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Art/Science Collaborations: New Explorations of Ecological Systems, Values, and their Feedbacks

Aaron M. Ellison ,[1] Carri J. LeRoy,[2] Kim J. Landsbergen,[3] and Emily Bosanquet,[4] with contributions from David Buckley Borden,[1] Paul J. CaraDonna,[5,6] Katherine Cheney,[7] Robert Crystal-Ornelas,[8] Ardis DeFreece,[4] Lissy Goralnik,[9] Ellie Irons,[10] Bethann Garramon Merkle,[11] Kari E. B. O'Connell,[12] Clint A. Penick,[13] Lindsey Rustad,[14] Mark Schulze,[15] Nickolas M. Waser,[5] and Linda M. Wysong,[4]

[1]Harvard Forest, Harvard University, 324 North Main Street, Petersham, Massachusetts 01366 USA
[2]The Evergreen State College, 2700 Evergreen Parkway NW, Olympia, Washington 98505 USA
[3]Science Division, Antioch College, Yellow Springs, Ohio 45387 USA
[4]Pacific Northwest College of Art, 511 NW Broadway, Portland, Oregon 97209 USA
[5]Rocky Mountain Biological Laboratory, Crested Butte, Colorado 81224 USA
[6]Chicago Botanic Garden, Glencoe, Illinois 60022 USA
[7]NOAA Fisheries West Coast Region, 1201 Northeast Lloyd Boulevard, Suite 1100, Portland, Oregon 97232 USA
[8]Department of Ecology, Evolution and Natural Resources, School of Environmental and Biological Sciences, Rutgers University, New Brunswick, New Jersey 08901 USA
[9]Department of Community Sustainability, Michigan State University, 480 Wilson Road, Room 131, East Lansing, Michigan 48824 USA
[10]Department of the Arts, Rensselaer Polytechnic Institute, Troy, New York 12180 USA
[11]Wyoming Migration Initiative, University of Wyoming, Laramie, Wyoming 82071 USA
[12]Department of Forest Ecosystems and Society, Oregon State University, 321 Richardson Hall, Corvallis, Oregon 97331 USA
[13]The Biomimicry Center, Arizona State University, Tempe, Arizona 85287 USA
[14]USDA Forest Service, Northern Research Station, 271 Mast Road, Durham, New Hampshire 03824 USA
[15]Department of Forest Ecosystems and Society, Oregon State University, 321 Richardson Hall, Corvallis, Oregon 97331 USA

Introduction

Collaborations between artists and scientists have a long history. In recent years, artists have joined with ecologists to showcase biodiversity, links between biodiversity and ecosystem function, and the effects of human activities on the broader environment. In many cases, artists also have provided "broader impacts" for ecological research activities, communicating scientific findings in creative and novel ways to audiences much broader than the readership of our technical journals.

At the 2017 ESA Meeting in Portland, Oregon, two back-to-back Ignite sessions highlighted new directions in collaborations between artists and ecologists. Although proposed and developed independently, the two sessions were strongly complementary. In the first session, organized by Kim Landsbergen, Emily Bosanquet, and Elizabeth Demaray, six presentations focused on how contemporary artists working with ecologists and environmental scientists are creating new works that would not

have been possible without the interdisciplinary collaborations. In the second session, organized by Aaron Ellison and Carri LeRoy, ten presentations emphasized not only how art can communicate ecological concepts to broader audiences, but also how ecologists have been influenced by art. In both sessions, presentations and the subsequent intense discussions illustrated how artists and ecologists working together can lead to new ways of seeing, hearing, experiencing, and knowing. These two Ignite sessions, attended by more than 100 people, also demonstrated the momentum for art/science collaborations that continues to build from previous art/science sessions and workshops at ESA meetings over the last several years.

Here, we describe contributions from many of the presenters. We asked each presenter to provide 1–2 key images from their presentation and a short description of it; these have been edited only lightly for clarity and consistency of voice, and they are presented in the same order as at the 2017 meeting. We hope that these vignettes not only encourage deeper exploration of all of the work by the presenters, their collaborators, and their colleagues, but also spark new ideas for art/science collaborations.

NOAA Fisheries and Pacific Northwest College of Art partnership: where art and science evolve and turn into change (Emily Bosanquet and Katherine Cheney)

In 2013, the NOAA Fisheries West Coast Region and the Pacific Northwest College of Art (PNCA) joined forces to advance a shared vision: bridging environmental science and conservation with contemporary art practices to create social change. This partnership seeded the establishment of PNCA's Art + Science Initiative, a platform supporting work at the intersection of art, design, science, and culture. The Initiative brings scientists, academics, and community leaders to campus for lectures and workshops. PNCA students create new works of art (Fig. 1) while working closely with NOAA Fisheries



Fig. 1. Images by Shelby Smith and Esteban Camach Steffensen from the Art+Science Initiative of the Pacific Northwest College of Art, a partnership between PNCA and NOAA Fisheries West Coast Region.

representatives and partner organizations to increase public awareness of watershed and community resource issues. The Initiative also sends PNCA student artists and designers out into the world through residencies, art commissions, presentations, and support for community projects in collaboration with multiple external scientific partners.

Curiosity: an installation inspired by NOAA, climate change, and copepods (Ardis DeFreece)

The PNCA Art+Science Initiative supported Ardis DeFreece as an artist-in-residence with NOAA Fisheries. DeFreece spent her residency at Hatfield Marine Science Center in Newport, Oregon, while she was working on her Masters of Fine Arts in Visual Studies at PNCA. This residency, in the laboratory of the late Dr. William Peterson, was an immersion in science that led to a transformation in DeFreece's creative practice to include work in the laboratory, data collection, and research. This residency not only crossed the disciplines of art and science, but also allowed her to become a better facilitator for discussions around climate change and our relationship to the natural world. "Curiosity" (Fig. 2), which resulted from the six-week residency, is now a permanent exhibition in the Visitor's Center at the Hatfield Marine Science Center. The installation consists of curiosity cabinets full of the tools, specimens, and detritus of marine ecosystem research, and life on the coast, narrative paintings, and collage. The work is a physical collaboration between scientific research and the art-making practice. It is also an intellectual collaboration in the shared ideas that went into the creation of the work and a call to viewers to open dialogue with wider audiences.



Fig. 2. "Curiosity" installation and a detail of the painting entitled "Curious Science." Oil over acrylic, 2015. Photographs by Ardis DeFreece.

Benefits of art/sci practice as an ecology graduate student (Robert Crystal-Ornelas)

Rob Crystal-Ornelas is a graduate student in ecology who makes embroideries as an artistic practice (Fig. 3). During his Ignite presentation, Rob encouraged everyone to find a way to incorporate creative practice in day-to-day life. His suggestions included taking a bit of time every day to sketch what you have seen on a hike or attend one-day workshops on art practices that may spark new, creative interests. He also identified a few benefits that he has experienced by adding creativity to his day, including lowering the stresses commonly experienced by graduate students.

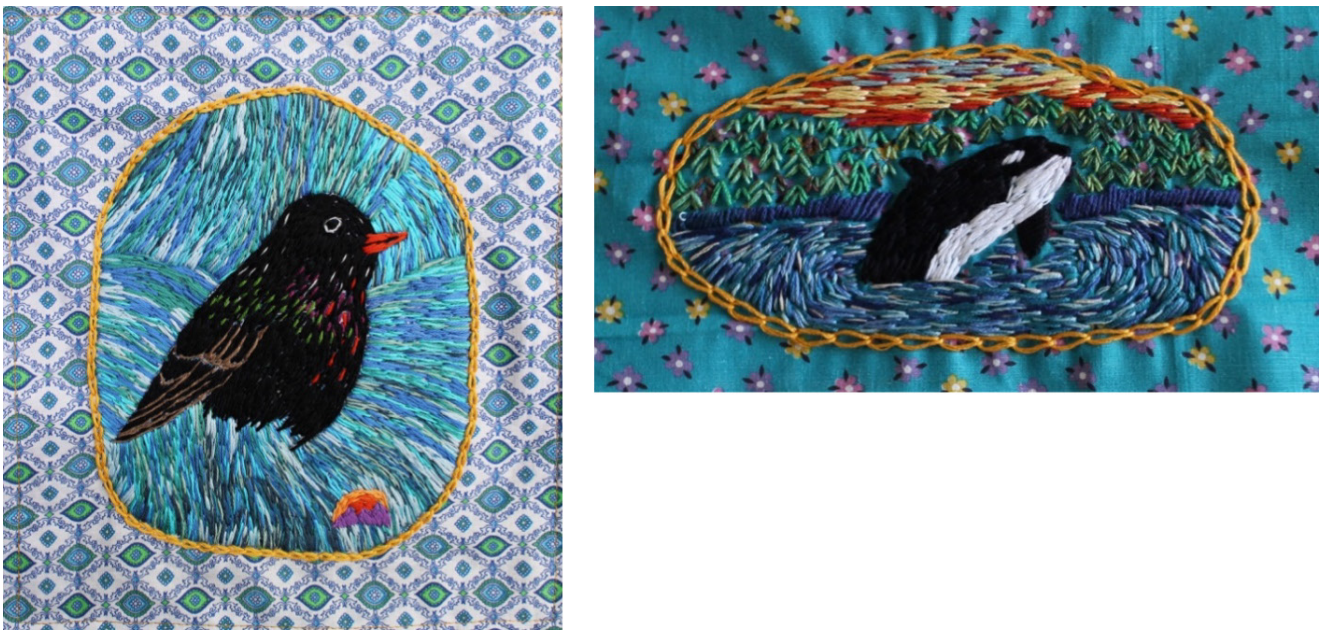

Fig. 3. Examples of Robert Crystal-Ornelas' embroidery projects that depict ecological scenes. Photographs by Rob Crystal-Ornelas.

In the field with weeds: artisanal strategies for art and ecology (Ellie Irons)

Ellie Irons works at the intersection of art and urban ecology, spending a lot of time in "vacant" or "abandoned" landscapes. Where someone else might see a decomposing parking lot full of undesirable plants, she sees a thriving urban meadow, and she uses strategies drawn from art and ecology to communicate this. One example springs from her Invasive Pigments project, in which she collected urban plants to process them into watercolor paints (Fig. 4). This artistic practice—"public fieldwork"—combines ecological fieldwork and socially engaged art and applies whether Ellie is collecting flowers for paint, seeds for the Next Epoch Seed Library, or lists of plant community data. The unexpected interactions with urban habitats and their inhabitants offer alternative pathways into environmental consciousness

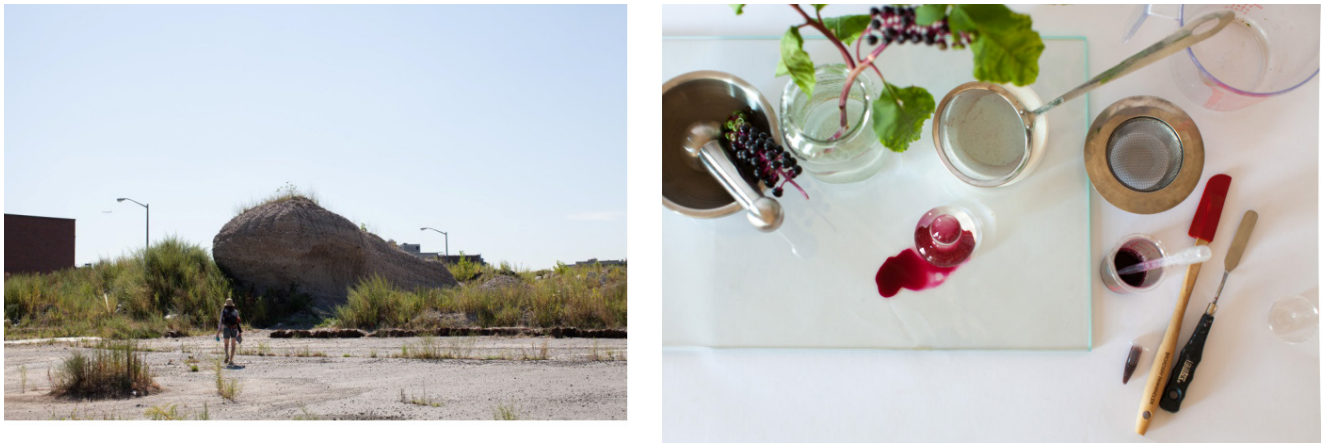

Fig. 4. Images from field collection and preparation of natural plant pigments. Photographs by Dan Phiffer (left) and Ellie Irons (right).

and ecological thinking that emphasize multispecies solidarity and present "disturbed" ecosystems as worthy of care and attention.

Forest discovery: an arts, humanities, and environmental science experience of place (Lissy Goralnik, Mark Schulze, and Kari E.B. O'Connell)

Deep in the Oregon Cascades, beneath a canopy of ancient evergreens, students listen to stories about rainfall and water science; they draw comics of spotted owls, analyze climate data, and create sound maps. As they reflect on their own special places, they compare shades of green, watch scientists, discuss morticulture, and imagine the forest after a storm, a fire, or a landslide. Weaving art with science, self with community, and person with place on the digitally interpreted Discovery Trail (Fig. 5) at the US Forest Service's H.J. Andrews Experimental Forest allows for conservation learning and empathetic awareness. Knowledge, awe, and responsibility come together as one cohesive experience of place that can inspire responsibility and action.



Fig. 5. Images from the Discovery Trail at the H.J. Andrews Experimental Forest (LTER). Photographs by Lissy Goralnik.

Art, community, and ecology (Linda M. Wysong)

Linda Wysong's interdisciplinary art practice acknowledges the interconnections between humans and other organisms. Her art is a complex collaborative experience for both the makers and the public that addresses the dynamic relationship between the natural and the built environments. Her work includes cultural discussions among artists, community members, biologists, engineers, planners, and policy makers. Wysong's ecological art embodies a consciousness of our shared land and experiences, and makes practical impacts on education about toxicants, habitats, stormwater management systems, and ecological restoration (Fig. 6).

Emergence: transformation and reassembly of a fractured landscape (Paul CaraDonna and Nickolas M. Waser)

Humans naturally filter, break down, and reassemble information as we strive to make sense of the world around us. Although the perspectives of artists and scientists appear very different, they share an



Fig. 6. Linda Wysong, *Water Tour*—the South Waterfront AIR residency, Portland, June 2008. Top: a water quality tour through a new community built on a former wetland (photograph by Yalcin Erhan). Bottom: Eye River, SE Clay Green Street Corridor, Portland, Oregon 2014 (photograph by Linda Wysong).

intersection that provides insight into how humans interpret nature. As part of the Art/Science Exchange at the Rocky Mountain Biological Laboratory (directed by CaraDonna and Waser), Mark Dorf explored this intersection in his "Emergence" series, in which he challenged our assumptions about information, communication, and perception of nature. In particular, Dorf explored the reductionist approach of scientists by amassing images of landscape features and then reassembling them into new landscapes (Fig. 7). Analogously, the models we assemble as scientists share these features: Their simplicity helps us to



Fig. 7. *Reassemblage #3* depicts a mountain that seems natural and idyllic, but on close examination, the mountain is wrong in many ways. Photographic reconstruction by Mark Dorf (2014).

identify important features of an ecological system, but they are likely to be subtly incorrect or incomplete in numerous ways. The key is to recognize their value while resisting the impulse to replace nature with our model of it.

Art that gathers data, science that makes meaning (Carri J. LeRoy)

We often think of art and science as polarized disciplines, yet the processes of both are remarkably alike. Practitioners in both fields make careful observations, ask specific questions, do extensive research, use specialized tools and equipment, replicate their studies or works, and interpret their results in a broader context. Carri LeRoy and the artists with whom she teaches encourage students to create art that gathers scientific data and to rely on science to imbue the art with additional meaning. One experiment used intaglio-printed images with a sticky coating to trap emergent aquatic insects at different distances away from a stream to explore resource subsidies (Fig. 8). The images were portraits of scientists that spoke to issues of inclusivity in science and were placed along a transect based on how much credit they have been given for their scientific work. This sci/art research experience helped to demystify both science and art and increased confidence in students from both disciplines.

Making bed sheets out of biodiversity (Clint Penick)

Clint Penick partnered with the College of Design at North Carolina State University to highlight insect diversity and the cuticle patterns on ants. The function of these minute structures that often distinguish species is poorly understood by scientists and goes completely unnoticed by non-specialists. Working with students from the College of Design, Penick's group catalogued ant-cuticle patterns



Fig. 8. Images showing intaglio-printed portraits of scientists coated with a sticky substance and placed in the field to capture emergent insects. Evergreen student artist/scientists: Devynn Stodola, Grace DuPen, Baz Brown, and Raine Penich. Photographs by Shauna Bittle and Carri LeRoy.

and tested how these patterns could influence the growth and spread of insect pathogens. Penick then partnered with textile designer Meredith West to develop a line of micro-animal prints based on ant-cuticle patterns that could be used to produce linens, wallpaper, and pillows (Fig. 9). Penick's group is now taking West's fabric designs into production to showcase insect diversity and to increase public interest in basic research on insect traits.

The Waterviz: a real-time confluence of science, art, and music (Lindsey Rustad)

At the USDA Forest Service's Hubbard Brook Experimental Forest, Lindsey Rustad, a Research Ecologist, is collaborating with artist Xavier Cortada, musician and composer Marty Quinn, information manager Mary Martin, Science Communicator Sarah Garlick, and others to create the Waterviz. The Waterviz (https://waterviz.org) is a new water cycle visualization and sonification tool (Fig. 10). Briefly, hydrologic data are captured digitally from a small, first-order catchment at Hubbard Brook using an array of environmental sensors. These data are transmitted to the Internet and are used to drive a real-time computer model that calculates all components of the catchment's water cycle. The complete set of measured and modeled data then drive a flash visualization and sonification of the water cycle at Hubbard Brook. The Waterviz is a novel approach that allows Internet users to intuitively experience the dynamic inputs, outputs, and storage of water in this small, upland forested watershed as they are occurring in near real time.

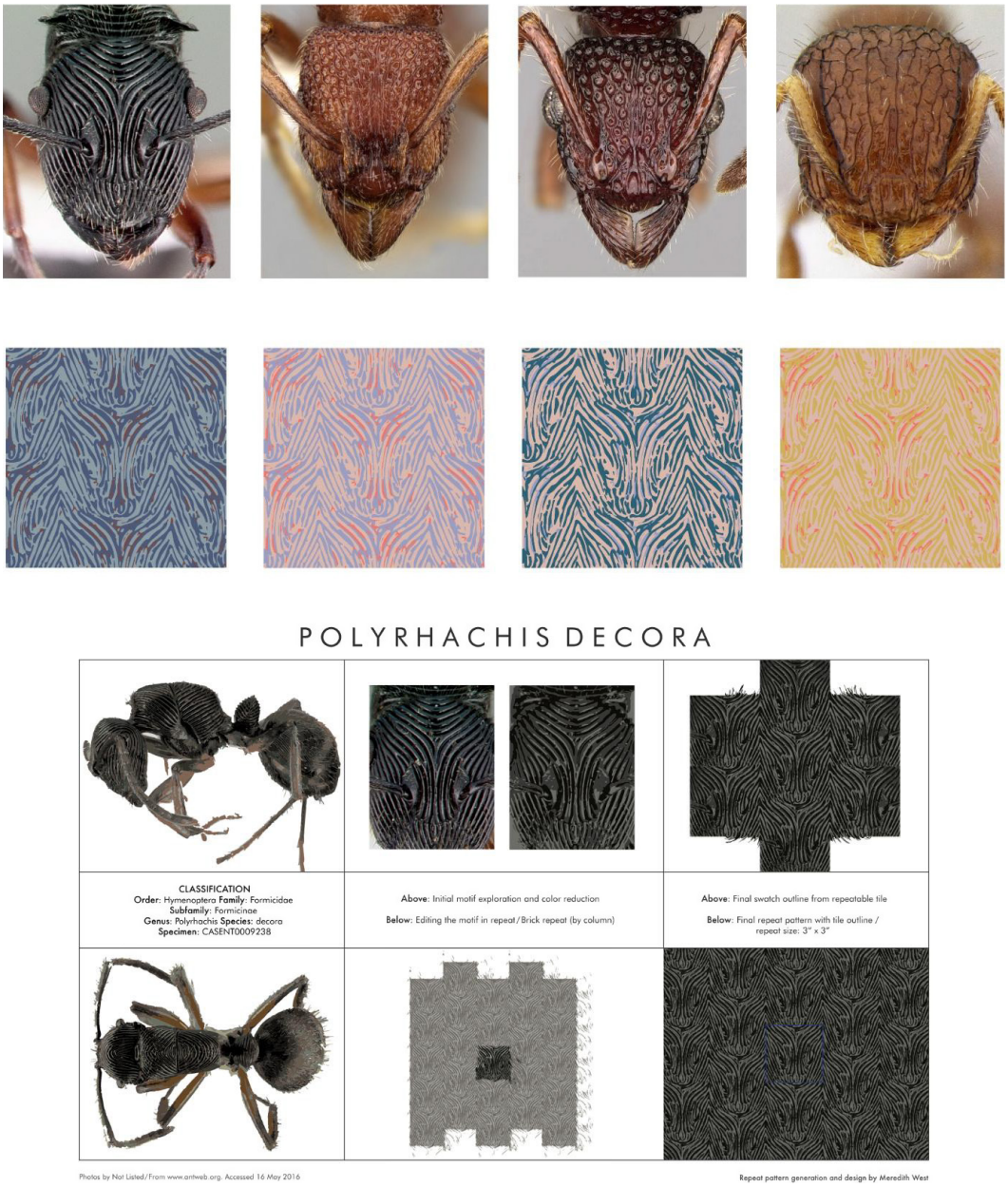

Fig. 9. Images showing ant morphology of various species and created biomimicry patterns.

Hemlock Hospice: art and science for declining hemlocks and the researchers who study them (Aaron M. Ellison, David Buckley Borden, and Salua Rivero)

Eastern hemlock (*Tsuga canadensis*) is slowly vanishing from North American forests as it is weakened and killed by a small insect, the hemlock wooly adelgid (*Adelges tsugae*). Ellison, Buckley Borden, and collaborators tell the story of hemlock loss through *Hemlock Hospice*, a collaborative, outdoor, site-specific sculpture installation currently being exhibited at Harvard University's Harvard Forest (Fig. 11). *Hemlock Hospice* uniquely blends science, art, and design to respect eastern hemlock and its ecological role as a foundation forest species; promote an understanding of the adelgid; and encourage empathetic conversations among all the sustainers of and caregivers for our forests—ecologists and artists, foresters

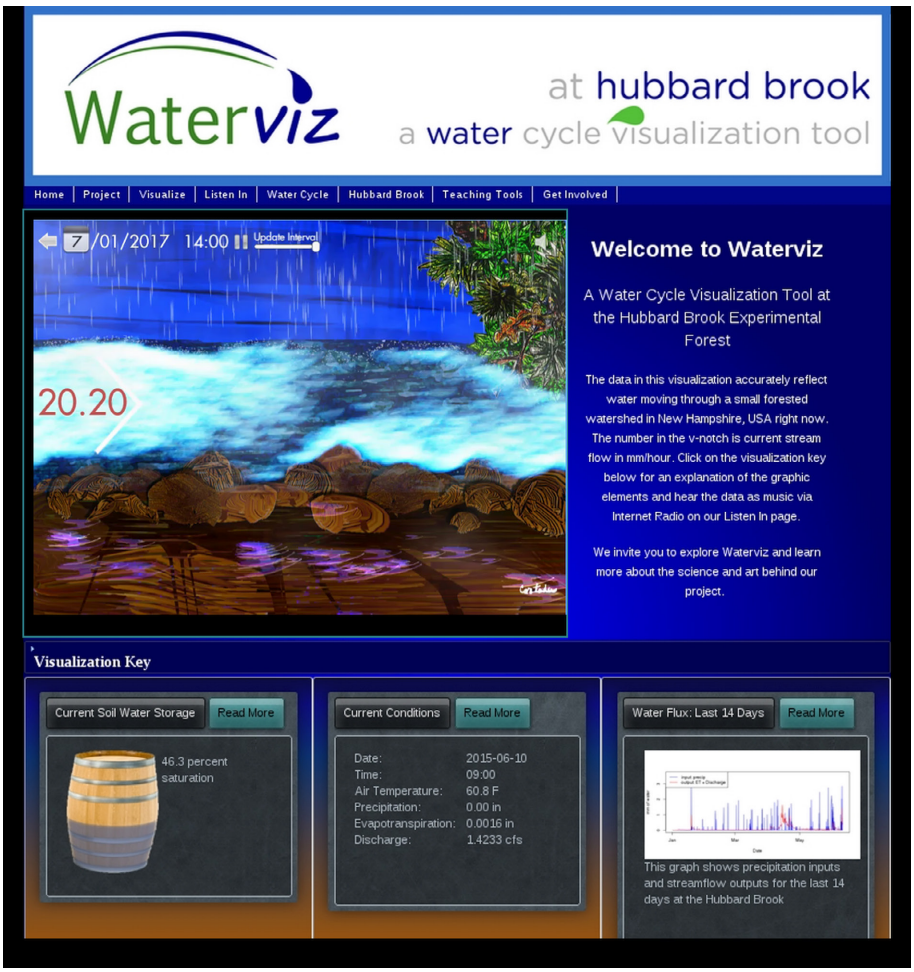

Fig. 10. Homepage of the Waterviz.

and journalists, naturalists and citizens—while fostering social cohesion around ecological issues. More expansively, *Hemlock Hospice* contextualizes hemlock decline in the broader context of climate change, local effects of our global economy on the natural world, and environmental impacts of our consumer culture.

Drawn to science: exploring historical and contemporary synergies between drawing, creativity, and science (Bethann G. Merkle)

As an illustrator and educator, Bethann G. Merkle has spent the past decade teaching "sketching for scientists" courses and training science educators in drawing, facilitation, and assessment techniques they can use in their own classrooms. Her efforts to re-establish drawing as an essential part of the modern science toolkit stem from research and personal experience indicating drawing is as relevant to science in the digital age as it was in the Renaissance. She explained in her Ignite talk that drawing helps us to visualize problems, systems, and potential solutions, all of which enhance our capacity to do and communicate science. Our brains understand images faster than words and remember images longer, too. Drawing is more than just means of documentation or communication; it also can be a



Fig. 11. Two of the 18 installations included in *Hemlock Hospice*. Top: "Exchange Tree" 8 × 10 × 12.5 feet, wood and acrylic paint, 2017. Collaborators: David Buckley Borden, Aaron M. Ellison, Salvador Jiménez-Flores, and Salua Rivero. Bottom: "Fast Forward Futures" 4 × 8 × 26 feet, wood, acrylic paint, and assorted hardware, 2017. Collaborators: David Buckley Borden, Jack Byers, Aaron M. Ellison, Salvador Jiménez-Flores, and Salua Rivero.

powerful research method, as demonstrated by artist–scholars including Maria Sybilla Merian, Leonardo Da Vinci, and John James Audubon. Others, including E.O. Wilson, Agnes Arber, Jonathan Kingdon, and Jean Polfus, attest that they would never have learned what they did without drawing their study species (Fig. 12). Finally, drawing techniques themselves have inspired innovation: for example, stippling informed the development of digital pixel technology.



Fig. 12. Sketches by Bethann G. Merkle. Left: self-portrait of the artist sketching a black-tailed jackrabbit. Right: natural history sketch of the endangered Wyoming toad for a citizen-science project focused on collecting long-term data about amphibians in Wyoming.

Conclusion

Collaborations between artists and scientists can be so much more than just good science communication. The compilation of projects presented in two Ignite sessions at ESA 2017 helped us to realize the power of these partnerships and the value of incorporating artists into our scientific practices at all stages of our scientific methods, not just after the studies are finished or helping us tell science stories. A recurrent theme centered around how collaboration with artists altered scientists' views, designs, and methods. Similarly, collaboration with scientists helped artists delve deeper into issues, gain insight into processes, and tackle more complicated concepts in their artistic practice. At a time when scientists are finding it difficult to have their voices heard, partnerships with artists can extend scientific messages and influence audiences unreachable through facts alone. These partnerships also may change and enrich the way we do both science and art.