

Environmental Explorations

Sculpting Solutions:

Art–Science Collaborations in Sustainability



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Crisscrossed by highways, dotted with brownfields, and largely cut off from the river that named it, the Bronx in New York City remains, despite everything, a picture of human resilience. Beginning in 2010, artist Lillian Ball and local youth organization Rocking the Boat seized upon an opportunity to give the community a piece of its river back, planting a stormwater mitigation project that also serves as a public park. Nearly 800 miles to the west, in a neighborhood in Chicago's South Side, a similar phenomenon unfolded last summer: Artist, Frances Whitehead of the School of the Art Institute of Chicago, teamed with the City of Chicago and students at Chicago State University to plant a bioremediation project at an abandoned filling station lot.

The upshot of these and several other projects around the world is that art is providing a new perspective on environmental sustainability. A small but growing and very determined group of artists is creating a range of innovative environmental art projects that solve on-the-ground ecological challenges, take action in the context of social complexity, and further environmental science. Transcending predictable categories of environmental problem solving, these artists are designing strategies that embrace the richness of the world, pulling in information and technology from a cross section of scientific disciplines.

Many individual elements of these projects will be familiar to anyone with an awareness of community-based sustainability projects—the artists engage with local communities, for example, and employ green infrastructure. Viewed as a whole, however, these efforts offer new models of bottom-up solutions to environmental problems that build on and learn from complexity. With an artist as lead agent, these projects capitalize on human memory and feeling while at the same time attending to environmental degradation, offering a refreshing set of ideas about sustainable development in the Anthropocene.¹

The work of these environmental artists is being studied as part of an international U.S. National Science Foundation (NSF) and U.K. Arts and Humanities Research Council (AHRC)-funded research project on art-science collaboration.² The project is examining collaborations across many different scientific disciplines and artistic practices, including the Advanced Visualization Lab at University of Illinois Champagne-Urbana, which employs “Renaissance Teams” of scientists and visual artists to solve visualization problems and create relevant technologies and products;³ the international nonprofit Cape Farewell, which takes artists on expeditions with scientists to view firsthand evidence of climate change in places like the Arctic and the Amazon;⁴ the Swiss artists-in-labs effort, which has created artist residencies in a number of different labora-

Artist Lillian Ball poses with the installed wetland at WATERWASH ABC with interns from Rocking the Boat, a nonprofit that teaches environmental job skills to Bronx youth. During the summer of 2011, the artist and young adults installed more than 8,000 native plants into a wetland and upland area to remediate stormwater runoff and help protect the Bronx River.



Jackie Brookner

Veden Taika (“The Magic of Water” in Finnish) consists of three floating islands that support phytoremediating plants and provide safe nesting habitat for endangered gulls. The phytoremediation helps clean pollutants in the water from agricultural runoff and the legacy of sewage treatment that left heavy metals and organic nutrients in the sediment. The mist, states artist Jackie Brookner, “is a phenomenological sculpture that attracts people’s attention. I hope it affects people emotionally and is a reminder that humans can do good things for other species.”

tories;⁵ and the SymbioticA laboratory at the University of Western Australia in Perth, which trains artists in life science technologies.⁶ These art–science collaborations represent a great range of institutional, technological, and political arrangements and goals. Emerging themes from the NSF/AHRC project include what digital design researcher Lone Koefoed Hansen and choreographer and writer Susan Kozel refer to as the affective, embodied nature of scientific learning.⁷ The project has also realized benefits of artist–scientist interaction in the advancement of traditional disciplines, as anthropologist Joseph Dumit describes in his book *Picturing Personhood: Brain Scans and Biomedical Identity*, as well as the production of a “third culture” between the two disciplines, according to University of California, Los Angeles, design professor Victoria Vesna.⁸

Artists such as Ball and Whitehead, who are well established in the art world, are bringing their aesthetic and

design talents to bear on specific environmental challenges and creating intricate, effective, beautiful, and very ambitious projects. Notably, such art–science collaborations also contribute to the development of applied environmental sciences, such as phytoremediation and green infrastructure. More powerfully, however, these projects offer models for solving complex problems.

The social and ecological complexity of environmental problems is a resonant theme whether the topic is urban planning, ecological restoration, brownfield revitalization, natural resource management, or ecosystem services. This complexity has been noted in research on climate change,⁹ urbanization,¹⁰ and polarized public psychology about the environment.¹¹ Environmental complexity has also been formulated as a challenge for the sciences—the task of integrating the ecological with the social in order to develop robust strategies for action.¹² This understanding has led to a burgeoning literature on

“postnormal” and “mode 2” science,¹³ transdisciplinarity,¹⁴ and what Matthias Gross, an urban and environmental sociologist at the Helmholtz Centre for Environmental Research describes as “real world” experimentation.¹⁵ Much of this literature insists on the importance of environmental projects that attend to the specifics of particular places and take social and cultural context into account. Environmental art holds real promise in this regard.

Sustainability as Culture; Art as Knowledge Production

Whitehead, a professor at the School of the Art Institute of Chicago, initially launched her project as a formal collaboration with the City of Chicago to embed artists in city work groups. Earlier this year, at a panel discussion at the annual meeting of the Association of American Geographers (AAG) she noted that the collaboration concept “in-



Lisa Shaw

The construction of Veden Taika involved the participation of many volunteers at all stages of the process, including students and local residents, (shown here assisting in the construction of lightweight “rocks” for the islands). The project also enabled cooperation between many different civic departments that had never before collaborated.

volves two interconnected hypotheses. First, that sustainability is largely a cultural problem, and thus requires a cultural framework to succeed. Secondly, that artists’ expertise can be of great value to transdisciplinary teams due to largely unexamined tacit knowledges that artists employ.¹⁶

Whitehead presents herself as a new knowledge producer and problem finder. She argues that the artist’s way of knowing provides a “lateral heuristic methodology,” a horizontal process of thinking that is critical to taking steps toward improved sustainability.¹⁷ Artists, she explains in a list on the Embedded Artist Project website, are creative and innovative, and, because they “compose and perform, design and execute,” they are accustomed to tight knowledge feedback loops. She also notes their ability to maneuver in noncompensatory economies, and she highlights their focus on making the implicit explicit.¹⁸ In Chicago, Whitehead is working to place herself in conversation with urban planners solving systemic problems and with scientists con-

cerned with the real-world application of their science, exploring how artists’ knowledge and methods might address wicked problems and further environmental science.¹⁹

New York artist Jackie Brookner, who teaches at Parsons The New School for Design and has undertaken a number of ecological art projects around the world, emphasized at the AAG panel discussion the importance of catalyzing change by reaching people at the level of emotion and feeling. “If we only restore ecosystems, we will keep only applying Band-Aids,” she said. “The stronger leverage point for intervening in the system is at the affective level, at the level of the body, the heart and the unconscious, which have to be moved if the paradigm is going to be changed. You have to restore values as you restore ecosystems to create an active and passionate public will that understands and acts in the interest of a healthier world.”²⁰

Whitehead, Brookner, and other environmental artists aim to foster a new culture of knowledge production, cre-

ate affective environments that move people, and accomplish successful on-the-ground restoration and remediation. They collaborate with scientists and planners to develop robust projects that make a difference in cleaning water and soil and in transforming popular understanding. They also seek to convince broader audiences about the promise of art in the world.

Washing Stormwater in the Bronx

WATERWASH ABC, for example, Ball’s project along the Bronx River, provides a model of how local businesses can undertake stormwater remediation and how environmental projects can engage with environmental justice issues. The South Bronx has the lowest ratio of parks to people in New York City and takes in 40 percent of the city’s waste, the handling of which is partly responsible for more than 60,000 diesel truck trips into the Bronx each day.²¹ Rates for asthma in Bronx County, including for children, are eight times



Kathleen Becker

Artist Lillian Ball demonstrates the recycled glass permeable pavement technology at the opening celebration of her first WATERWASH® installation at an eroded boat ramp in Mattituck Inlet, Long Island (completed before the Bronx River project).

higher than the national average.²² In addition, the quality of Bronx River water suffers from repeated combined sewer overflow events, which occur after rains when overburdened waste treatment facilities release a mix of stormwater and untreated sewage into waterways.²³

Ball's partnering organization in the WATERWASH ABC project, youth development program Rocking the Boat, uses traditional wooden boatbuilding and environmental job training to help young people in the Bronx. Ball and the program's director Adam Green reached out to a local businessman with property on the edge of the Bronx River. The company, ABC Carpet and Home, worked with them to open up the riverfront for the stormwater mitigating wetland and public park. The park provides Bronx residents a view of the river and education about green infrastructure solutions to water quality problems. Public access to much of the riverbank in this area was blocked years ago by warehouses and factories built on landfill, and the river has suffered from decades of pollution. To create her

project, Ball also engaged with an environmental engineering firm, eDesign Dynamics, to help her design the wetland, and a contractor, Excav Services, who worked with her to construct the wetland and lay a winding pathway of permeable pavement constructed of recycled glass that leads visitors to a view of the river. The project was paid for via

To understand the problem, Whitehead researched many of the more than 400 abandoned gas station sites in Chicago.

a \$350,000 grant dispersed by the New York Attorney General's office from the Bronx River Watershed Initiative, which was created with fines exacted on the river's polluters.

An overarching goal of WATERWASH ABC is to educate local people

about the metabolism of urban water and the causes of river pollution and familiarize them with the capacity of soil and plants to strip water of most pollutants. In its creation (the project was opened to the public this past spring), the project provided diverse groups of people with opportunities to participate, including the group of paid apprentices from Rocking the Boat who assisted in planting the wetland. Several of these youth will return to the site as environmental apprentices, working with collaborating scientists at Drexel University to monitor the effectiveness of the wetland in mitigating parking-lot runoff.

Visitors to this private/public park can read a sign that describes the efforts of all the different partners: the Bronx-based business, nonprofit groups, teenagers, scientists, and the artist, Ball. Other signs explain how the constructed wetland works as it slows rain or snow runoff that would otherwise drain directly off the warehouse's 30,000-foot parking lot; allows the water to gently percolate through soil and plant roots;



Frances Whitehead, David S. Graham, and A.P. Schwab

Working with the City of Chicago's Department of Environment, artist Frances Whitehead was asked to consider: What is a sustainable brownfields cleanup? What is a cutting-edge approach to phytoremediation? And what can be done with the city's abandoned gas stations with few or no redevelopment prospects? Working with her colleagues Whitehead developed a "swatchbook" of possible uses for the widely distributed sites, thinking about them as a collection of sites rather than individual parcels. Inset: GIS Map of the 400+ abandoned gas stations on City of Chicago roster in 2009.

and, ultimately, cleans it of hydrocarbons and other pollutants before it joins the river.

Ball was both the visionary and project manager for *WATERWASH ABC*, providing not only inspiration and ideas but also daily oversight of the construction. Attention to details was critical to the project's success. "I have thought long and hard about potential ways to make a difference," Ball has written. "How can an appreciation of place engender public involvement? What kind of visual strategies reinforce the scientific values protecting natural spaces?"²⁴

Cleaning Soil and Advancing Phytoremediation Science in Chicago

Whitehead's project investigating sustainable options for abandoned gas station remediation involved direct work with the City of Chicago. The challenge there lies not only in contaminated soil but also in the question of what to do with such sites when there is very little opportunity for redevelopment. Abandoned gas stations are a classic symptom of urban blight: weedy, fenced-off spaces with a low likelihood of redevel-

opment.²⁵ Neighborhoods in less well-off areas of cities struggle to find the resources to clean up and invest in these small, widely distributed spaces.²⁶

To understand the problem, Whitehead researched many of the more than 400 abandoned gas station sites in Chicago. Her solution, called *Slow Cleanup*, offers a new vision for the widespread, troublesome lots, engaging phytoremediation not only to clean up the site but also to create a beautiful and productive space. Designed in collaboration with Purdue University soil chemist A. Paul Schwab and City of Chicago brownfields geologist David



Frances Whitehead

Before, during and after photos of the installation of the phytoremediation test plots. Students from the Art Institute of Chicago crafted the metal edging and plants were installed by the environmental jobs training program GreenCorps Chicago during the summer of 2011.

S. Graham, the project includes greenhouse and field trials in order to produce data on the remediation capabilities of a long list of never-tested native horticultural plants.

Whitehead and her team determined that a limited number of plants have been tested for phytoremediation. Potential remediators, the group conjectured, might include horticultural plants that could provide a whole range of ecosystem services, including urban agriculture, bird and pollinator habitat, biofuels, winter color, fragrance, and urban bosques. Whitehead emphasizes that the recalcitrant hydrocarbons left in the soil at abandoned gas stations are not taken up by plants; rather, plant roots exude simple organic compounds, especially phenols, which enhance soil microbial activity that in turn breaks down the hydrocarbons—effectively dismantling them.

Whitehead explains that the name of her project comes from the Slow Food movement, which asserts the value of cultural heritage over speed,

recognizing the relatively slow process of the phytoremediation of petroleum residues. “*Slow Cleanup* flips the fast, cheap, easy paradigm of dig and dump remediation and embraces time as an underutilized asset,” she says. “Can we think of these degraded sites as cultural heritage, literally that which we inherit?”²⁷

Last summer, Whitehead worked to install the first *Slow Cleanup* site, which hosts a number of field plots testing the new plants. Because it is field research being pursued in concert with greenhouse trials, Whitehead was concerned about community engagement with the project, given that much of it would be fenced off while data were being gathered from the soil and plants. After talking with the neighborhood alder, the team of artist and scientists selected a large site adjacent to Chicago State University (CSU), which has a predominantly undergraduate and minority student body with a burgeoning urban ecology program. The team partnered with CSU on the site as a place for the

environmental science students to study and monitor the soil and plants for future changes. Unprompted, the community leaders named the site the “Cottage Grove Heights Laboratory Garden,” delighting Whitehead, who described it as “creating a transgressive equivalent—that a community garden can also be a site of public research.”²⁸

In addition, Whitehead laid out the site as a kind of performance for passersby. “Like Versailles for citizen viewers,” she says, explaining how her radiating lines, which divide the plots within which different plants are being tested, move out from particular vantage points.²⁹ These points will coincide with places in the fence where people can stop, take in the gardens, and read signs that inform them of the experiment that their neighborhood is hosting. In addition, Whitehead arranged the plantings in order to create a seasonal color clock, so that in front of a shifting background mosaic of trees, the lower growing forbs and bushes in the foreground will take turns flowering, moving from left to



Lillian Bell

Signs at WATERWASH ABC inform visitors about the people who worked together to create the project, as well as how the wetland functions to clean up parking lot runoff and offer habitat to urban wildlife. The railing was salvaged from the old Yankee Stadium.

right. The site celebrates seasonal and phenologic change, bringing attention to time as it is marked by plants. She left a gathering space for students and convinced the city brownfields department to fund a more attractive fence (which was originally chain-link) to signal the value of the Laboratory Garden as a long-term investment.

“We refer to this as the Knowledge Site,” she says. “We are growing knowledge here.”³⁰

The Art Context

These projects sit within a broad, diverse, and expanding area of participatory ecological art in which artists engage with scientists and local community members to intercede in specific examples of environmental degradation and injustice. Other notable environmental artists include Helen and Newton Harrison, who since the 1970s have pursued conversations and created maps and other images in the interest

of promoting ecological sustainability with communities all over the world. In addition, Tim Collins, Reiko Goto, and other artists worked with Carnegie Mellon’s Studio for Creative Inquiry in the late 1990s to restore slag heaps at Nine Mile Run in Pittsburgh, and Mirle Laderman Ukeles has presided over the transformation of New York City’s

“Art is familiar to most people as a source of entertainment, illustration, decoration.”

Fresh Kills landfill into parkland since before its closure in 2001. Environmental artists with projects in other areas of the world include Georg Deitzler in Germany, who has created what he calls “self-decomposing laboratories”—oyster mushrooms that degrade, among other things, polychlorinated biphe-

nyls³¹—and Betsy Damon, who directs Keepers of the Waters, a nonprofit that has worked to preserve and remediate riparian zones in China and other places.³²

Like many of the artists just mentioned, Aviva Rahmani has experience in remediation, helping to transform a former coastal town dump into flourishing wetlands over a period of 10 years (*Ghost Nets* 1990–2000) in collaboration with the Wells National Estuarine Research Reserve in Maine. However, she has grounded her practice equally in art, geographic information systems science, and environmental science and has worked on environmental issues in Delhi, Copenhagen, and New Orleans. In addition, she has collaborated with scientists pursuing on-the-ground solutions to global warming at the Institute for Arctic and Alpine Research at the University of Colorado, Boulder. At the AAG panel on art, science, and environmental change held earlier this year, she noted, “Art is familiar to most people as a source of entertainment, il-

lustration, decoration. It is less familiar as a knowledge system and source of creative options that take equal place with other forms of systems theory and modeling. Art can present new insights. It also engages people in novel interactions with surprising results.”³³

Focusing on the community-oriented and collaborative work performed by artists pursuing environmental remediation and community development projects, Malcolm Miles, author and professor at the School of Architecture, Design and Environment at Plymouth University, United Kingdom, has written on the unique position of artists in these types of environmental projects: “Reclamation artists act as communicators and researchers, and as intermediaries between those who have power and those who do not, a possibility derived from the autonomy claimed for art in the modern period, which allows critical distance and independence of viewpoint whilst . . . regaining a sense of engagement and interaction with diverse groups in society.”³⁴

The idea of art as motivator for social action and participation is certainly not new, and can be traced back to Allan Kaprow’s interactive “Happenings” in the 1950s and 1960s; the work of the art collective Fluxus in the 1960s and 1970s; and Joseph Beuys’s 1975 declaration (borrowed from the German Romantic Novalis) that “everyone is an artist,” each playing a part in a grand social work of art.³⁵ French art critic Nicolas Bourriaud wrote of “relational aesthetics” in the 1990s, describing work centered on the contingencies of environment and audience. Unlike earlier participatory performances, Bourriaud’s concept eschews a distant utopian agenda in favor of the immediate here and now.³⁶

Perhaps what most distinguishes the work of the artists just described is their commitment to intervening in specific instances of environmental degradation. This explains the strong collaborative element as these artists seek out engagements with environmental scientists, urban planners, and community and business leaders in order

to research problems, design solutions, and monitor results. They want to know that their art works. Thus, these projects are propelled forward by artists with a strong sense of urgency to address the world’s environmental problems; a feeling that the traditional approaches to art do not support artists in direct, practical engagement; and a belief that conventional approaches to environmental problem solving often lack key elements of culture and meaning.

Artist as Collaborator

The labor of collaboration cannot be emphasized enough as a demanding

Art can present new insights. It also engages people in novel interactions with surprising results.

aspect of many of these projects.³⁷ This is one reason why these efforts can be distinguished from landscape design, which might also attend to ecological flows and movement of people and water in a way that remediates pollution of some kind. But the work behind these artistic endeavors reveals how these artists are moving in extra-institutional, transdisciplinary spaces, where there are no ready-made connections or path dependencies. Environmental artists have to forge their way, and often without much compensation.

As Ball explains,

For my WATERWASH ABC project, I picked the site, identified a nonprofit group to work with, and put together the team. I worked with the nonprofit Rocking the Boat to apply for the grant, to pull our permits, and do all the organizational things to make the project happen. So, in my project the artist is lead agent as well as project manager. This is important in the process of getting

things done because otherwise, when funds get tight, the aesthetics is typically what gets cut.

Betsy Damon, the Keepers of the Waters director, emphasizes the importance of the relative freedom and autonomy that allow artists to create novel approaches to problem solving and to direct their own projects:

Art in many ways has become a commodified box that you buy and enjoy, or not. But these projects are different—this is creativity. And because we are not on a salary and a short leash, that is a big deal. We suffer there but we are free, creating this new form. What we are doing is re-integration, joining with others since ecosystems are all integrated, and pioneering the reintegration to create real change.

Artists have long claimed the turf of a special vantage point on the world, but that perspective has typically been associated with a level removed from everyday society. But as Whitehead insists, these artists actively engage with environmental problems, and therefore have a unique tool kit that establishes them solidly as doers, capable of identifying and researching problems, then conceiving and building solutions.

Conclusion: Contributions of Art-Science

These artists offer visions of how environmental cleanup can be pursued as a cultural, social, and scientific undertaking. Their projects clean soil and water. They also provide models for public-private partnerships, environmental education, youth development, environmental justice, and green infrastructure development. They offer insights into several specific sustainability challenges. They are advancing areas of applied science that are lagging in identifying key publics for environmental problems. The projects also assist cities facing crises of infrastructure,

and they underscore the importance of technologies that provide access to the environment and facilitate participation.

The “real-world experiments” Matthias Gross argues for allow community members to make decisions even in the context of uncertainty and risk, and they learn from each decision, thereby generating new knowledge.³⁸ Whitehead’s Slow Cleanup offers one example of such a real-world approach via its integrated plan of research that unfolds both in the greenhouse and at a particular site, each influencing the other.

The projects also underscore the importance of participation—by students, community alders, neighbors, and city horticulturalists, as well as scientists and planners, all of whom represent different kinds of expertise about a place. The vague notion of “public” distills into different groups with particular needs and potentials that can be integrated into the site design. The WATERWASH ABC project, for example, engages Bronx youth not merely as victims of the environmental injustice that has cut off access to the river, but also as potential experts and sources of citizen science about changes in the river.

The art projects described here also speak to the power of technologies to engage that diversity of participation. For example, the practice of citizen wolf howl surveys has allowed many people in Wisconsin to observe and engage with an increasing but mostly invisible presence the wolves in that state, itself a large-scale, real-world experiment in the restoration of a species once nearly extirpated from much of its range.³⁹ In the garden as envisioned by Whitehead, people have a way to indirectly engage with what they cannot see but can be tremendously influenced by—soil microbes that clean their soil—and to appreciate the work of these microbes as they help plants generate color, flowers, and food.

These projects also contribute to the growing task for cities to rethink infrastructure, a serious issue in developed as well as developing cities.⁴⁰ Urban areas concentrate a large proportion of those most at risk as lives, property, en-

vironmental quality, and future prosperity are threatened by increasing storms, floods, heat waves, and drought and by overloaded and failing water, drainage, and energy infrastructure. The U.S. Environmental Protection Agency has identified stormwater as the number one threat to water quality in the country, as sewage systems struggle to keep up. Recognizing the limitations of traditional gray infrastructure, the city of New York plans for the first time to invest more than half its budget for new development on green infrastructure.⁴¹

Models provided by artists like Ball and Whitehead show how a distributed, site-sensitive approach to reclaiming urban stormwater or cleaning urban soil carries tremendous generative potential: supporting gardens; creating shade and color; offering opportunities to interact with other species and other people; building community; teaching the power of soil and plants to clean and maintain an urban environment; and granting a moment of pleasure. These are complex and ambitious goals, but the packaging is practical, offering a basic ecological model of relationships that can be useable by others in different places. Moreover, each project responds precisely to a particular place and time, and via that situated strategy offers purchase on the challenge of decision making in the face of uncertainty.

What might be the most important contribution of these art–science efforts, however, is the inclusion of culture and emotion as critical elements of environmental projects. Whitehead’s color clock and Ball’s meandering path to a river view offer the possibility of joy and pleasure. The artists’ sensitivity to neighbors and local history provides a way for people to feel integrated with and supported by—rather than replaced or supplanted by—these environmental efforts. The opportunities offered to young people to learn by getting their hands dirty—to literally feel soil, roots, and water with their hands and feet—are a valuable part of environmental education not easily obtained by many urban youth. Integrating science and culture, these art–science collaborations

broaden both the audiences and the participants for sustainability.

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