and believe everyone has something to contribute and gain from visiting our site. Trips vary in length from one day to 2 weeks, depending on the course. We do have Art classes overlap with other non-Art classes, which provides great opportunities for our students to meet and build community alongside peers they would otherwise not meet or interact with during their regular course schedules on campus. We've also found that it hones communication skills by allowing space for open dialogue and mutually shared experiences. Art classes come out annually to learn about the history of the islands and the unique ecology, which they then use to create sculptures, dance performances, photographic pieces*

*or other installations shown in the campus Gallery. We also support opportunities for service-learning to students from all disciplines - we had an Art Capstone create a multi-panel mural as a visual representation of a large-scale restoration project. Given we've contributed hundreds of volunteer hours, it's nice to have a visual reference to that project. Another example is an upcoming opportunity where students interested in volunteering reached out to us and we paired them up to collect insects alongside experts from the Santa Barbara Botanic Garden. The student participants are from multiple disciplines and feel proud to be giving back to the island. Establishing a few professional connections to lean on after graduation is a bonus.*

**NL: You set that up like an internship. Are they getting credit?**

*RS: They are not. They're volunteering their time, but we cover all expenses associated with transportation, on-island accommodations, and food for the duration of the trip. We have philanthropic funding that allows us to provide that kind of support.*

*Let me step back for a minute. Dr. Cause Hannah, who was our founding director, was a staunch supporter of being interdisciplinary and understanding that people learn in a variety of different ways. Having that artistic interpretation or representation of some of what we do helps to broaden outreach, not just to our campus, but to the local community and K-12s as well. The main project that we utilize our art students in is our marine debris monitoring and removal project that we've been doing since 2016. We bring a lot of that trash that is hiked out from remote beaches back to campus, and then we have students make sculptures or different pieces with it. The Grant Coordinator Emma Akmakdjian is also part-time faculty at Pepperdine University, and she's a professional artist. She has her classes creating pieces as well, and we've done installations at Channel Islands National Park headquarters, the Santa Barbara Zoo, and we do a Marine Debris Art Show every year or two at a local brewery to increase awareness. If there are local professional artists who are interested in obtaining materials to create pieces, we invite them to showcase their art.*

*Emma's Pepperdine students are making sailboats out of Styrofoam buoys - they're cutting them in half, and then they decorate them and attach sails. I think she's made it into a "for fun" contest to see how well they function. The other aspect of that is exposing students to challenges with commercial fisheries. Being located on the Channel Islands and adjacent to an international shipping lane, we get materials from all over the world that pop up on our shores. That's another educational piece that can be showcased through art.*

*We also support art capstone projects, where we have small groups of students working together or individually. One group of three ceramic students came out with their faculty mentor and took photos and impressions of different things from across the island. (Given it's a National Park, we're not allowed*

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to remove or collect anything.) Back on campus, they then created plates, bowls, mugs, and platters, all inspired by the island. Our visitors get to use those items at every meal.

**NL: What are some of the things that you need to do with relationship building, with planning and fundraising, or working with your administrators? What is the process of starting up a program where you're teaching art classes at a field station and inviting students onto your campus?**

RS: It usually starts with a conversation. We'll reach out to certain faculty and say, "Hey, we have this partner. They have a specific need. Do you have any students who have experience or interest in doing that?" I find a lot of my job revolves around serving as a hub of connections. Through conversations with our partners and with a few students or an individual, we confirm we have donor funding that supports student access and student research, so there would be no out of pocket expenses for the students. Then we have to coordinate schedules, confirm with our partners at Channel Islands National Park, there are no concerns with the project, schedule transportation well in advance, and then monitor the weather. If it's a small cohort like one to four students, we can usually add them on to a trip where maybe there's a class coming out already, and we're going to be on the island. An advantage of a small student cohort overlapping with a course, is if it's a health science class for example, then it's super cool, because these students from different disciplines, who would very likely never engage with each other on campus have the space and opportunity to do so. [They] have the opportunity to share experiences and backgrounds, ask questions about processes, or even volunteer to help the art students. That could be collecting photographs, marine debris, or what have you. If someone wants to teach a course and have the island serve as the classroom, then that requires some additional discussions about expectations, funding, and scheduling well in advance.

**NL: So if you're talking about something like a handful of students, that might be something like a field trip that could be planned a few months in advance?**

RS: Correct, a few months if it's a few students. For a course, we plan our schedule close to one year out. The limiting factor is boat transportation to the island - boats run from March through November, there are seasonal challenges with marine conditions and weather, and the boats run 3 days per week. We typically host college courses on weekends and K-12 groups mid-week. Each student or group of students, must have a faculty mentor to work with us.

**NL: But if it's a course, do you need a year of planning to make that happen?**

RS: Yes, a year of planning, especially if we are doing a course where students need to apply, like our Summer Island Experience class or our idea for an art-science intersection course. We have a new partnership with the California Nature Art Museum bringing artists and members out to learn more about the Channel Islands, and I'm hopeful that relationship can expand to involve our students as well.



**NL: I'd love to hear about the interdisciplinary project.**

*RS: It's called Art Science Intersection. Emma Akmadjian, faculty at Pepperdine (she's a CSUCI alumna, and serves as our marine debris grant coordinator) is one of the instructors, alongside Dr. Matt Furmanski (CSUCI) – he's been bringing art students out and volunteering wherever he can since the beginning. They had a discussion recently with the Dean of Arts and Sciences, and given budgetary constraints that California universities are currently being faced with, they were not willing to entertain the idea of adding the course for the summer of 2026, though we have plans to try again. Students would have the opportunity to work with Art faculty and Natural Resource experts to identify parallels between ways scientists and artists approach questions or issues, as well as thinking of ways to compliment each other with communicating data, challenges, advocate for funding, etc.*

*We have another effort called the Island Experience that currently is an environmental science and anthropology cross-listed course that teaches students about the history of the Channel Islands. This includes both natural and cultural history, given we've had human occupation out on Santa Rosa Island dating back over 13,000 years. We're working on getting an endowment or long-term funding to support this. The idea is the course would alternate disciplines and instructors from summer to summer so as to not overextend one individual; it could also change disciplines and focus any given summer. I have colleagues from performing arts and theater who are interested in teaching this course down the road. This is something new that we're trying to figure out, and get some seed money to support for the costs associated with housing on our main campus before and after the island trip, transportation to the island, as well as food and materials, including costs associated with everybody spending eight days on the island. For this course, students would pay tuition, but then all other costs associated with the course would be covered by our program using donor funding.*

*Very early on, there was a cross-disciplinary course that was biology and art, and it was basically scientific renderings of different species around the island that students observed. The finished product is beautiful.*

**NL: What is your experience with building relationships with the local community? This might be local Schools, local organizations, or Indigenous people in the area? How do your programs interface with those kinds of community folks?**

*RS: We do have some interaction with local Chumash tribal representatives and have hosted a teen summer program, which was very well received. The biggest challenge I've found with the k-12 and community groups is funding, which is becoming more competitive. We would love to host tribal members more often, but aligning schedules can be difficult given our transportation limitations to/from the island. We are going to work with our Indigenous student club/org and continue to support initiatives*

*of the National Park as well. FSML directors could look into whether or not they have access to Native American Initiatives funding, or something similar, to help support visitation by these groups.*



Jose Galvan  
Martinez (2020),  
*Sushi for the  
Grandkids*, mixed  
media (marine  
debris collected on  
Santa Rosa Island)

*There are local artists' studios that do summer programs for teens that we have taken a bunch of marine debris to and had the students spend a day creating pieces, learning about the issues surrounding marine debris in our region, and then we showcase the finished pieces at our Art Show. During COVID, in 202-2021 we hosted an online Art "Gallery" called Gateway to Expression.*

*(<https://ciartgalleries.cikeys.com/SRIRS/>) Given we couldn't be in-person, or host anyone on the island, we worked with Faculty, students and our other visitors from k-12, the boat transportation concessionaire and anyone else interested, to collect and curate a show highlighting images, artwork, research, and other content including student testimonials about their trips to the island. The culmination was the work of our staff and faculty as well as a student Capstone who created the website and layout for their senior project.*

*And then it's working with either friends or existing relationships, or asking other faculty, if they have relationships with either other universities or community colleges, to learn more about either bringing them out to the island, it's a recruitment tool for the university, or adding to the student artist portfolio. We're trying to look into different partners to do art installations. Breweries are kind of an easy thing because they usually have space, and some of them here have outdoor space, maritime museums, and marine sanctuaries. So these are student exhibits, exhibits of student work that comes out of some of these courses. And then there are other professional artists that specialize in either using found items, specifically, marine debris, that have reached out to us asking for materials, or that our faculty have professional relationships with.*

**NL: So where does that come from?**

*RS: The Native American Initiatives money was one-time funding from the CSU System we applied for. We used it to comp user fees for accommodations on the island for the teen Summer program. Our partners at the National Park have been trying to get tribal members who can trace their lineage out to Santa Rosa Island for an overnight trip, which would require use of our facility for accommodations. Coordinating schedules has been challenging, so that hasn't happened yet, but we're still having that conversation. We have had other tribal members join groups on day trips to provide additional context and a blessing for the group's journey. Those are very special moments.*

**NL: I want to go back to earlier stages of partnerships with teachers, and thinking about when, let's say, a faculty member has an interest in teaching at your field station, but has never been to your site, or maybe has never been to a field station before, might not have taught in the field. Do you work with them at all in terms of helping them develop a rubric, or helping them develop their syllabus, or helping them figure out what kinds of expectations for students, how much energy they have during the day, like how long a field trip takes? Do you help with those kinds of logistics, with planning and stuff?**

*RS: Yes, absolutely. So typically, if I have somebody who's never been out, and they reach out, I'll invite them to do a day trip, without their group first. They can shadow another instructor, bringing their class out so that they can [plan]: What does packing everything look like? What does loading the boat look like? What does offloading once we're on the island look like? How close is the facility to the pier? It's a five-minute walk. But what does that mean? What do accommodations look like? We have both spectrums as far as what group leaders want to accomplish – some want to do 16-mile hikes every day, others are happy providing ample “free time” to their students. And we say, you know, you really need to plan for the lowest common denominator, because, especially given our student population, [we serve] mostly first-generation [college] students, and even if they live locally, they've never been to the beach. They've never been on a boat. They very likely have never stayed overnight away from home. So there's*

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*a lot of firsts, which are great, but [it's important to] have realistic expectations. And we're all about sense of place, sense of self, and a sense of community.*

*Time and time again, we hear from students that they had this imposter syndrome, where they didn't think they belonged on the trip, and they almost didn't come, but they're so thankful that they did it, which is what is so wonderful about field stations, watching that happen. We do a reflection at the end of every trip, before everybody separates. We ask everyone what their favorite part of the trip was. Which can range from just having communal meals for the first time in a long time, seeing the Milky Way or the stars, seeing whales and dolphins, to just being away in nature, or going on their first hike. And then we ask about something that really resonated with them. This could be seeing something, or it could be just having quiet time and disconnecting from technology – we don't allow internet access when they're out there to kind of force them to engage with each other and this special place.*

*So we will invite the faculty/teachers to do a day trip and do a dry run. We're encouraging group leaders, faculty specifically, to have a second faculty member with them to support the program, to support the students, and to give them a break. It's a lot for one faculty member. And if there's an emergency, it's always better to have backup. Plus, if you're trying to teach, you have content you're trying to impart, or activities you're trying to lead, answering questions about [logistics], and then helping guide the cooking and the cleaning. Everybody has to cook their own meals and bring their food. We don't have a cafeteria. We're too small. Talk about your life lessons, it's all encompassing, it's a lot of work, and it's very impactful. And so we say, do a day trip, and then we have a group leader safety orientation and pre-trip meeting, and ask them to have their itinerary available so we can go over it and make any tweaks or suggestions. Some of them, like the English faculty, always have downtime for the students to go spend some time and sit somewhere by themselves and journal or write.*

*I think managing expectations is the biggest thing, and the first trip is usually the hardest. I think usually the faculty will err on the side of less-is-more for their first trip. And then once they're a little more comfortable, and they see what works, they can expand beyond that. If a group leader isn't sure about what to do, our staff can lead a walk through the historic ranch complex followed by one of closest hikes where we space students out, and ask them to use their senses during the silent walk. It's about one mile in silence navigating through the bottom of a canyon. Then we share our observations without repeating anyone before continuing on as a group for 3 more miles. It's the fastest way to really get them connected with the place. We also can provide some activities for students if the group leader isn't really sure of what to do - long-term photo-point monitoring, service learning projects, etc.*

*But it definitely takes some finessing, a new position we have this year is a faculty liaison to act as a resource for faculty who've never done a trip, or provide some pointers on streamlining the process.*



**NL: How are you managing what's going on right now, in terms of grant funding, scientists who've been displaced, or DEI programs that are threatened? What are your hopes with regard to that? What are your coping strategies, funding strategies?**

*RS: Funding is a challenge for us. So the university covers three permanent positions for us. We have no operating budget from the university and rely heavily on donor funding to support student access, which also covers our staff transportation. Edison International, who provides local electricity here in our area, gives us \$10,000 a year to support our students and program. We have philanthropic strategies that are pretty strong, and we have some long-term donors that are great, who help support student research and paid student internships.*

*My biggest suggestion is we need diversity when it comes to funding. We have one donor who is extremely flexible and has helped with capital equipment replacement and deferred maintenance expenses. We're currently working on pursuing an endowment for a fourth position that will focus on educational programming, ensuring we're in compliance with all the current regulations and curriculum standards, to secure that position, regardless of what state funding is doing. Our University recently had to cut \$10 million off of our campus budget. That was a bit of a shock and a challenge, but administrators handled it well.*

**NL: Do you find yourself feeling marginalized by your home institution? Do you find yourself having to rationalize your existence, or do you get good support from your home institution?**

*RS: I would say that it has improved. It's still a consistent effort to communicate exactly what we do and what we don't do, and that we're often overlooked as a recruitment tool for the university. What a great recruitment tool. I know it seems like a no-brainer, but we do host middle school and high school students. And nobody seems to be aware or acknowledge that. So that is something we need to improve upon. In addition to trying to secure funding for more staffing, I am working on restructuring our staffing based on 10 years of experience and seeing what works and what our shortcomings are and why we lose staff. Adequate pay in our region is very challenging. All FSML Directors should be advocating with their home institutions for more publicity and acknowledgement given the breadth of our operations and the significance of our impacts on students, local communities and partners.*

*Last year we moved from being under Academic Affairs to [being] under the office of the president, which is actually really great for us, because we are now being acknowledged as a unique asset serving as an attraction and a recruitment mechanism for the university. I strongly feel like we function as a hub of partnerships, given all of the different research and agencies and NGOs that are working on these islands and talking about ways our students can support them. Or if we can pay for internships to help them with some of their research, offering our math and statistics courses to do data analysis for some of these partners, Spanish faculty translating contracts, etc. I have been focusing on trying to bring the*

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*Channel Islands to our campus, to engage folks who cannot come to the islands - that can be data, photos and reports, anything really to help them feel connected. We have a lot of students who are non-traditional, they have families, they work full-time, and go to school full-time. They don't have the bandwidth to do a trip. We need to reach them as well.*



Matthew Williams, *Cathedral*. Black and White 35mm Film, Spring 2019

**NL: You mentioned middle school and high school. How does that work? Are you working with local public schools, and what is the structure?**

*RS: We have partnerships with four different local counties. We're expanding to San Luis Obispo County to do an annual summer long-term monitoring project to gauge Torrey Pine expansion on the island. We have an application portal where they can identify what the course is, what the intention behind the trip is, what they're going to be doing, and how it aligns with their curriculum. Given we partner with a National Park, we run interference with regards to confirming whether someone needs a permit and ensuring resources are protected. K-12s typically have stricter regulations as far as teacher to student ratio. We have a lot of repeat teachers who are now trying to bring new teachers with them to experience it and help more students become engaged with the Islands.*

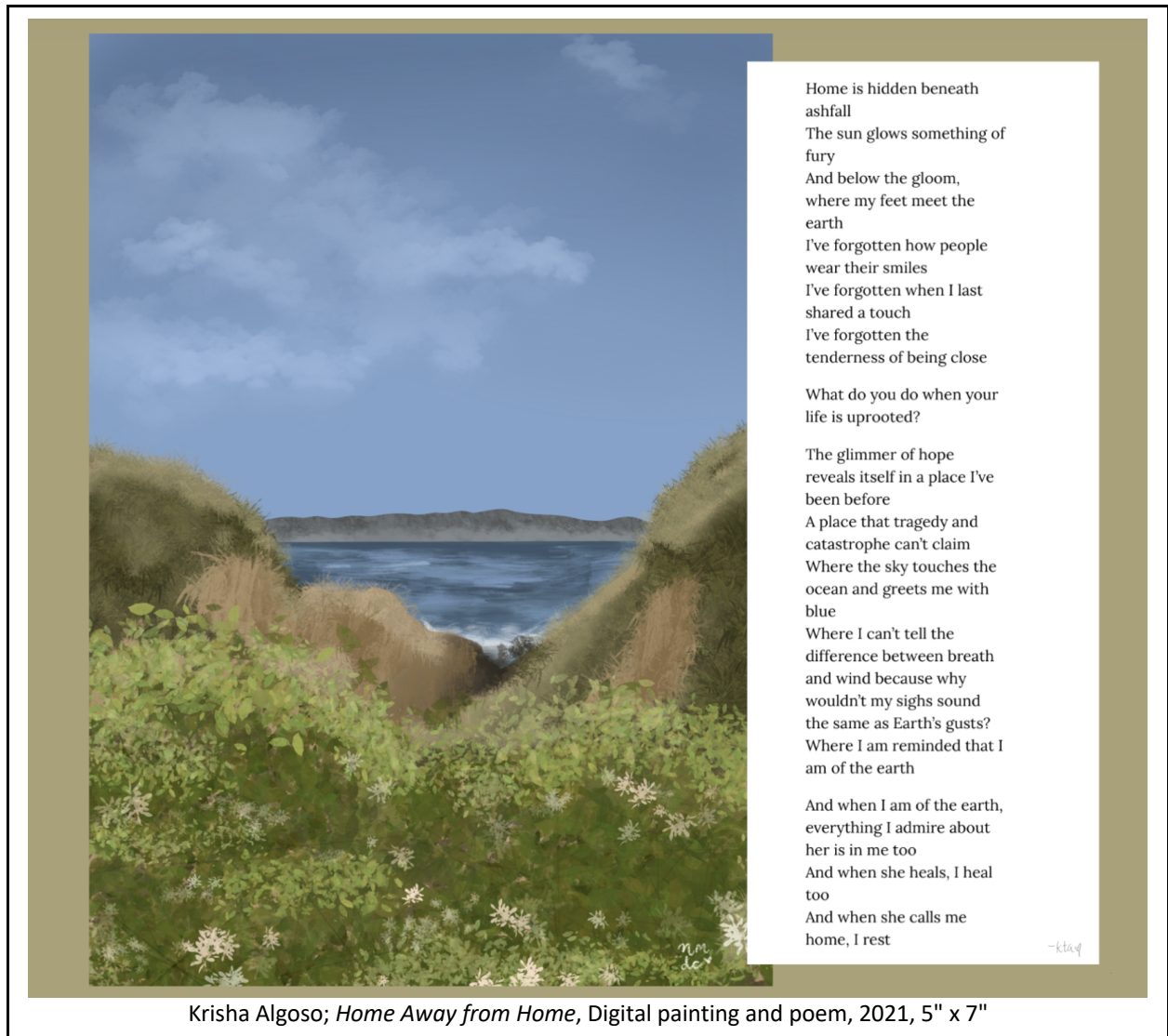
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*Another newer pathway is the National Park working with local school districts to try to get curriculum focused on the Channel Islands into their classes. We've hosted some teacher workshops where the park has brought out a group of teachers from science or math to learn more about the resources and talk with the park directly. We're not as involved in those trips, we're mainly providing accommodations. We do however, talk about the classes and instructors who come out to provide additional context and examples of what can be done. We also talk about the different types of classes that we host, and what our faculty and students are doing. There are legal contracts for use of the facility, there are insurance requirements where the state, the board, and the university have to be listed as additional insured, as well as the US government, since we partner with the park and occupy park-owned facilities. Probably the biggest hurdle is the indemnification language. Obtaining all of this can take months, which is part of the need to start the process so early and plan so far in advance.*

*Our fees are very low, which I'm working on, trying to get them increased a little bit, because all of the expenses are increasing. But the lower costs also help with accessibility. It's a difficult balance.*

***NL: To close, in addressing field stations, marine lab directors specifically about arts education programs at their field stations, anything else that you want to share with them?***

*RS: I think there are so many opportunities out there. It's just being open and starting those conversations; there are very likely funding opportunities for donors who are interested in supporting the arts, whether it's access, or maybe it's materials, or a fee associated with hosting, or an installation of pieces that come from courses. I think there's probably funding out there that could support that, or even a residency where it's either a student, a professional, or a grad student. It could be a Master's of Arts student who then comes and talks, does an oral or gallery presentation on campus, or at the field station or marine lab - it could be a great community event attracting like minded individuals. I think there's more opportunity to find different creative ways to engage and expand, which also helps all of us.*



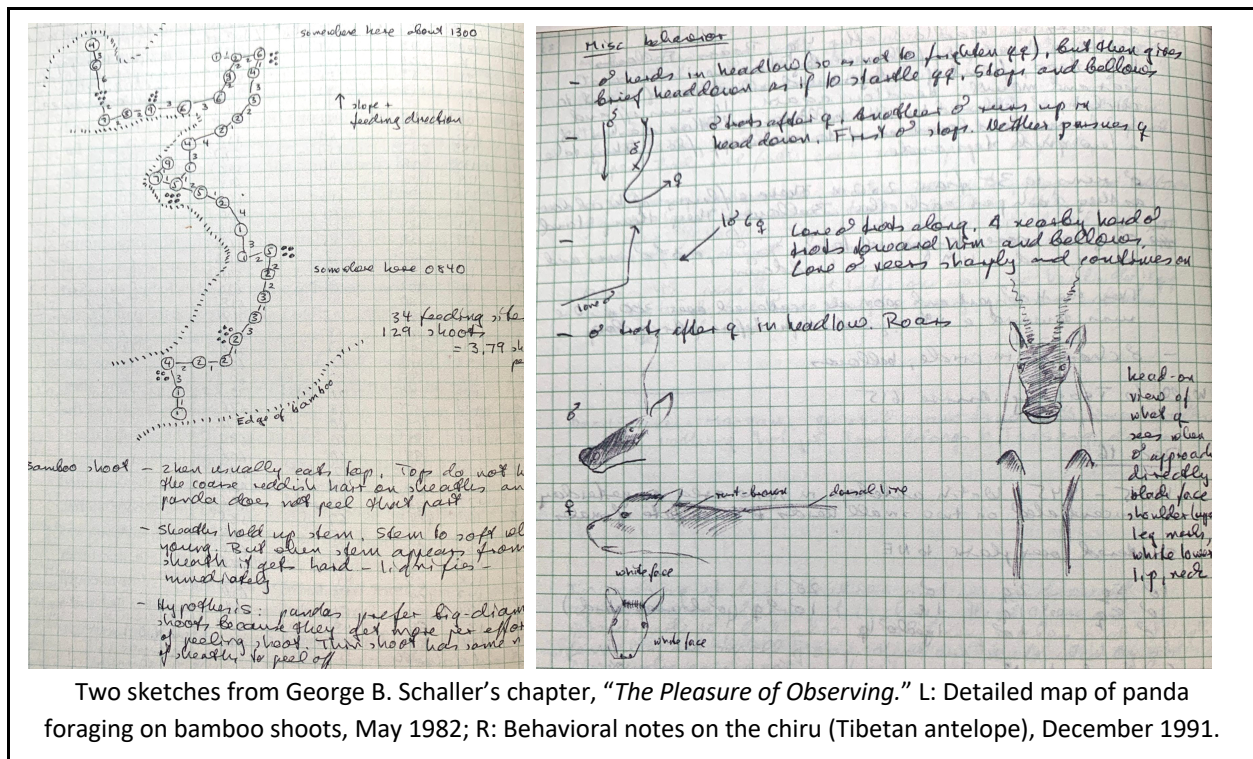
Krishna Algosio; *Home Away from Home*, Digital painting and poem, 2021, 5" x 7"



## 9. Drawing as a tool for biology/ ecology learning at FSMLs

### A. Observational drawing fundamentals

Among the myriad ways that artists can engage with field stations and marine labs, one of the most obvious ones is using drawing for natural history observation. Researchers may make sketches in field notebooks, or draw specimens or anatomical parts of specimens. Some impressive examples of these uses are explored in “Field Notes on Science & Nature” edited by Michael R. Canfield. Even though we now have access to photographs for capturing species images, GPS for mapping, and other technologies, observational sketches in the field can help researchers notice details that they might otherwise miss. These careful observations can generate questions and even begin to suggest hypotheses.



Because drawing is so effective for slowing attention, biology and ecology educators often assign drawing as a teaching tool for students, in the classroom, lab, and field. Familiar examples include assigning students to draw dissections, draw and label what they view through a microscope, and or make field sketches in a nature journal.

This review article enumerates quite a few important reasons why drawing an effective pedagogical tool for biology or ecology education:

*“Scientific understanding of nature is based on strong observation skills (Weeks, 2005). Unlike photography, sketching requires **close observation**. This close observation naturally **generates questions** (California Academy of Sciences, 2023). Sketchers notice details they did not see before, they may wonder why something is the way it is, and they may **see connections** to other phenomena. In this way, the act of sketching **sparks interest**, **improves knowledge**, and can **encourage further exploration** of the subject. Furthermore, studies have shown that drawing **improves memory retention** (Balemans et al., 2016; Fernandes et al., 2018; Meade et al., 2018; Scheiter et al., 2017; Wammes et al., 2019). Ainsworth et al. (2011) give five reasons why drawing is a valid instructional tool. They argue that drawing **increases motivation to learn**, provides an opportunity to learn what makes an image an **effective communication tool**, allows **demonstration of conceptual understanding**, allows **new information to be connected to prior knowledge**, and helps to **make thinking explicit**.”*

– Higley et al 2024, The Value of “Bad” Drawing in Teaching

Most biology and ecology educators may appreciate the value of drawing as a tool for learning, yet very few are trained in even basic drawing skills, and fewer still are trained in how to impart those skills to students. This chapter provides some basic drawing tools, techniques, and tips that are tailored specifically for observational drawing of the natural world, with an emphasis on their use as a learning tool for science.

### Starting out

#### Mindset

Young kids can make symbolic drawings such as the one shown here, in which a square with a triangle on top represents an abstract “house.” Around the age of 10-12, children's brains develop the ability to draw more realistically. They can distinguish specific lines and shapes, observe areas of light and shadow, and (crudely at first) translate these to the page. Unfortunately, this is about the same age when we stop teaching art in our schools, at least in most public schools in the US. The result of this unfortunate timing is that many of us don't feel good about our drawing skills. Imagine if we didn't offer access to bicycles at precisely the age when kids grow out of tricycles.

We'd have a lot of adults who lament, “I wish I could ride a bike, but I just don't have the talent.” Reassure your students: **Drawing is a set of skills, just like riding a bike.**





Don't use the "T" word: Talent

A common misconception is that drawing is a special talent reserved only for a lucky few. Like most other human endeavors, of course there are outliers. To continue the previous metaphor, there will always be a few highly athletic individuals who will win the Tour de France, but that doesn't mean that the rest of us can't ride a bike, because we're not talented enough. Beginning drawing students may get discouraged at first, and this is natural with any new endeavor. One hasn't developed control, muscle memory, and it seems awkward to take on even the simplest attempts.

Drawing requires practice, and truly the best way to get better at it is to just keep doing it. It takes time to improve, which leads us to the next point:

Begin at the beginning of semester

As an educator, if you know you're going to require students to draw at some point in your biology or ecology class, give them enough time to practice so that they can improve. If you spend an hour or so introducing materials and a few techniques, and give students a few introductory assignments, they are more likely to experience some progress. You might encourage them to draw in the lab once a week, make sketches when they are in the field, or make a few observational drawings as homework. Even copying other drawings or photographs will build skills. Ideally you want the students to reach a point where the drawing becomes more a tool for observation than a source of frustration.

Emphasis on process, not product

Unless you are teaching a class in scientific illustration, remember your learning goals are to use drawing as a tool for observation, to slow down attention, and to generate questions. Drawing requires a slow attention that is increasingly rare. (See Shari Tishman's "Slow Looking: The Art and Practice of Learning Through Observation"). It's not the drawing itself, but rather that deeper state of attention that is the true goal of most observational drawing in biology/ ecology education. The observations that result from drawing might lead the student to generate questions about structure-function relationships, to notice morphological details that suggest taxonomic relatedness, or to point out characteristics that could be adaptations to the environment. See the rubrics at the end of this section for ways that other educators have assessed student work.





### Tools

Here are a few tools that can give your students better results with beginning drawing projects.

Drawing paper for this purpose should be big enough (standard 8.5" x 11" is fine), and I wouldn't suggest using half-size small sketchbooks at first. The paper should be blank and unlined, with some "tooth"-- in other words, a slightly fibrous surface texture, not too slick (like "newsprint") but not too bumpy (like some handmade papers). Plain copier paper is just fine. If you are using a blank sketchbook or field notes, then spiral-bound is preferable to a hard-bound book, because it opens flat.

Pencils. For drawing pencils, you can just use a standard #2 pencil, but you may want to offer a few other options as well. Drawing pencils are ranked for their softness or hardness, with the softest pencils leaving the darkest marks of graphite on the paper, and the hardest pencils leaving the lightest marks. In drawing pencils, "B" is soft and "H" is hard. For example, a "2B" pencil is roughly the equivalent of a #2 pencil, a "4B" or "6B" pencil will leave very dark marks, and a "4H" will leave very light marks. The harder pencils are only used in special circumstances, such as drawing light lines like dandelion fluff or stamens of a flower. (When using a hard pencil for general drawing, one is inclined to "bear down" too



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much and can inadvertently emboss, or even tear, the paper.) It may be helpful to provide at least a few of these alternative pencils, if not one per student, then perhaps a few for the classroom so students can share.



Basic drawing tools. Upper left: Drawing pencils 2B, 3B, 4B;  
Upper right: Kneaded eraser; Lower left: Paper blenders (estompes); Lower right, Sharpeners.

Kneaded eraser. This little tool can really change things, and it's super cheap. Unwrap then knead it like Silly Putty. It can be used like a regular eraser, but it can also be shaped into a wedge to remove a very thin line of graphite, or since it's slightly sticky, it can be tapped on the paper to pick up small amounts of graphite. [Watch a 30 second kneaded eraser demo here.](#)

Paper blender / AKA estompe / tortillon: Use this tool to blend areas of graphite and make a range of grays – smooth transition from light to dark. [Watch a 30 second paper blender demo here.](#)

Sharpener. This may sound obvious, but keeping sharpeners handy will improve the quality of the drawings and enhance student experience. Encourage students to keep their pencils sharp so that their lines can be more accurate, nuanced, and specific. When students have easy access to a pencil sharpener (even cheap little metal ones) they will have more control and precision.

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### Keeping it all together

If students are headed out into the field, a large **Ziploc bag** or similar is helpful to keep art supplies together and dry in a backpack. One of the quirks of drawing supplies is that the kneaded eraser is slightly sticky so it tends to collect pencil shavings – it's helpful to wrap that little tool in its original plastic wrapper.

### **First drawing**

When working with beginning students, for the very first drawing of the semester, I like to choose a subject that is a simple organic form, ideally somewhat asymmetrical, and I find it best if it has minimal surface color. The subject (specimen) needs to be something the shape of which doesn't have a name. For example, when you read the words "leaf-shaped," it's possible that an ovate leaf, roughly like an almond shape turned vertical, may have popped into your mind. That mind's image of a leaf can get in the way of seeing an actual leaf in front of you, which may be at an angle that exhibits foreshortening, may be less symmetrical than the iconic minds-eye image, or may be atypical or flawed in some way. The brain's verbal labeling of shapes can interfere with our ability to simply observe the shapes before us. I find bones ideal for this purpose of the first drawing, and even cart them around to my beginning classes because they work so well. Field stations and marine labs often have collections of bones, crab claws, and other such specimens.



Collection of bones from Shoals Marine Lab, used for first drawing class.

### SKETCH FROM MEMORY – 5:00

Once you have chosen a set of organically shaped subjects to draw (bones, shells, etc.), this is a great exercise for the **very first drawing practice**.

- 1) Start by looking. Have students **look at their subject** for one full minute and really study it. It's fine for them to handle the subject a little bit, but eventually you want to ask them to put the object down and **set it in place, hands off**, and just look for a full minute.
- 2) Have students *put them under their chair* and try to **draw it from memory** for about three minutes. This will elicit gasps and groans, but you can use that comedic moment to reassure them no one will judge this next part.
- 3) Then: Ask them to take their object out from under the chair, look at it again, and **compare** it to the drawing. Ask students to share what they got right, what they missed, what they noticed after drawing, etc.

Afterward, point out to students that observational drawing can be thought of in these same three steps: first looking, then drawing, then editing. When we draw, we often skip past the looking step, race through the drawing step, so that when we get to the editing step, we are overly critical of the rushed and careless work and thus often fall into negative self-talk and that tiresome myth about “no talent.” If however, we slow down and really look with this same devotion of time, then draw with care, the editing step becomes more useful as a set of adjustments. It's look, draw, compare... look, draw, compare... just as before, with the added advantage of being able to look at the subject while working.



Students in a Cornell University Marine Invertebrates class, practicing observational drawing skills.



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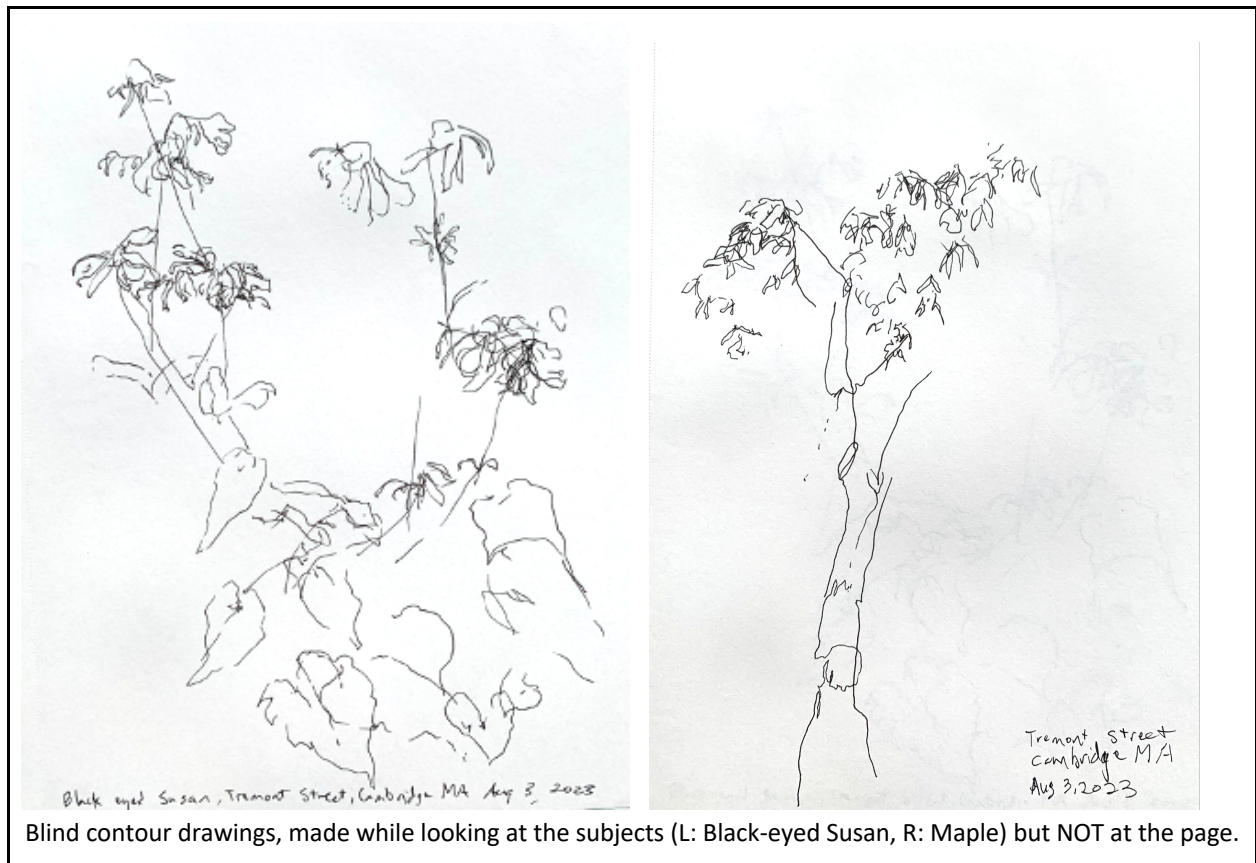
### Warm-ups

The following are three drawing exercises that are often used as warm-ups in a beginning drawing class. Calling them “warm-ups” is misleading, because they are just as useful as tools to get unstuck when drawing becomes confusing – they redirect the brain to its visual mode.

#### Warm-up 1:

##### BLIND CONTOUR – 3:00

You look at the object but not at the paper. (You might gently remind students of this if they are tempted to look) Have the students draw every edge – the outline of the object, and any lines or edges within it – but draw . . . . v e r y S L O W L Y as if their pencil is following a tiny ant crawling along the edges. Just take time and follow every “innie and outie” and every curve. It’s OK if it looks wonky.



Blind contour drawings, made while looking at the subjects (L: Black-eyed Susan, R: Maple) but NOT at the page.

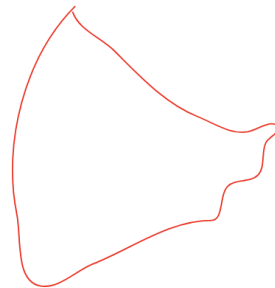
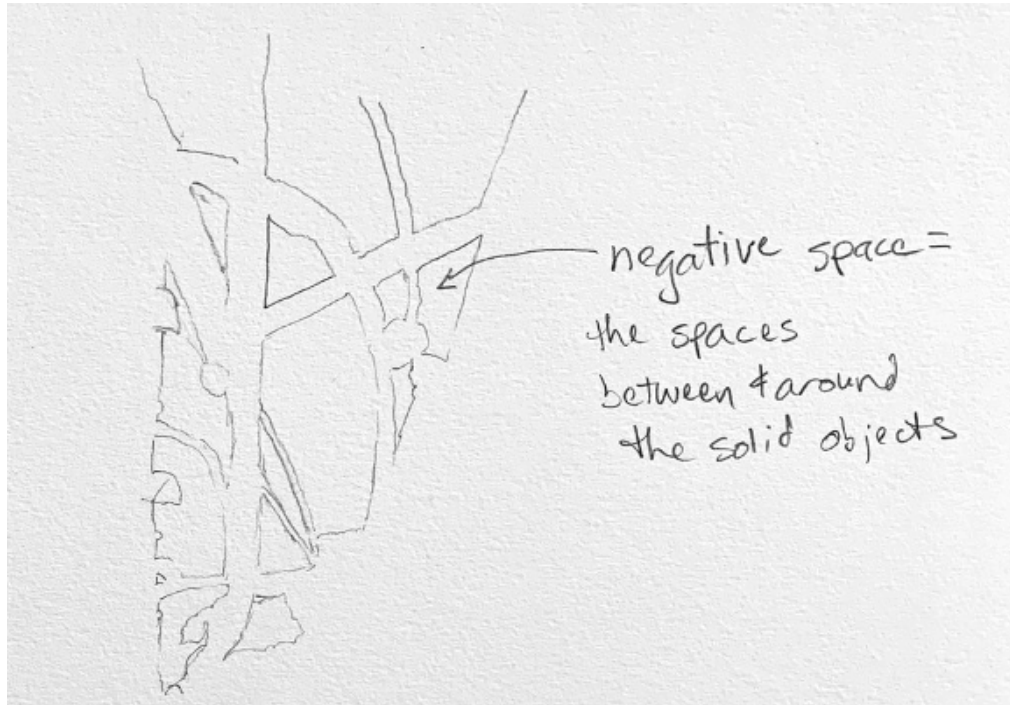
After this exercise, have students share their blind contour drawings with each other. Allow a few minutes of levity, offering a welcome break from the challenge of trying what are often new and unfamiliar skills. The surprise of these odd drawings will offer a moment of letting go, loosening up, and usually a bit of laughter as students share these odd results with each other.



**Warm-up #2:**

**NEGATIVE SPACE – 3:00**

In a negative space exercise, you draw the space around the solid objects, or between. Try putting a few simple branches and twigs into a jar or vase, and have the students draw the shapes of the “air between the twigs.” Or better yet, step outside and draw the “air between twigs” on a tree or shrub.



Top: Negative space drawing of twigs. Bottom: Negative space drawing is especially useful when drawing through a microscope - drawing the spaces between the object and the edge of the illuminated microscopic image field.

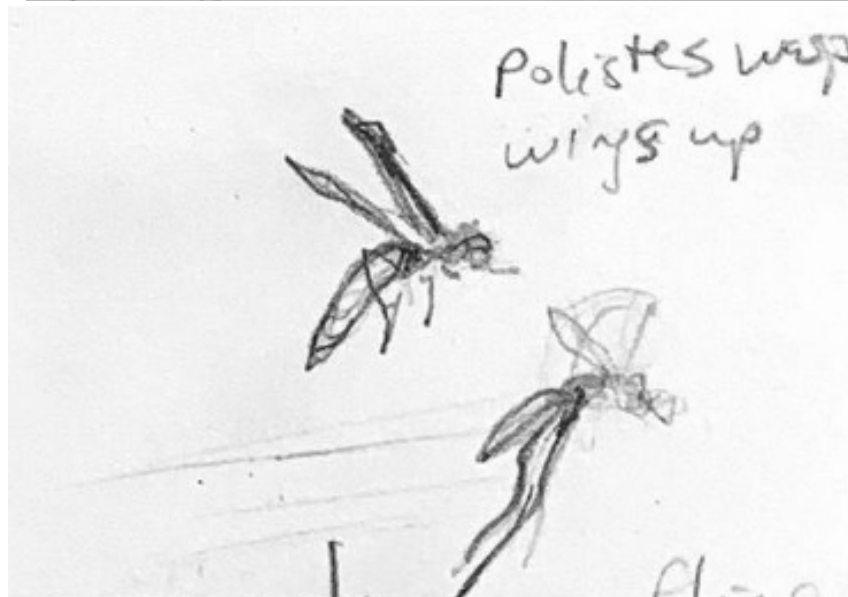
## Warm-up #3:

### GESTURE DRAWING – 3:00.

Quickly capture the “gesture” or general shapes, and if there is a head, note the direction it’s pointing. Gesture drawings are essentially very quick sketches. Challenge the students to sketch an entire subject (this could be a bone, a tree, a twig with leaves and flowers, etc.) Suggest that they make very quick directional lines to just capture the vibe, the overall shape of the thing, with very little detail. The value of this exercise comes from repetition. Making two 1-minute gesture drawings and three more 30-second gesture drawings will take the pressure off any one drawing to be perfect. The goal is to get the eye and hand moving quickly, and the habit of making multiple sketches is a good one to establish. Gesture drawings/ quick sketches are also particularly useful for animal movement. Multiple gesture drawings on a page are useful as a study for birds in flight, fast-moving rodents, etc.



I just saw



Polistes wasp  
wings up

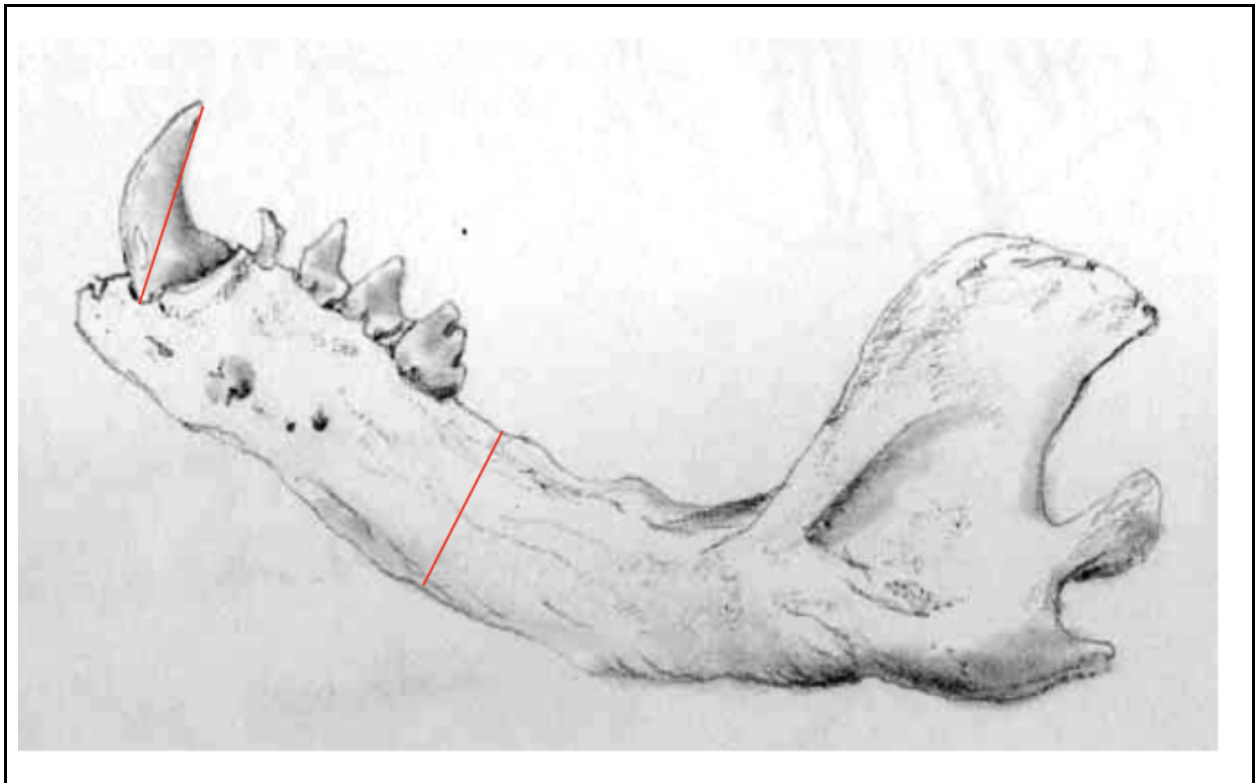
Some gesture drawings of animal movement from field journals.

## Drawing a subject

Getting down to the business of drawing a subject and spending a bit more time on it, the following are three tools that can help your students succeed – **measuring using relationships, finding shapes, and noticing areas of light and dark.**

### RELATIONSHIPS & MEASURING

One way to measure and to see proportions is to **use one part to measure the whole.**

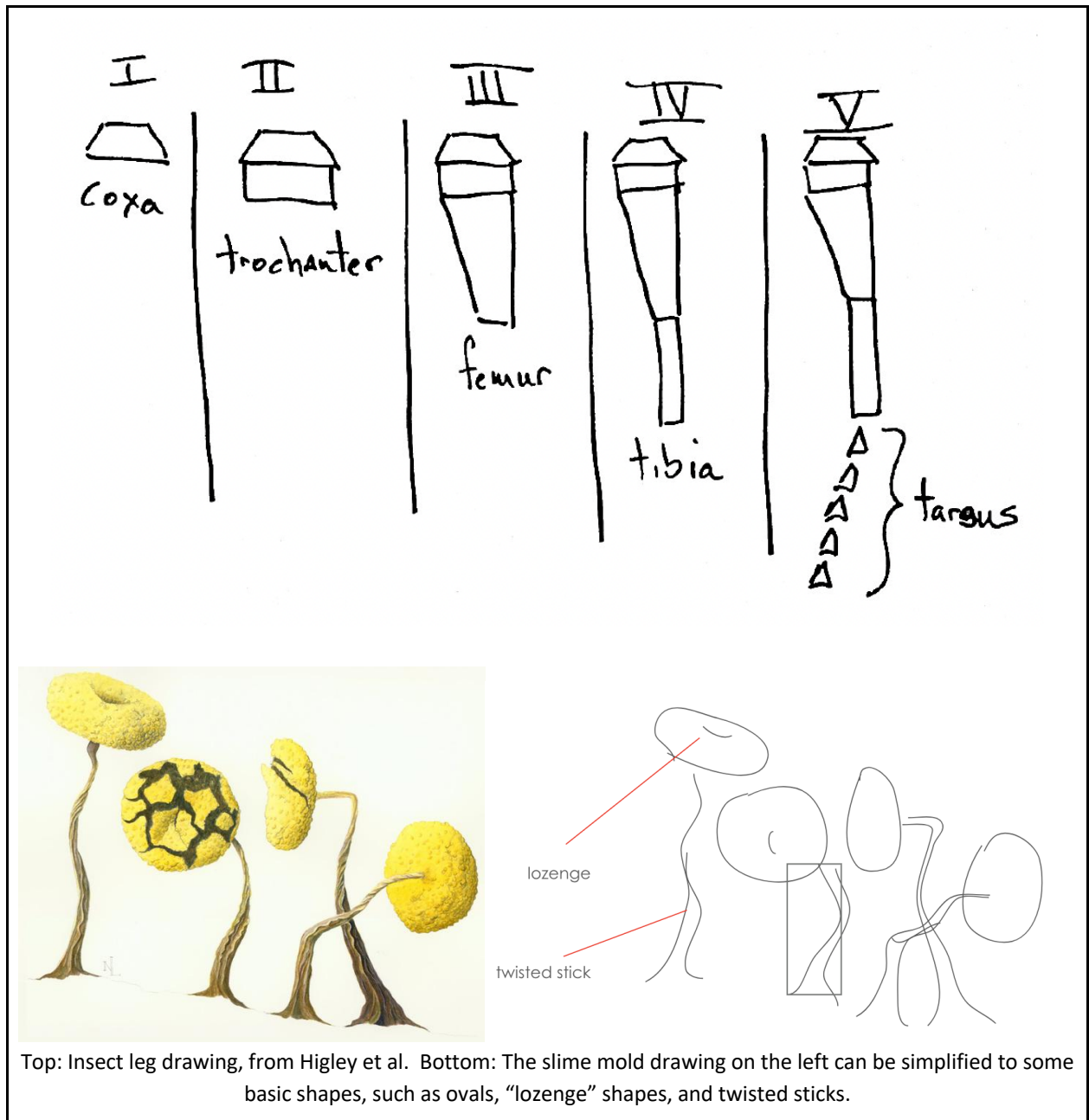


In the example above, the biggest tooth could be a measuring device. The lower edge of the jaw is roughly one “tooth” wide, the straight part is about three “teeth” long before it curves, then after the curve it’s another “tooth and a half” long, etc.

This is also useful when **drawing through a microscope**. Pick one part/ component and use it as a measurement reference. In a scope, you can also use the distance from an object to the **edge** of the circle as a reference.

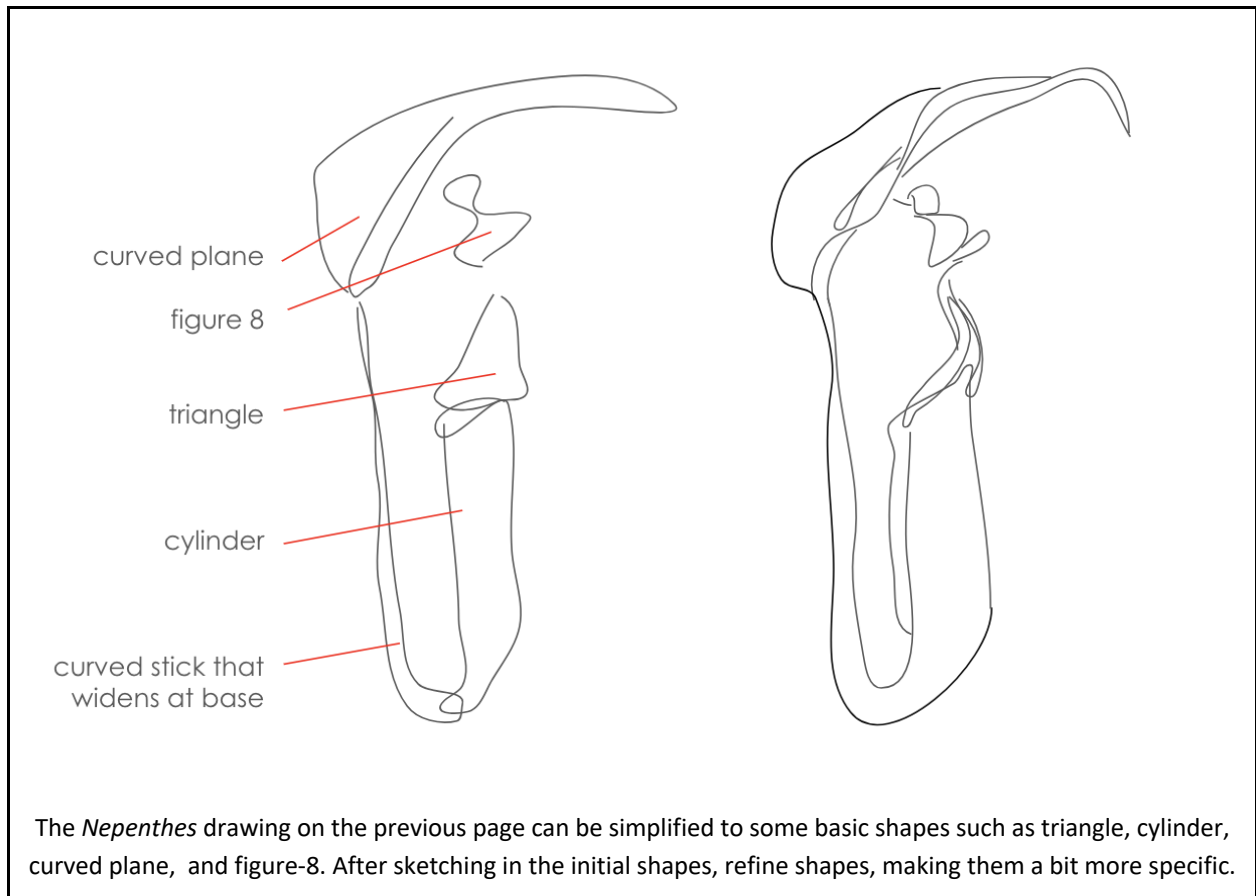
## FIND SHAPES

Reduce objects to **simple geometrical shapes**. Make sketches of the general shapes of objects and their parts. Breaking a complex object into components can increase understanding of structures.



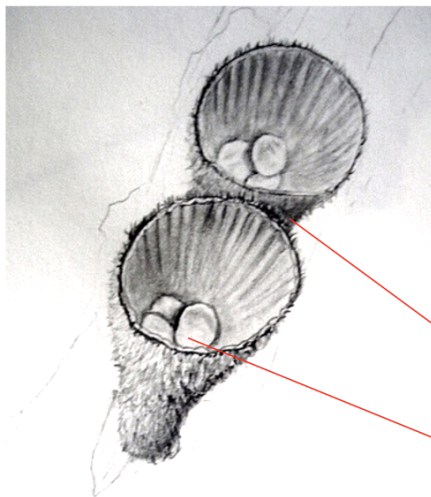






## Shading

### LOOK FOR AREAS OF LIGHT AND DARK



After roughing in the overall shape, practice shading in the drawing. Notice where the light source is and where the shadows are falling. Notice the quality of the light – are there sharp shadows from bright sunlight, or is the light softer and more diffuse? Look for **areas of light and dark**. In the drawing to the left, what shapes have the darkest values? What shapes have the lightest? How many in-between values of gray can you identify?

**darkest value**

**lightest value**

**Color pencil and a bit of color theory**

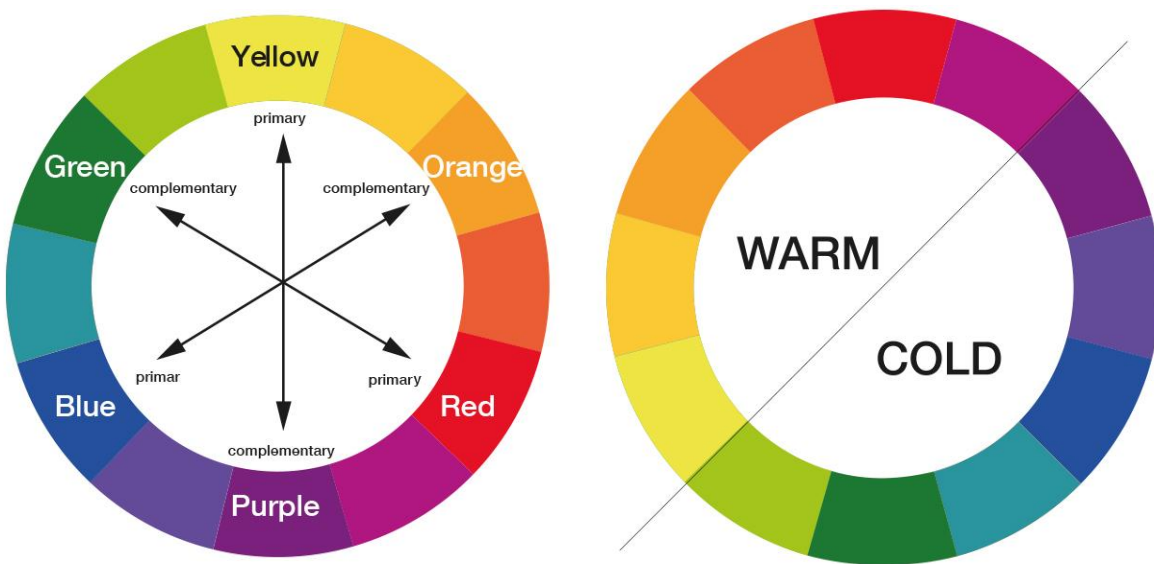
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There are many resources available describing how to work with color pencil, so this is only a quick summary. Here are a few tips that can be useful.

### Color language

First, a reminder about the color wheel, and some color language:

- Hue - “what color” it is, for example “orange”
- Temperature - warm (reds, yellows) vs cool (blues, blue-purple, blue-green)
- Saturation - how “rich” or intense it is vs how “greyed.” Jewel tones are highly saturated.



### Palette

A palette of color pencils does not need to include every color in nature, because every color can be mixed from a limited palette of a dozen or so colors. Unlike a lot of other art supplies, brand matters – Berol Prismacolor are preferred. Color pencils are made from a binder, in this case a type of wax, and pigment. The advantage to Berol Prismacolor is a higher ratio of pigment to binder, which means the colors will be richer. If you’ve ever tried to work with inferior supplies, Crayola color pencils for example, you may have experienced frustration because those have a much higher binder to pigment ratio. No matter how much you draw onto the paper, there’s very little pigment being deposited, as it’s mostly wax. Here is a palette of Berol Prismacolor color pencils that I recommend. At the time of writing this Guide, each one costs around \$1.50. The links are only for your convenience – these are commonly available at most art supply stores and online.



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| Primary Colors                | Secondary Colors             | Earth Colors                 | Optional / Shared                                   |
|-------------------------------|------------------------------|------------------------------|-----------------------------------------------------|
| <a href="#">Crimson Red</a>   | <a href="#">Olive Green</a>  | <a href="#">Tuscan Red</a>   | <a href="#">Colorless Blender</a>                   |
| <a href="#">Pink</a>          | <a href="#">Apple Green</a>  | <a href="#">Sienna Brown</a> | <a href="#">Embossing tool, small,</a><br>about \$6 |
| <a href="#">True Blue</a>     | <a href="#">Chartreuse</a>   | <a href="#">Yellow Ochre</a> | <a href="#">Exacto knife</a> about \$6              |
| <a href="#">Indigo Blue</a>   | <a href="#">Parma Violet</a> | <a href="#">Dark Umber</a>   |                                                     |
| <a href="#">Canary Yellow</a> |                              |                              |                                                     |



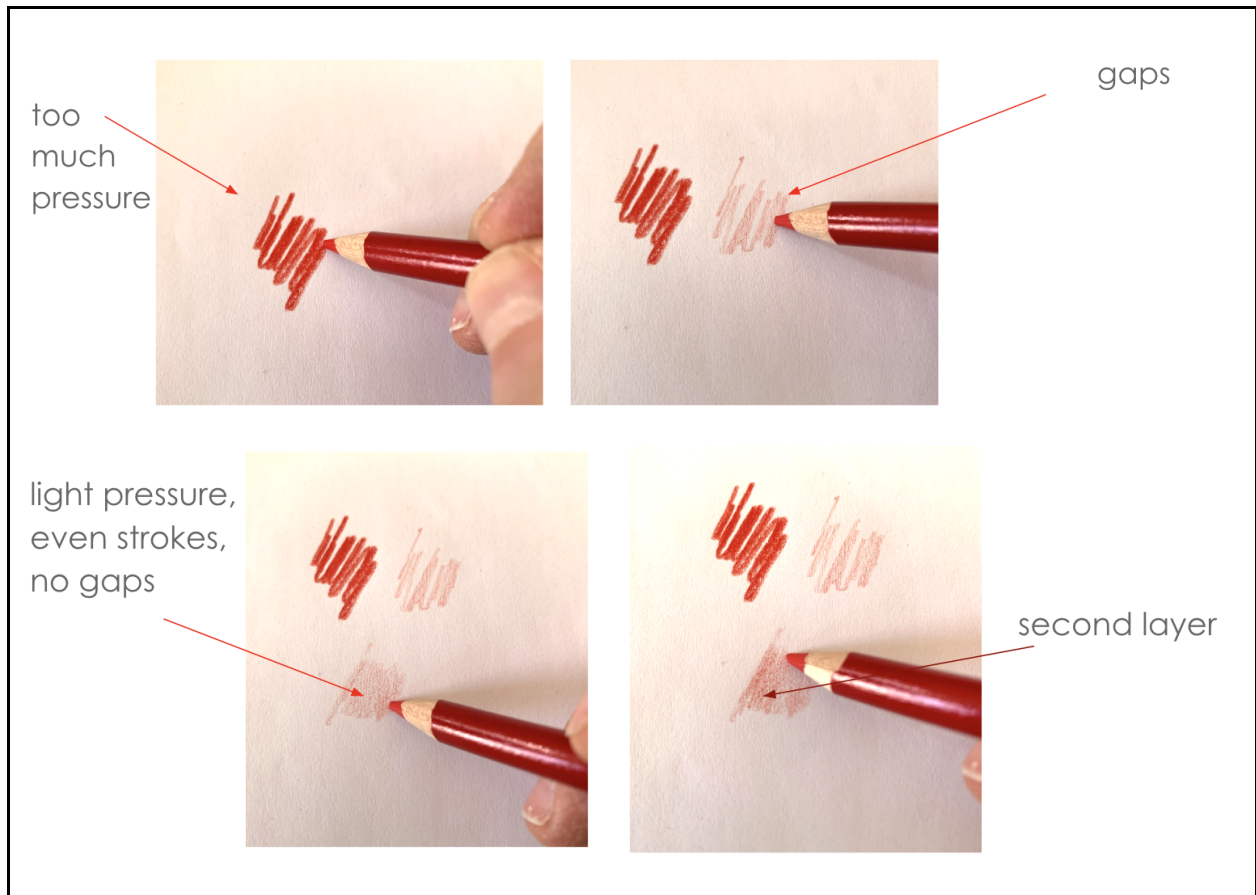
A palette of color pencils is ideally only about a dozen colors - others can be mixed.



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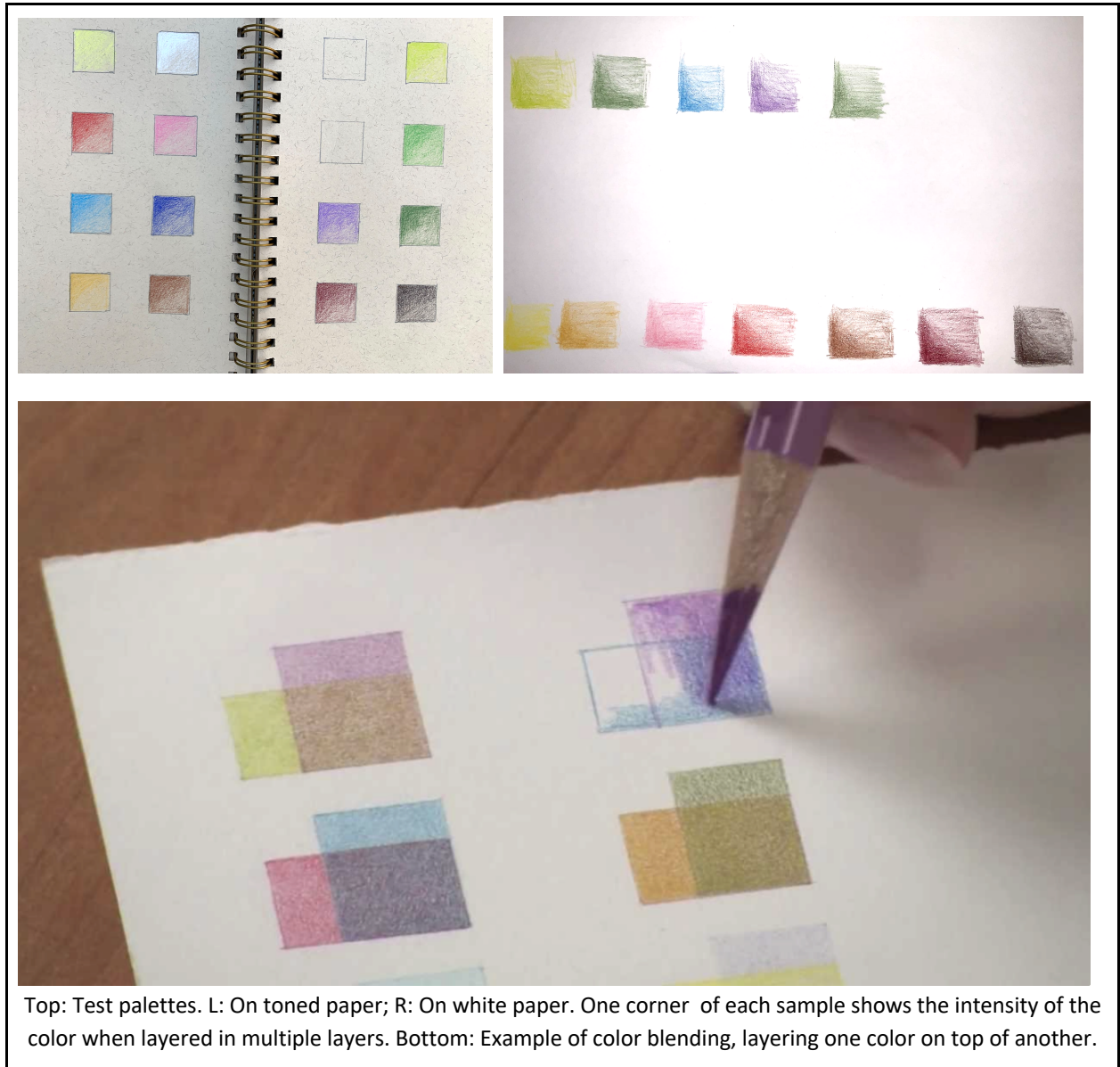
### Color pencil technique

The technique when working with color pencils is deceptively simple, but the trick is to lay down an **even layer of color** with **light and even pressure, leaving no gaps**. If there are gaps, go back and fill them in with light, even strokes. Even if the end goal is an area of deep, intense color, this is not achieved by bearing down with a lot of pressure – it's achieved by multiple layers of color. Light, even layers of color, layered one on top of another gives you the greatest control.



One good way to practice the technique, and also create a tool for later use, is to make a test palette. The colors will invariably look a little different on the page than the color painted on the outside of the wooden pencil. This test palette will serve as a handy reference later when drawing in the field, for comparison to colors in the natural world.

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Top: Test palettes. L: On toned paper; R: On white paper. One corner of each sample shows the intensity of the color when layered in multiple layers. Bottom: Example of color blending, layering one color on top of another.

### Color mixing

To make colors more natural, they need to be blended by layering on top of the other. To make colors more “neutral,” less saturated, add a color that is opposite on the color wheel. For example, to make an Apple Green or Kelly Green look more like a natural leaf color which might be a muted olive color, add some red. This is fairly counterintuitive so it’s a good idea to try it on a scrap paper first so you can practice which red and green you want to use, how much of each, which order to layer them, what other colors to add, etc. Olive Green and Tuscan Red are a combination you might try, for example. If it needs to be deepened, for example in shadow, a light layer of Indigo Blue on top of that. If it needs to be brightened up a bit, try a layer of Yellow Ochre. These are just some examples of color combinations and

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you'll need to work with what's in front of you – **Look, Draw, Edit** – and try several samples on scrap paper to see what works.

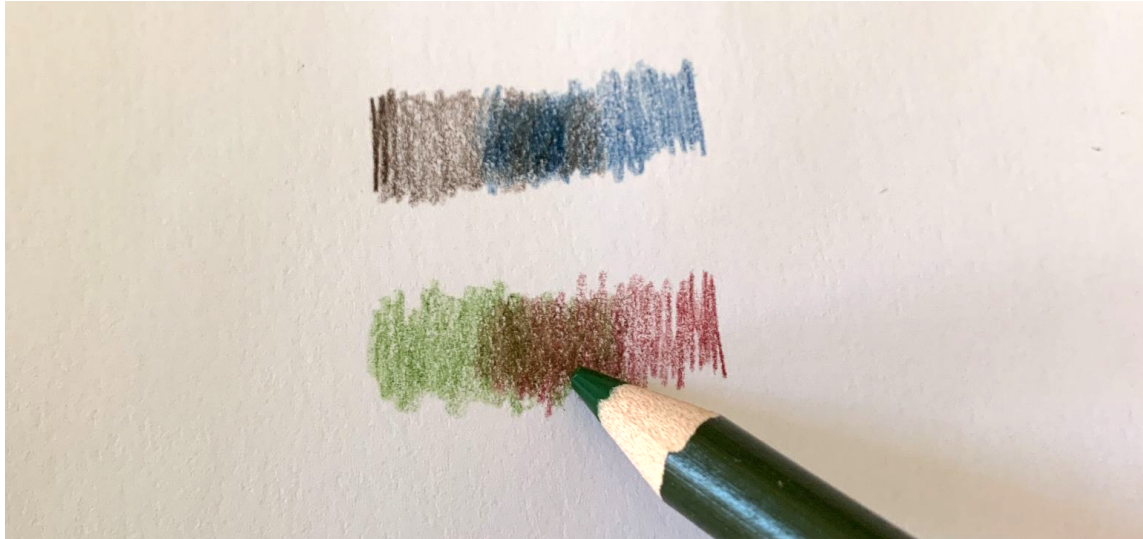
The color mixing using colors opposite on the color wheel is also useful for shadows. For example, to shade a yellow flower petal, it's not just darker, it's more grey, so you might add a (VERY) light layer of Parma Violet. The Violet is a much stronger color, so you'd probably want several layers of yellow and only the very lightest pressure with the Violet, and maybe another layer or two of some of the yellows on top of it.



Two layers of Canary Yellow, a bit of Yellow Ochre in the corner, then a very light layer of Parma Violet.

This principle also works for making black. Notice there is no black pencil in the recommended palette. That's because in nature, there are very few "pure blacks." There are green-blacks (think of deep shadows in hemlock or spruce), brown-blacks (think of furrows in a tree trunk), blue-blacks (think of the shadow of a shark skin as it swims into the darkness of the ocean), etc. Mixing blacks takes a bit more time, but it will produce a much more specific and accurate color. With the recommended palette, try layering Dark Umber + Indigo Blue, or Olive Green + Tuscan Red (more layers will move from deep green to deep brown to dark grey).

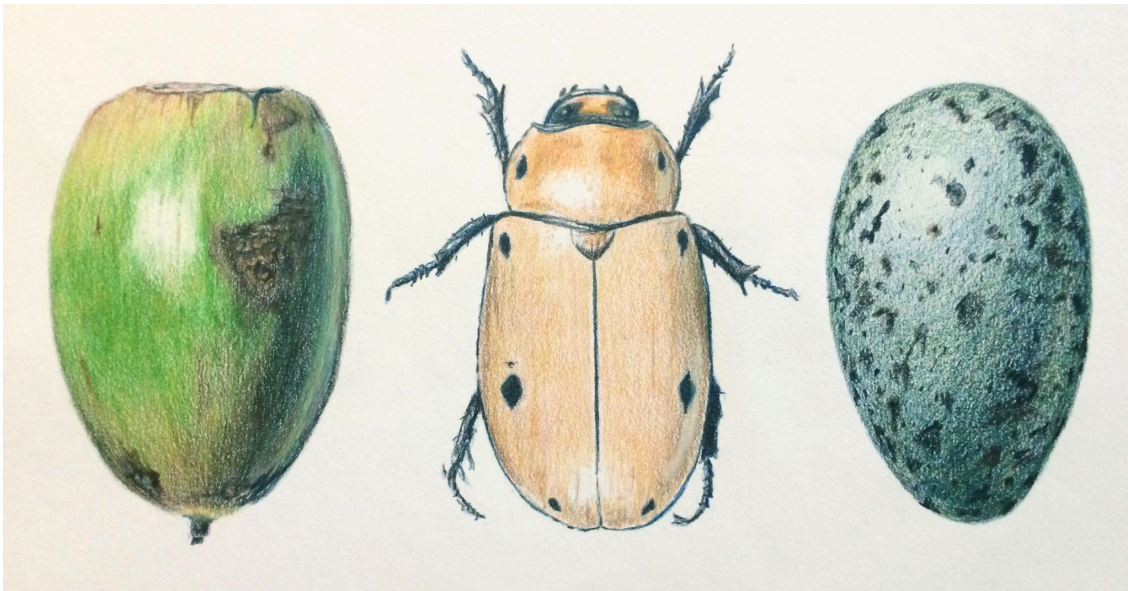




Above, Dark Umber + Indigo Blue in multiple layers; Below, Olive Green + Tuscan Red.

Use the white of the paper

Making a color pencil composition requires a bit of planning ahead. Make a pencil drawing first, outlining the outer contour lines and any interior lines dividing parts, or describing shapes like highlights, shadows, or color changes. You use the white of the paper as the lightest light, so you want to draw the shape of those highlights so you can avoid laying down any color there.



Use the white of the paper for light areas. Because the eggshell had a more matte surface, I added a very light layer of color to the egg's highlight whereas the acorn was more shiny and had an almost pure white highlight.



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### Removing color pencil (partially)

If you make mistakes, color pencil can't be erased. But you can remove some of it.

- 1) Using an Xacto knife, VERY gently scrape some of the wax and pigment off the surface of the paper, taking care not to dig into the fibers of the paper. If you start seeing paper fibers, stop.
- 2) Gently BLOW the color pencil wax crumbs from the paper – DO NOT brush the crumbs away with your fingers as they will leave streaks on your paper.
- 3) With a kneaded eraser, gently dab at the area where the color pencil was removed, which will pick up a bit more of the pigment. You won't get back to the white of the paper, but you can make the color lighter, and sometimes this enables you to go back over it with another color. There's a limit to how much you can mess with it, though, because you've now disturbed the paper and color pencil layers and it may be hard with any high level of detail.



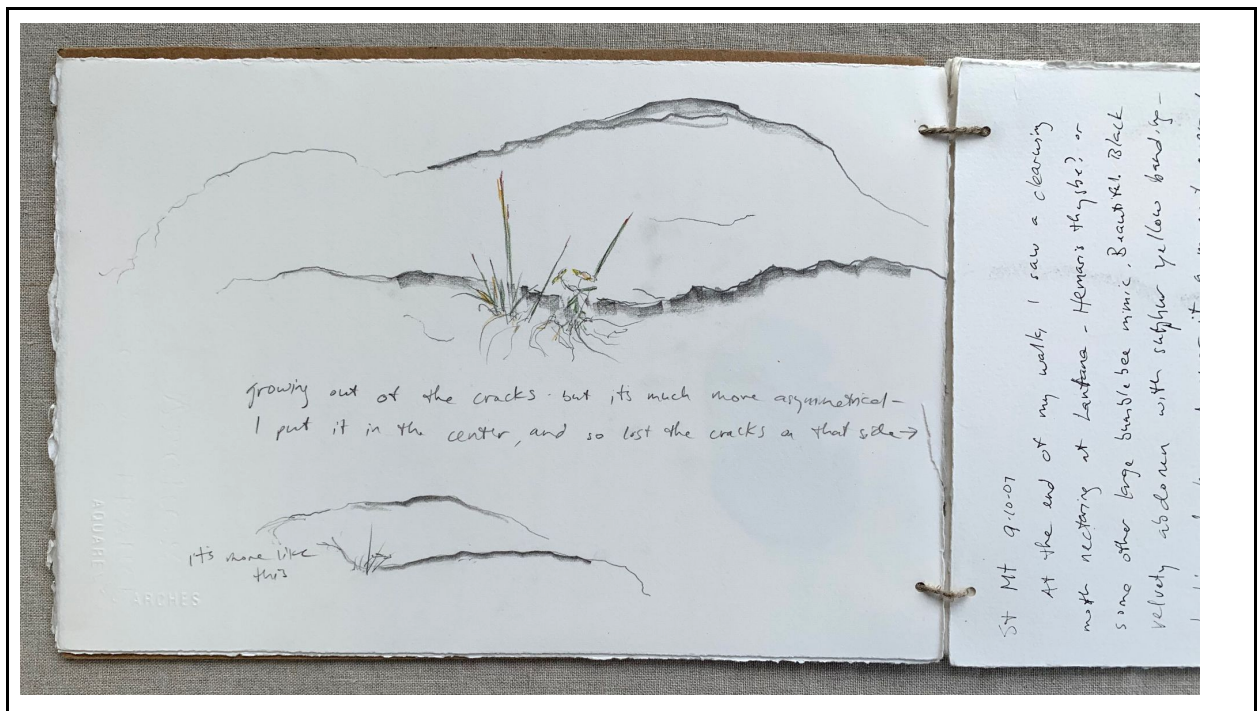
Using a sharp Xacto knife, gently scrape some wax and pigment off the surface, without disturbing paper fibers.

## B. Nature journaling

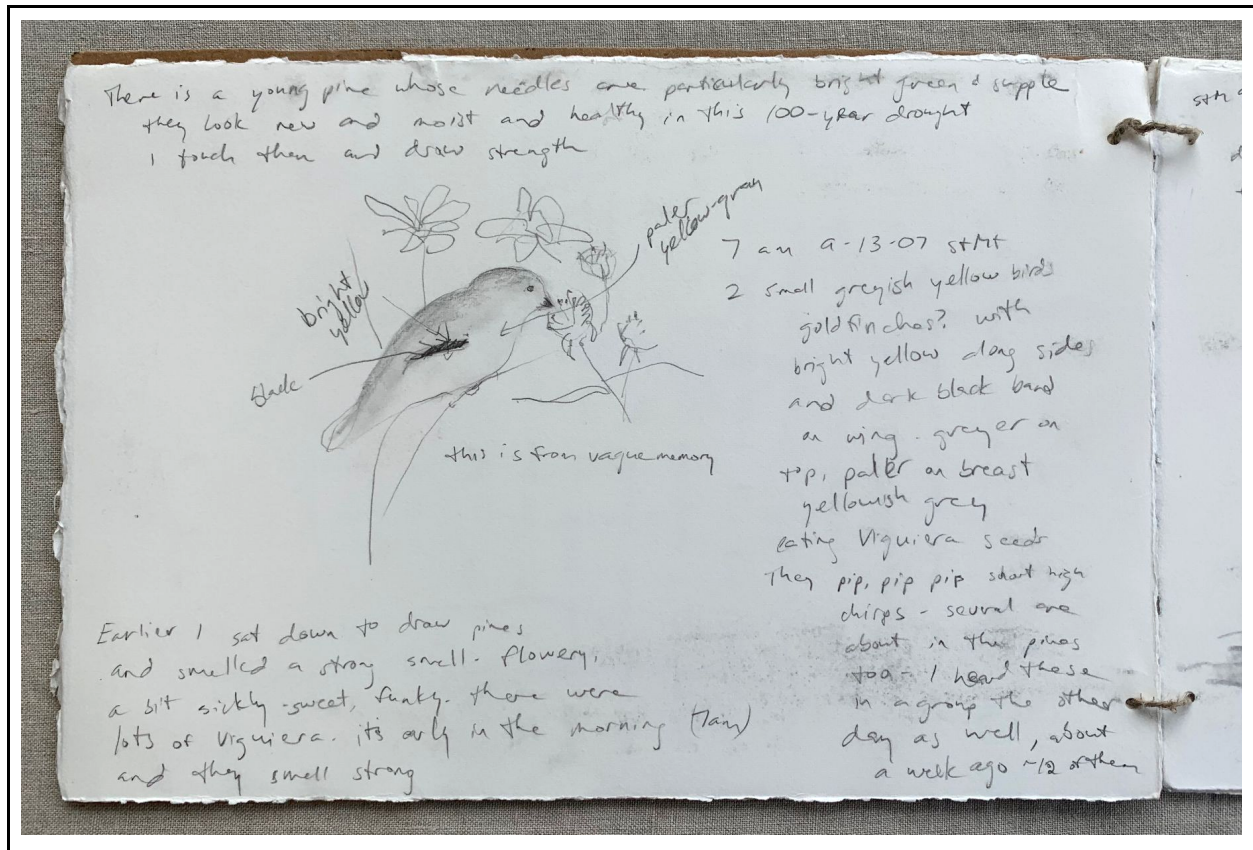
Nature journals can serve many functions. They may be simply a depository for collecting data in the field, they may be an invitation to be more observant and attentive, they may be opportunities to sketch maps, organisms, stream diagrams, and many more uses. Whatever your reasons for requiring students to keep a nature journal, you may find some of the following ideas to be useful.

### Gesture drawings

One of the simplest ways to dive into a nature journal is to make a few quick sketches and notes. This can be a really low-pressure, low investment activity, and can take as little as five minutes. From the warm-up section, you will remember that gesture drawings quickly capture the general shapes such as a plant's habit, leaf direction, etc. They are quick sketches that allow you to remember patterns, placement in the landscape, habitat, etc.



Gesture drawings are great for capturing animal movement. Sometimes in the field, animals move away quickly so you have to draw from memory, but a quick gesture drawing can anchor the overall image and provide a place to start making notes such as "field marks" – What shape was the beak? Was there a stripe? Dark marks?



**Gesture Drawing PROMPT:**

Ask students to make quick sketches in the field followed by notes, which can include:

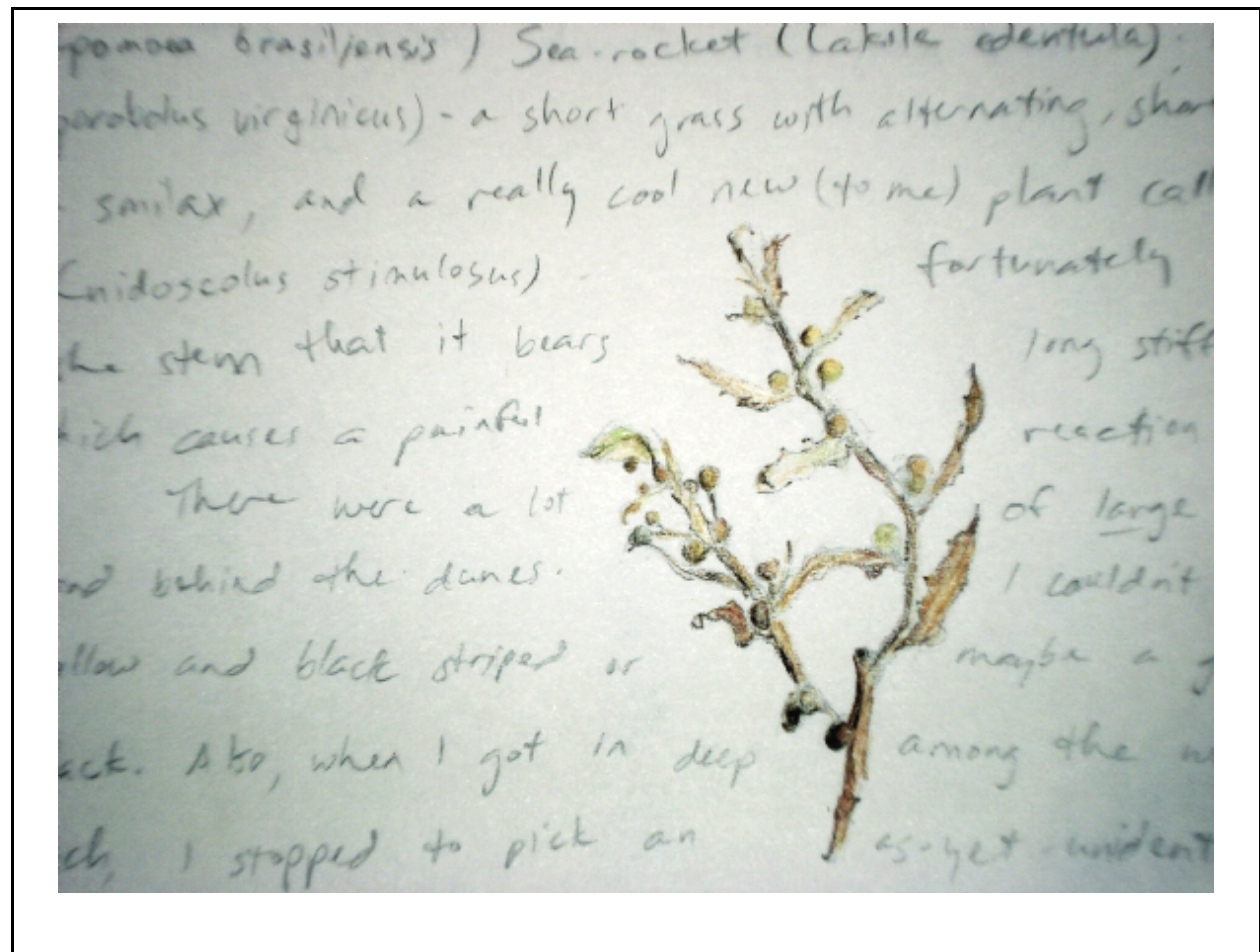
- Observations about the species / landscape they were drawing
- Observations about weather, sounds, smells, environment
- Questions, predictions that they might follow up on later.
- Notes prompted by:
  - **I notice...**
  - **I wonder...**
  - **It reminds me of...**



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### 10 x 10 x 10

Focusing on a very small area for a short time can heighten observation, and toggling back and forth between drawing and writing engages different parts of our brains. This simple activity increases observation quickly.



### 10 x 10 x 10 PROMPT:

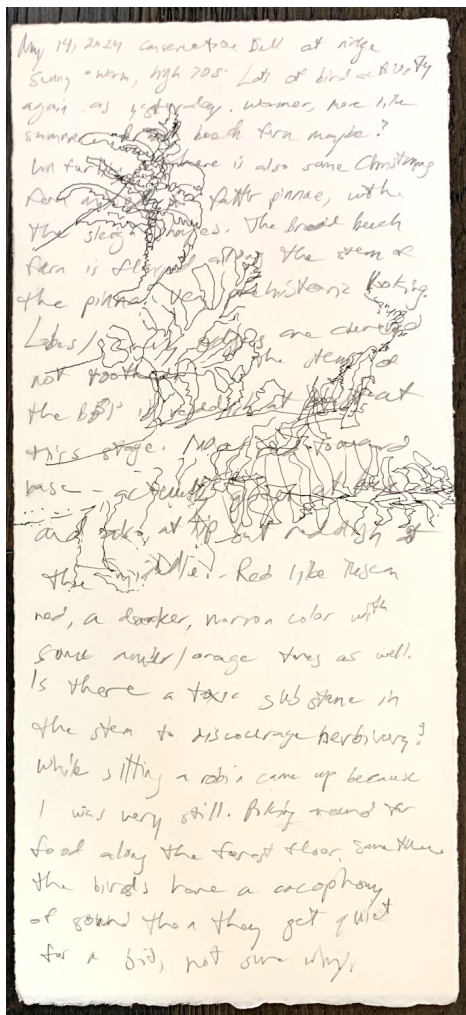
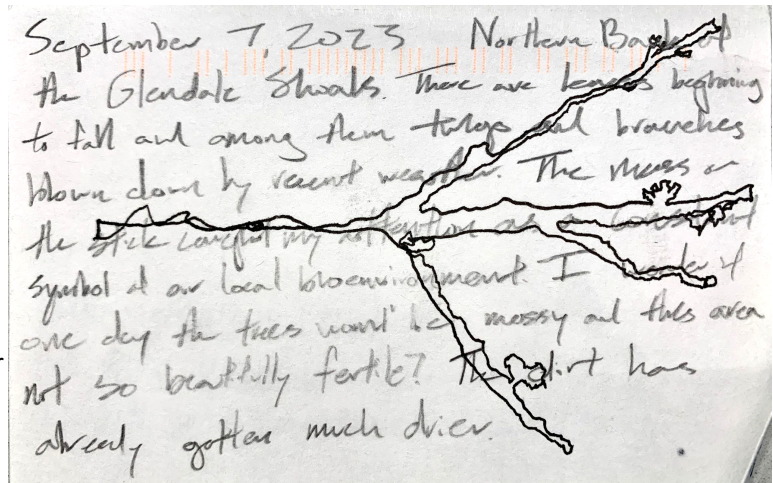
- 10: For **10** minutes sit in a natural area and observe.
- 10: Then draw something the size of the palm of your hand (roughly **10** cm square).
- 10: Then write **10** observations or questions about what you observed.



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### Artifacts of Attention

Like 10 x 10 x 10, this exercise also toggles back and forth between drawing and writing, and because it starts with blind contour which is especially low-pressure. The value of blind contour in this instance is that it encourages close attention and the student can focus entirely on the environment without worry about whether or not their drawing is “good enough.”



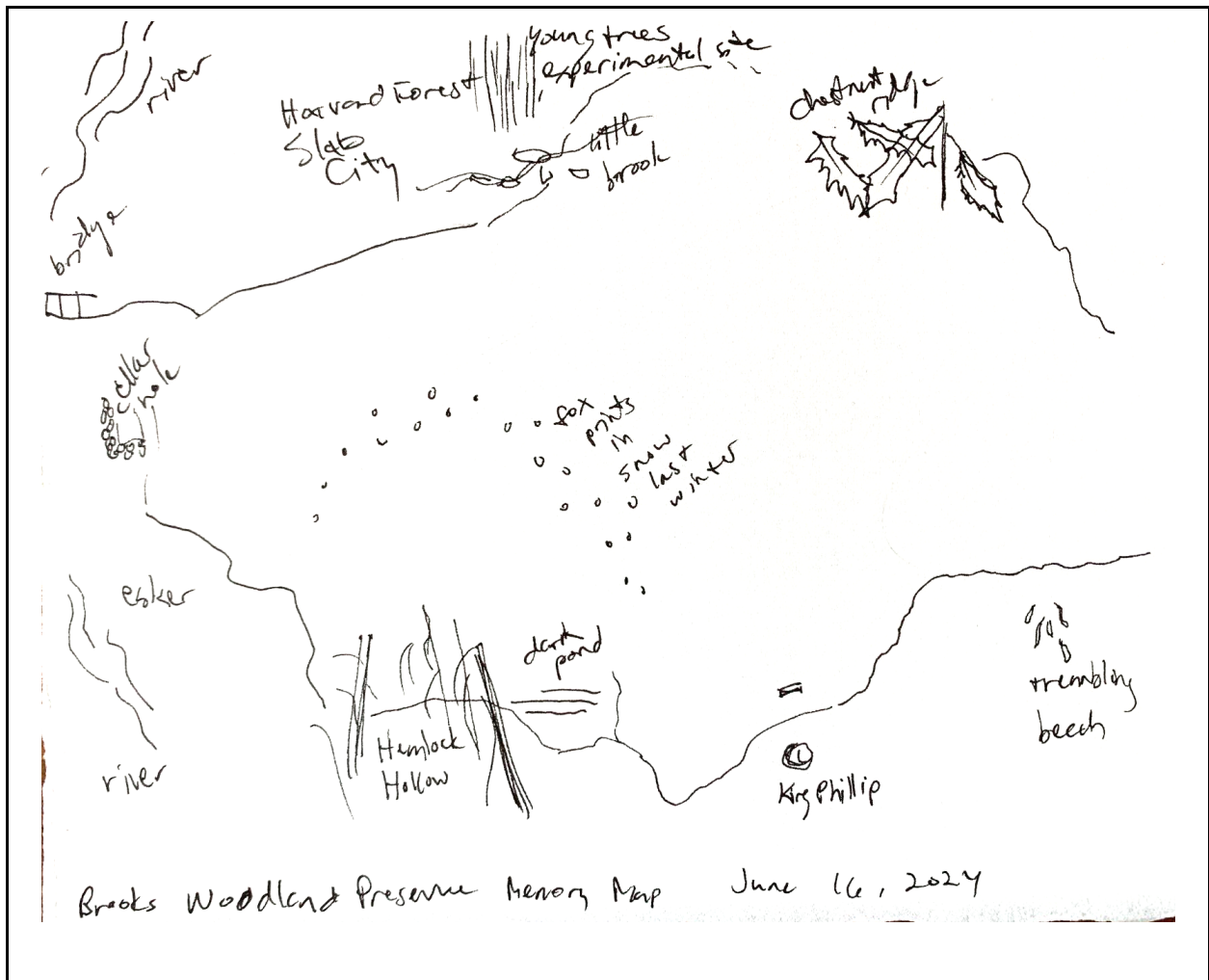
### Artifacts of Attention PROMPT:

- **Step 1: in pen:**  
Blind contour - looking ONLY at the subject and NOT at the paper, slowly and attentively trace the outlines of its contour, like an ant crawling slowly along the edges, trace every innie and outie.
- **Step 2: in pencil:**  
After several minutes of slow, attentive blind contour drawing, write observations about what you noticed while drawing.

The resulting drawings and notes will have a sketchy scribbly quality, raw and unpolished.

## Memory Map

A memory map is intended to be an evocative record of experience, rather than a cartographically accurate depiction of geography. It may contain notes about place such as “where I tied my boot laces” or “fox tracks last winter” or “sounds of wind in the trees.” The map is not likely to scale, and is instead in proportion to experience or memory.



**Memory Map PROMPT:** After a hike, canoe, or other trek, or after multiple trips to the same location, draw a map of the site from memory. Label it with memories and place names based on experiences, natural observations, etc.

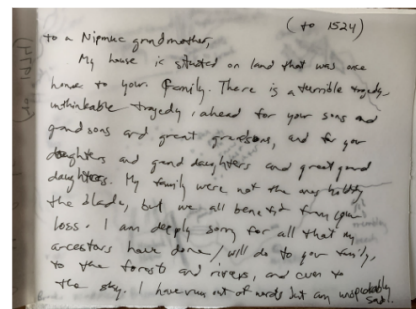
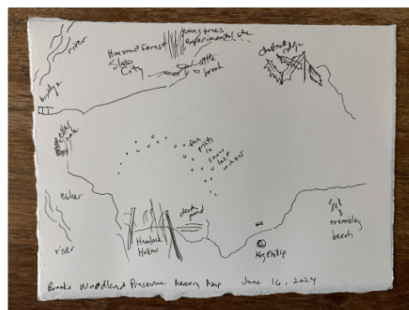
# Ecotones Guide for Arts at Field Stations & Marine Labs – 2nd Edition

## Layered Landscape Letters



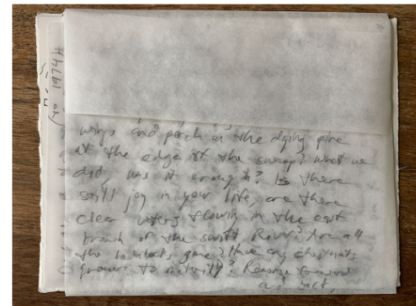
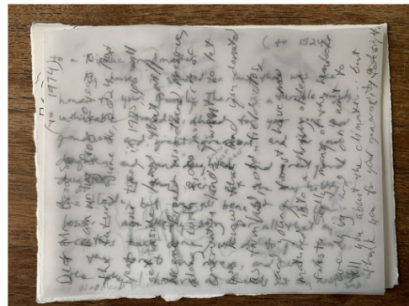
This activity draws attention to layers of natural history and cultural history in a place, and is based on a *palimpsest*. A palimpsest is a document that has an older layer of writing that was partially erased, and a new layer of writing on top of the old, often oriented sideways to the original writing, and the older layers partially show through. Left is a page from a 13th century Byzantine prayerbook, written on top of treatises from Archimedes that had been copied in 10th century Constantinople.

The “Layered Landscapes” activity starts with an image of the landscape, then layers other speculations about past and future on top of that landscape.



## Layered Landscapes PROMPT:

Start by drawing a landscape, which might be an accurate map, a memory map, a landscape drawing, etc.



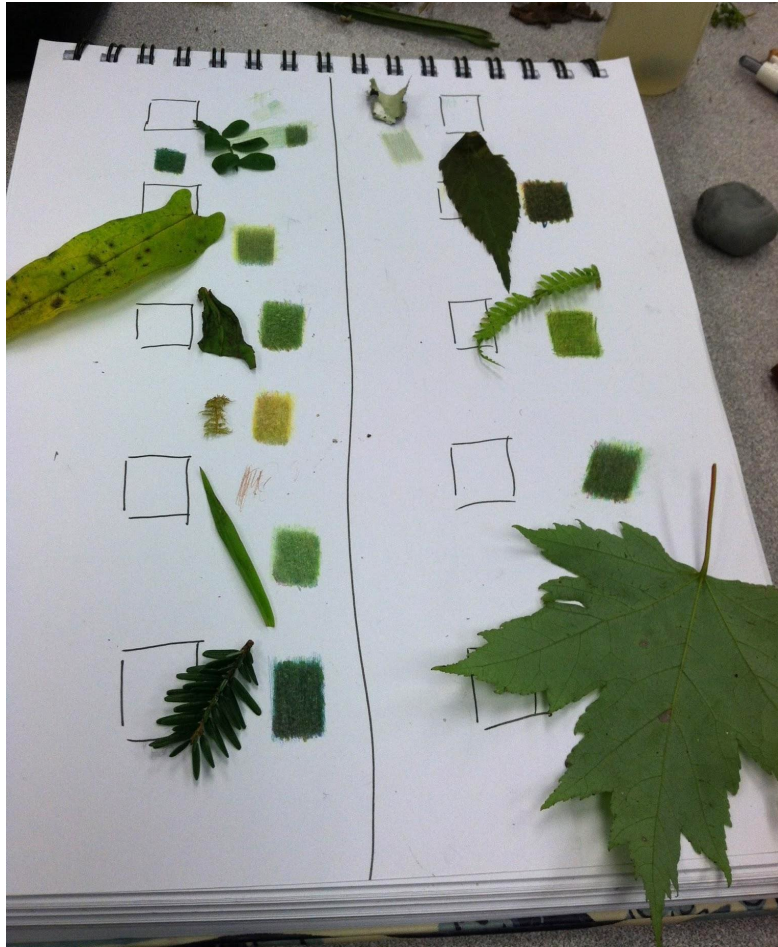
On tracing paper, vellum, translucent paper, or other translucent paper, write three letters:

1. To someone who lived in that place 500 years ago
2. To someone who lived in that place 50 years ago
3. To someone who might live there 50 years in the future.

This activity encourages students to look for clues in the landscape suggesting natural and cultural history from the more distant past and the more recent past, and to imagine what might happen to that landscape in the future



## Green Day



This exercise is helpful as a first activity after learning color pencil techniques, and is used to practice color mixing. The challenge of learning how to “make color” teaches students how to see color more accurately, which can lead to more nuanced natural history observations such as why young leaves might be bronze in color, or why conifers often have a deeper green color than broad-leaved trees.

### Green Day PROMPT:

Draw 5-10 squares rectangles in pencil .

Find five different shades of green, for example

- a deep dark forest green in shadow,
- a bronze green,
- an icy green,
- a bright spring-green chartreuse,
- and a kelly-green shade.

Use what you know about color mixing to make the square match the color, as close as you can.

Work slowly.

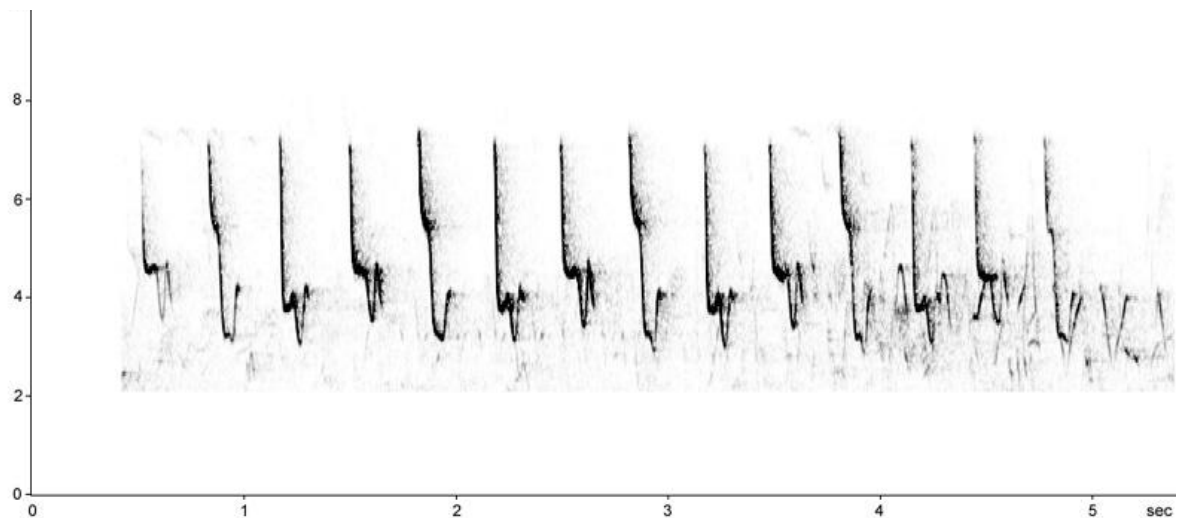


## TWO NATURE JOURNAL PROMPTS FOR SOUND

Many nature journals focus on what we can see. In addition to what we see, what we hear can give clues about the environment, but sounds are harder to record and quantify. Here are two ways to capture environmental sound – one, using a musical staff to create a record of sounds over time, and two, a sound map to create a record of sounds in three-dimensional space.

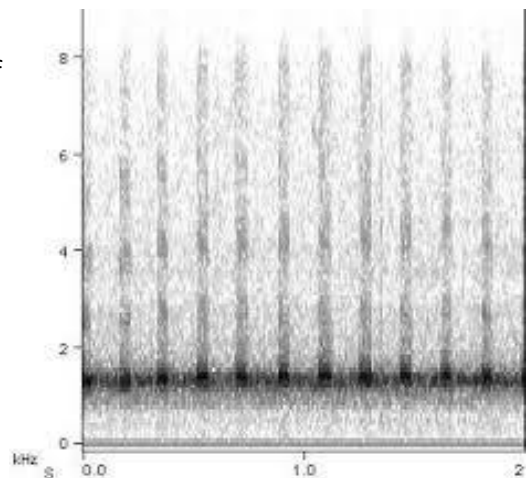
### Music of Sound

A sonogram produces a record of sound over time, with the x axis representing time moving from left to right, and the y axis representing frequency. In sound, “frequency” translates as high or low pitch, with lower sounds appearing higher on the sonogram and higher sounds appearing higher on the sonogram. For example, in the sonogram below, this is a series of rapidly repeating, descending chirps, each with a little trill at the end.



Buzzy sounds or “white noise” occupy many frequencies. The term “white noise” means that the sound is made up of so many different frequencies from low to high pitch that it doesn’t have a pure tone. This is analogous to the color white, which is made up of many different wavelengths of light in the color spectrum. Here are two examples of white noise. Rather than pure tones, these might sound like “CH - CH - CH - CH - CH”

Musicians will be familiar with this way of depicting sound, as it’s similar to musical notation, which is also like an x-y axis, with time moving left to right, and high and low pitch depicted on the “y-axis.”



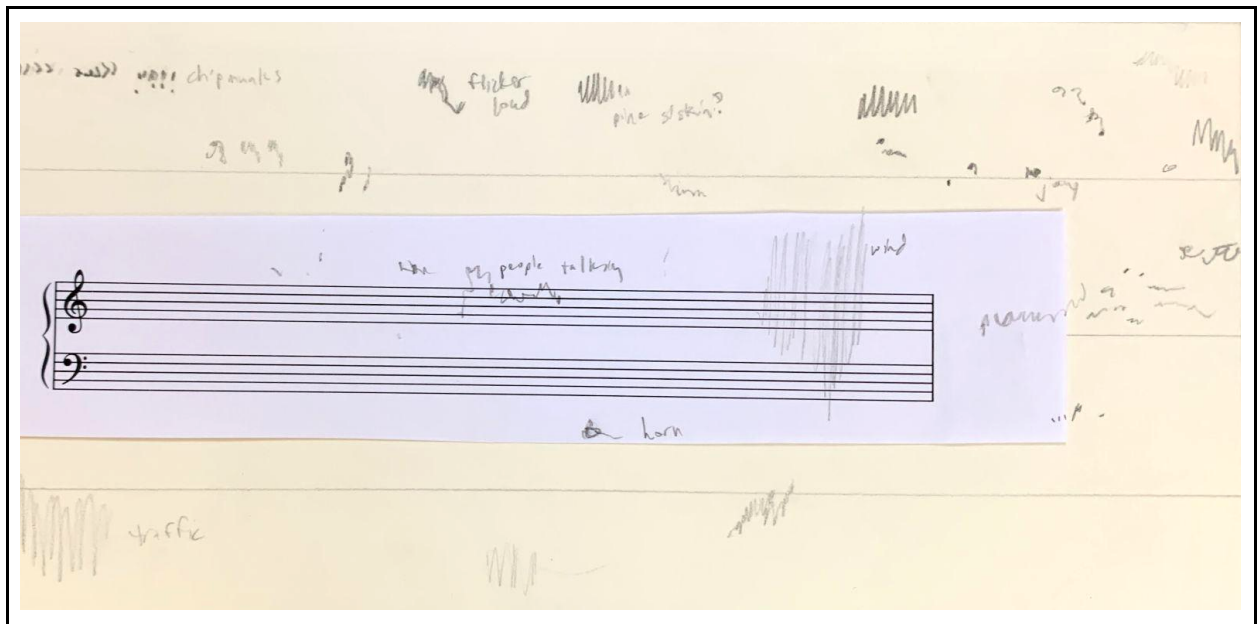
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Below, the syllable "some" is a low note, depicted low on the staff, and the syllable "where" is high on the staff.



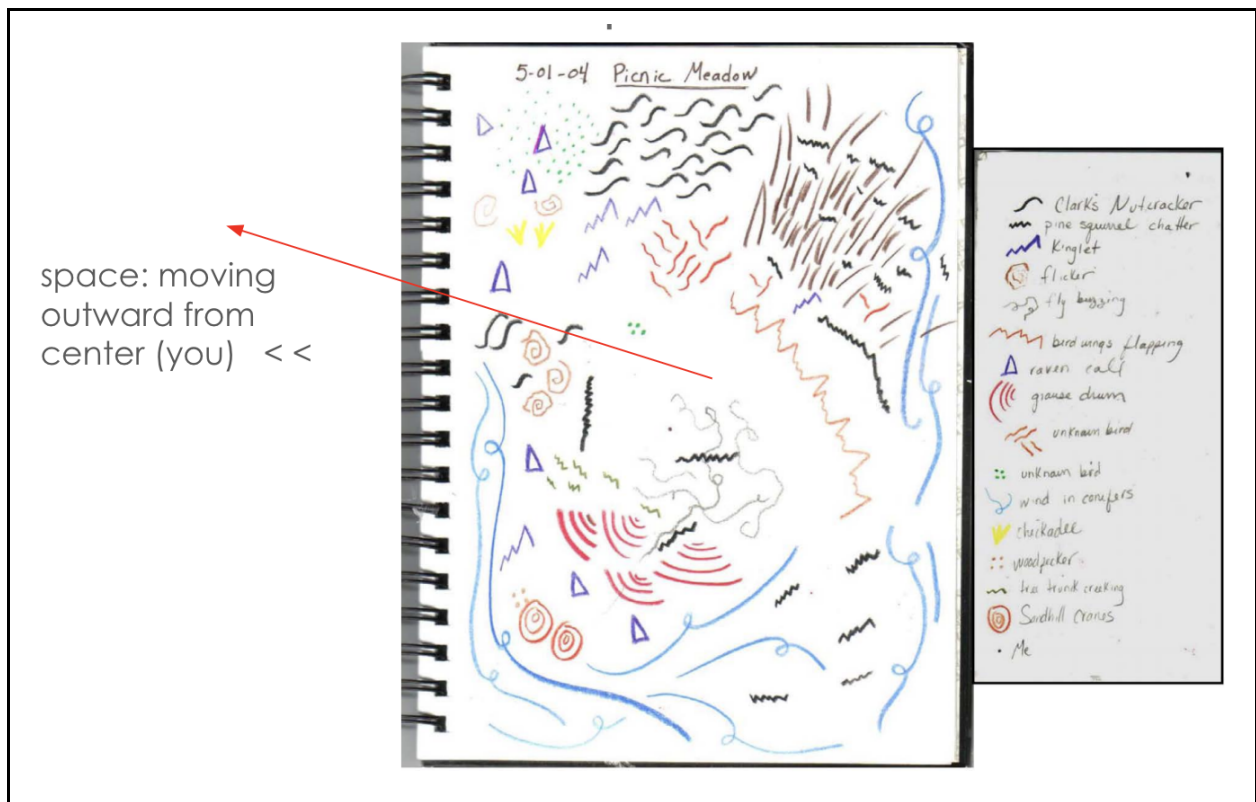
### Music of Sound PROMPT:

With the staff as the range of human voice, mark high pitched sounds above, and low pitched sounds below the staff. With time flowing from left to right, you can designate a set time for example, one minute of listening.



## Sound Map

Rather than depicting the pitch and frequency of sounds, a sound map simply places them in space, relative to the listener. You can create a visual key with shapes, colors, numbers, etc. that symbolize certain sounds you are hearing in the landscape. Don't feel pressured to name the species of animal making the sound, but instead give them sounds your own descriptive language. If you know it's a crow, write "Crow," but you could also write "Caw" or "Squawk" to describe the quality of the sound. You might also describe "rustling" or "buzzing" or other sound words like that, without naming the source if you don't know it.



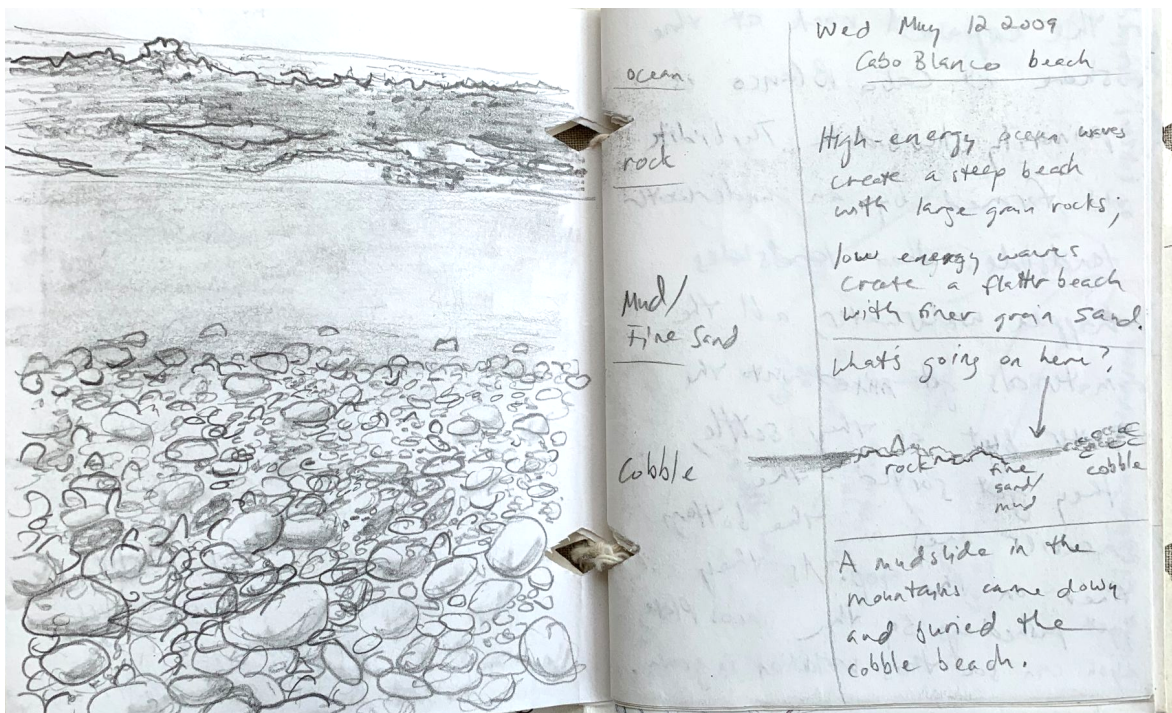
**Sound Map PROMPT:** To make a sound map, you can assign symbols to different kinds of sounds, then place them in the landscape, with yourself at the center.

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## Zones

To observe patterns – patches, communities, and zones.

- In a forest, what types of trees are around you? What ages are trees (estimate)? What parts of the forest are younger / more disturbed?
- In a meadow or field, what are plant habit types, what leaf shapes?
- What patterns on the landscape indicate different soils, salinity, or moisture?
- At the ocean edge, what organisms/ patches exist along tidal zones?)
- What are patterns of animal signs – patterns where animals have eaten, patterns of tracks?



## Zones PROMPT:

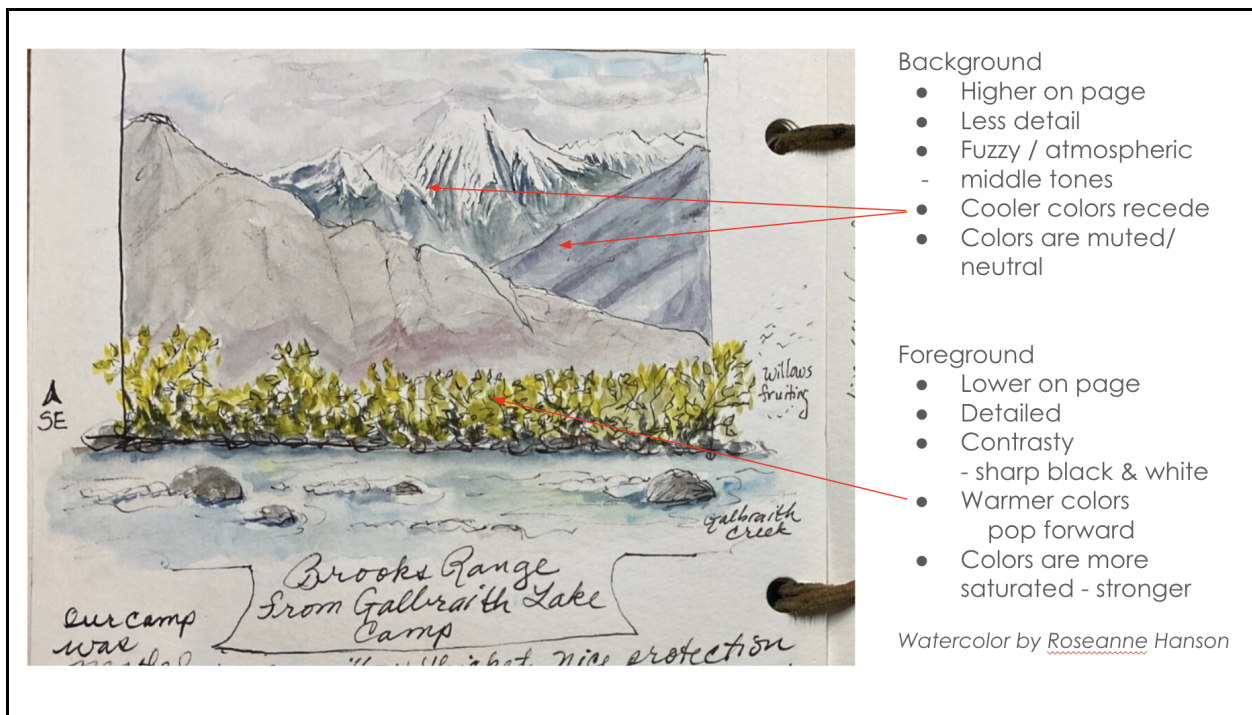
Use photos, drawings, symbols, and/or writing to record patterns, then follow up by asking questions about possible causes for the patterns.

- What do you notice about transitions or zones of habitats or microhabitats?
- What do you think caused/ is causing those changes?
- What do you predict?



## Landscape Drawing

In the field it's often useful to record an overall view of the landscape. Maps are helpful, but a landscape drawing can capture even more detail about landforms, water, flora, etc. A landscape drawing seems simple but it can be challenging to give a sense of depth. Here are a few tips that can help: Foreground objects are larger, more detailed, with more contrast between lights and darks, and with warmer colors (greens shift toward more yellow-green). The background is higher on the page, objects are smaller, there is less detail, lower contrast (think misty or foggy), and colors are cooler (greens shift toward blue-green). The reason the background is low-contrast and cooler in color is that you are looking through the atmosphere, which shifts color toward blue.



### Landscape Drawing PROMPT:

Draw a landscape that includes foreground, middle ground, and background.

Make the **foreground more detailed**, and in the background just general shapes. (Hint: You don't have to draw every blade of grass in the foreground, but if you draw a few in detail, the mind's eye will fill in the rest.)

Use **more contrast** in the foreground, and in the background, use more grey areas. If using color, use **warm colors** in the foreground.

## C. Rubrics for Observational Drawing & Nature Journaling

Here are a few rubrics that others have developed to assess student work in natural history observation drawing, and in nature journaling activities. They are available on the internet and can be adapted for your own use.

### Drawing in biology rubrics

- [Scribd Scientific Drawing rubric](#)
- [Teachers Pay Teachers \(free\) Microscope drawing rubric](#)
- [Teachers Pay Teachers Draw a Cell rubric](#)

### Nature Journaling rubrics

- [Wild Wonder nature journaling rubric](#)
- [RCampus nature journaling rubric](#)
- [NSTA Nature journaling rubric](#)



Students at Shoals Marine Lab doing observational field sketches as part of an Animal Behavior class

## 10. Creativity and its role in science

One of the common questions that comes up when discussing art-science interdisciplinary work is “What does art bring to science?” Finding value in science for artists may be more evident on the surface, but beyond illustration and storytelling with clarity and emotional impact, what do artists do for science, really? I think one of the most compelling reasons for scientists to invite artists into their milieu is that artists are comfortable working with **creativity**. Creativity is not the opposite of critical thinking – it’s a complementary tool that, used in balance with analytical thinking, can lead to innovation.

This section will point out a few good reasons for creativity at FSMLs, some ways to open up creative thinking, and research-based processes that temper creative thinking with analytical thinking. The final section will close by pointing out some ways that field stations and marine labs already provide fertile environments to promote creativity.

### Why do FSMLs need creativity?

In the excellent collection of essays entitled “Ecology of Place, Contributions of Place-based Research to Ecological Understanding,” edited by Ian Billick and Mary V. Price, in the chapter “Ecological Invariance and the Search for Generality in Ecology” Ron Pulliam and Nickolas M. Waser write about the importance of creativity: “...excessive regimentation can stifle creativity, akin to artistic creativity, that represents the most mysterious and productive aspect of the scientific endeavor. Although “wild ideas” are usually just that, it is equally true that forward leaps in understanding usually are culled from such unorthodoxy, so we would be ill-advised to impose any orthodoxy too strongly.”

“Intuition is the forgotten half of scientific thinking.”

- Marten Scheffer

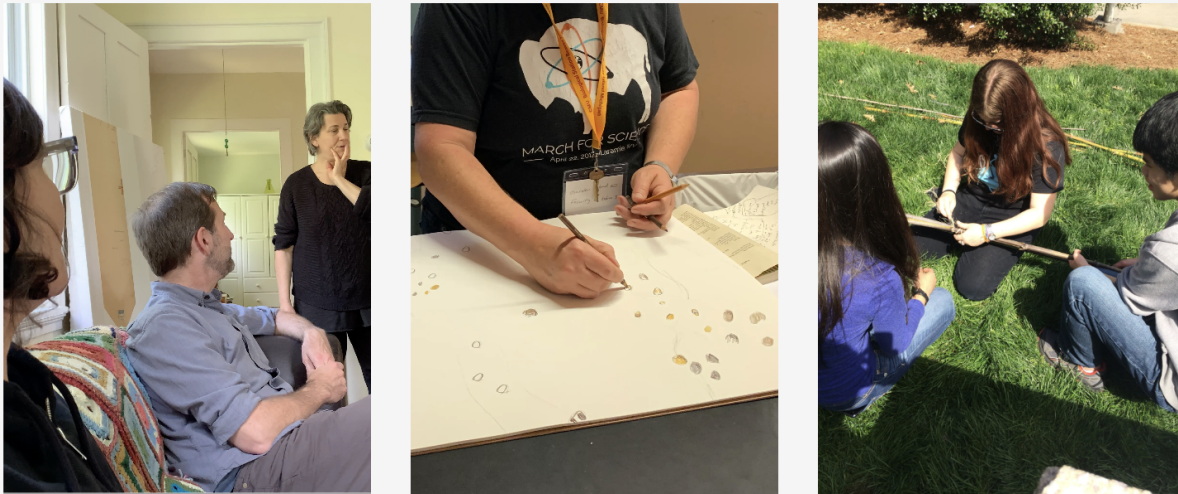
### Creativity in science

While it may seem that creativity is more relevant to the arts than to science, creativity has a role in scientific work as well. There is always problem-solving in the lab and the field, and that invariably involves some creative thinking. Scientists often need to make a new tool or adapt an existing tool for a new purpose. Experiments rarely go as expected, and sometimes the work needs to take an unexpected turn. The curiosity that leads to exploring a new direction, the spirit of innovating, the courage to tolerate uncertainty – these are key elements of creativity. In that light, creativity is one of the key things that art and science have in common.

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### Creativity in art-science interdisciplinary work

Creativity plays a major role in art-science interdisciplinary work as well. It can feel daunting working across disciplines, especially wandering into the borderlands between fields that differ as much as art and science do. It's a challenge determining which "rules" guide an interdisciplinary project, or whether it makes sense to invent new "rules" to fit the trans-disciplinary work. This is true whether the interdisciplinary work is a collaboration between workers trained in two different disciplines or the work of one individual working across two or more disciplines. Creative thinking helps art-science disciplinary workers reflect on which guidelines or practices make sense, and to invent new guidelines that fit the goals and intentions of the art-science project.



Left: Creativity workshop at Art + Science In the Field asIF Studio in Petersham, MA; Center: Art for Science Communication workshop at OBFS meeting 2022, Right: Emory University students working on "Evolution: An Art Experiment" for Atlanta Science Festival.

### Creativity in other aspects of FSML mission

Innovative and imaginative thinking is important to education, conservation, cultural work, community collaboration, and planning for an uncertain future. Guiding students to think creatively is one of our best weapons against the rising tide of AI, when paired with critical thinking skills. Conservation goals often require unusual solutions that bring together unexpected partners – innovative strategies result when we open up to allow new ideas to emerge. When FSMLs seek to partner with community members, especially with those who have historically been marginalized, that cultural and community-building work often requires an open curiosity and willingness to try new things. In general, FSMLs face unprecedented challenges on every front – from public hostility to science to funding cuts to political turmoil. As we face a complex tangle of "hard problems" we will need to address them with our entire minds, our entire selves – intellectual and analytical yes, but also curious, intuitive, emotionally sensitive, aware of our senses.



## Where does creativity come from? And how can we get more of it?

Let's start with a standard definition of creativity, which is:

### Novelty + Usefulness

Any exploration that gives permission to a completely open, playful, wild imagination can produce something new. But an idea isn't regarded as creative unless it also serves some purpose. Usefulness might mean a tool for a new experiment, patched together out of junk lying around the lab. But it also might mean a work of art that audiences find surprising or moving: Wonder and emotional response are culturally useful. Or it might mean a new collaboration, bringing together surprising groups of stakeholders to meet conservation challenges.

It's a myth that creativity is reserved for a special few – it's a set of human skills that are available to all of us. Like athletic ability or mathematical genius, there may of course be those individuals who are outliers with regard to creativity, but we all have the capacity to make new connections and to innovate. The good news is this capacity is not fixed – we can increase our creative thinking. There is a growing body of evidence about how we can activate our creative thinking, develop creative habits, and collaborate in ways that better lead to innovation.

## What science tells us about creativity

### Remote associations

What do we mean by remote associations? Neuroscientists tell us that the brain can't actually create new ideas. Instead, we are retrieving information from our memory, then connecting those with other pieces of information stored elsewhere in our memory. It's through these connections, or **associations**, that we can make novel combinations that become new ideas. When we brainstorm, the first few ideas are often similar to one another. For example, let's say I'm working with you and a group of your colleagues. I give you a word and ask you to tell me what comes to mind. The first few words, the closest associations, will be pretty similar between you and your neighbor. Let's say I give you the word,

### RAIN

Your first few words, along with those of your neighbor, might be

RAIN > COAT

RAIN > DROP

RAIN > STORM

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But if you challenge yourself to go past that first association, and find more remote associations, you'll come up with more surprising results. Here's a quick one I tried:

RAIN > COAT > PAINT > BRUSH

RAIN > DROP > KICK

RAIN > STORM > CHASERS

RAIN > GAUGE > MILLIMETER

To give this a try on your own, come up with a word or image as a starting point, and challenge yourself to generate associations based on the first ones that come to mind. Don't settle for the first few associations, push past them to generate **more remote** associations. To conserve energy, the brain prefers the familiar. Force your brain to reach beyond the first thing that comes to mind... follow the rabbit tracks.

Marten Scheffer, laureate of the Spinoza Prize, has worked on tipping points in ecosystems. He is a champion for intuitive and creative thinking in science. (See <https://www.nwo.nl/en/cases/intuition-points-way-expertise-does-rest> ) Along with Frances Westley and Carol Folke, Marten Scheffer co-edited a series of peer-reviewed publications for Ecology & Society in 2020, titled Reconciling Art and Science for Sustainability. (See <https://ecologyandsociety.org/feature/112/> ) Among these, Scheffer is first author of a paper entitled "Dual Thinking for Scientists" (<https://ecologyandsociety.org/vol20/iss2/art3/>) which promotes the idea that scientists engage not only in critical thinking, but also the more imaginative, open-ended associative thinking with which artists are more familiar.

In an opinion article for PNAS entitled "The forgotten half of scientific thinking," he writes, *"Although thinking is the core business of scientists, we rarely ponder how it thrives best; this is ironic, as there is abundant scientific insight to draw upon. For example, it is now known that thinking has two complementary modes: roughly, association versus reasoning. We systematically underestimate the role of the first, and the way our institutions, meetings, and teaching are organized heavily reflects this imbalance. By contrast, many of the greatest scientists systematically nurtured a balanced dual-thinking process. We should follow their example and reform scientific practice and education to catalyze the unusual combinations of knowledge that often turn out to have the highest impact."*

### Divergent Thinking vs. Convergent Thinking

One test for creativity (and an exercise to boost creativity) is **divergent thinking**. Divergent thinking is open-ended, not goal-oriented. Whereas convergent thinking seeks to solve a problem or generate an answer, divergent thinking is exploratory. For example, convergent thinking asks, "How can I bind these papers together?" Divergent thinking asks, "What are all the uses I can imagine for a paper clip?" Or you

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might see how many uses you can generate for a simple object like a toothpick, a brick, an empty plastic water bottle, etc.



**PROMPT:** How many ideas can you come up with for what to do with a rubber band, in one minute?

Now, once a minute has passed, see if you can go another minute and generate a few MORE ideas. What are some ways to assess your divergent thinking?

- Of the two sessions, which one generated the largest NUMBER of ideas? A large number of ideas gives a rough measure of your **fluency**.
- How many different CATEGORIES of uses did you find (for example, fastening, decorating, tightening, etc.)? This is a rough measure of your **flexibility** – the variety of types of uses.
- Which ones were the most ORIGINAL? The rarity or novelty of your ideas is a rough measure of their **originality**.
- How ELABORATE were your descriptions? For example, if you wrote, “use as a bracelet” this is less elaborate than if you wrote, “Find seven different colors of rubber bands, and each day of the week, pick a different color of rubber band to wear around the wrist, and use it as a reminder of which day of the week it is.” The level of detail is a measure of **elaboration** of your descriptions.

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Another way to promote divergent thinking is the SCAMPER method.

**SCAMPER** stands for:

**S**ubstitute

**C**ombine

**A**dapt

**M**agnify/ **M**inify

**P**ut to another use

**E**liminate

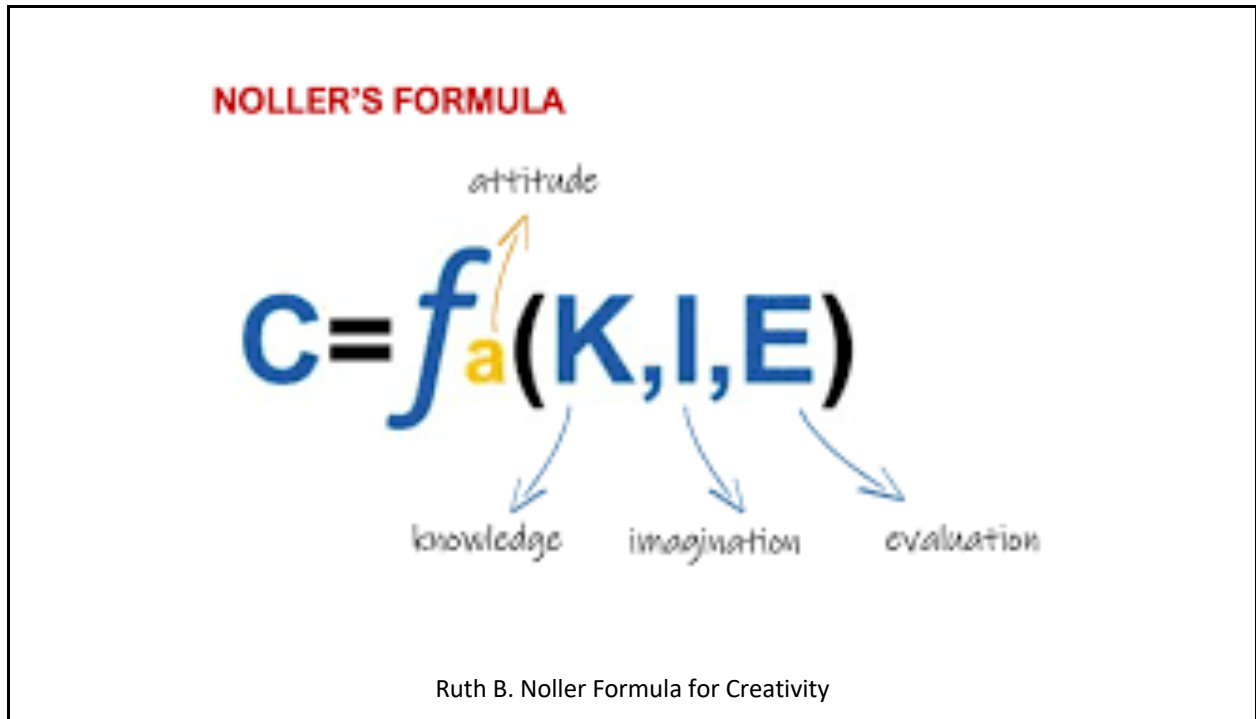
**R**everse

At this point, an analytical thinker and skeptic might say, “OK, I see how to generate new ideas and go way out there. But let’s come back to Earth.” In other words, all this risk-taking and open-ended exploration is great for brainstorming new ideas, but at some point, these ideas need to be grounded in reality, to fulfill the other half of the creativity definition: novelty + usefulness.

How do we balance open-ended intuitive thinking with analytical thinking? What is the role of creativity, and where are the limits or constraints on that creativity? How do we curate these ideas, in order to create something that is truly of value? Creativity researcher John Baer points out that there is no such thing as generalized Creativity, with a big “C.” He argues that creativity training only works within a specific domain. In other words, you might be creative in mathematics but not with visual images, or a dancer might exhibit creativity with movement but have little innovation in the realm of poetic use of language.

The influential work of mathematician and creativity researcher Ruth B. Noller promoted a “formula” for creativity. It may seem somewhat contrived to force a concept like creativity into a mathematical “formula,” but it can be a helpful device to keep in mind. It encapsulates a lot of the ideas that are still at work in contemporary creativity science such as design thinking, domain-specific creativity (a la John Baer, see above), and a way to balance divergent thinking with convergent thinking to come up with ideas that are both novel and useful. The formula, simply stated, is that creativity is a function of knowledge, imagination (divergence), and evaluation (convergence), which are all activated by a creative attitude.





These are all interesting in theory, but how does one work with this on a practical level? Here is a process that I have found effective. One might visualize this process as a fish with a big tail, like a Beta fish:



> First, start with **bringing something to the table**. Your knowledge and experience, the background from the field in which you work, a specific problem you are trying to solve. In Design Thinking, this step is the “Listening” step, in which you receive input from various sources, and then try to define a problem or goal. In the framework of John Baer’s domain-specific creativity, what we bring is the domain.

< Now comes the **divergent thinking** part. To activate a more open-ended, imaginative brain state, many creativity researchers cite the work of Mihaly Csikszentmihalyi, well known for his work on “flow” states of mind. There are lots of ways to promote divergent thinking. Many artists know that they are more creative at a certain time of day, or in a certain setting (quiet? Surrounded by people in a

cafe?) Some creativity researchers point to the brain's Default Mode Network as a source of this kind of thought. The DMN is basically the brain's resting state when you are not activating your pre-frontal cortex. It's what you do when you let your mind wander, daydream. Walking can set up good conditions for divergent thinking, as can taking a bath. One might think about the first two steps in this process as: 1) Think very hard, then 2) Let go and don't think at all. During this state, scribble ideas, jot down, doodle, even hum a tune and put words to a made up song, use your body, use space, use toys and play as tools to generate ideas. You might try free writing, as promoted by Natalie Goldberg in her short book, "Writing Down the Bones: Freeing the Writer Within." You might try collage or drawing, even if you "don't know how." A sense of play is your friend here. Reassure your risk-averse brain that it's OK to make a mistake.

> Here's where divergent thinking gets tempered by **convergent thinking**, and novelty gets balanced by usefulness. Take your wild ideas and start combing through them. If you've really opened up to being wildly imaginative, you will have generated some ideas that are just downright impossible. That's great, and it means you were activating your intuitive, imagining mind. Now in the narrowing process, you can start the convergent thinking/ critical thinking stage by separating what's possible. With this slightly shorter list of images/ ideas/ words that are possible (but still somewhat out there) don't toss the really wild-sounding ideas yet. Take a look at them and see what's in them that might be useful. Do you have the kernel of an idea in there that could be built on? Have you stumbled on something that feels true, even if you can't quite define it yet? Did you inadvertently name an idea that seems to keep coming up in your work but is difficult to talk about? Are there components of ideas that can be combined to create something useful? At this point you are using both critical thinking and imagination to identify and more clearly define some idea that may be of value in your work.

### **FSMLs are ideal environments for creativity**

There are many reasons why FSMLs are fertile environments to promote creative thinking.

#### Openness to experience and diversity

Creativity is stimulated by new experiences, and when we approach new situations, new cultures, new sensory experiences, this curiosity promotes creative thinking. This provides good arguments for engaging multiple kinds of stakeholders in the work at a FSML, for promoting cultural and socio-economic diversity, and for inviting people to work across disciplines. Inviting artists to FSMLs helps dissolve the boundaries of disciplinary silos and helps everyone to think differently. (Li et al 2015, Li & Zheng 2025, Leung et al 2008, Abui Raya et al 2023)

#### Encouragement of safe risk-taking.

Our brains are risk averse. Because taking risks can cost energy, we often default to the familiar. Nudging your brain to go down new pathways that may or may not lead anywhere useful, takes a bit of energy and purposeful risk taking. The atmosphere of a FSML often guides scientists, artists, students,

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community members, and other visitors to try new things - head down a trail, try participating in field work, or paddling in new waters.

### Serendipity

The atmosphere of working with others, from different places, at different points in their careers, from different fields, and taking risks together, can promote serendipitous discoveries. This might just be an interesting conversation on the porch at the end of field work, it might be a seed planted for a collaborative long-term experiment, or it might lead to the development of interdisciplinary teams that find the courage and inspiration to work outside of their familiar scholarly or cultural territory.

(Darbellay et al 2014)

### Nature

The unique environments to which FSMLs provide access give us sensory input, direct observation, stimulus to follow up and discover layers of natural history. Spending time in nature has been shown to boost creative thinking. (Plambech & van den Bosch 2015) This may be because nature inspires images leading to artistic work, metaphors for science communication, or natural processes that develop ideas for biomimicry. The images of branching trees or rippling water provide inimitable complex visual stimuli that activate creative thinking. The same is true for the myriad sounds, aromas, and bodily sensations such as temperatures, air movement, and moving through wild and complicated places. Walking itself is one of the best ways to stimulate creative thinking, and this is an activity that so often takes place at FSML sites. (Oppezzo & Schwartz 2014)

For additional creative thinking prompts, research-based creative thinking tools, and other information about creativity, see my creativity website, <https://sparkjuiceflow.com/>.

## 11. Case Studies – Video Interviews

### **An established artist in residence program at a field station: Eric Nagy, ArtLab**

#### Introduction:

Eric Nagy is Associate Director of Mountain Lake Biological Station, which hosts an artist-in-residence program called [Art Lab](#). From the ArtLab website:

*“ArtLab brings artists and scientists together to share viewpoints, observations, philosophies, and perspectives in their common quest to observe and understand the world around them. Art and science are both creative endeavors. The diversity in how artists and scientists observe the world and attempt to communicate what they see enriches and enlightens them both. The ArtLab program provides time, space, and inspiration to create, learn, and explore. It is set on a remote but comfortable Appalachian mountaintop where artists are surrounded by biological questions, answers, historical artifacts, collections, scientific activity, wildlands, and most importantly, the people who love these things. During the ArtLab program 60-80 scientists, artists, and students call Mountain Lake Biological Station home. The Station has a growing art collection including work from past resident artists, long-time Station resident Lucile Walton, and John James Audubon.”*



**VIDEO:** Watch [video interview with Eric Nagy](#)



**Artists commissioned for a science communication project: Lindsey Rustad, WaterViz**

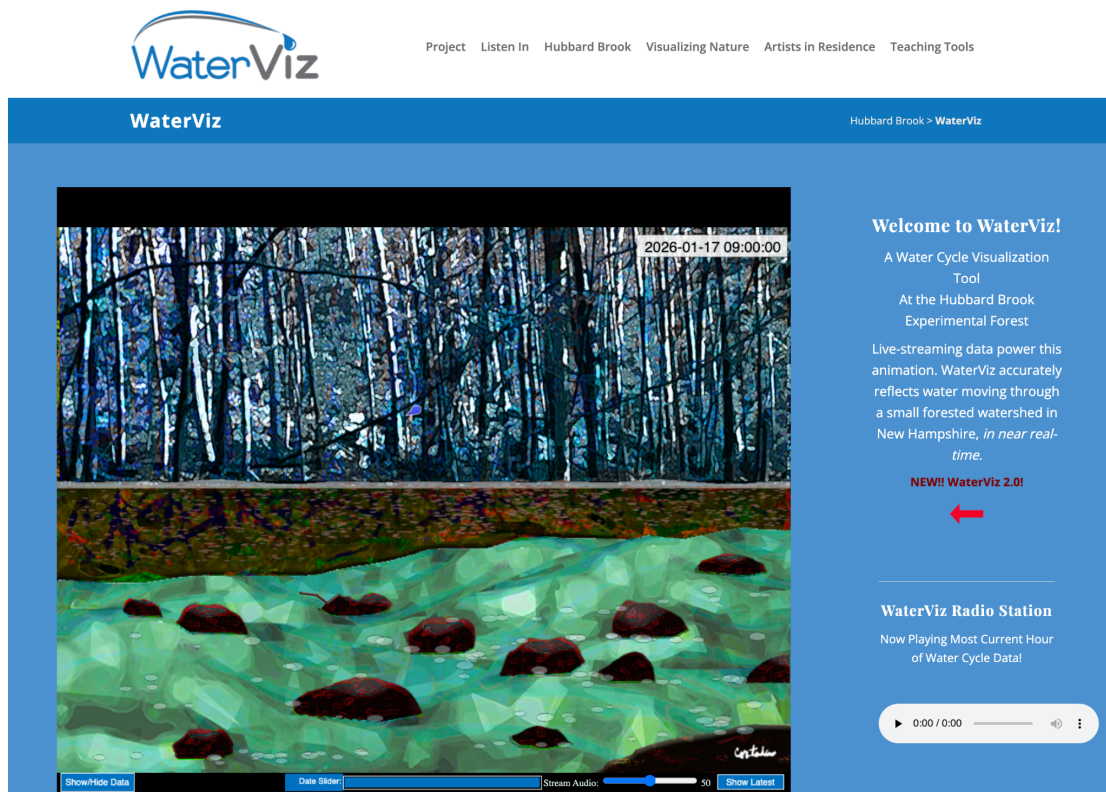
Introduction:

From the Hubbard Brook website:

*"The Hubbard Brook Experimental Forest (HBEF) is home to one of the world's most influential long-term ecological study sites. Located within the White Mountain National Forest in central New Hampshire, this 7,800-acre forested site was established by the USDA Forest Service in 1955 as a center for hydrologic research in New England. Abundant small watersheds serve as a natural laboratory for research on water yield and quality in response to natural and human disturbances.*

From the WaterViz website:

*"Hydrologic data, captured from a small watershed at the Hubbard Brook Experimental Forest in the White Mountains of New Hampshire using an array of environmental sensors, is transmitted to the internet and used to drive a computer model that calculates all components of the water cycle for the catchment in real time. These data, in turn, drive artistic visualizations and sonifications of the water cycle, reflecting the hydrologic processes occurring at that moment in time."*

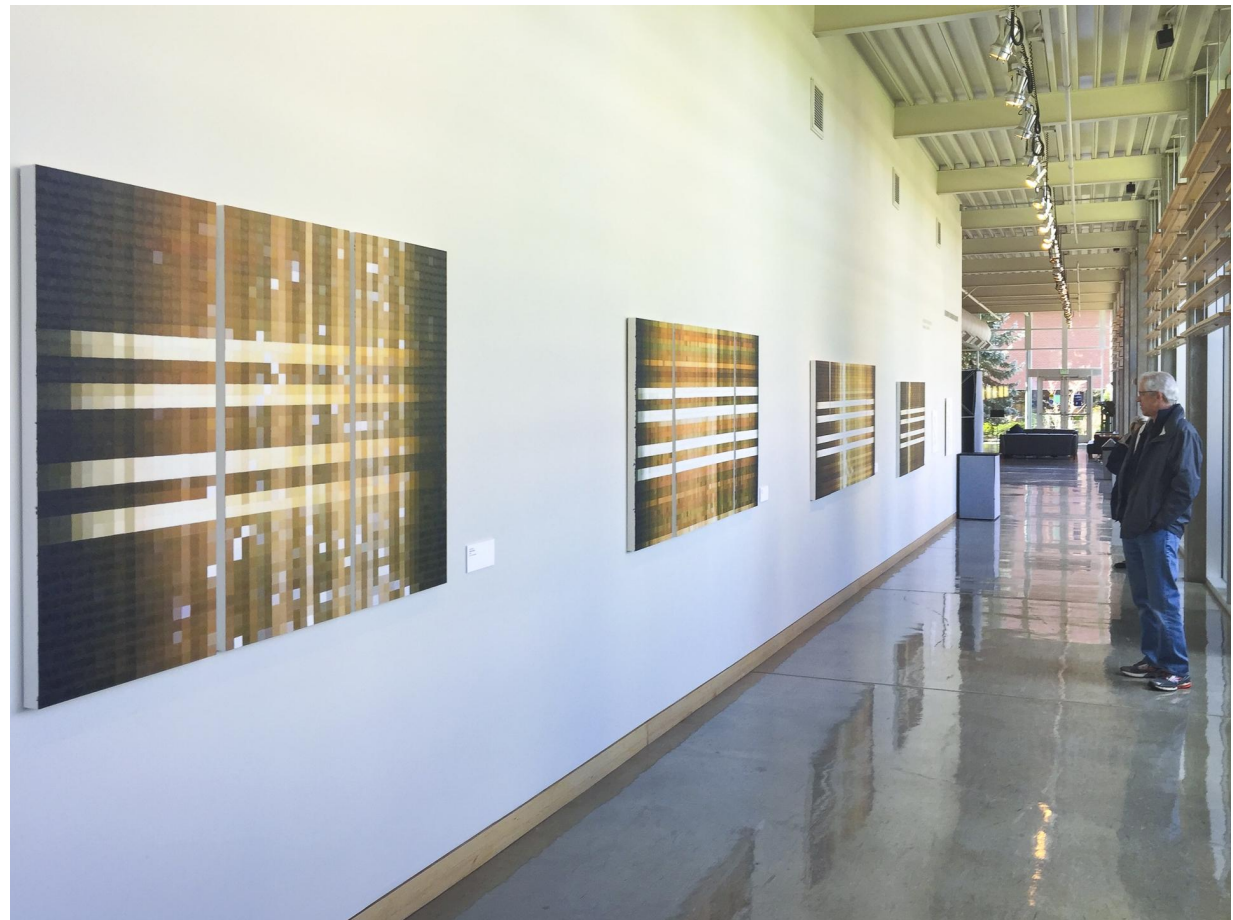


**VIDEO:** Watch [video interview with Lindsey Rustad](#)

### **Artist working with multiple LTERs: Leah Wilson, HJ Andrews, Hubbard Brook**

#### Introduction:

Leah Wilson is a place-specific visual artist and writer. Her artwork is informed by rigorous physical engagement with the environment, keen observation, and a curiosity toward scientific ecological research. She has worked for over a decade at HJ Andrews Experimental Forest, and is in the early stages of a collaboration with Lindsey Rustad at Hubbard Brook Experimental Forest. She has served on a residency advisory committee at [Pine Meadow Ranch Center for Arts and Agriculture](#) which encourages art-science engagement at its residency program, and was co-author of the first edition of this guide.



**VIDEO:** Watch [video interview with Leah Wilson](#)



**Artist working at multiple field stations: Todd Gilens, UC NRS sites**

*Introduction:*

From [Todd Gilens' website](#):

"I am a visual artist and designer working with people, places and ideas. Trained in landscape architecture, I use drawing, photography and writing as ways to engage sites and subjects. I look for projects that can be shaped in dialogue with communities and clients, developed through historical research, cross-disciplinary learning, and the unique conditions of the places they will inhabit. My focus is on large-scale processes like water systems and ecological change, and how critical but largely invisible processes can be meaningfully encountered."

Image below: *Confluence: Stream Science, Handwriting, and Urban Curbs*, a mile-long poem about water, land, and how stories orient us to the places we inhabit. It was installed in Reno, Nevada in September, 2023 and was in place for a year. The poem started at Idlewild Park and ends at City Hall, with several tributary lines between. See also: [Nevada Humanities blog post, on Confluence](#), [Science Friday interview](#), [Truckee Meadows Parks Project: Confluence](#)



VIDEO: Watch [video interview with Todd Gilens](#)

## 12. Funding

Artists often have limited access to funds for facility fees, travel, etc. Here are some tips to find funding:

- Use a grant search tool such as [Foundation Center](#) to find private foundations in your region that support arts and/or environment and/or science education.
- Contact a local arts residency or other arts organization, and ask if they are willing to be a fiscal sponsor. [Read more here about fiscal sponsorships](#).
- Develop arts programs through [Broader Impacts](#) of NSF grants. For more resources regarding broader impacts, see the [Center for the Advancement of Informal Science Education \(CAISE\)](#) website, or [Advancing Research Impacts in Society \(ARIS\)](#).
- Look for arts funding through [State and Regional Arts Councils](#).
- For public art such as murals, try searching for grants using the term “[creative placemaking](#).”
- To increase impact, package your project with other FSMLs and try for a group grant.
- If you can work with project partners such as arts organizations or community groups, grant funders often like to participate in creating collaborations across sectors, so emphasize partnerships in your proposal.
- Even if you can’t find a grant proposal that fits, reach out to funders who seem aligned with your goals. Art-science is a growing field, and part of our work is educating philanthropists. Start a conversation with funders and build relationships that may pay off for future projects.



Annicka Chaffey, excerpts from “Cora: Finding a Home in the Scrub,” a comic produced in collaboration with scientists at Archbold Biological Station. Comic art and graphic novels are under-explored art media at FSMLs.



## 13. Selected Resources

### Peer-reviewed papers, reports, and books

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- Duggan K, Campbell LK, Gunther B, Parkinson C. 2018. Common ground: art, data, and ecology at New York State field stations. New York (NY): Harvestworks Digital Media Arts Center and New York City Urban Field Station. 28 p.
- Ellison AM, LeRoy CJ, Landsbergen KJ, Bosanquet E, Borden DB, CaraDonna PJ, Cheney K, Crystal-Ornelas R, DeFreece A, Goralnik L, et al. 2018. Art/science collaborations: new explorations of

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### Other resources and links

- Antennae: The Journal of Nature in Visual Culture, <https://www.antennae.org.uk/>
- Arts at CERN, <https://arts.cern/>
- Arts at MIT, <https://arts.mit.edu/>
- ArtSci Converge blog (2014-2019) <https://artsciconverge.blogspot.com/>



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- Cultural Programs of National Academy of Sciences (CPNAS) <https://www.cpnas.org/>
    - See CPNAS DASER <https://www.cpnas.org/exhibitions-events/events/dc-art-science-evening-rendezvous/>
  - Cultural Programs of National Academy of Sciences (2020): JD Talasek interviews Faerthen Felix & Jeff Brown of Sagehen Creek Field Station/ ArtSci Converge, Bill Fox of Center for Art & Environment at Nevada Art Museum, and Peter McCartney of the NSF Field Stations & Marine Labs (FSML) program.
    - Video: <https://www.youtube.com/watch?v=PKqXGAYXJCQ&t=483s>
    - Sagehen: A Proving Ground for Science and Art: <http://www.cpnas.org/exhibitions/sagehencatalogue.pdf>
    - Other info about this CPNAS event: <http://www.cpnas.org/events/daser-082020.html>
  - EcoArtSpace, <https://ecoartspace.org/>
  - Ecological Reflections, <http://www.ecologicalreflections.com/>
  - Institute for Art + Environment, Nevada Museum of Art, <https://www.nevadaart.org/art/the-institute/>
  - [Leonardo@Djerassi Art Science](#)
  - Rhode Island School of Design (RISD) Nature Lab, <https://naturelab.risd.edu/>
  - School of Visual Arts (SVA) Bio Art Lab, <https://bioart.sva.edu/>
  - Symbiotica Center for Excellence in the Biological Arts, <https://artscience.arizona.edu/research-sites/symbiotica-center-excellence-biological-arts>
  - UCLA ArtSci, <https://www.artsci.ucla.edu/>
  - UCross, Video: <https://www.youtube.com/watch?v=ao5IANDxIDA>
- 

**Books rooted in the Andrews Forest** (Compiled by Fred Swanson and Shelley Stonebrook for PRAX.)

**A sampling of books based substantially on the long-term program of inquiry at the Andrews Forest and its implications for society:**

Luoma, J. 2006. *The Hidden Forest: The Biography of an Ecosystem*. OSU Press (originally Henry Holt)

Herring, M.L. 2013. *Ellie's Log*. OSU Press.

Brodie, N., Goodrich, C., Swanson, F.J. (eds). 2016. *Forest Under Story: Creative Inquiry in an Old-Growth Forest*. U Washington Press.

Robbins, W.G. 2020. *A Place for Inquiry, A Place for Wonder: The Andrews Forest*. OSU Press.

Herring, M.L. 2024. *Born of Fire and Rain*. Yale U Press.

Mapes, L. 2025. *The Trees are Speaking: Dispatches from the Salmon Forests*. U Washington Press.

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### **A sampling of books in a variety of genres that include sections set in Andrews Forest. Most were created by writers in residence:**

- Eisenberg, C. 2010. *The Wolf's Tooth: Keystone Predators, Trophic Cascades, and Biodiversity*. Island Press.
- Fleischner, T.L. 2011. *The Way of Natural History*. Trinity U Press.
- Pyle, R.M. 2012. *The Tangled Bank: Writings from Orion*. OSU Press.
- Kimmerer, R. 2013. *Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge, and the Teachings of Plants*. Milkweed.
- Deming, A.H. 2014. *Zoologies: On Animals and the Human Spirit*. Milkweed.
- Ellison, A.M. 2017. *Vanishing Point*. Self published.
- Rush, E. 2018. *Rising: Dispatches from the New American Shore*. Milkweed.
- Powers, R. 2018. *The Overstory*. Norton.
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### **A sampling of books by authors that took inspiration from the Andrews Forest when writing about humans' relationship with forests. Perspectives include the humanities, ethics, conservation, land use policy, forest management, and appreciation of old-growth forests:**

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- Spies, T.A., Duncan, S.L. (eds). 2009. *Old Growth in a New World: A Pacific Northwest Icon Revisited*. Island Press.
- Moore, K.D., Nelson, M.P. (eds) 2010. *Moral Ground: Ethical Action for a Planet in Peril*. Trinity U Press.
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### **A sampling of catalogs from art exhibitions inspired by the Andrews Forest:**

- The Arts Center. 2016. *Rot: The Afterlife of Trees*. The Arts Center, Corvallis.
- Bayles, D.P. 2018. *Old Growth Dialogue*. Alder Ego Press.
- Lowdermilk, S. and others. 2022. *About Hope?* Self.
- Bayles, D.P., F.J. Swanson. 2024. *Following Fire catalog –Still*. Alder Ego Press.
- Bayles, D.P., F.J. Swanson. 2024. *Following Fire catalog – Typologies*. Alder Ego Press.
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## Ecotones Guide for Arts at Field Stations & Marine Labs – 2nd Edition

Borden, D.B. 2024. *Feral Fellowship: A Collection of Interdisciplinary Collaborative Work*. Unfinished Book Bureau.

**A sampling of books with chapters about *how* and *why* to incorporate the arts and humanities at long-term ecological research sites, including the Andrews Forest:**

Waide, R.B., Kingsland, S.E. (eds). 2021. *The Challenges of Long Term Ecological Research: A Historical Analysis*. Springer.

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