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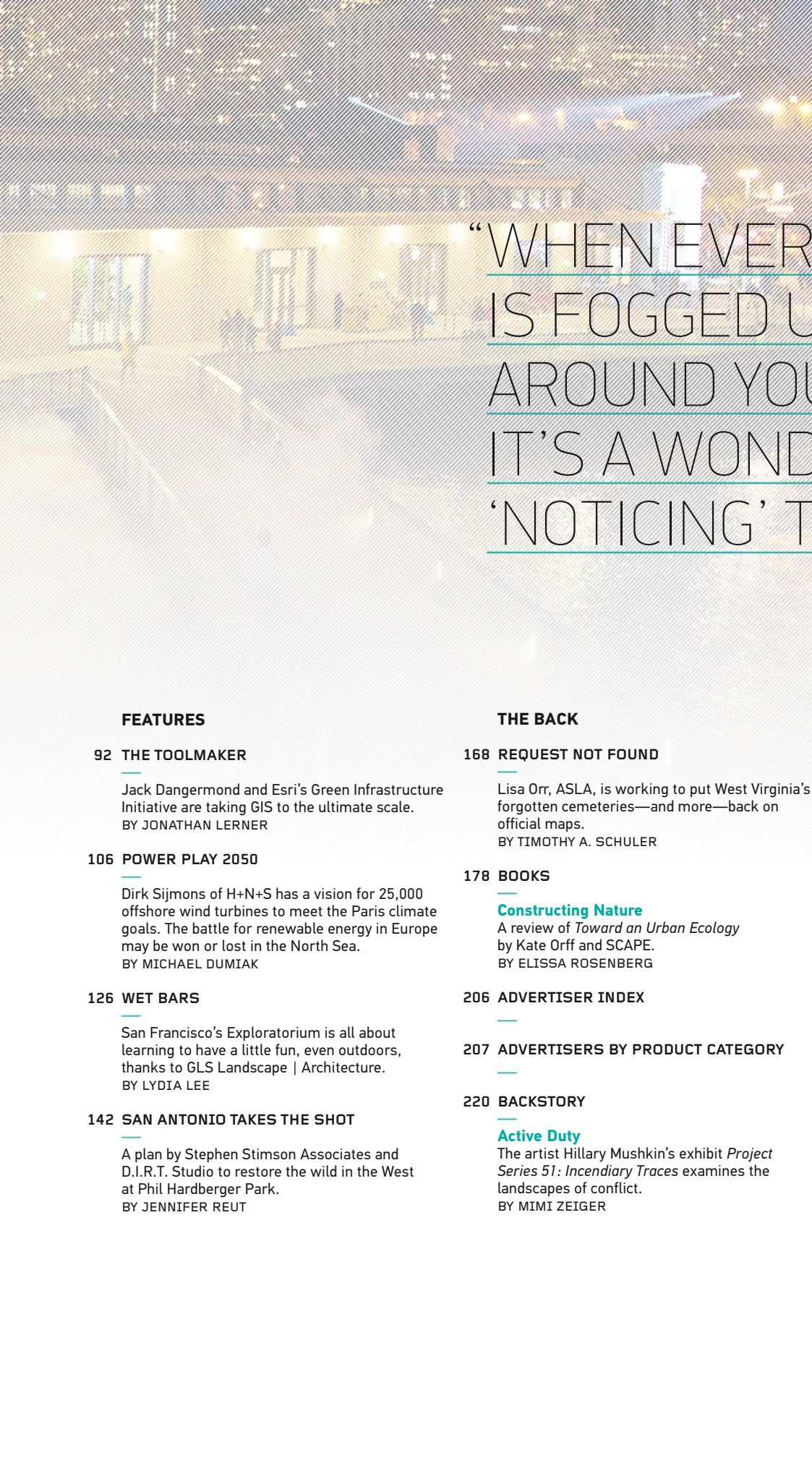
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IT’S A WONDERFUL
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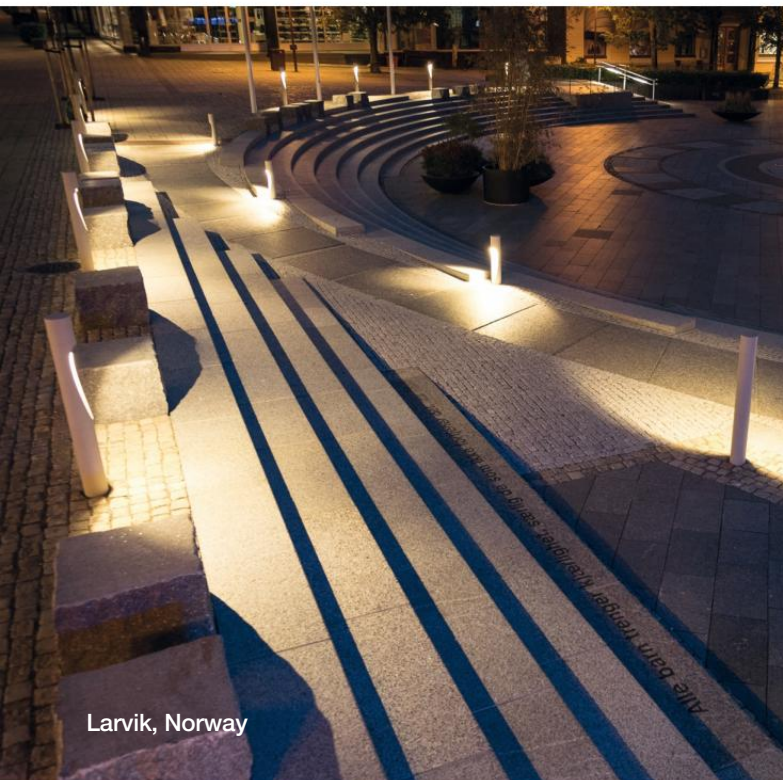


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ON THE COVER

Energetic Odyssey, the
North Sea, by H+N+S
Landscape Architects,
page 108.

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"I had to leave fused bamboo dimensional lumber and other wood composites out in order to meet length specifications. I hope to write about them in another article soon."



MICHAEL DUMIAK ("Power Play 2050," page 106) is based in Berlin. You can reach him on Twitter @r8lobster.

"Heading to the Rotterdam port to see the sand works, you can take the long surfer route by car (which I didn't have), or shuttle across the channels to a drop-off point from which they recommend you bicycle to the visitor center. That's three straight miles of pedaling."



ELISSA ROSENBERG ("Constructing Nature," page 178) is an associate professor emerita in the Department of Landscape Architecture at the University of Virginia and teaches at the Graduate Urban Design Program, Bezalel Academy of Arts and Design, Jerusalem. You can reach her at elissabrosenberg@gmail.com.

"The oyster is effectively a small filtration machine that can have a macroeffect in cleaning the contaminated water of New York Harbor."

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OLD FRIENDS AND NEW

For all his zeal, and two whole years now as chairman of the House Committee on Oversight and Government Reform, Rep. Jason Chaffetz (R-Utah) might have been expected to show more sophistication in introducing a major resource bill on January 24 that he then found himself having to withdraw a little over a week later. The bill was H.R. 621, the Disposal of Excess Federal Lands Act. The title aptly conveys its spirit. It would have handed over three million acres of federal lands to several western states, an extraordinary shift of land management policy, and one long sought by no-government factionalists, especially in the West. He introduced the bill a few weeks after House Republicans, in one of their first acts of the new session of Congress, changed rules to ease the selling off of federal lands.

What Chaffetz did not anticipate, inexplicably, was the hot, swift backlash to his land giveaway among conservation and sporting groups, such as the National Wildlife Federation, the Wilderness Society, Backcountry Hunters & Anglers, Trout Unlimited, and others. These organizations oppose the dissolution of federal lands for various reasons—they want to protect plant and animal populations and habitat, their members like to hunt and fish freely on U.S.-owned land, or their constituencies simply enjoy exploring the outdoors in places as close to wild as possible. The interests of mainline conservationists, who tilt progressive, converged significantly with the interests of the sporting community, many of them conservatives whose support Chaffetz will need on countless other issues. On February 2, Chaffetz posted an apology on Instagram, a photo of himself wearing camouflage gear and holding an adorable dachshund, to say he is a “proud gun owner [and] hunter,” that his bill “sends the wrong message,” and to promise that it “dies tomorrow.”

It was a rare bit of sobriety in a new Congress where the majority members in both houses are fevered by the prospect of dismantling many long-standing environmental protections. Among the legislation being introduced in the House, there is, notably, H.R. 861, “To Terminate the Environmental Protection Agency,” introduced by a Florida Republican freshman, Rep. Matt Gaetz. (ASLA opposes the measure and has issued a statement asking for its withdrawal.) There is the House Joint Resolution 69, introduced by Rep. Don Young (R-Alaska), which would reverse an Obama rule that took effect last year

to prevent sport hunting in Alaska national wildlife refuges of bear cubs or sows with cubs; hunting bears with traps or snares; hunting bears from aircraft; and to reduce periods when hunting coyotes or wolves is allowed. It has passed the House; the Senate has not acted as of early March.

And then there are the plans coming from the administration. The White House’s 2018 budget is likely to call for a 24 percent reduction of the EPA’s budget, a \$2 billion cut, and a reduction of 3,000 employees, or 20 percent of its workforce. Among the programs targeted hard are ongoing restoration projects on the Chesapeake Bay, the Great Lakes, and Puget Sound. The Great Lakes Restoration Initiative would be withered to 3 percent of its current funding, dropping from \$300 million to \$10 million. The Chesapeake Bay project would retain 6 percent of its current funding, or \$5 million. These figures are meant to send a message that clean water is a nuisance rather than a priority. But here is where the White House will likely face a Chaffetz moment.

Cutting these programs will require congressional votes. The Great Lakes initiative is a favorite of Republicans and Democrats both. When word emerged of the proposed cuts, Michigan lawmakers quickly voiced displeasure. The state’s senior Republican, Rep. Fred Upton, called the proposal “alarming.” In Maryland, the Chesapeake Bay cleanup, which survived a Supreme Court challenge in 2016, is called antibusiness by the American Farm Bureau, because a key part of the cleanup is reducing agricultural nutrients flowing into the bay, the nation’s biggest estuary. But the fishery and oyster businesses around the bay think it very probusiness to keep aggressively cleaning up the bay, as do businesspeople invested in the wealth of outdoor recreation along and between its shores. The Trump people are mistaken if they expect the “business community” to come to their side unequivocally in support of these cuts to restoration programs. For the grass roots, in a topsy-turvy environment such as this, it’s crucial to know who your allies are, and that they may not be the allies that have traditionally first come to mind.



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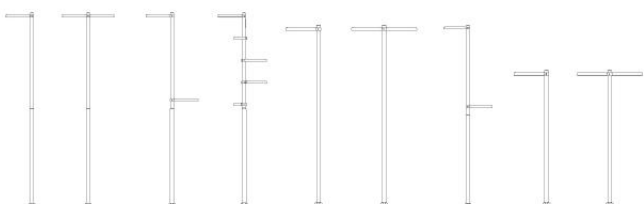
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GOING BACK TO THE ROOTS

I have always been a bit skeptical of the idea of genealogy as applied to cultural endeavors, and of the implication of a distinct division between “Western” and “Eastern” thought. The juxtaposition of two articles in January’s Books section rekindled my doubt. In Julia Czerniak’s thoughtful review of Christophe Girot’s new book *The Course of Landscape Architecture*, we’re reminded of the familiar tropes of the forest clearing and the walled garden as the acknowledged “first landscape archetypes...of all Western landscape.”

Where does this leave the Aztec landscapes such as Teotihuacán, based on direct reference to a relationship with mountains and sky? What about the Hohokam irrigation networks in the Sonoran Desert, traces of which can still be seen on Google Earth? The earthworks of the ancestral Puebloans? These are all placemaking responses to landscapes of the Western Hemisphere, with aesthetic intention and embedded meaning in addition to function. As the brief blurb about Diana K. Davis’s book *The Arid Lands: History*,

Power, Knowledge points out (directly following the feature review), “Great civilizations once sprang from desert regions, and people thrived there for thousands of years before colonizers from wetter places deemed them problematic.”

At the end of her review, Czerniak describes Girot’s concept of “topology,” which might “develop into a new language of landscape.” I would say that in addressing the spatial qualities and ecosystem features of arid landscapes, many of the first peoples of the North and South American continents were already doing this. Whether this represents a different set of roots, a new branch in the genealogical tree, or a rephrasing of “Western” as “European–Mediterranean,” I do not know. But I look forward to a continued acknowledgment of the expanded scope of where landscape architecture happens, and I hope that the question of whether our work is about what landscapes do or what they mean soon seems like the outdated distinction that it is.

ZOE EDGECOMB, ASLA
CHARLOTTESVILLE, VIRGINIA

NO PLACE FOR POLITICS

I agree with Bradford McKee’s reaction to Trump and with much of his philosophy in general. I disagree, however, with using *LAM* as a forum for political soapbox talk and climate change hand-wringing. *LAM* is a trade journal serving professionals of many ideologies. It also is not, as one letter to the editor states, an “environmental magazine.” It is a landscape architecture magazine. I should not, and prefer not to, even know the political beliefs of the magazine staff.

As much as I might agree with many of the ideas expressed, they contribute nothing of value to my understanding of landscape architecture and its practice. I wish the magazine would return its focus to design-related articles. Leave the global warming debate and Trump to others.

SCOTT PEATROSS
MEMPHIS, TENNESSEE

SUBMIT

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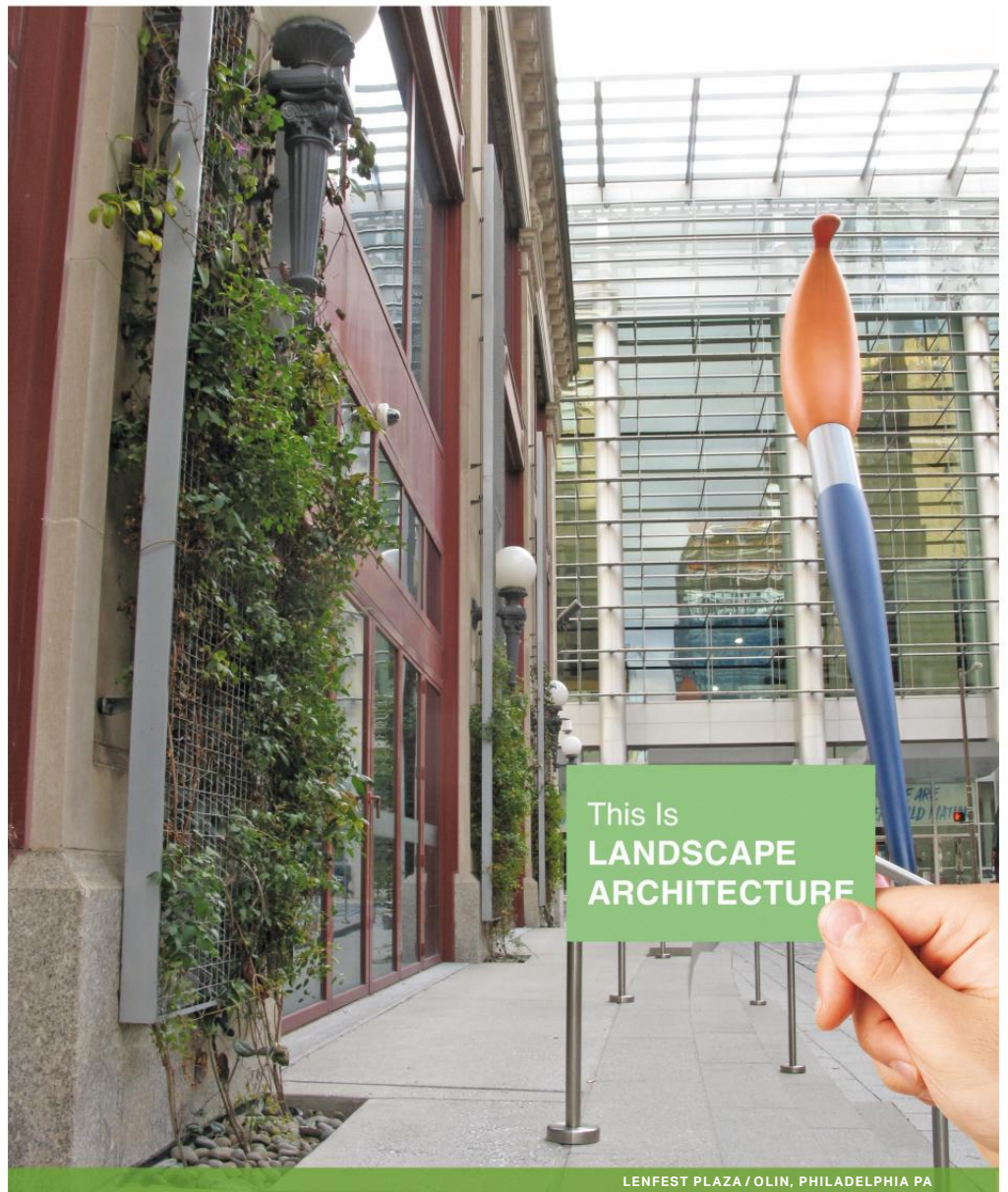
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FOREGROUND



TRADD AND OLGACOTTER

NEOLENTINUS LEPIDEUS

This fungus is a valuable species for use in mycoremediation, in **ECOLOGY**, page 52.

SEE YOU AT THE DUMP!



IN SEATTLE, PUBLIC WORKS BEGET PUBLIC SPACE.

BY TIMOTHY A. SCHULER

ABOVE

Public walking paths will wrap around an off-leash dog park and even climb the facade of this electrical substation in South Lake Union.

Gas Works Park might be Seattle's most famous example of putting a park where a person least expects it, but a few blocks away, a much smaller sliver of green space builds on the tradition. On first glance, it seems like your typical neighborhood park: basketball court, playground, picnic tables, rain garden—all of it woven together with curvilinear paths and plantings. But look closer, and you'll notice that this new park is part of a 6.5-acre trash and recycling facility. "Instead of being an eyesore or a pollution hazard, it's really now an amenity," says Dean Koonts, ASLA, a principal at HBB Landscape Architecture, which designed the landscape.

Opened in late 2016, the North Transfer Station is one of several recent municipal infrastructure

projects in Seattle that integrate public space. Among them is the 110,000-square-foot Denny Substation, designed by NBBJ. When it opens in 2018, this electrical substation will provide the fast-growing South Lake Union neighborhood 44,000 square feet of public amenities, including a dog park, a plaza, gallery space, art installations, and dramatic elevated walkways that climb the facility's multifaceted facade.

It's a trend that could help distribute park space more democratically, as these types of undesirable facilities traditionally have been located in lower-income communities. Atypical projects bring atypical challenges, however. At the North Transfer Station, the design team had to ensure the facility and surrounding park wouldn't inadvertently attract wildlife. "You don't want to create a rat problem," Koonts says. Trickier yet was Denny Substation, where all the site furniture had to be

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LEFT

At the North Transfer Station in Wallingford, amenities like the basketball court were placed away from vehicular entrances.

BOTTOM

Juniper plantings and a public plaza create a buffer between the residential community and the trash facility.

grounded. The team worked with manufacturers to conceal the required grounding wires. “We had to make sure that if we have an off-leash area that dogs weren’t going to get electrocuted if they pee on something,” Koonts says.

Although not alone in combining public works and public space, Seattle seems to be on the forefront, in part owing to a long history of integrating public art into city projects. Ruri Yampolsky, the director of Seattle’s public art program, says artists have “loosened up” the ways the city thinks about space. The practice is also driven by Seattle’s urban growth boundary, which forces the city to accommodate water, waste, and energy infrastructure within the urban fabric. At the same time, an increased emphasis on public engagement has highlighted the need for such projects to “be a better neighbor,” Yampolsky says.

Not every project has to be as flashy as the Denny Substation, Koonts says. For a combined sewer overflow project near Seward Park, HBB included habitat restoration along the Lake Washington

shoreline and an asphalt walkway that runs atop the buried sewer line. Koonts says the latter is a move HBB has used elsewhere as a low-cost way to build trails in underserved neighborhoods. “It’s like, if we just put an asphalt trail on top of [the utility line], we can connect this street and this street,” he says. “Now, it’s an amenity. It’s that simple.” ●

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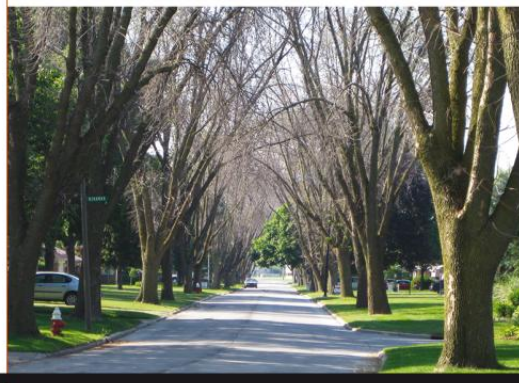
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BETTER: PARTNERS IN CRIME?

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BY MADELINE BODIN



LEFT

A street lined with ash trees in Toledo, Ohio, after a beetle infestation.

Having more trees in a neighborhood leads to fewer crimes. That's a hypothesis that scientists have been trying to conclusively prove or disprove for decades. When Michelle Kondo, a social scientist with the U.S. Forest Service's Northern Research Station, saw that the City of Cincinnati kept detailed records of where and when it removed ash trees killed by the emerald ash borer, an invasive beetle, she saw a natural experiment that might offer more proof.

Kondo and her team combined the tree removal data with crime data from the Cincinnati Police Department, comparing census blocks where dead trees had been removed to census blocks where they had not. They adjusted for several factors that influence the crime rate, including poverty levels, and found that the death and removal of mature ash trees could be pegged to a 1 to 2 percent increase in certain crimes, including theft, assault, and murder.

"These findings add to the evidence tying more residential trees to less crime," says Frances Kuo, director of the Landscape and Human Health Laboratory at the University of Illinois at Urbana-Champaign and author of a highly cited 2001 study, "Environment and Crime in the Inner City: Does Vegetation Reduce Crime?" published in the journal *Environment and Behavior*, which linked more trees with lower crime rates. She adds, however, that "from a scientific standpoint, it's too early to conclude that having more trees actually discourages crime."

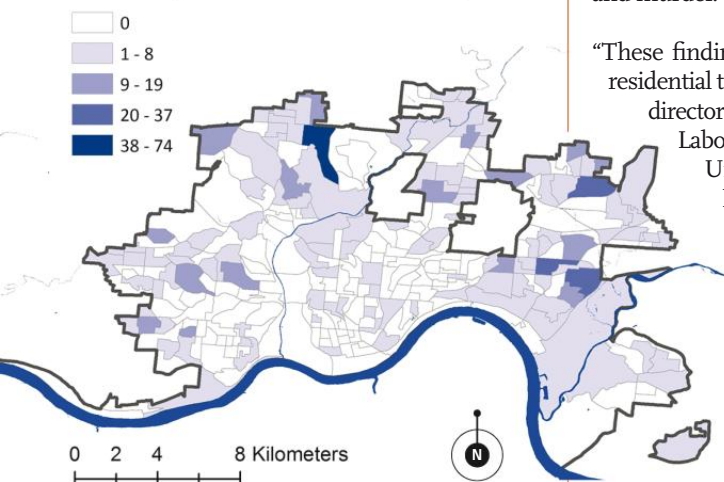
What Kondo and her team may have inadvertently shown is the widening influence on society of invasive species such as the emerald ash borer. Even the modest increase in crime described in Kondo's study would cost a significant amount to accommodate in policing, says Aaron Chalfin, an assistant professor of criminology at the University of Pennsylvania, who was not involved in the study. "Our best guess as a field is if a city increased the size of its police force by 1 percent, the incidence of violent crime would go down by maybe a half of a percent," he says.

If each police officer costs \$140,000 a year in salary, benefits, training, and equipment, Chalfin says, then the equivalent policing costs would justify money spent on tree maintenance and replacement as well as the cost of efforts to eradicate the emerald ash borer and other tree pests. Kondo did not address this in her study, but she says she would like to see further research that could put a scientifically valid dollar value on efforts to save trees that are at risk.

The solution isn't to design around the impact of tree pests, says Jill Mahon Johnson, the Midwest coordinator of the U.S. Forest Service's urban and community forestry program. There will always be a new one. Instead, she says, Kondo's study gives landscape architects yet another reason to advocate for principles such as species diversity and tree health in their projects. The ability to fight off invasive tree pests—and crime—is reason enough to design for vigorous trees, she says. "Maximize the potential for individual trees to thrive, but also for the urban forest as a whole to remain healthy and vibrant." ●

DAN HERMS, TOP; MICHELLE C. KONDO, SEUNGHOON HAN, GEOFFREY H. DONOVAN, JOHN M. MACDONALD, BOTTOM

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A NEW PROGRAM SPROUTS IN DELAWARE

**THE UNIVERSITY OF DELAWARE'S
LANDSCAPE ARCHITECTURE
MAJOR IS THE FRUIT OF A
DECADES-LONG EFFORT.**

In the 1970s, the University of Delaware was an unlikely hub of contemporary landscape architecture. Although it had no formal degree program, it offered courses in landscape design, and among the instructors was Conrad Hamerman, a close friend and colleague of Roberto Burle Marx. W. Gary Smith, FASLA, a student at the university at the time, recalls Burle Marx's visiting their design studios and giving them critiques. Other times, it was Buckminster Fuller and Isamu Noguchi. "[It] was this incredibly rich environment," Smith says. "And then it never really developed into an accredited program."

Forty years later, the university welcomed its first class of landscape architecture majors, the first of whom will graduate in spring 2018. Housed in the College of Agriculture and Natural Resources, the program grew out of an existing horticulture major. For Jules Bruck, ASLA, the current director, it was a chance to "reframe what's important" in landscape architecture. It was also something of a necessity.

Although a graduate landscape architecture program had been discussed for more than a decade, in 2011, an educational consultant hired by the university recommended a bachelor's program as a better investment. With enrollment in the horticulture program dwindling, a four-year professional degree program—one that ended in licensure and significantly higher salary expectations—was attractive to prospective students and the university, Bruck says.

Because of its provenance, the program has a strong emphasis on plants. Smith, who taught at the University of Delaware from 1989 to 1998 and now runs his own practice, says that will be a differentiator. Students will learn about ecology and groundwater "and not just from a theoretical perspective," he says. "They're going to learn about it in ways that help them to make functioning landscapes. These students, when they get out, [are] going to find that they are a rare breed, and that there's a real place for them in our profession."

Bruck says rubbing shoulders with plant and soil scientists gives both students and design faculty a broader perspective on the world. "The scientists stop me in the hall and talk to me about this new thing they're learning about the rhizosphere," she says. "If I were a landscape architect in a department of landscape architects, I wouldn't be having a serious dialogue about the rhizosphere."

If new programs offer opportunities to frame landscape architecture with 21st-century ideas, they also come with the kinds of challenges often reserved for young practices. "I say that our BLA program is a lean start-up," Bruck says. "We don't have the resources that a lot of the bigger programs do." Nevertheless, the students' enthusiasm is palpable, she says. "I feel like I'm gonna live off the energy of my students for the rest of my life. They are so proud and so pleased to be landscape architecture majors. It feels different than when they were horticulture majors." ●

ABOVE
Landscape architecture students at a lecture about Roberto Burle Marx, who had close ties to the University of Delaware.

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**IN LONDON, LANDSCAPE PROJECTS ON FLOOD-PRONE PROPERTIES
PROVIDE DATA FOR LOCAL GOVERNMENT.**

BY GEORGE BULL

ABOVE

At Queen Caroline Estate in London, a shallow stony basin helps manage stormwater from the roofs of the adjacent buildings during heavy rainfalls.

In 2013, having identified the London borough of Hammersmith and Fulham as prone to flood risk, the United Kingdom environmental nonprofit Groundwork put a proposal to the borough's council: Let us retrofit green infrastructure in three public housing projects, and not only will we demonstrate that climate-proofing works, we'll also supply the data you need to make the business case for future projects.

Groundwork secured 50 percent of the needed funding from the

European Union's Life+ program and, alongside a contribution from Drain London—a partnership responsible for managing surface water flood risk and drainage assets—the council committed the other half. Three sites were chosen: Richard Knight House, Cheeseman's Terrace, and Queen Caroline Estate, each reflecting a different property type and size. Over the next two years, Groundwork retrofitted a mixture of ground-level and vertical rain gardens, swales, and stony basins, and enough shallow green roofs to cover a basketball court. "The features were sized to accommodate rainfall events varying in scale and intensity up to a 100-year storm," says Mark Bentley, a principal landscape architect at Groundwork.



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Lined by gabions, low-level green roofs at Queen Caroline Estate reduce the amount of rainwater draining directly to the sewer and create wildlife habitat.

Where there was limited landscape, such as at Cheeseman's Terrace, a greater number of smaller interventions were scattered between buildings. At Queen Caroline, the largest of the properties with 262 apartments, expanses of hard paving were replaced with permeable but hard-wearing Austrian gravel lawn, or *Schotterrasen*.

The funding included a 15-month commission for the University of East London to monitor the landscape's performance. In 2016, that funding was extended by the bor-

ough for another 12 months. On-site weather stations provide data on continuous rainfall and, though most runoff comes from paving and roads, at the base of the downpipes there are flow meters to measure the amount coming off the roof. "In the rain garden basins we have pressure sensors to give us data on water level, and time-lapse cameras take pictures every 15 minutes so we can actually see the water filling up and infiltrating the ground," Bentley says.

Results indicate that 89 percent of rainfall falling onto green roofs is absorbed and 100 percent of rainfall across the three properties has been diverted from the storm drain system. "We've found that [the features] have outper-

formed in terms of the amount of water that's gone into the ground," Bentley says, "and although the pictures exist as a technical reference, they're also a powerful tool for showing the community how effective the features are."

The total amount of surface water the interventions intercept is "relatively insignificant," says Peter Massini, the principal policy and program officer of green infrastructure at the Greater London Authority, the administrative body for the city. But that's to be expected. "The benefits come from the cumulative impact of hundreds of such projects. This is effectively a proof of concept, demonstrating the practicality of retrofit, the potential to engage residents and other stakeholders in design and implementation, and utilizing or tweaking existing local authority budgets to implement low-cost interventions." ●





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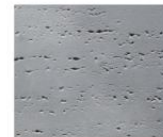
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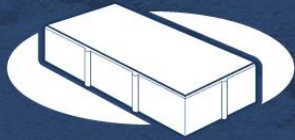


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ROOT CAUSE



WHEN IT COMES TO MYCORRHIZAE, A LOT OF LANDSCAPE ARCHITECTS ARE STILL IN THE DARK.

BY KYNA RUBIN

ABOVE

As part of an urban landscape in Honolulu, Rick Quinn, ASLA, clustered native plants to spur interplant cooperation and interaction with the soil microbiome.

Forest researchers and organic farmers who have studied permaculture long have understood that naturally occurring mycorrhizae are vital to a landscape's ecological health. These underground webs—mutually beneficial associations between fungi and roots—are part of nature's way of protecting trees and plants from drought, pests, and disease. But practical knowledge about how to harness mycorrhizae is lacking among landscape architects, says Rick Quinn, ASLA, a principal at HHF Planners in Honolulu.

When Quinn studied landscape architecture in the 1970s, he says, he learned about ecosystem functions. "But once we got into the realities of private practice, we set all that aside," he says. The reality is "nurseries with limited plant material grown in sterilized conditions, contractors used to installing in certain ways, planting

in nonnative soils, overwatering and overfertilizing, then getting insect problems. You just fall into that routine." This ornamental-garden approach works, he says, but requires a lot of fertilizer, water, and chemicals.

Quinn's new technique is designed to encourage natural mycorrhizae associations. When possible, he purchases plants from multiple nurseries with varying microclimates and soil conditions that can provide an assortment of beneficial microorganisms. He has also adopted unconventional watering schedules. In summer, he waters deeply (half an inch of water) once a week, and does a shallow watering (an eighth of an inch) three times a week. The resulting soil moisture fluctuations place just enough stress on plants to nudge their roots into forming organic, beneficial relationships with fungi.

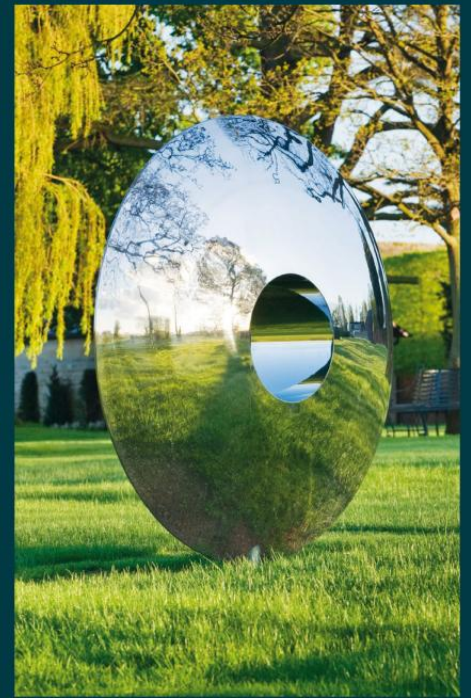
In California, Josiah Cain, ASLA, of Sherwood Design Engineers in San Francisco, has applied strategies pioneered by permaculture experts on several rural restoration and farm projects, using vegetation, bioswales, and soil inoculated with fungi to protect water bodies from bacteria associated with horses and cows. Cain says urban landscapes with engineered soils could benefit from the same approach.

Developing commercial mycorrhizae products is a challenge because pinpointing which fungi are beneficial

to which plants is a tricky business, says Nicole Hynson, head of a University of Hawaii lab that studies plant-fungus interactions. The same fungus, depending on the situation, can be beneficial, neutral, or parasitic.

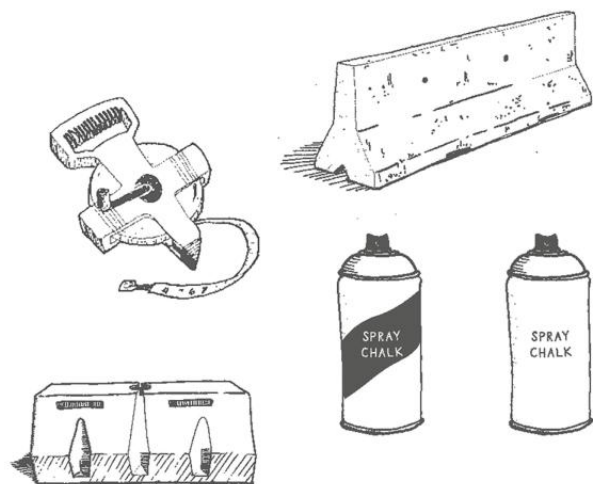
Still, crossover from science to practice is possible, Hynson says. She has led workshops for nonprofit and public agency staff on techniques for culturing and inoculating plants with symbiotic microorganisms. "These types of efforts could easily be transferred to landscape architecture," she says, though applying these practices requires buy-in on both sides: Some land managers she's worked with have concerns about introducing wild microbes into their greenhouses for fear of pathogens.

Even eager learners like Quinn find the breadth of knowledge needed to understand mycorrhizae challenging. "To really do this you almost need to be a soil scientist, an entomologist, a fungal expert, and a botanist," he says. Soil science research has not been collated and translated in ways applicable to landscape architecture, Quinn says. Practitioners might be inclined toward a whole-system view if the science were made more accessible. Landscape architects, he says, need "to reach out to these other disciplines and say, 'You've done a lot for agriculture. Help us [learn] how to apply this new understanding.'" ●



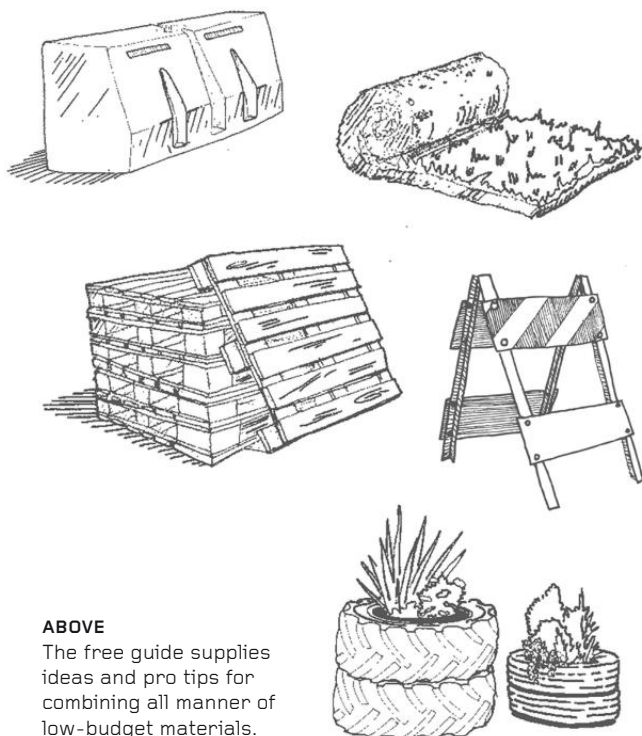
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NUTS, BOLTS, AND EVERYTHING IN BETWEEN

**THE TACTICAL URBANIST'S GUIDE IS AN EASY
HOW-TO FOR STREET SAFETY.**



ABOVE
The free guide supplies ideas and pro tips for combining all manner of low-budget materials.

In city after city, the questions were the same: Where do you get traffic tape? How much will the paint cost? How long will it last? Pretty quickly, Mike Lydon, a planner and the founding principal at Street Plans Collaborative, realized that would-be tactical urbanists needed a manual, a practical how-to for the creative placemaking and street hacking he'd been championing for the past 10 years.

In December 2016, Lydon's group released just such a manual. The *Tactical Urbanist's Guide to Materials and Design* is an astonishingly detailed (and charmingly illustrated) resource for anyone with a penchant for guerrilla placemaking. Available as a free download, the 132-page booklet covers the basic principles of tactical urbanism, common materials, and case studies. The bulk of its pages are devoted to the nuts and bolts that Lydon says organizers were hungry for, annotated with the occasional pro tip. For instance: While flexible delineator posts range from 27 inches to 36 inches in height, cities such as Chicago and Seattle use the 27-inch model "to reduce the chances of interfering with bicycle handlebars."

As fun as it is to flip through, the guide—and tactical urbanism in general—is about making cities safer. More than 35,000 people died in traffic-related incidents in 2015, according to the National Highway Traffic Safety Administration, a 7 percent increase from 2014. "As a field, we don't self-critique enough, in my opinion, how poorly we're doing on street safety," Lydon says. "We've constantly underscored that yeah, these projects are a lot of fun,

yeah, they can be cheeky, or they can be guerrilla, or they can be illegal even, but when it comes down to it, we want people to be safe."

The guide is especially useful as a communication tool, says Nina Chase, ASLA, a landscape architect with Riverlife in Pittsburgh. There are nearly two dozen case studies and the blueprints to build them, almost down to the dollar. But Chase also hopes designers will treat basic materials like bollards and box planters as a jumping-off point. "For me, it's like, how can you take some of these simple elements and flip them on their head?" she says. "Even a pallet—you can deconstruct a pallet and put it back together in a creative way."

Chase's Kit of Parks, which won KaBOOM!'s Play Everywhere Challenge, is a good example. Developed with Philip Dugdale, International ASLA, of Sasaki, the temporary, transportable play set was made out of little more than insulation foam and yellow paint. This spring, a polyurethane-coated, high-density-foam version of the kit will be debuted in Boston, in partnership with the city's Parks and Recreation Department.

Lydon is all for experimentation. "We [don't] want people to just look at this thing and copy-paste," he says, and he encourages landscape architects and other designers to submit their ideas and projects for future versions of the guide. "A lot of these elements aren't beautiful. The plastic posts and yellow traffic tape—we like these materials because they're effective, but we're always looking to add a bit more beauty and whimsy to our projects." ●



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NEW URBANISM, NEW HUD



HOW THE HELPMATES OF HOPE VI SEE HOUSING IN THE TRUMP ADMINISTRATION.

BY ZACH MORTICE

The founders of the Congress for the New Urbanism (CNU) started off with a bang. The small but influential cadre of advocates for walkable and traditional-looking urbanism began meeting in 1993—the first big gathering was held at the historic Lyceum in Old Town Alexandria, Virginia, with its “enormous entablature,” as the historian Vincent Scully noted in his opening remarks. The CNU’s beginnings dovetailed with the passage of a piece of legislation that enshrined the group’s approach to city building as federal policy: the U.S. Department of Housing and Urban Development’s HOPE VI program. After decades of crumbling, dysfunctional government-built-and-

managed public housing projects, housing would instead be at least partially constructed and controlled by private developers and management companies. They would build lower-density, “mixed-income” communities of row houses and garden apartments. By the numbers, the lower density was made easier because Congress, in 1995, ended what had long been the “one-for-one” replacement rule for any public housing to be demolished. Housing vouchers, to be used to pay private landlords (who are not required to accept them), were considered sufficient for tenants not accepted into newly built units. At any rate, the policy change posed no obstacle to architects and planners.

But the 2016 election of Donald Trump was a tidal wave that washed over every corner of government—public housing design guidelines and funding policy included. HUD and the New Urbanists’ HOPE VI legacy are now in the hands of Ben Carson, a retired neurosurgeon and GOP presidential primary candidate, who is neither an expert nor even a novice in affordable housing policy or design. So what does the future of affordable housing and New Urbanist development look like in the Trump administration?

The CNU declined official comment; the group has been all but silent on the transition since the election. But several of the organization’s founding

ABOVE
The Rockwell Gardens
public housing project
in Chicago, demolished
in 2006.

BY PAUL GOVETTE (CC BY-NC-SA 2.0), VIA FLICKR



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members see limited upside for public housing from the nation's first real estate deal-maker president. There is one exception: Andrés Duany, of DPZ in Miami, who could be called the godhead of New Urbanism.

ANY AFFORDABLE HOUSING LOSSES WILL STRESS AN ALREADY OVERBURDENED SYSTEM.

Duany is pleased to see a HUD secretary from the private sector, with experience in institutions driven by quantitative metrics that define success or failure—in Carson's case, medicine. "As opposed to government bureaucracy, which has no need to monitor itself," he says. But Duany says Carson's "number one" qualification is that he grew up in low-income (but not publicly subsidized) housing. "The fact that he grew up in housing like that, for me, counts for more than anything."

Duany's colleagues are less sanguine. "On every level, I see us losing ground," says Peter Calthorpe, an architect and planner and founder of Calthorpe Associates in Berkeley, California, who is a CNU cofounder.

Calthorpe is concerned about a rollback of the Affirmatively Furthering Fair Housing rule established in the Obama administration. The rule, which Carson attacked in a *Washington Times* editorial as a "dangerous"

failed socialist experiment, would require municipalities to seek out and document housing segregation proactively. Bills in the House and Senate have already been introduced to nullify the rule and to bar federal funds from being used to gather data that measures housing segregation.

Additionally, there's a "twofold threat" facing the Low-Income Housing Tax Credit used to finance the vast majority of affordable housing built nationwide, says Marion McFadden, the vice president of public policy at the affordable housing nonprofit Enterprise. First, Congress could simply eliminate it through tax reform. Or, if corporate taxes are reduced in a tax reform bill, private companies will have a smaller tax burden overall, and less need to relieve tax pressure with credits.

As some CNU founders argue, any affordable housing losses will stress an already overburdened system. HOPE VI (for which funding ended in 2010) and the similarly privatized programs that followed it opened up new ways to fund housing via the private sector. HOPE VI alone built 111,000 units, according to the CNU, and gave out \$6.7 billion in grants. But the housing crisis has grown worse. And CNU does not generally advertise the numbers of units its work did not replace once they were demolished. Enterprise estimates the nation's current need at \$26 billion for renovations of existing properties alone. And only

one in five eligible families nationwide receives housing assistance. In Chicago, 282,000 people signed up for housing assistance the last time waiting lists were opened up, in 2014. Fewer than half of this number made it to the list.

"The scale of the need far, far [exceeds] the scale of resources that have been dedicated to it, and I don't see that improving under the Trump administration, and the fear would be that it would get much worse," says Daniel Solomon, an architect and planner who is also a CNU cofounder and now a partner at Mithun in San Francisco.

By contrast, Elizabeth Moule, a CNU cofounder and partner at Moule & Polyzoides Architects and Urbanists in Pasadena, California, hopes that Trump can use his business acumen to take advantage of the recent history of privatization in HUD policy. "Since Trump is a developer, he might see some unique public-private partnerships with developers," Moule says.

Ed Gramlich, a senior adviser at the National Low Income Housing Coalition, in Washington, D.C., says he's "cautiously optimistic" about Carson after seeing his positions evolve from his time on the campaign trail to his Senate confirmation hearing in January. But he says he doubts that Trump has much interest in applying his real estate expertise to making housing more affordable and equitable.

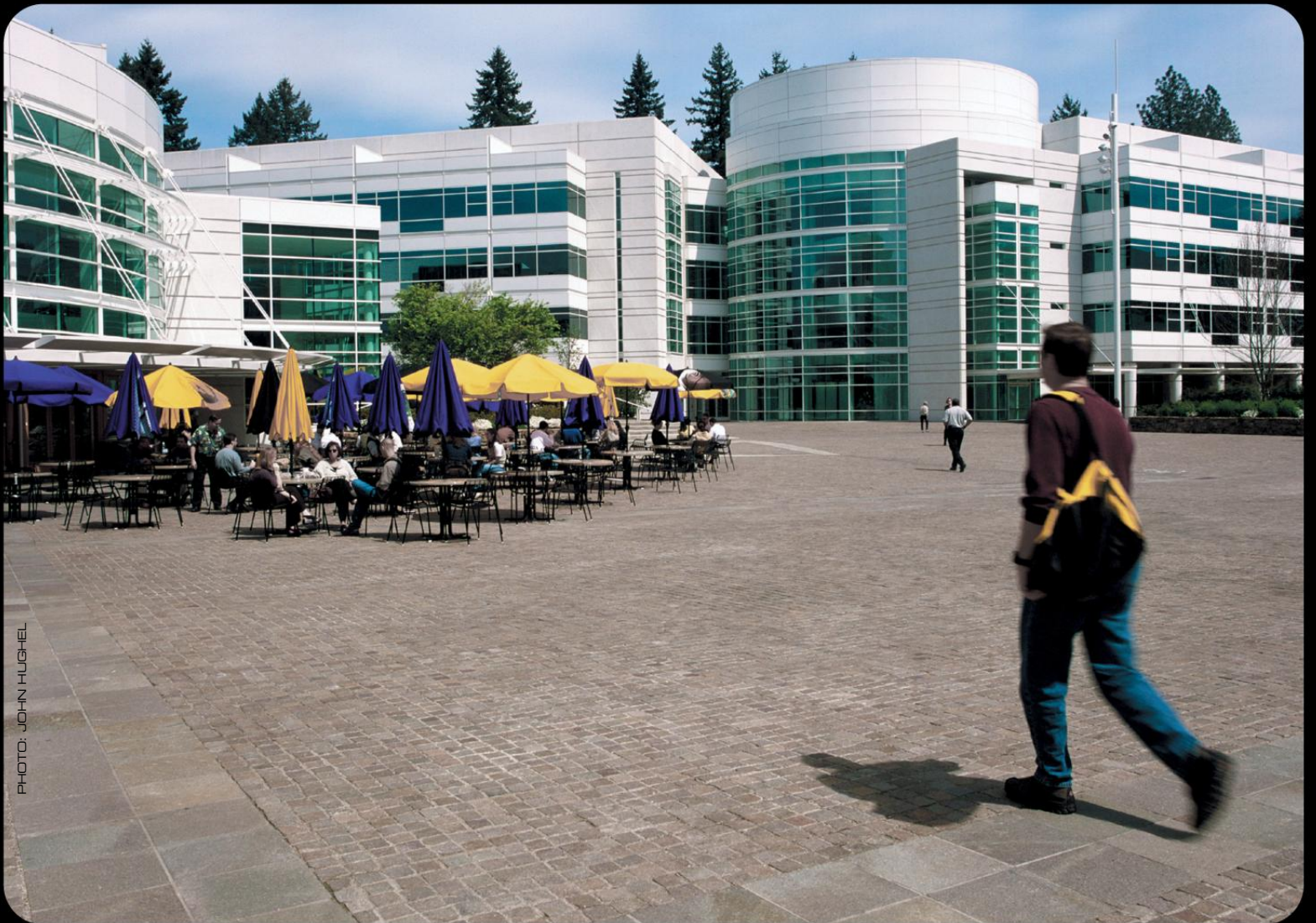


PHOTO: JOHN HUGHEL

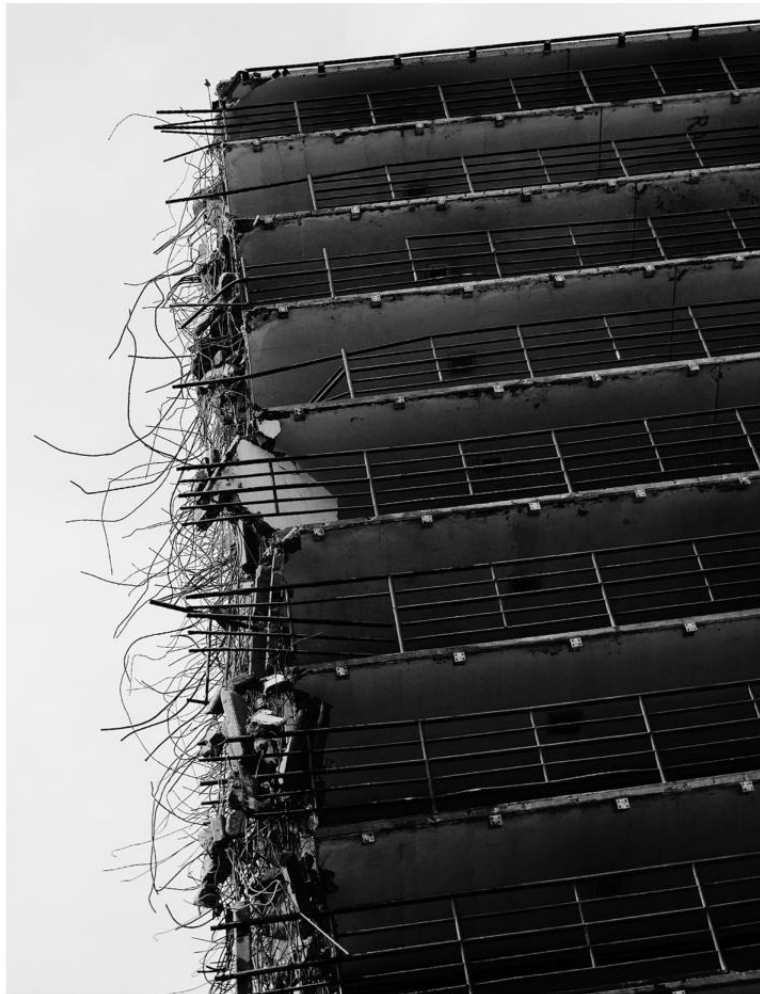
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ABOVE

There has been a net loss of 200,000 units of public housing since the 1990s, when Congress changed the rule requiring 1:1 replacement of housing.

“There’s nothing Trump has said that would suggest that’s a priority at this stage,” Gramlich says. HUD’s current policies give strong preference to mixed-income housing that comingles people of different tax brackets. But Trump’s campaign drew harsh lines around who may or may not qualify for the government’s help, or for fair treatment. In fact, Trump first entered the public consciousness in 1973 as the defendant in a U.S. Department of Justice lawsuit for refusing to rent apartments to African Americans. For these reasons, Calthorpe says he doubts that inclusive, mixed-income public housing is anything the new administration would meaningfully support. “I don’t think you can paint it in a color that makes it attractive to him,” he says.

Duany’s excitement about Carson stems in part from his hope that he and his boss will be able to cut down on the “stratospheric, indescribable, unbelievable” red tape hindering the industry, allowing more (and smaller) developers to get involved in building public housing. A shift to decrease regulation in ways that lead to more and better public housing would be contrary to the past two decades of policy results. A key part of HOPE VI was to deregulate and diffuse responsibility for public housing to the private market, yet that approach to date has done little to even approach levels of demand.

A report by the Urban Institute, *A Decade of HOPE VI: Research Findings and Policy Challenges*, finds in the HOPE VI program an inability to adequately help residents through the demolition of old public housing projects and the construction of new homes, long lag times between demolition and construction, and persistent issues in housing the most vulnerable and disadvantaged residents. Sometimes the public housing units being demolished were already vacant, but this was often a symptom of managerial neglect rather than a lessening need for public housing. There’s also little evidence so far that new mixed-income public housing is helping residents leave poverty behind by connecting to new networks of cultural capital through their mixed-income, market-rate neighbors. HOPE VI “wreaked tremendous

havoc for public housing residents,” Gramlich says. “It harmed a lot of people.”

And there’s still the most significant issue with HOPE VI, which even Duany concedes: “The problem was that it reduced density,” he says. Stung by high-rise, high-profile public housing failures like that of Pruitt-Igoe in St. Louis, design guidelines emphasizing low-density town houses and small apartment buildings mean that it’s nearly impossible (and no longer required) to build back all the units lost in a given tower demolition. The Center on Budget and Policy Priorities estimates that there has been a net loss of 200,000 units since the mid 1990s, when Congress changed the replacement rule. Some of this slack has been taken up by the Section 8 voucher system, which gives those eligible a voucher to pay rent in a privately owned apartment. But these vouchers are often only enough to live in the poorest, most segregated neighborhoods, which runs counter to HUD’s own goals with mixed-income development.

Gramlich says many of the HUD administrative and communication issues with residents have been much improved. But with HOPE VI, housing agencies were “quick to demolish and not at all quick to replace,” he says. ●

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FROM PHYTO TO MYCO

**TO HELP RECLAIM POLLUTED WASTELANDS,
A SPECTRUM OF BIOLOGICAL REMEDIATION
APPROACHES IS EXPANDING.**

BY LAUREN MANDEL, ASLA

TOP

Reclamation efforts have restored parts of Alley Pond Park's native ecosystems and their hydrologic functioning.

INSET

Man-made fill, pollution, and invasive plants occupy many non-restored areas of the Cross Island Parkway.

Reclamation efforts begun in the 1970s continue to transform Alley Pond Park in eastern Queens, New York, from a contaminated dumping ground back into an ecologically rich public open space. The 654-acre refuge—which is bisected by the Long Island Expressway and the Cross Island Parkway—contains a network of natural features that support wildlife habitat (such as springs, creeks, kettle ponds, freshwater wetlands,

brackish marshes, salt marshes, tidal flats, meadow, and forest) and infrastructure that supports local human populations (including trails, boardwalks, an environmental center, and a new combined sewer overflow retention facility). A 2004 restoration project surrounding Alley Pond Park's internal highway interchange used phytoremediation—a process wherein plants and their associated microbes store or metabolize pollutants

within contaminated soil, sediment, surface water, or groundwater—whereas an adjacent 2011 remediation effort did not. Why do so few reclamation projects deploy this sustainable, plant-based technology?

“The devil is in the details,” explains the landscape architect Kate Kennen, ASLA, who owns the Boston-based landscape design and planning firm Offshoots, Inc. “It’s really about fitting



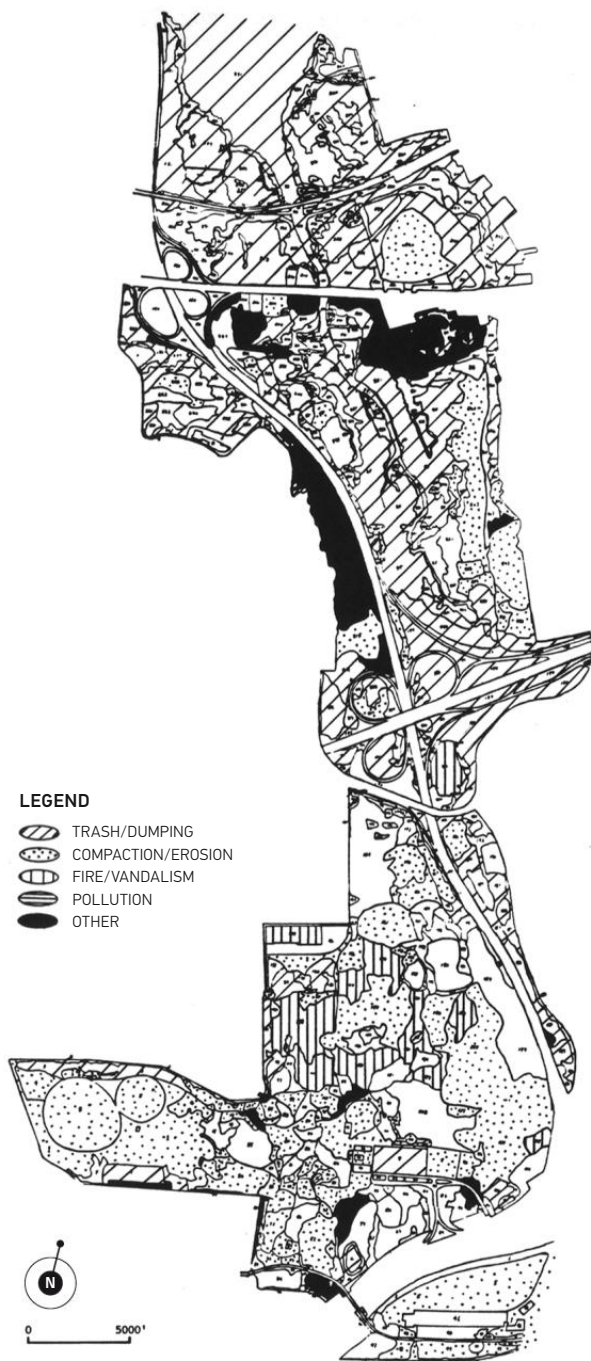
SUNAMI™ II Shade Sculpture, Pierce's Park, Baltimore, MD



Photo by Jim Coudon

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ABOVE
A management plan of the park from 1988.

TOP RIGHT
After phytoremediation within Alley Pond, water laps over a constructed spillway.

the method with the right opportunity.” Kennen is referring to the variables of geophysics; site contaminant composition, depth, and concentration; and project timelines that need to align for various phytoremediation methods to perform successfully. With training from Cornell University and



Harvard’s Graduate School of Design (GSD), Kennen has a sophisticated understanding of phytoremediation, evident in the 2015 book she coauthored with fellow GSD faculty Niall Kirkwood, FASLA—*PHYTO: Principles and Resources for Site Remediation and Landscape Design* (Routledge). The book, which won a 2016 ASLA Honor Award for Communications, demystifies phytoremediation for designers and planners. It culls through myriad published research on the subject, most of it field based, to synthesize phytoremediation’s scientific underpinnings, opportunities, constraints, and fruitful applications, leaving scientific jargon by the wayside.

Taking a shallow dive into phytoremediation’s inner workings can help landscape architects gain the confidence needed to integrate the technology effectively into their practice. Two core terms are essential in illuminating the mechanisms at play and the appropriate conditions under which various phytoremediation strategies can be successfully deployed. Phytoextraction is a mechanism whereby a plant takes up and stores a contaminant within its tissue; the plant then needs to be

removed from the site and properly disposed of. Phytodegradation, by contrast, is when a plant and its associated microbes within the rhizosphere (the immediate root zone) destroy a contaminant by breaking it down into harmless elements; the plant can then remain in place. Certain plant species are adept at using one mechanism or the other to target specific contaminant types that threaten soil performance, water quality, habitat value, human health, and environmental justice. “I think just having the basic, dip-your-toe-in knowledge about the different phytoremediation options will yield the most promise,” Kennen says. She stresses that landscape architects should collaborate with a phytoremediation engineer or agronomist, one capable of providing expertise on which plant species are proven to remediate each targeted contaminant while likely to survive the site’s growing conditions and degree of contaminant saturation. The U.S. Environmental Protection Agency’s “Phytotechnology Project Profiles” web page (clu-in.org/products/phyto) provides a database of completed phytoremediation projects that includes the engineers of record, offering a



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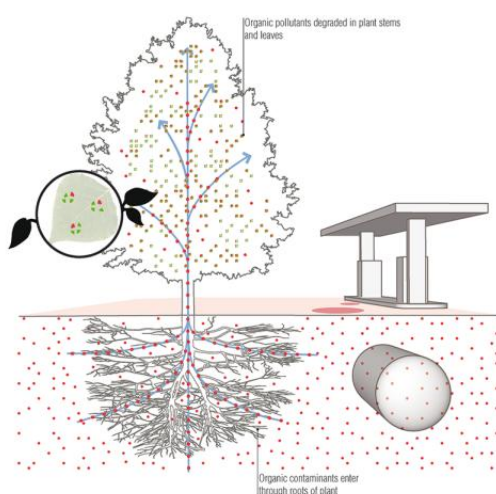
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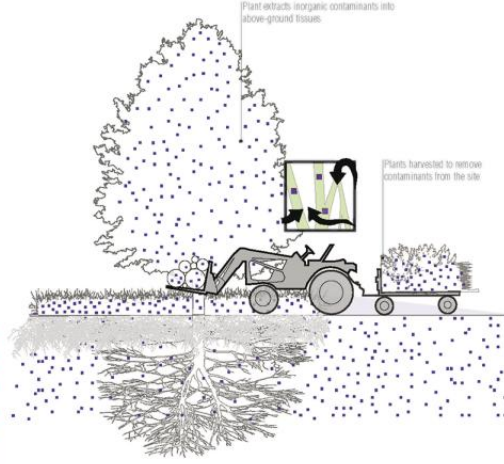
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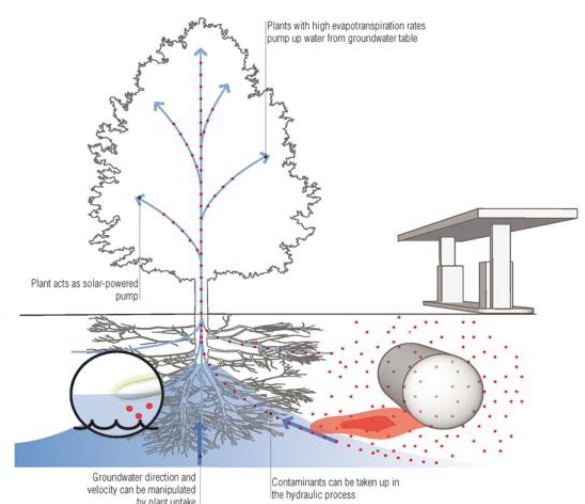
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PHYTODEGRADATION—Plant destroys contaminants.



PHYTOEXTRACTION—Plant extracts and stores contaminants into harvested tissues for removal.



PHYTOHYDRAULICS—Plants change groundwater hydrology, uptake water, and contaminants.

ABOVE
Phytoremediation uses varied mechanisms for removing pollutants. From left to right are phytodegradation, phytoextraction, and phytohydraulics.

starting point for identifying experienced subconsultants for future remediation projects.

Pollution is generally classified by characteristics such as its existence in nature, persistence, or disposal, but for phytoremediation, the most relevant property is chemical composition. This yields two pollutant classes: organic and inorganic. Organic pollutants, which consist mainly of manufactured compounds found within contaminants such as agrichemicals, chlorinated solvents, and petroleum, present one of the greatest opportunities for phytoremediation because many of the underlying compounds can be broken down through phytodegradation into less harmful elements such as carbon and nitrogen. Inorganic pollutants are generally elements found on the periodic table, such as mercury or lead. They present a significant obstacle because, by chemical definition, the element can't be broken down any further. In the rare instance that an inorganic pollutant is successfully phytoextracted from the landscape—as has been the case with nickel stored in the tissue

of yellowtuft (*Alyssum murale*)—the toxic plant material must be removed from the site and properly disposed of, essentially transferring the contamination problem to a new location. Contaminant removal and disposal introduce potentially serious risks that are often not included in a phytoremediation project's cost or risk assessment, namely potential contaminant leakage during transportation and worker exposure to toxic material.

Alley Pond Park is no stranger to pollution. Various reports and articles published since the late 1980s cite significant illegal dumping (of cars, tires, trash, and debris), pesticide contamination (with Phenothrin, a synthetic compound that kills mosquitoes), oil spills, and fecal pollution (of pathogenic bacteria, suspended solids, and dissolved iron, magnesium, zinc, copper, and chromium) from the park's five combined sewer outfalls. One of these was continuously discharging as recently as 2013, according to a study published in *Annals of Environmental Science* (Eaton et al., 2013).

A comprehensive initiative to restore Alley Pond Park's environmental health and ecosystem functioning has driven continual reclamation efforts since the 1970s, including the 2004 restoration surrounding the park's internal highway interchange. That project, led by the New York State Department of Transportation (NYSDOT), involved reconstructing the cloverleaf on-ramps and restoring 12 acres of surrounding parkland by dredging Alley Pond, creating two detention ponds, and planting more than 60,000 native, emergent phytoremediation plants. NYSDOT did not respond to repeated requests for an interview, but a press release in 2000 by the agency stated that “these ponds will be vegetated with bioremediation wetland plantings capable of removing pollutants from the storm runoff.” The press release, along with the ponds' downslope adjacency to roadside oil separators, suggests that the phytoremediation plantings were largely intended to target petroleum products within the runoff—organic pollutants that can be easily phytodegraded.

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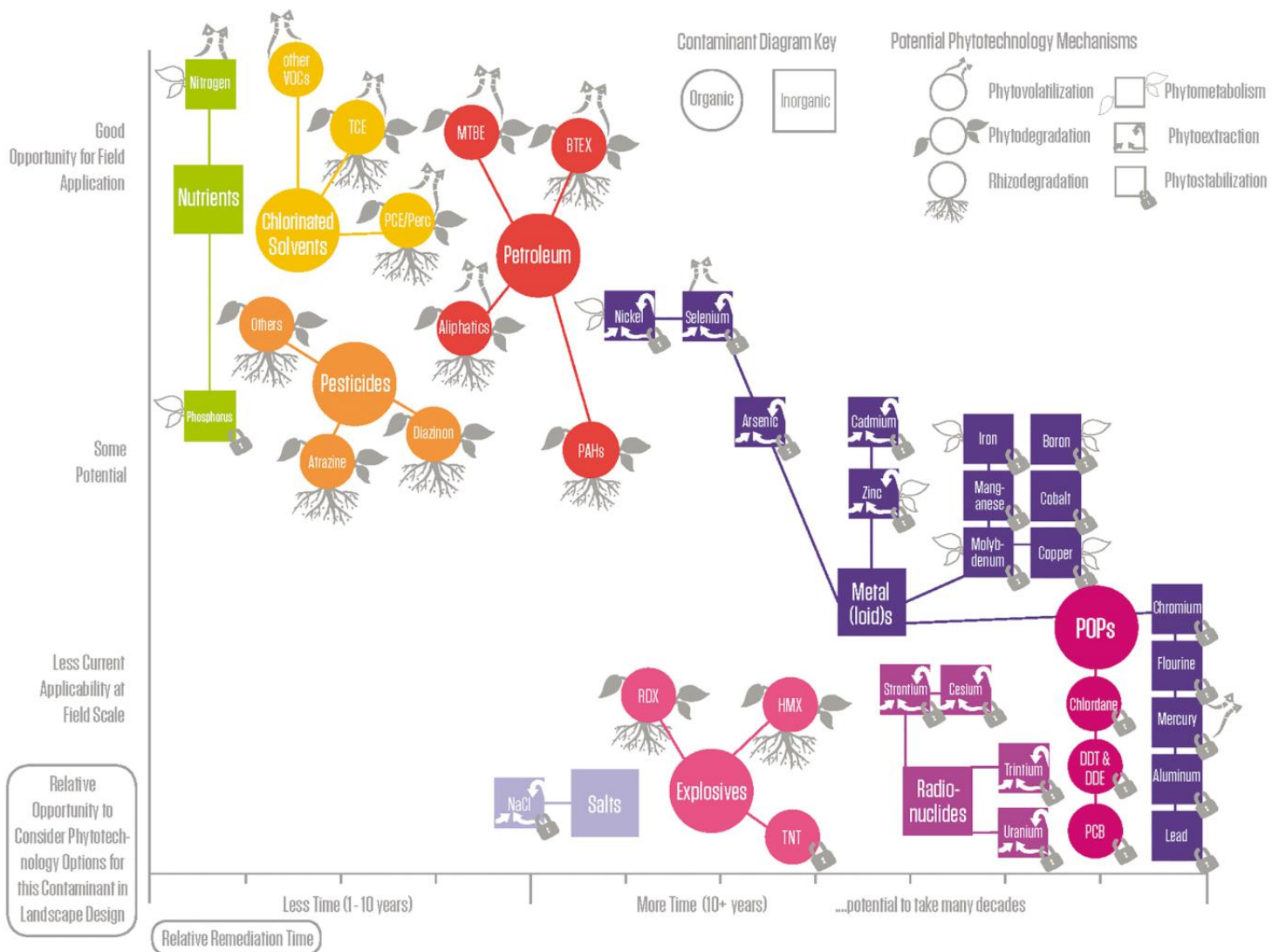
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ABOVE
Opportunities for phytoremediation in site design, based on potential and time needed to remediate contaminants.

Seven years later, in 2011, the New York City Department of Environmental Protection (NYC DEP) opted for dig and haul, rather than an in situ biological approach, when mitigating a wetland due north of the highway interchange. The contractor, Tully Environmental Inc., removed more than 60,000 cubic yards of regulated, nonhazardous soils, trash, and debris from the 21-acre site before planting approximately 109,000 wetland plants and additional upland species. Given the site's tidal influence and location

downstream of several combined sewer outfalls, the wetland would have likely been exposed to the park's fecal, oil, and possibly even pesticide pollution—a mix of organic and inorganic contaminants. Why didn't NYC DEP follow NYSDOT's lead in harnessing the power of plants to soak up these pollutants?

NYC DEP portfolio manager Matthew Osit says that for contaminated soil, "our typical process is landfill disposal," an expensive solution that costs the agency around \$400 per cu-

bic yard if the material is hazardous. Chris Haight, a project manager from the New York City Department of Parks and Recreation (NYC Parks)—the entity that manages Alley Pond Park—cites similar practices, saying: "Normally we dig and test soils, and if we do find contaminants, we excavate to remove them all by actually removing the soil and disposing of it properly." From Kennen's perspective, phytoremediation presents a huge financial advantage compared to digging and hauling, as little as 10 percent of the cost of the invasive



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alternative in instances when the right set of site, contaminant, and project timeline conditions are present. “On the cost side, we actually have lots of metrics showing how inexpensive it can be,” Kennen says, “even when you incorporate in the long-term maintenance and monitoring costs.”

Nonetheless, phytoremediation has remained absent from each agency’s reclamation tool kit. Haight suspects that in addition to maintaining procedures supported by agency precedent, NYC Parks may be hesitant about the time it takes for phytoremediation strategies to run their course and effectively treat site contaminants. For example, even when relying upon a fast-growing genus such as poplar (*Populus*) to remediate a site contaminant, the bulk of construction activities may need to wait a number of years while the

trees grow and take up the contaminant from an increasingly large soil volume. This delayed construction scenario may present hurdles related to project financing and return on investment. When more favorable site, contaminant, and design variables occur, fast-growing herbaceous plants may be deployed before or during site preparation, or phytoremediation plants may remain in place after construction, while the site is occupied, as a contributing feature of the design. Despite NYC Parks’s historical hesitations, a current project at Randall’s Island, off Manhattan, may set a new precedent as the agency’s anticipated foray into the plant-driven technology.

Additional opportunities for biological remediation exist when phytoremediation is not possible or practical. One such process, called mycoremediation, harnesses the power of fungi to store or degrade contaminants within soil or water. Certain fungal species and their associated microbes are capable of targeting contaminants that plants can’t, such as animal manure and persistent organic pollutants, such as dichlorodiphenyltrichloroethane (DDT) and polychlorinated biphenyls (PCBs). “What the fungi are doing is initially breaking

the contaminant down to a certain degree, and then they’re inviting the bacteria to assist in that degradation,” says the South Carolina-based mycologist Tradd Cotter. “It’s a species sequence approach; it’s like a relay race.” For example, fungi are capable of degrading most hydrocarbons by 60 to 80 percent, but “they need those microbes to get to the finish line,” Cotter explains. For simple contaminants, like manure, this process can occur quickly, even in a few hours. More complex pollutants, such as DDT, require additional contact time between the molecule and the fungi–enzymes–bacteria “disassembly team” to degrade the toxin effectively.

TOP

The New York City Department of Environmental Protection used dig and haul and nonphytoremediation plantings within this 2011 wetland restoration.

INSET

By August 2014, the plantings were healthy and robust, but an opportunity may have been missed for these plants to perform “double duty.”



TAKING IDEAS FROM IMAGINATION TO THE SITE.

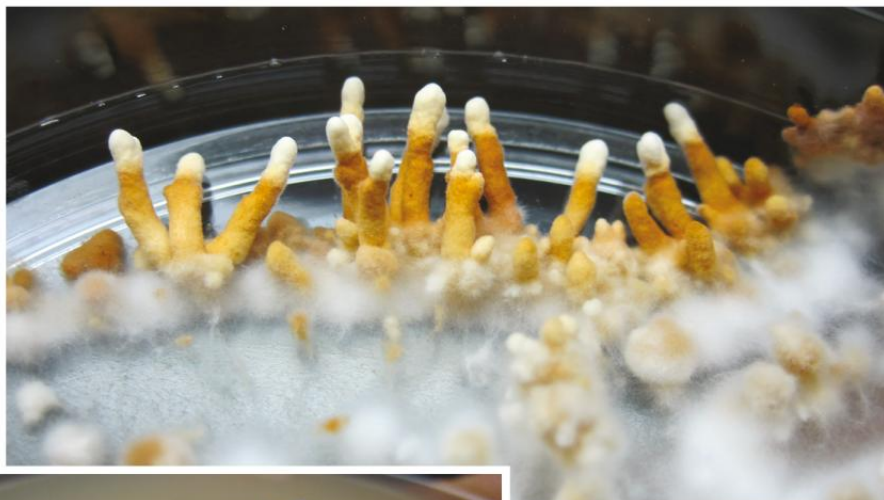
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If the pollutant is waterborne, contact time can be increased by directing the flow to a lined holding pond, swale, or rain garden that has been designed to support an extended residence time and inoculated with fungal mycelium (the filamentous tissue that grows underground and supports the fruiting bodies visible aboveground).

Contaminated soil requires a different approach. The existing substrate is either inoculated, inoculated then soaked with a slurry of naturally occurring microbes, or capped with up to 12 inches of inoculated wood chips and then drenched with water. “The bulk of the magic happens with the indigenous soil microbes,” explains Cotter, who knows firsthand that healthy soil teems with biodiverse microbial life. Identifying a fungal species capable

of remediating each contaminant is a different story, because between 1.5 and 5 million species of fungi exist on the planet. One technique deployed by the research and laboratory team at Cotter and his wife Olga Cotter’s company, Mushroom Mountain, involves surveying contaminated sites to see if any fungi naturally occupy the space. “If you do find a mushroom growing out of a contaminated area,” Cotter says, “then that can be collected, dried, cloned, and cultured in our labs” to produce the mycelium inoculant. Unlike plants, however, mycoremediation often requires the use of local ecotypes, meaning that a species capable of remediating a pesticide in Oregon will not necessarily be effective in New York. The sample generally needs to come from a location geographically similar to the contaminated site.

Another constraint of mycoremediation is the safe removal of heavy metals. Unlike plants, many fungal species are actually adept at extracting and storing metals, particularly in their fruiting bodies. The problem is that wildlife may eat the fruiting bodies, creating a potentially worse environmental impact. If metals need

to be remediated, Cotter suggests removing the fungi from the site before their fruiting bodies emerge, like a disposable filter.

As with phytoremediation, mycoremediation is also not effective below certain soil depths. Fungal enzymes are aerobic, meaning they require oxygen to survive. Techniques such as fracturing (also known as fracking) or adding a peroxide drench can introduce oxygen at greater depths, but lower down in the soil column, oxygen will remain the limiting factor. When organic pollutants occupy depths below which fungi or plant roots can reach, which is generally 15 feet for trees, naturally occurring soil microbes capable of consuming the contaminants can be encouraged to multiply (via sugar injection) or can be introduced if not already present. This process has been particularly effective at rapidly remediating petroleum leaks deep beneath gas stations. As brownfield and grayfield reclamation becomes increasingly common in landscape architectural practice, bioremediation—with plants, fungi, and microorganisms—must be integrated into the designer’s tool kit. ●

LAUREN MANDEL, ASLA, IS A LANDSCAPE ARCHITECT AND INTEGRATIVE RESEARCHER AT ANDROPOGON ASSOCIATES AND THE AUTHOR OF *EAT UP: THE INSIDE SCOOP ON ROOFTOP AGRICULTURE* (NEW SOCIETY PUBLISHERS, 2013).

TOP

Neolentinus lepideus, a fungal species that can break down creosote, is a good candidate for mycoremediating recalcitrant compounds.

INSET

Pleurotus ostreatus fungus struggles to mycoremediate the herbicide Atrazine.



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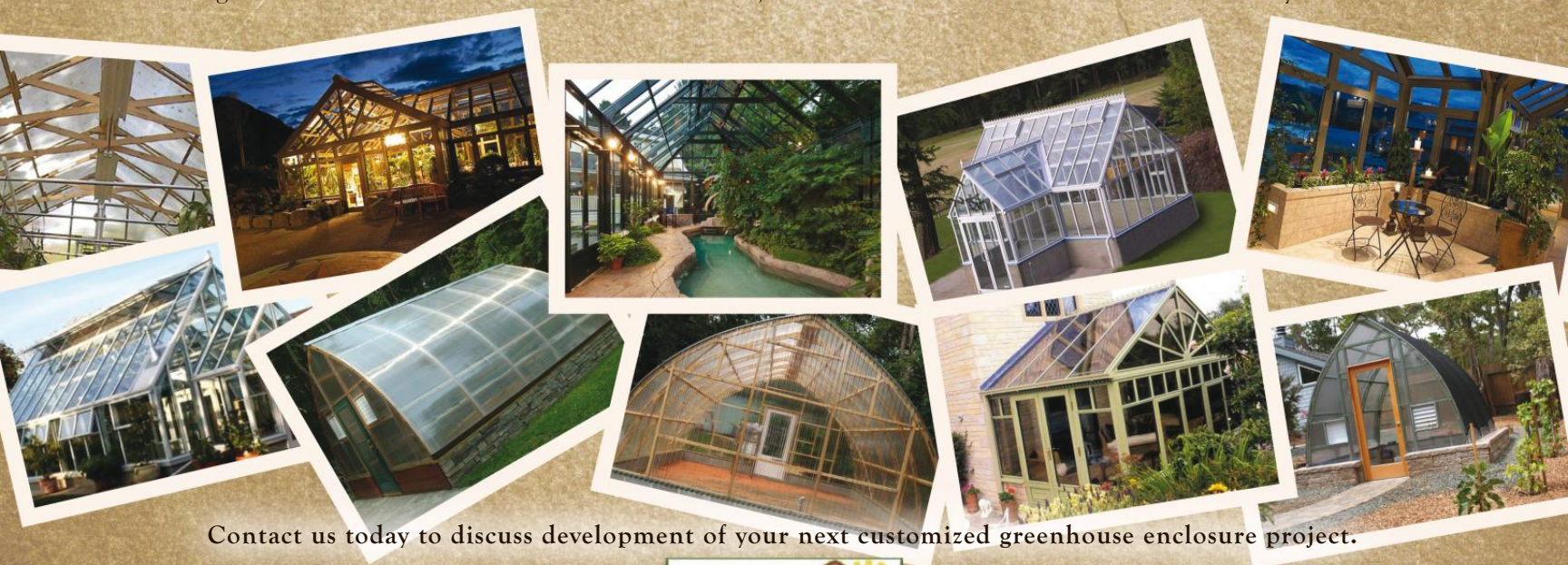


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HARD CHOICES



PROMISING NEW ALTERNATIVES TO TROPICAL HARDWOODS COME WITH CAVEATS.

BY MEG CALKINS, FASLA

ABOVE

Thomas Balsley Associates and Weiss/Manfredi used Kebony lumber for decks and custom seating at Hunter's Point South Waterfront Park.

The past decade has brought an explosion in the use of tropical hardwood decking and furnishings in public, institutional, and commercial landscapes. Whereas wood decking was once largely the purview of residential landscapes, now it can be found in urban settings from the High Line to West 8's sculptural Wavedecks. Tropical hardwoods are so durable, hard, and decay-resistant that they appear to be the ideal material, yet the impacts of using even hardwoods certified by the Forest Stewardship Council can be substantial and threaten the most critical ecosystems of our planet.

Wood is a renewable construction material if you compare the amount of time a wood member is in use to

the amount of time it takes to grow a tree to yield a comparable piece. But that is not always the case. For example, it takes 90 years to grow a *Handroanthus heptaphyllus* tree to yield ipe lumber for deck boards, but the deck boards will likely not be in use for 90 years even if they are reclaimed, refinished, and reused.

As concern for the health of tropical forests is increasingly recognized in sustainable design thinking, alternatives to tropical hardwoods for decking and site furnishings are making their way into the market. The most promising alternatives are thermally modified lumber, polymerized lumber, acetylated lumber, and black locust lumber.

The environmental impacts of logging for tropical hardwoods are well documented (see, among other reports, "A Trail of Stumps" by Jane Hutton, *LAM*, May 2013, which explained how the legal market for such woods can lend cover to gray- or black-market products). A 2014 Greenpeace study of logging in the Amazon estimated that in Pará State, one of Brazil's main logging regions, 78 percent of hardwood lumber is harvested illegally. Documents are forged or obtained illegally, trees are cut and dragged from pristine old-growth forests in the dead of night, and logs find their way onto the wrong trucks. The result is that the Amazon rain forest is disappearing at an alarming rate of one acre per second, resulting in an 18 percent loss in the past 30 years.



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CLOCKWISE FROM TOP LEFT

A winding black locust trunk was used to support the "limb ramp" on a residential play structure in New York State; thick, furniture-grade black locust slats were used perpendicular to the length of the linear benches at Hudson Park and Boulevard in New York; MVVA celebrated the irregular form of black locust trees at this play structure for a private residence in New York State. The trees, from a nearby site, were debarked, sanded, and sealed with hemp oil.

But FSC-certified tropical hardwoods are OK, right?

Although the Forest Stewardship Council (FSC) sets a rigorous, well-respected standard, some experts believe it is possible to cheat the system, particularly in the Amazon and other tropical forests where fraud and illegal harvesting are rampant. The 2014 Greenpeace study states: "Several situations could occur that might result in illegal timber being traded under the FSC label, such as a company further up the supply chain violating laws in the country of origin or the timber's true origin being

hidden from the buyer by means of misappropriated documents." Additionally, critics cite FSC's willingness to certify old-growth tropical hardwood forests around the world, including those in the Amazon.

Even selective harvesting of tropical forests (promoted by FSC as a sustainable logging method) for species such as ipe or cumaru can result in the forest's ecological decline. Research has shown that within years of selective harvesting of high-value species, the forest is likely to be clear-cut and turned to agriculture, contributing to forest fragmentation.

Plantation-grown tropical hardwoods are an alternative to old-growth forest tropical hardwoods, particularly if the plantations are FSC-certified—but they are not a comparable alternative. Tropical hardwood lumber from plantations is not as dense, decay-resistant, or durable as the forest trees that have been growing for well over 100 years. And the most valued tropical hardwoods are very slow-growing, which means their growth on plantations is a truly multigenerational investment.

The European Union and some U.S. municipalities are actively encouraging alternatives to tropical hardwoods for site and architectural uses. European Union legislation requires all importers of tropical hardwood

to certify that the wood comes from sustainable sources. And going a step further, the government of Norway has banned the use of tropical hardwoods in all public projects, stating: "There is no international certification that can guarantee in a reliable manner that imported wood is legally or sustainably logged." New York City, San Francisco, and many smaller municipalities in California have banned tropical hardwoods on projects that receive public funding. This has spurred the development of new wood treatments.

Three new wood modification technologies have come to the U.S. market from Europe in recent years. These technologies—thermal modification, acetylation, and polymerization—use physical, biological, or chemical processes to produce property improvements in softwoods and U.S. hardwoods, resulting in lumber that performs competitively with tropical hardwoods. Manufacturers of modified woods seek to improve durability through resistance to decay and termites, and to improve properties of lumber such as dimensional stability and hardness.

Thermally modified wood

Thermal modification, or TM, heats wood to temperatures above 400 degrees Fahrenheit, permanently modifying the carbohydrates (hemicelluloses) and rendering the wood



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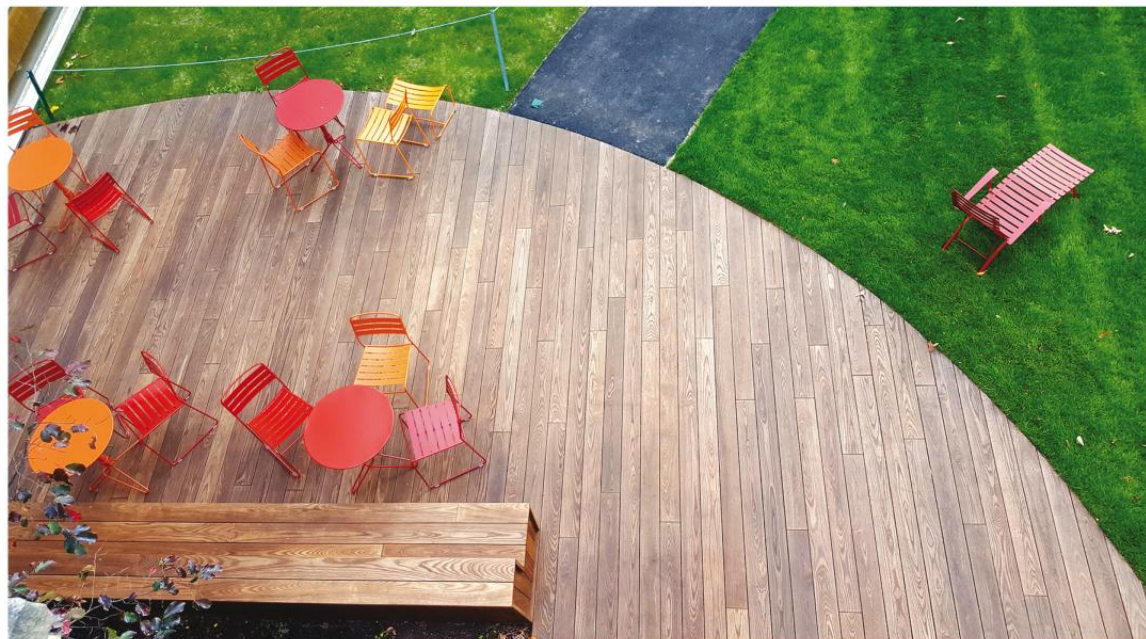
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ABOVE
MVVA used Thermory, a thermally modified lumber, for a deck at Wellesley College. They found radial cuts easier with Thermory than with hard, dense tropical hardwoods.

inedible to decay organisms and insects. By limiting oxygen and using methods such as steam or hot water, the wood doesn't burn. During the process, the wood is dried to lower its moisture content and to reduce expansion and contraction owing to moisture changes over the life of the lumber. The result is a lumber resistant to decay and insects that is dimensionally stable and darker in color. There is some loss of strength as well, but testing shows that it is not significant.

No chemicals are introduced in the nontoxic thermal modification process, so the lumber is easily recyclable. Energy to heat the wood and transport it to and from Europe is the main environmental impact; some companies take steps to capture waste heat and use renewable fuel sources.

Both hardwoods and softwoods can be thermally modified, with varying results. Thermory, one of the main suppliers of TM decking, cladding,

and lumber in the United States, uses ash, spruce, and southern yellow pine. Some of the ash and pine are sourced from the United States, and although FSC-certified woods are not standard, they are available by special order.

Thermory's TM ash has a European durability class rating of 1, "very resistant" to decay; its TM southern yellow pine is rated 2, or "resistant." Mark Challinor, a principal at Thermory, explains that a durability rating of 1 means the wood can be used in ground contact, but it is not guaranteed for that use. In a deck application, the understructure is typically built with conventional pressure-treated lumber, and the decking is Thermory lumber.

Challinor explains that owing to its decay resistance, durability, and stability, Thermory is priced at a premium, like ipe, but cost savings come in the ease of constructability. Challinor offers that the product is easier to work than ipe and requires no special

tools or predrilling, which cuts installation time and waste. Ipe is very hard and sometimes irregular, with board-end splits and cracks, resulting in time-consuming connections and layout of wood members.

Emily Mueller de Celis, an associate principal of Michael Van Valkenburgh Associates (MVVA), used TM lumber for a deck and custom benches at Wellesley College. She concurs with Challinor's statement about TM lumber's ease of constructability. "It allows complicated radial cuts that are difficult to achieve with ipe and black locust lumber." She adds: "Because it is not as dense as ipe, it does not hold heat, making sitting on the bench or walking barefoot on the deck more appealing in the heat of summer."

Acetylated wood

The acetylation process uses acetic anhydride and heat to modify wood's composition, greatly reducing the ability of the wood to absorb water and rendering the wood more dimensionally stable and durable. Wood's swelling and shrinking are reduced by 75 percent, and its durability is substantially increased. One manufacturer, Accoya, estimates a 50-year use life for its acetylated radiata pine in aboveground applications and a 25-year life given ground contact. As with TM wood, microorganisms and fungi are no longer able to recognize

	JANKA HARDNESS POUNDS- FORCE (LB _F) DENSITY AVERAGE DRY WEIGHT (LBS/FT ³)	LIFE EXPECTANCY IN USE AND DURABILITY CLASS (EUROPEAN MEASURE OF DECAY RESISTANCE) 1 = very resistant 2 = resistant 3 = moderately resistant	PRODUCT TYPES AND CONSTRUCTABILITY NOTES	COMMENTS
THERMALLY MODIFIED HARDWOOD Ash Southern yellow pine (SYP) Spruce	Ash 1,400 lb _f 37 lbs/ft ³ 5–7 percent moisture content	Ash 25–30 yrs SYP 20 yrs Spruce 25 yrs Ash 1 Ground contact SYP 2 No ground contact Spruce 1 Ground contact	Decking, Lumber 16" o.c. joist spacing for decks SS screws or hidden clips No predrilling	Moisture content is about half that of the untreated species. Wood grain is pronounced and TM ash is dark brown. Surface can be treated with natural oil products to delay graying and weathering. Thermory's Joint End Matched (JEM) joints allow decking to end between joists, saving time and cuts. Ash and SYP are grown in U.S., but treated in Estonia. FSC certified is available special order.
ACETYLATED Radiata pine Southern yellow pine (SYP)	Radiata 930 lb _f 32 lbs/ft ³ 3–5 percent moisture content	Radiata 25 years in-ground contact; 50 years aboveground Radiata 1 Ground contact SYP 2 No ground contact	Decking, Lumber Laminated Lumber Use SS screws Predrilling recommended	Radiata pine is fast growing compared to ash, but grown in New Zealand and treated in the Netherlands. Swelling and shrinkage is reduced by 75 percent or more. Outperforms CCA-treated lumber in in-ground stake testing. Accoya is C2C Gold certified.
POLYMERIZED/ KEBONIZED WOOD Scots pine Radiata pine Southern yellow pine (SYP)	Radiata 1,619 lb _f 37–42 lbs/ft ³ SYP 1,708 lb _f 42–53 lbs/ft ³	No info on life expectancy Radiata 1 Ground contact Scots pine 1, 2 No ground contact SYP 2 No ground contact	Decking, Lumber Use SS screws, avoid galvanized 16" o.c. joist spacing for radiata decking 24" o.c. for SYP and Scots pine decking Predrilling required	Scots pine and Radiata pine decking are available FSC certified. Scots pine end grain cuts should be treated with a wood preservative. Radiata pine is grown in New Zealand and treated in Norway. Close to 50 percent more weight is added with treatment.
BLACK LOCUST <i>Robinia pseudoacacia</i> Eastern U.S.	1,700 lb _f 48 lbs/ft ³ 11 percent moisture content	50+ years 1 Ground contact	Decking, Lumber Custom sizes and shapes	Only heartwood is decay resistant, not sapwood.
IPE <i>Handroanthus</i> spp. (formerly <i>Tabebuia</i>) Amazon	3,510 lb _f 69 lbs/ft ³ 12–18 percent moisture content	40+ years 1 Ground contact	Decking, Lumber Screws and nails must be predrilled Use SS screws, avoid galvanized	Heartwood is more decay resistant. FSC certified adds significant cost. Challenging to build with. Hard and dense with high cutting resistance during sawing. Grain can tear out during sanding. Oily wood does not take finishes or glues easily.
CUMARU <i>Dipteryx odorata</i> Amazon	3,330 lb _f 68 lbs/ft ³ 12–18 percent moisture content	40+ years 1 Ground contact	Decking, Lumber Screws and nails must be predrilled Use SS screws, avoid galvanized	Heartwood is more decay resistant. FSC certified adds significant cost. Challenging to build with. Hard and dense with high cutting resistance during sawing. Grain can tear out during sanding. Oily wood does not take finishes or glues easily.
REDWOOD <i>Sequoia sempervirens</i> Western U.S.	450 lb _f 26 lbs/ft ³ 10–14 percent moisture content	10–15 years Heartwood is 2–3	Decking Lumber	Very soft. Not durable in high traffic settings. Only heartwood is decay resistant. Decay resistance varies.
WESTERN RED CEDAR <i>Thuja plicata</i> Western U.S.	360 lb _f 23 lbs/ft ³ 10–14 percent moisture content	10–15 years Heartwood is 2	Decking Lumber	Very soft. Not durable in high traffic settings.

EVEN SELECTIVE HARVESTING OF TROPICAL FORESTS CAN RESULT IN THE FOREST'S ECOLOGICAL DECLINE.

the wood as a food source. Stake tests show that the wood performs better in-ground than lumber treated with chromated copper arsenate (CCA), a standard treatment since the 1930s that was voluntarily phased out beginning in 2003.

The acetylation process, similar to that of TM, alters the full cross section of the wood, so cuts and machine holes do not need to be treated with a preservative. Because there is minimal shrinking and swelling of the wood, paints and finishes are expected to last longer.

Accoya, the main acetylated wood supplier to the United States, is given the second-highest rating, gold, by the Cradle to Cradle Products Inno-

vation Institute, a sustainability certification organization. The institute recognizes it as a nontoxic, biodegradable product that involves recycling of processing waste; an energy-efficient manufacturing process; and responsible corporate policies. However, transport energy is one of the major environmental impacts of Accoya's most durable product, radiata pine, as it is grown in New Zealand, shipped to the Netherlands for treatment, and then shipped to the country where it will be used.

Polymerized wood/kebonization

Kebonized lumber is softwood impregnated with furfural alcohol (a monomer and agricultural by-product) then heated to penetrate and surround the cell walls of the wood. Kebony, a Norwegian company, is the main manufacturer employing this polymerization process. It ships southern yellow pine and maple from the United States, radiata pine from New Zealand, and Scots pine from Scandinavia to a treatment plant in Norway. The company's deck boards, cladding, and dimensional lumber are distributed around the world.

Kebonized lumber shares its durability (European durability class 1—"very resistant" to decay), dimensional stability, and color traits with thermally modified and acetylated lumber. But because of the polymer-

ization, it is heavier and harder, comparable to black locust in hardness. Given the hardness and increased brittleness, the manufacturer recommends predrilling screw holes and using self-sealing stainless steel screws. The kebonization process adds an additional 50 percent to the dry weight of southern yellow pine.

Thomas Balsley Associates (now a part of SWA Group) specified Kebony for decking and custom seating at Hunter's Point South Waterfront Park in Long Island City. Owing to New York City's ban on the use of tropical hardwoods in city-funded projects, Balsley's firm searched for alternatives among wood lumbers, as the designers did not want to use plastic lumber. They proposed Kebony to the NYC Department of Parks and Recreation, and the department decided to approve its use as a test case for other city parks. Kebony was installed on the project four years ago, and it has been so successful that designers are using it on the final phase of the project.

Black locust

Black locust (*Robinia pseudoacacia*), native to the Appalachians and the Ozarks, is a fast-growing pioneer species that is considered invasive in some parts of the United States. Black locust trees grow large enough to yield high-quality, dense, decay-resistant heartwood lumber in 25 to 40 years—just 20 to 40 percent of

BELOW

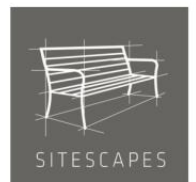
This view of a bench at Shoemaker Green illustrates the rich character of black locust lumber.





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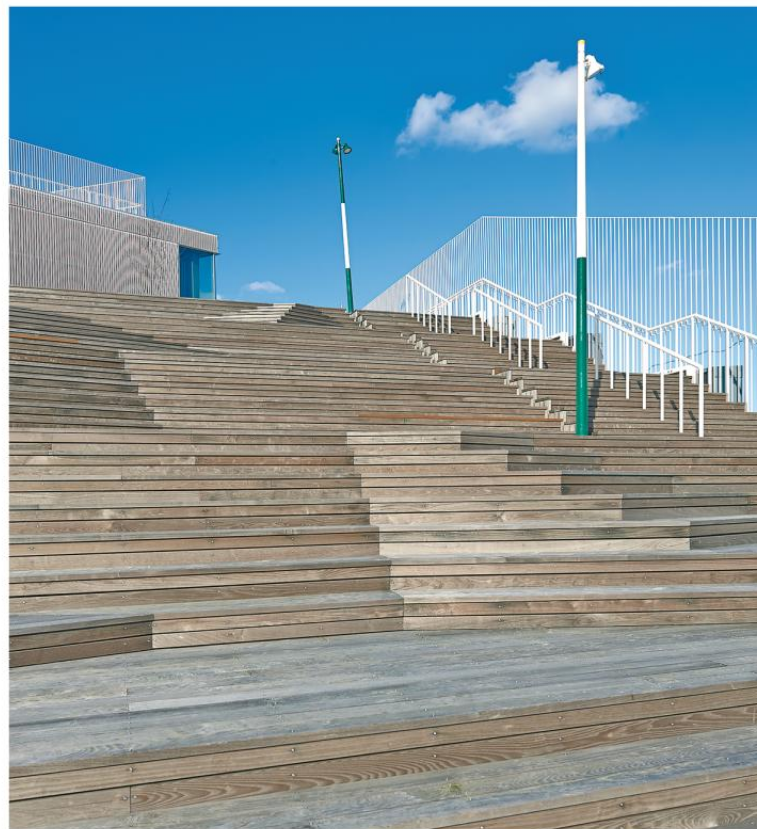


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the time needed to grow comparably decay-resistant tropical hardwoods. Its Janka hardness rating, a measure of how well the wood can withstand dents and dings, is 1,700 pounds-force (lb_f), tougher than white oak at 1,360 lb_f or red maple at 950. The Janka hardness number also can predict challenges in nailing, screwing, sanding, or sawing, and although black locust is hard compared to U.S. softwoods, it is only half that of ipe and cumaru—notoriously challenging woods to build with.

Visually, black locust is known for its knots, mineral streaks, surface checks, and bark insertions. Many proponents of black locust, like Thomas Amoroso, ASLA, of Andropogon Associates, appreciate the natural character of the wood. Clients must be prepared for the appearance—and changing appearance—of the wood. The lumber grain can open up and look like it's splitting, then close up again within one season. It is quite durable, but clients can be alarmed at what looks to them like failure. Premium grade has few imperfections; No. 1 grade is less expensive but has more imperfections.

In the United States, black locust is not grown on plantations. It is harvested from open areas where it sprouts up at the edge of farm fields and vacant lots, which creates the largest challenge of using



black locust lumber—procurement issues. The lead time to source and air-dry good-quality wood to the ideal 11 percent moisture content can be substantial. For benches at Shoemaker Green on the University of Pennsylvania campus, Amoroso sourced the lumber from a local woodworker in Lancaster County, Pennsylvania. Yet at the U.S. Coast Guard headquarters in Washington, D.C., a much larger Andropogon project, the contractor resisted using black locust because large quantities were required, and the project was on a tight construction schedule. The team settled on FSC-certified ipe for the decking. Emily Mueller de Celis cites black locust procurement issues as a reason MVVA shifted its specifications at Wellesley College to thermally modified lumber. She

found it far easier to procure, with no lead time at all for the contractor. Until modified lumber products and black locust lumber came on the market, there were really no comparable alternatives to tropical hardwood lumber. Modified lumber and black locust lumber offer durability, decay resistance, and dimensional stability that sometimes outperform the hardest tropical hardwoods. As most installations of the modified lumber products have been in use for less than a decade, time will tell if they can perform as expected for 25 to 50 years, but their future looks bright. ●

MEG CALKINS, FASLA, IS A PROFESSOR IN THE DEPARTMENT OF LANDSCAPE ARCHITECTURE AT BALL STATE UNIVERSITY. SHE IS THE AUTHOR OF *MATERIALS FOR SUSTAINABLE SITES* AND THE EDITOR OF *THE SUSTAINABLE SITES HANDBOOK*.

ABOVE
JJW Architects used Thermory ash decking at the South Harbour School in Copenhagen, Denmark.

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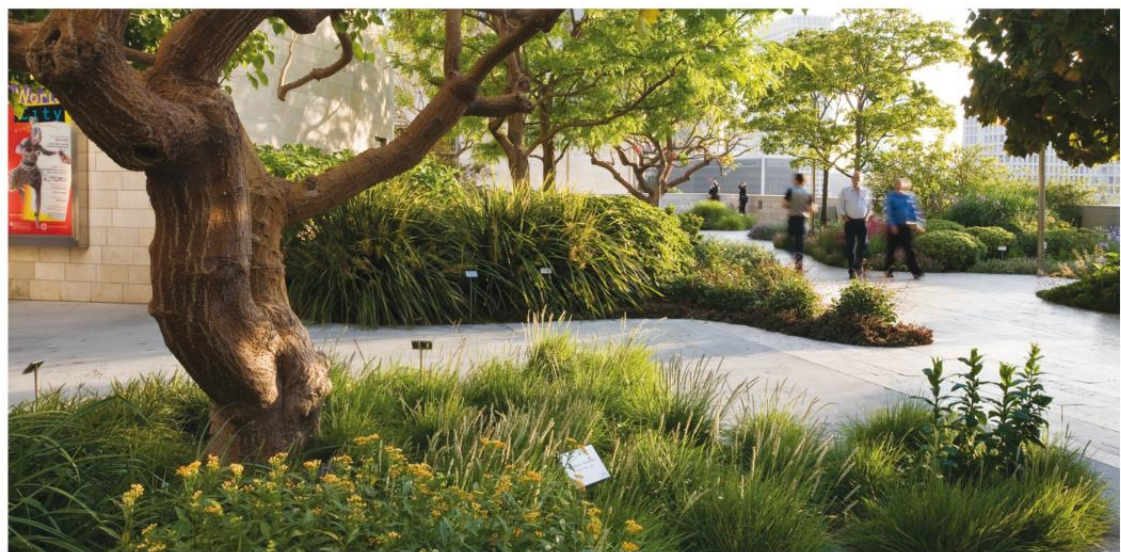
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THE WAY
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—Michelle Sullivan, '88, ASLA, RLA, ISA, LEED AP, principal, MIA LEHRER + ASSOCIATES



Featured Work from Our Alumni

Above, from left to right:
Disney Concert Hall Gardens, Melinda Taylor, Melinda Taylor and Associates
(photo credit: Tim Street Porter)

Maracanã Stadium, Rio de Janeiro, Brazil,
Paul Comstock, Paul Comstock Landscape
Architecture (photo credit: Paul Comstock)

Left: Disney Concert Hall Gardens, Melinda
Taylor, Melinda Taylor and Associate
(photo credit: Saxon Holt)



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freaks
rejoice



ZDlink controller



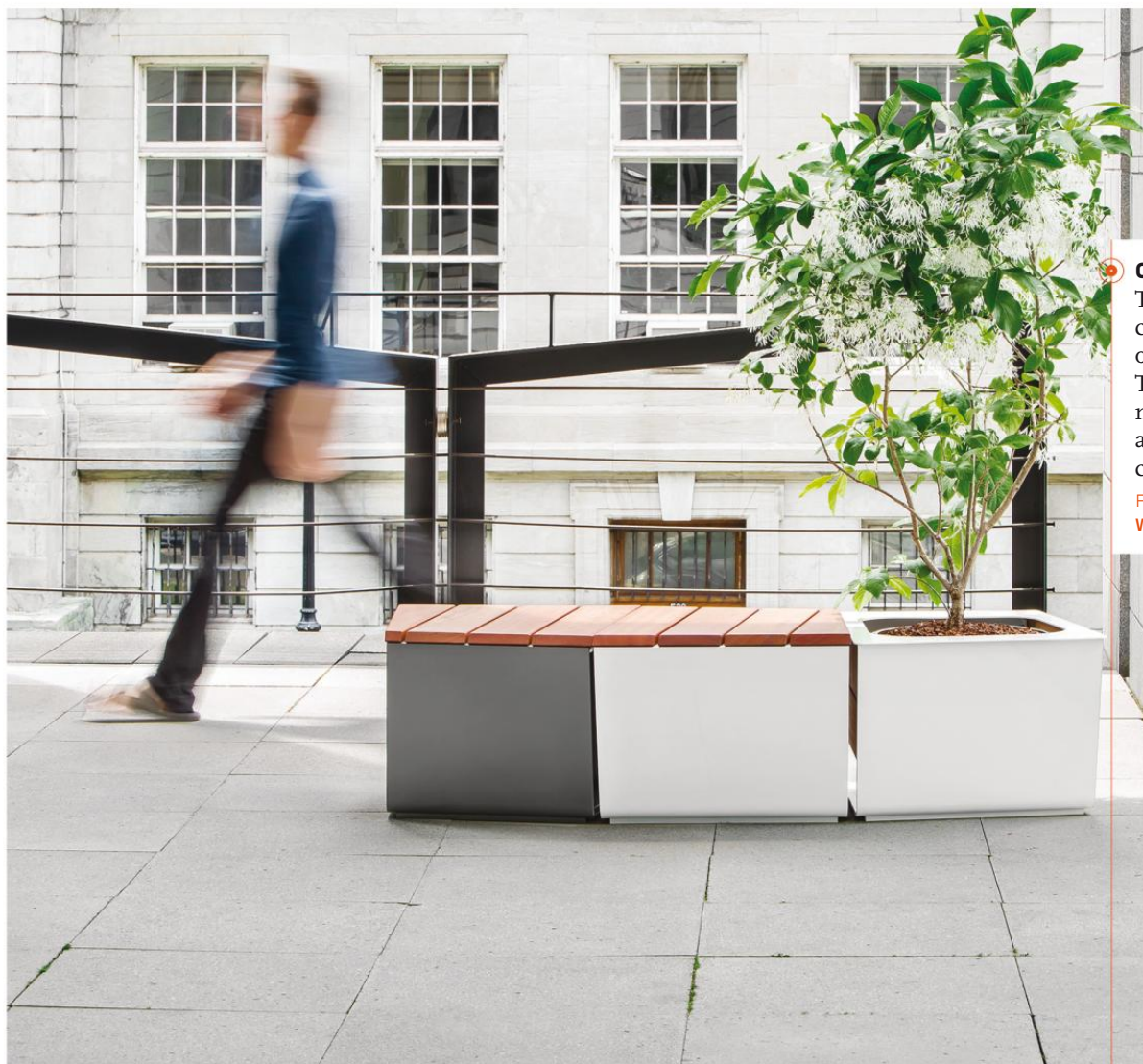
With ZD Technology™ and Luxor Accessories, the **ZDlink** controller zones and dims almost any brand of dimmable 12V or 110V fixture. And it runs relay-driven elements like fire pits or fountains. *The excitement it generates may be uncontrollable.*

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This container can be ordered in three different sizes, the largest of which can support a small tree and hold up to 317 gallons. It comes in two base colors or it can be customized to any color in the RAL series. ●

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LANDSCAPE

Supported by a galvanized steel base, the Landscape bench is clad in wood lamella that runs horizontally on the seat and vertically on the optional back. The bench can be ordered straight or in any of five different curved seating segments. ●

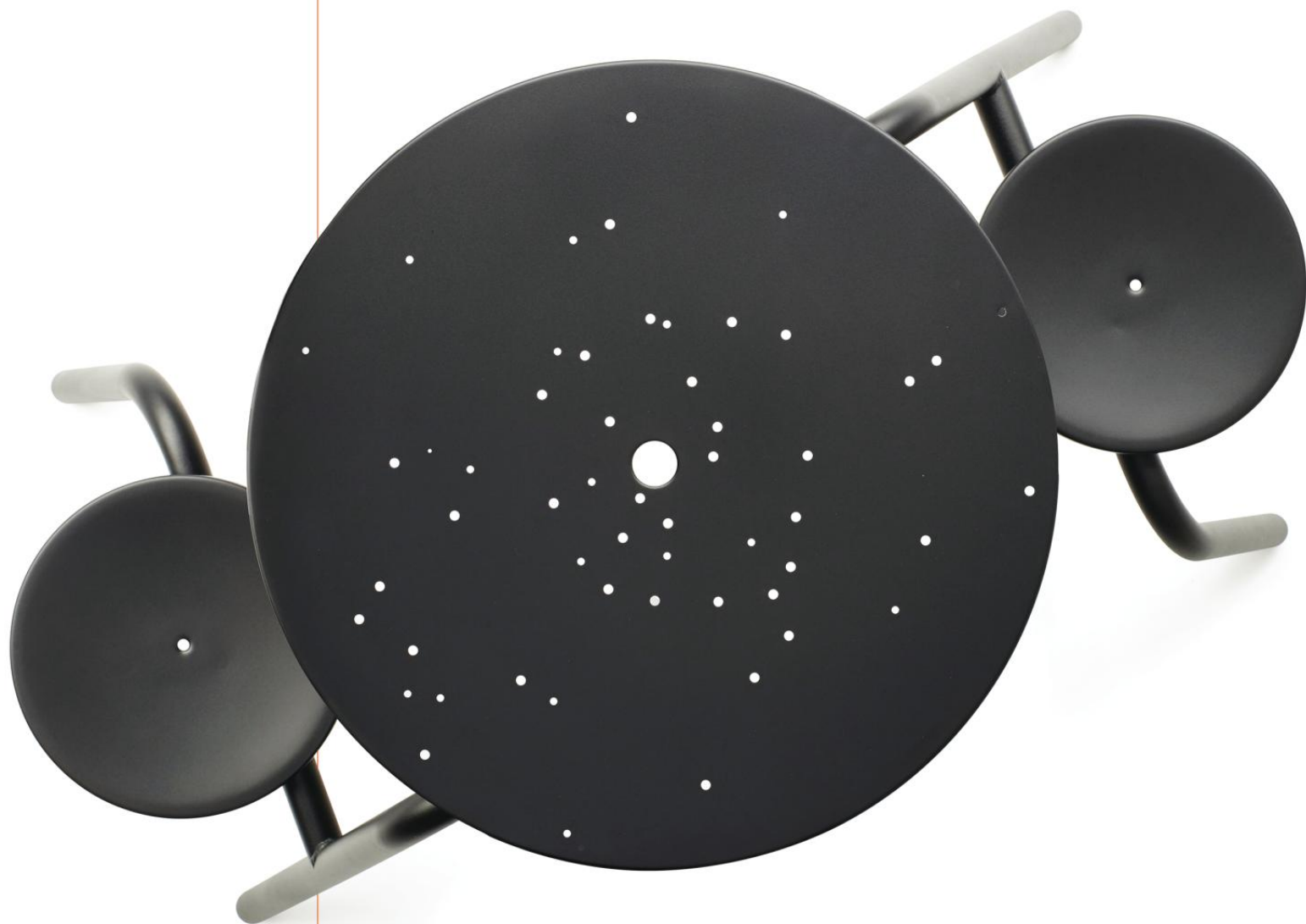
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Created to combat the public urination problem in Paris, this whimsical French design puts a public urinal above a compost bin filled with dry material that can be carted away once full. It is coated in anti-graffiti paint and capped at the top with a planter for design interest. ●

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● **VIRUS**

Available in two-, three-, four-, and five-seat configurations, the Virus picnic table is made of powder-coated steel and is available in seven different colors. All configurations retain a relatively compact area and can be combined to accommodate different group sizes. ●

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BIRD BENCH

This distinctive bench, created by the Italian designer Piergiorgio Cazzaniga, is made of plantation teak and galvanized steel. It can be ordered on its own or with its design counterpart, the Bird Outdoor Table. ●

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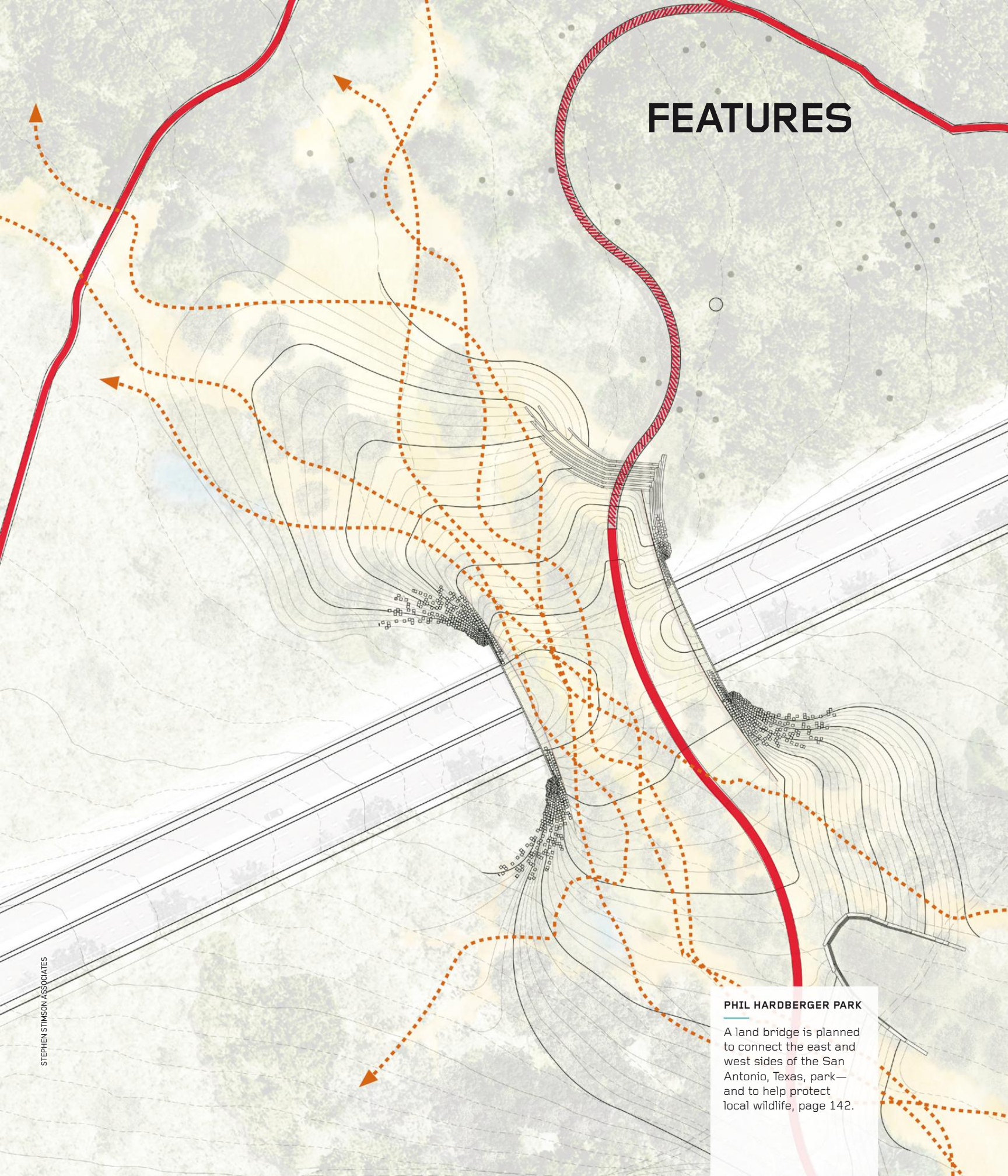
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FEATURES



PHIL HARDBERGER PARK

A land bridge is planned to connect the east and west sides of the San Antonio, Texas, park—and to help protect local wildlife, page 142.

JACK DANGERMOND WEARS
OVERSIZED TORTOISE-SHELL
GLASSES. AT 72, HIS HAIRLINE HAS
RECEDED HALFWAY BACK ON HIS
HEAD. FOR WORK, HE DRESSES
CASUALLY—OPEN COLLAR, V-NECK
SWEATER. HIS MANNER IS GRACIOUS
AND ENERGETIC, BUT CALM AND
NOTABLY CONFIDENT. HE TENDS TO
SPEAK AS IF IN FINAL DRAFT, WHICH
HE CREDITS TO YEARS OF DICTATING

THE TOOL

CORRESPONDENCE. HE IS TALL AND
RANGY, BUT IT'S QUITE POSSIBLE
THAT WHEN HE ARRIVED AT THE
HARVARD GRADUATE SCHOOL OF
DESIGN (GSD) IN 1967 TO EARN AN
MLA HE WOULD HAVE BEEN TAKEN
FOR A GEEK. HIS ULTERIOR MOTIVE
IN GOING THERE, AFTER ALL, WAS
"TO START PLAYING WITH COMPUTER
MAPPING"—WHEN COMPUTER
MAPPING BARELY EXISTED.



MAKER

**JACK DANGERMOND BUILT
A TECH COLOSSUS, AND
A FORTUNE, FROM GIS.
NOW HE'S SHARING IT ALL
TO SAVE THE WORLD.**

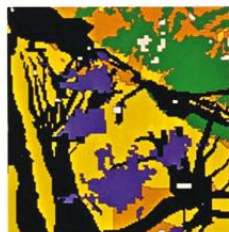
BY JONATHAN LERNER



Environmental
Systems
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Los Angeles Suitability/Capability



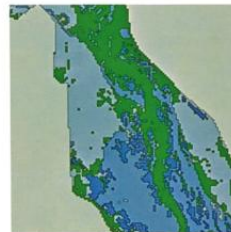
Road Accessibility Study



Wash. D.C. and Land Use/Census Data



Ski Resort Mount Yakadake-Japan



Miss. River Wildlife Habitat Model



Maryland Statewide Plan Sys. (MAGI)



Forest Map-SBDNO National Forest



U.S. Mortality Atlas-NCHS-HEW

THIS PAGE
Images from a
1980s Esri brochure.

information systems program. (An arc, on a map, is a shape defined by connecting x, y coordinate pairs; counterintuitively, an arc may be curved or straight. The term has been incorporated into the names of Esri products ever since.) “We actually sold four copies the first year, which was just amazing to me,” Dangermond says. Esri soon transformed itself from a provider of contract mapping services to a developer of mapping

products, including the extensive ArcGIS family of programs. Those have become all but essential for work in land-use planning, but also in fields as wide ranging as epidemiology, interior space planning, and package delivery. The products are powerful. And expensive—except to the schools and nonprofits that get them at deep discounts or for free.

By the end of 2016, Esri had 3,800 employees in 41 locations around the world, and the Dangermonds’ personal net worth was \$3.4 billion. They still live in Redlands, which is closer and perhaps more akin to the Sonoran Desert than it is to Tinseltown. Both Redlands and Esri’s headquarters there are attractive, but the glam factor is minimal. The campus is a complex of clean-lined low-rises designed around gardens, courtyards, and atriums, all designed with Dangermond’s hands-on



CLOCKWISE FROM ABOVE
 Dangermond and staff confer during the company's early days; Esri's first headquarters building; Dangermond at work on a light table; entering map coordinates with a digitizing puck.



involvement. It's a shady, verdant microenvironment in a dusty locale. The extraordinary lifestyle blandishments some tech companies provide employees—lessons in stand-up comedy, sound-proofed jam rooms outfitted with drums, amps, and guitars—are not in evidence, nor are too many of the millennials such perks are supposed to attract. The vibe is relaxed, but mature. Kaitlin Yarnall, a cartographer and the deputy director of the Centers of Excellence in Photography, Mapping, and Journalism at the National Geographic Society, has been involved in Esri's collaborations with *National Geographic* magazine, and says, "It's run like a family business. Laura still does

the books. They don't have expense accounts. If you go out to dinner with Jack, it's awkward—he'll be like, 'OK, how do we want to divide this up?'"

Privately, the Dangermonds have taken the Giving Pledge, by which enormously rich people promise to use the bulk of their wealth philanthropically. Esri, the company, also commits significant resources pro bono. Since 2010, it has provided more than 40,000 software licenses to nearly 5,000 nonprofits engaged in conservation, humanitarian, and sustainable-development programs in 134 countries. Most pay only an administrative fee amounting to 2 percent of retail. In conjunction with President Obama's Connected initiative, Esri also invested more than \$40 million in software, curriculum



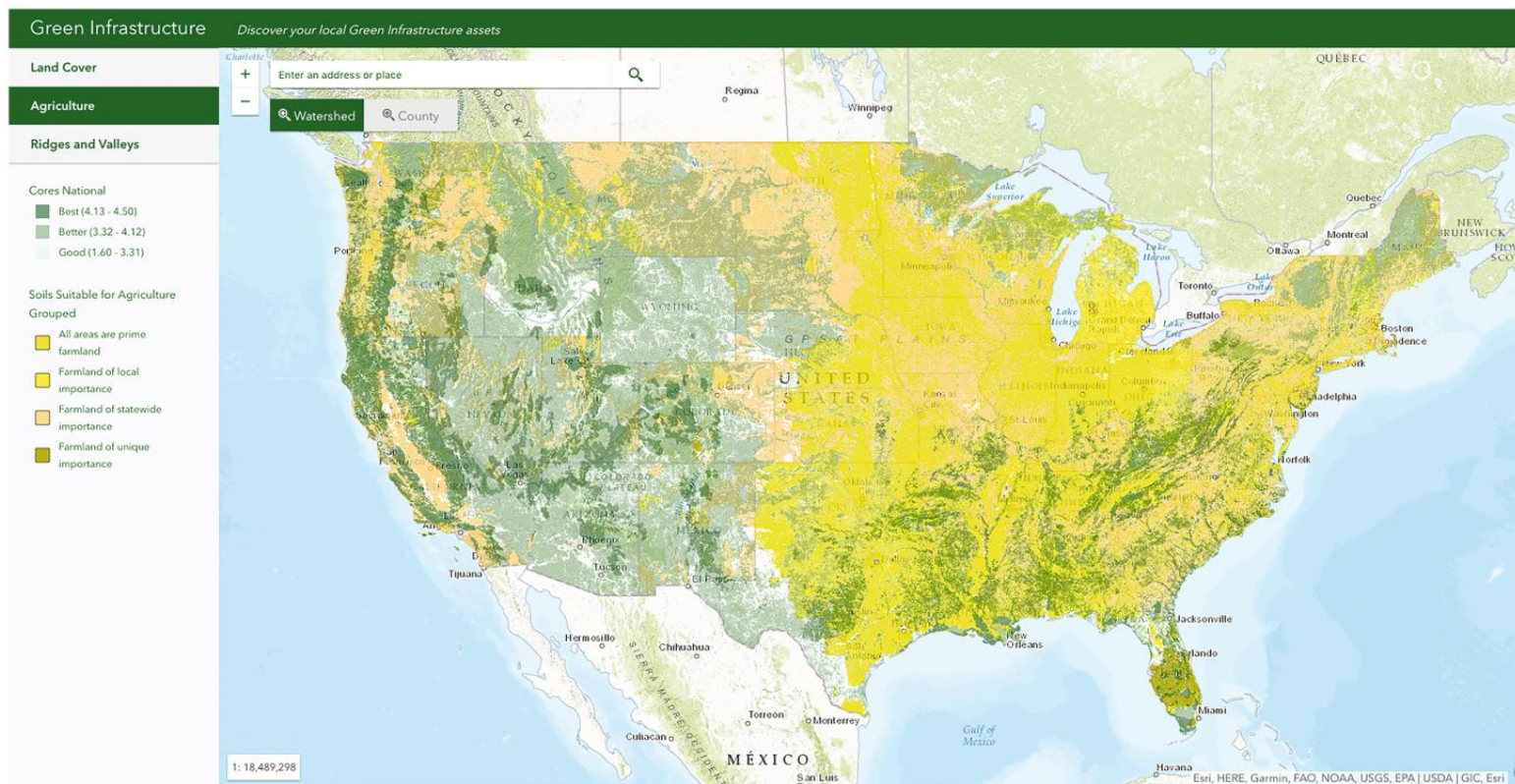
development, and support for teachers at K–12 schools, and some 4,000 American schools now use ArcGIS Online, a component of the company's current flagship software package. And recently, at Jack Dangermond's prompting, and to encourage sustainability planning, Esri has launched a free, open-access, web-based software platform and a trove of mapping data for the United States called the Green Infrastructure Initiative.

An increasingly common understanding of green infrastructure is that it is a set of tactics, deployed at the local level, for things like managing stormwater or mitigating the heat island effect. Esri's initiative is about green infrastructure as strategy—for larger areas like a county, a watershed, or even, at least conceptually, the entire continent. The idea is to identify and secure the critical remaining large cores of relatively unspoiled landscape. The two senses of green infrastructure aren't unconnected; both are about ecosystem services. Small, low-tech tactical interventions like planted roofs and rain gardens, inserted into the gray infrastructure of your urban neighborhood, can help prevent it from flooding during rain events. Meanwhile, the naturally occurring systems of an untrammelled mountain valley can supply clean water for your entire city. The places that can support such big natural systems are spatially fragmented and increasingly diminished by

population growth and development. It will take strategic thinking at the larger scales to protect, restore, and reconnect them.

That's the conceptual underpinning of the Green Infrastructure Initiative—the web tool—which is meant to encourage practical efforts in that direction. It provides anyone concerned with sustainability a cost-free and easily accessible way to do mapping and map-based planning. (The nomenclature is awkward. Accurately put, the website with the open-access mapping data and software, in itself, is not an initiative but a tool of the initiative.

ABOVE
Lush plantings in Esri's Redlands, California, headquarters reflect Dangermond's background in landscape architecture.



ABOVE AND OPPOSITE
Screenshots from Esri's Green Infrastructure Initiative website show areas of prime U.S. farmland (above) and different types of land cover (opposite).

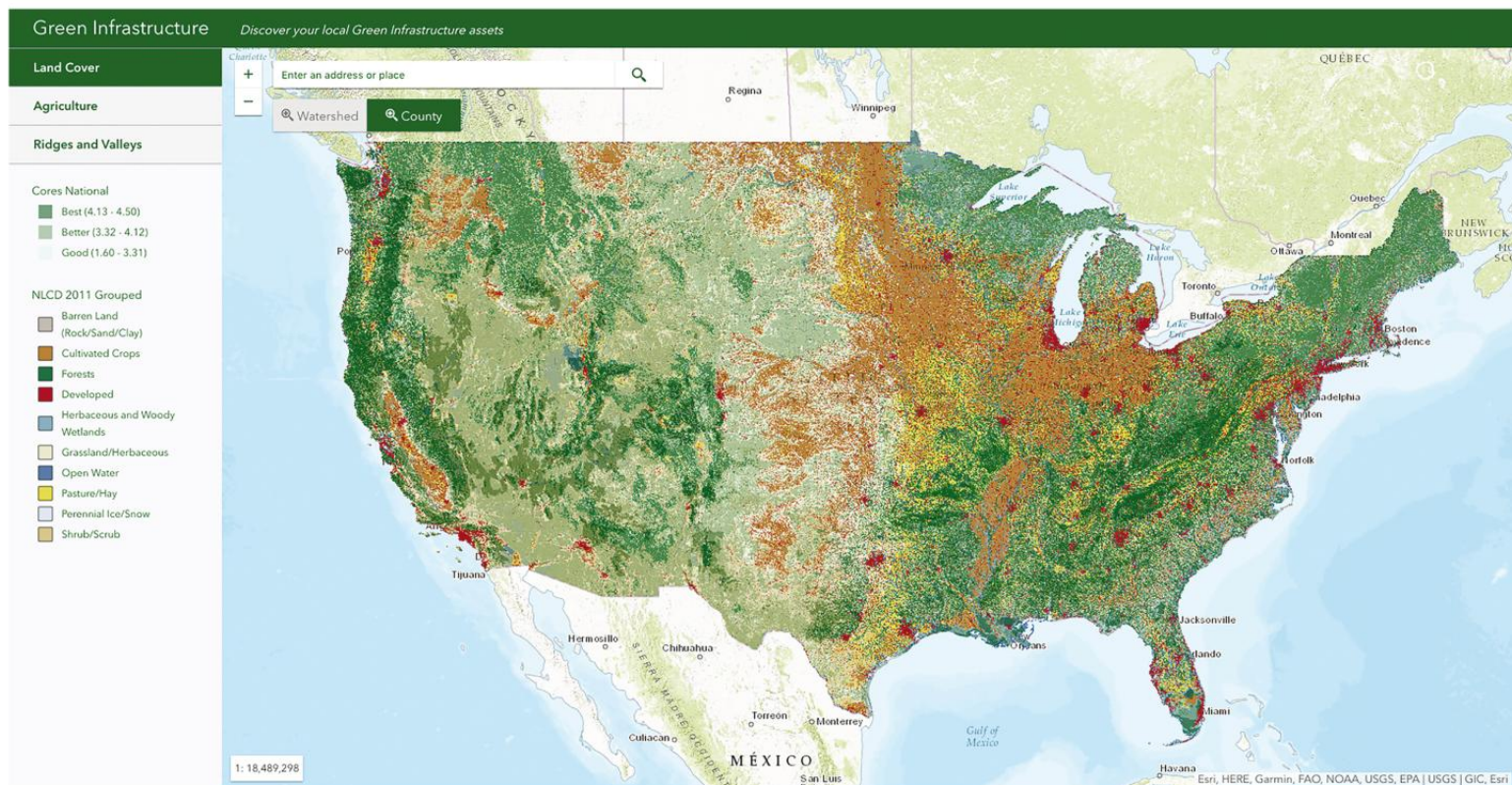
The web address—www.esri.com/about-esri/greeninfrastructure—could be more intuitive, too.) “Jack realized that habitat loss happens at the local level,” says Hugh Keegan, who led the team that built it. Like Dangermond, Keegan trained as a landscape architect but has spent most of his career developing software at Esri, and currently manages its Applications Prototype Lab. “The place to try and influence is local government, local planning boards, local zoning boards. That’s who the target audience is,” Keegan says. “But GIS is a big fundamental hurdle for many small communities. Most don’t have it.” Neither do most nongovernmental organizations and citizen activists. Now anyone with a web browser can access and use the tool.

The map data, from sources such as the National Land Cover Database, identifies undeveloped areas, or cores, of at least 100 acres and at least 200 meters in width. So you can’t use it for fine-

“JACK REALIZED THAT HABITAT LOSS HAPPENS AT THE LOCAL LEVEL.”

—HUGH KEEGAN

grained analysis, or for planning in urbanized places. But for working at larger scales, it can reveal patterns and systems that green infrastructure planning would protect, such as aquifers and wildlife corridors. The quality and detail of the data, which covers the continental United States, is uneven, depending on its origin. But users can supplement it with more accurate local data they may have. Using the apps that Keegan’s team developed for the site, which are simplified versions of ArcGIS software, you can manipulate the data layers you’ve selected to suit your goals. A particularly useful—and user-friendly—feature is the ability to assign and play around with the relative weight of the various sets of data you’re working with. That can reveal the relationships among them and also the implications of different planning scenarios. You can download the maps you create as PDFs. Also accessible through the website is a “Living Atlas” of maps other people have made and shared. These depict myriad features and conditions in specific regions, such as scenic trails and other cultural assets, topography and soil types, and sea-level-rise projections. The Living Atlas maps serve as ex-

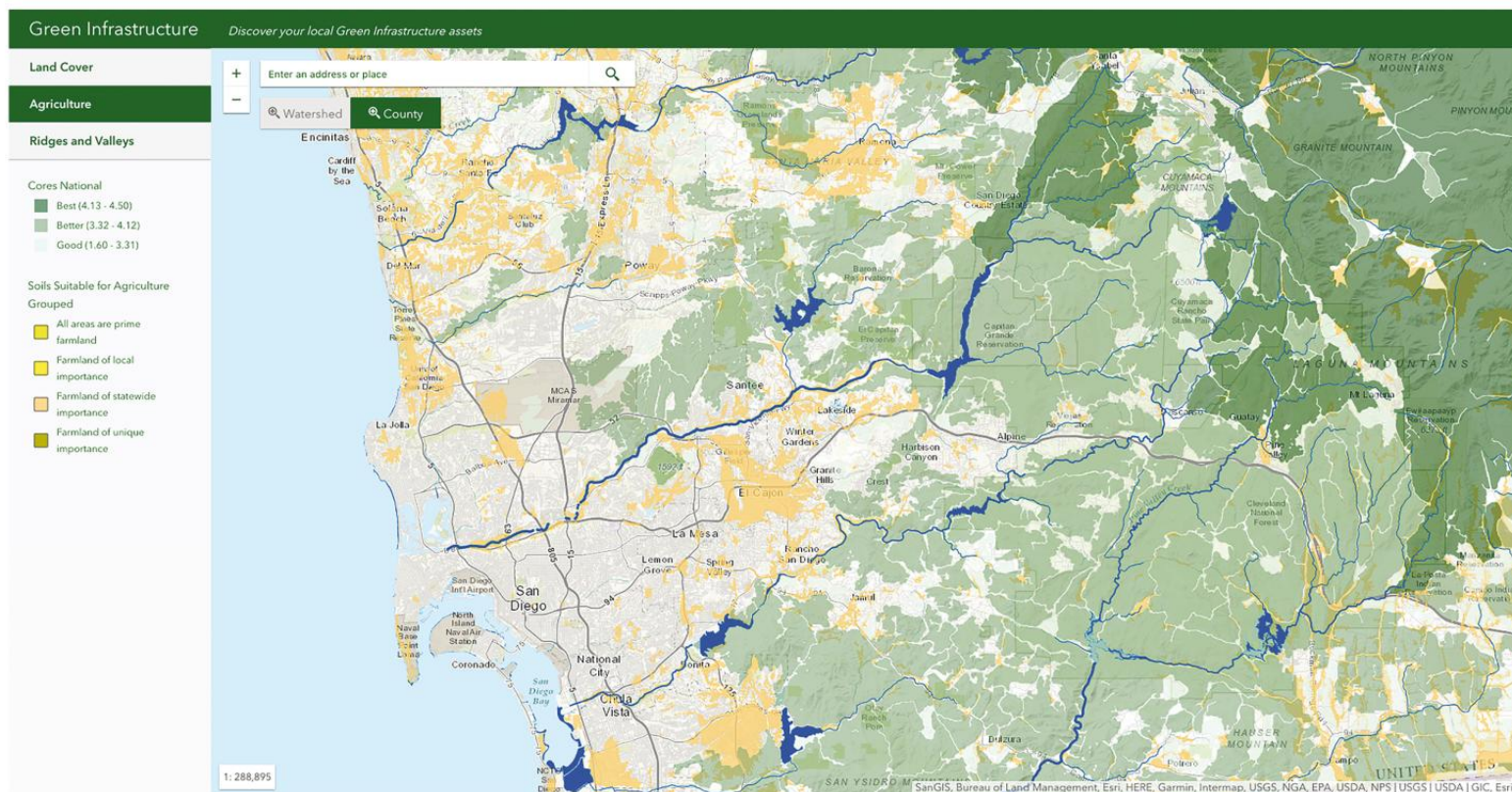


amples of how GIS can inform green infrastructure planning, and information from them can be brought into maps you might be making with the initiative's apps.

That is not to say that it is an especially easy and intuitive platform to work with. It's no smartphone app. Those without GIS experience will face a learning curve. Nor does it make available for free the full, vast power of the programs Esri sells. Ambitious users will sometimes find themselves at a point where they can't do what they want without making a software purchase. Right now, as its developers know, it needs refinement—more, and more detailed, data, and better guidance documentation for users—and they're working on that. Still, over and above providing the software platform itself, there is enormous value in the many layers of national-scale data they have already assembled and rendered consistent and compatible. That's because locating, acquiring, and matching up different categories of data can be the most time-consuming and expensive aspect of digital mapping. Even after it is enriched, the Green Infrastructure Initiative will not with a few clicks turn people into landscape architects, regional planners, or civil engineers. But it can “create that foundation that can

get people going,” Dangermond says. “It's going to take a million people that get together in their own communities and their own geographies, and stand up—not against the forces of destruction of nature; that's probably too bold of a way to say it—but there's got to be a counterforce, particularly at this time, that speaks with the voice of science.”

Because the Green Infrastructure Initiative web tool was only launched last June, is still being publicized, and is open access, it is difficult to know how many nonprofessionals have begun using it, for what, and who they are. However—and curiously, because this was not its express purpose—it is already being taken advantage of by planners, and by landscape architects at least in academic settings. Brian Orland, FASLA, a professor in the College of Environment + Design at the University of Georgia, says, “I want to bring the core concepts of geospatial thinking to students without spending the time of teaching them all



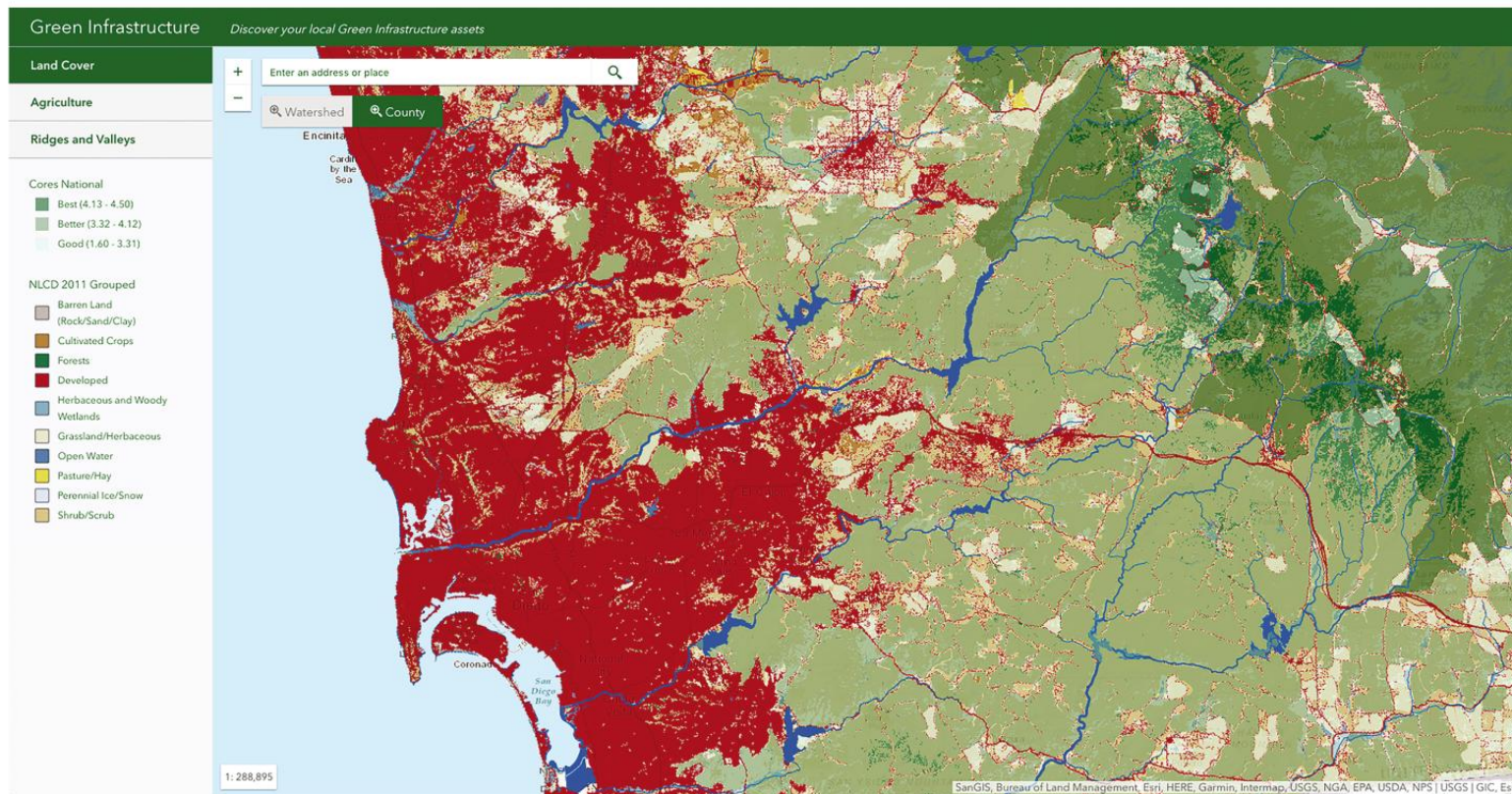
ABOVE AND OPPOSITE
Green Infrastructure
Initiative maps zoom in
on Southern California
to show agricultural
areas and land cover.

the technicalities of a full-bore GIS program.” He finds especially valuable the ability to adjust the relative weight, or importance, of multiple factors, for example. “The information is coarse, but I’m trying to introduce the students to the idea of coarse relationships, and how the whole system works.”

Dangermond has had something like this initiative in mind since Harvard. “In the idealism of the time, I began to think we could develop a database for the entire United States. Where would we locate new urbanization? What areas should be in conservation? People had thought about that concept for a hundred years, using plastic overlay maps. But it wasn’t realizable in any practical way.” There were too many kinds of data to correlate, and no ready way to illustrate the interrelationships for decision makers. Then in 2015, in Salzburg, Austria, he met Arancha Muñoz-Criado, who studied at the GSD a generation after him. She was giving a lecture about

her work as the director general of landscape architecture and planning for the autonomous region of Valencia, Spain. Muñoz-Criado had championed a planning approach for the region and its 550 municipalities that, simply put, starts with an inventory of existing unspoiled areas, determines which of those would be most valuable if preserved and bolstered, and then directs growth to the already developed or more environmentally compromised spaces left over. In this approach, even for very localized planning decisions, knowledge about the larger scales is essential. Aquifers, forests, the ranges of species, and the impacts of climate change, for example, don’t conform to geopolitical boundaries. Besides, every species or ecosystem service needs a certain minimum amount of space to survive or function adequately—hence the emphasis on large intact cores.

Muñoz-Criado believes that Valencia was the first place where “the name, concept, and content of green infrastructure was introduced into the urban planning process and made mandatory.” Since then, the European Commission has endorsed green infrastructure planning; Muñoz-Criado herself is now helping define a nationwide policy for Spain. Dangermond



**“THERE’S GOT TO BE
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—JACK DANGERMOND

brought her into Esri’s Green Infrastructure Initiative project; Keegan calls her “Jack’s muse.” She came with both a designer’s sensibility, not a typical strength of software brainiacs, plus, Keegan says, “a European perspective, which is that there are cultural elements of a community that have been in place for 500 years,” such as trails, viewsheds, and other heritage elements that tie people to their landscapes. These also exist in the comparatively young United States. She says, “Green infrastructure has three functions. One is the ecological function. The second is the framework for growth. And the third is about quality of life and access to nature, preserving those landscapes and corridors not only for animals, but also for people.”

Muñoz-Criado says, “Jack knew that this was the future. He knew that green infrastructure was about transparency, about knowledge, about putting, in one map, everything together—and that it could be done now with the technology he had.” That technology has made Dangermond among the most suc-

cessful people trained in landscape architecture on earth, measured by earnings and also, arguably, measured by the reach and potential impact of Esri’s products. Kaitlin Yarnall says, “Even though he has a tech company, because he comes from a landscape architecture background, it’s all about the application of the technology. To do something, to fix something. He really, actually believes that GIS, and landscape architecture, and green infrastructure, and smart planning and land use can change the world.”

Dangermond’s origins are rather more modest than such a sweeping vision might suggest. He grew up in Redlands where his Dutch immigrant parents, “a gardener and a maid,” as he describes them, “realized that they needed to get their kids an education, so they started a nursery.” The three sons all studied landscape architecture, enrolling at the nearby college now called California



ABOVE AND OPPOSITE
The interconnectedness of land, water, habitat, and infrastructure is made visible in Green Infrastructure Initiative maps.

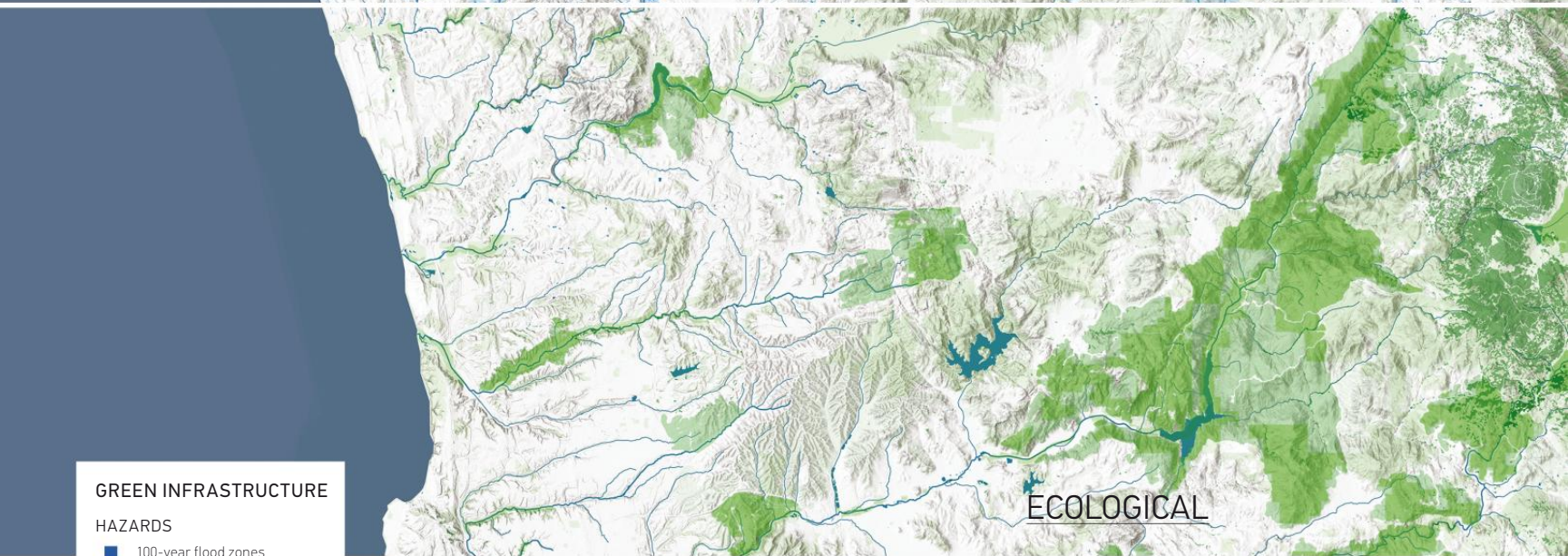
Polytechnic State University. Allen, the oldest, now deceased, quit school early to help run the family business. Pete, the next, who went on to become director of California's park system and now has a private practice in Sacramento, is widely honored for helping expand parks and support conservancies and environmental causes across the state. Their sister, Marsha MacLean, has been a teacher in Redlands' public elementary schools for 30 years. Dangermond says, "I learned everything about growing a tech business in a nursery. Because it's making sure, contextually, that everything's watered. Nurturing. Making sure things are weeded and fertilized. And then being able to sell. We learned customer service at a very young age. We learned how to figure out what was needed and wanted. It became a natural thing for us to do complex problem solving, which is what a garden and landscape designer does. It was very practical, because we would also have to sell the people on this concept. Sell them the plants. With the workers in the nursery, help them implement these concepts and make it come alive. It's the DNA of public service that we grew up with."

The culture inherited from this family business that not only sold things but engaged with customers about how to use them is replicated at Esri. Dangermond says that Esri "is set up fundamentally to support our users." Once a year, he sends a questionnaire to all of them. "They give me a lot of guidance." He himself responds in writing to the trends revealed in the feedback. "I spend a month at it, day and night. It's my way to manage getting customer service in here. It's a great management tool, but most people are scared to do it." Hugh Keegan recalls, "The first 500 or 1,000 employees interviewed with both Jack and Laura. That happened up until I had been here 10 or 15 years. Every employee, whether you were interviewing to be a janitor, or whatever. There was no confusion about who you were working for."

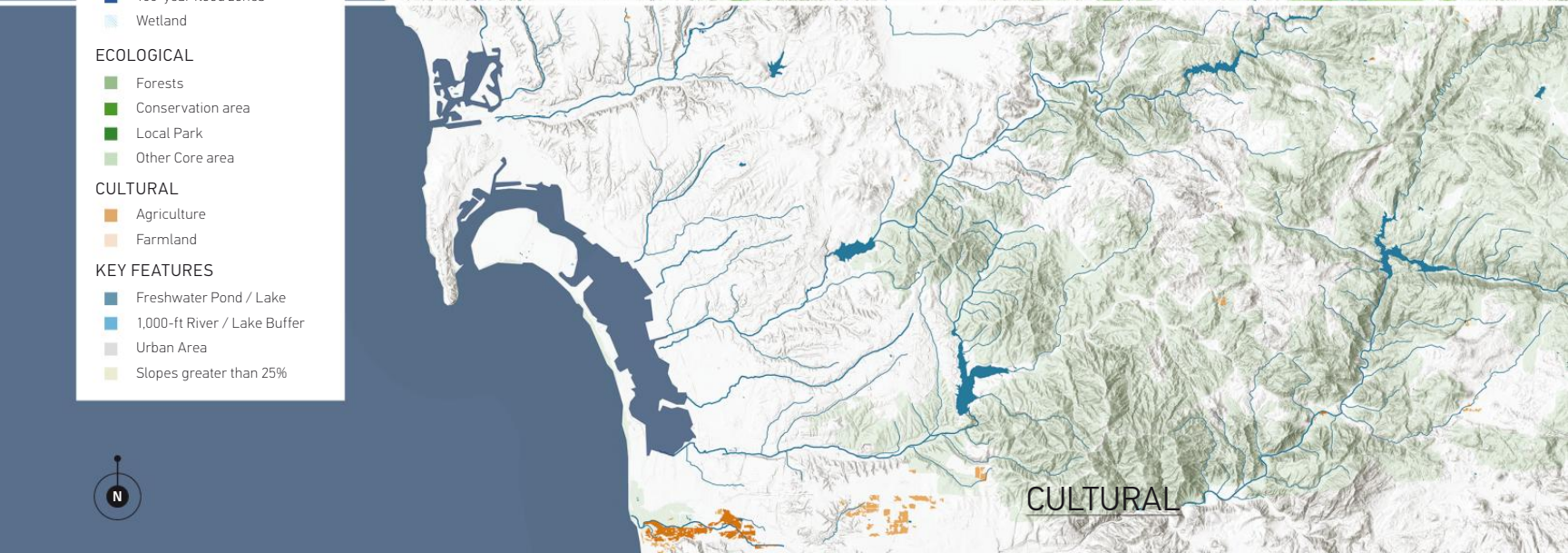
It's telling that the Dangermonds have stayed in Redlands, once a citrus farming center but long since swallowed into the unfashionable sprawl of San Bernardino County, which has one of the highest poverty rates in the country. Esri is the largest employer in the town, and makes it "much more interesting than the adjacent communities, with a big cadre of international folks," Keegan says. "We hire smart, well-educated employees who are married to smart, well-educated spouses." Silicon Valley, "though it's fun for a lot of people," says Dangermond, "is fine for young people who are on the get-rich-quick fast track, but it's not so interesting if you want to have a genuine life." He also supplies this



HAZARDS



ECOLOGICAL



CULTURAL

GREEN INFRASTRUCTURE

HAZARDS

- 100-year flood zones
- Wetland

ECOLOGICAL

- Forests
- Conservation area
- Local Park
- Other Core area

CULTURAL

- Agriculture
- Farmland

KEY FEATURES

- Freshwater Pond / Lake
- 1,000-ft River / Lake Buffer
- Urban Area
- Slopes greater than 25%





ABOVE
Jack Dangermond at
Esri headquarters.

OPPOSITE
Green Infrastructure
Initiative maps show
the Southern California
region.

no-frills explanation: He and Laura were already there, and it was cheap. “We had no money, and to be able to start a company and make it go to our scale we just did very practical things, and we still do.”

In the office suite where Keegan’s lab is housed, just downstairs from Dangermond’s, there is an overhead “dashboard,” an array of monitors showing information such as how many people are currently interacting on the platform and how much information has been uploaded that day. Dangermond likes to step in and savor the numbers. He says, “Open data, open maps—every day between 10,000 and 15,000 new data sets are shared. It’s not Facebook, but yet it’s extraordinary. There are 3.2 million users, creating their maps, matching up their maps, and using other people’s maps.”

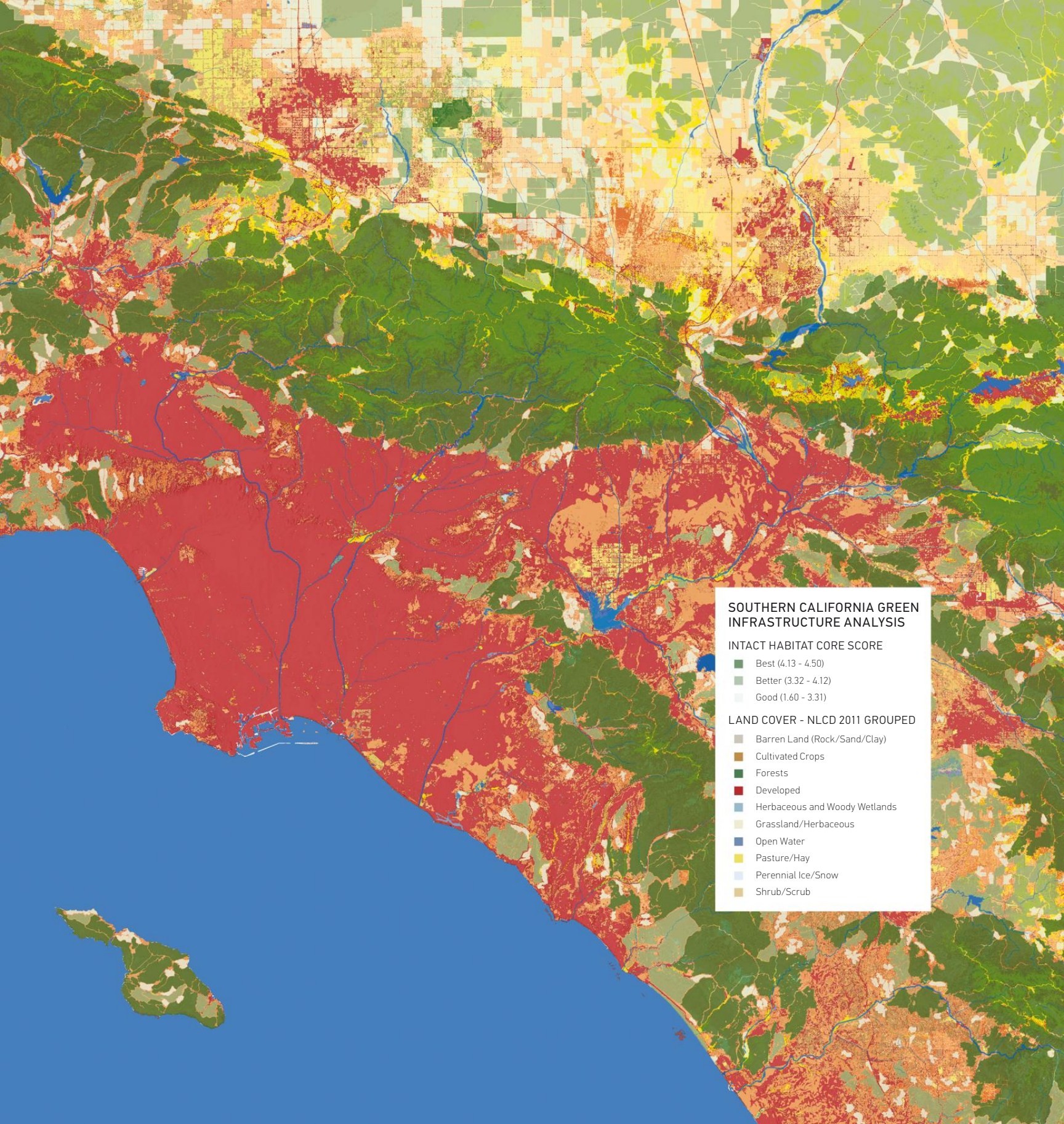
Some 350,000 organizations use Esri software. Dangermond suggests that the company’s greatest achievement has been disseminating the concept—even more than the tools—of spatial analysis into so many different fields. But his own grounding

**“YOU WANT ME TO BE
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boards, and quickly assess the impact of ideas.” That provides a way of “understanding the costs of externalities, of bad decisions, as well as the positive side of developing cities that really work.” Considering his possible legacy, Muñoz-Criado asserts that “green infrastructure has to be done at the political level, and I think his dream is to help decision makers and politicians to deliver this concept.” Dangermond, characteristically, assesses himself with modest intensity. “You want me to be inspirational, like I’m a leader. I’m not like that. I’m a very practical guy. But I believe in this deeply, that green infrastructure planning as a methodology can be a huge counterbalance to the continued systematic destruction of nature, and to population footprints that are wiping out so much of what we care about. I’m pretty riled up about that, I suppose.” ●

CONTRIBUTING EDITOR JONATHAN LERNER’S MEMOIR OF THE WEATHER UNDERGROUND, *SWORDS IN THE HANDS OF CHILDREN: REFLECTIONS OF A RADICAL WEATHERMAN*, WILL BE PUBLISHED BY OR BOOKS IN MAY.





A tall blond man is walking a Russian wolfhound along a stream. The stream is moving through beach sand into a large lagoon off the Kijkduin promenade in a seaside suburb of The Hague, Netherlands. It's not quite beach season, and it's blustery. Over scudding clouds the sun coming up is bright, but the gray sea is running fast and flecked with white, and the wind blows foam up the beach. Over the man's shoulder are tall, reedy dunes and the tips of towering chimneys, billowing clouds of steam.

These chimneys, up to 575 feet high, rise from the Maasvlakte 2 harbor complex, where the Port of Rotterdam sits across from the Hook of Holland. This point is where some of the most important interactions between the North Sea and its neighbors are happening and will happen over the next three decades.

Maasvlakte 2 is a massive human intervention, another grand bargain between Dutch ingenuity and the sea: In exchange for not swallowing them in cold saltwater, the Netherlands promises the sea a modicum of foresight, hardheaded com-

MICHAEL DUMIAK



POWER PLAY 2050

**A DUTCH VISION OF CLEAN ENERGY IN NORTHERN WATER.
DOES IT HAVE A CHANCE?**

BY MICHAEL DUMIAK

mercial instincts, and very good engineering. With 365 million cubic meters of sand, the Port of Rotterdam pushed its coastline two miles farther into the sea and created a new harbor for giant ships. One of the persons who dreamed up the 2,470-acre outer perimeter, the landscape architect Dirk Sijmons, is now turning his gaze away from land. He believes that the North Sea holds the key to Europe's meeting its ambitions of carbon-free energy and a curb on climate change: specifically, that offshore wind power can provide a lion's share of energy for the countries bordering the North Sea and their 190 million people.

Doing so will require, at some point over the next 35 years, the deployment of 25,000 offshore wind turbines of a size able to produce 10 megawatts (MW) or more each. That means anywhere from four to 12 turbines leaving harbors such as Maasvlakte every day for 10 to 20 years. Even ardent supporters of clean energy rarely put it in such concrete terms, at least to the ministers who would be essential to making this happen and the workforces that would absorb these changes. But Sijmons and his firm H+N+S, along with an unlikely team of government officials, business leaders, designers, and nonprofit groups, did just

ABOVE

Tall ships: The Port of Rotterdam and the Hook of Holland would be the scene for sending big turbine blades out to sea.



that as they explored the possibilities over the past 18 months in what Sijmons calls a vigorous exercise in “research by design.”

We’ll always have Paris

At the end of December 2015, the heads of state of 195 nations signed an agreement in Paris pledging to curb climate change and a set aim to keep the rise in average global temperatures below 2 degrees centigrade, or 3.6 Fahrenheit. As part of the Paris Agreement, the European Union, which at that point still firmly included the United Kingdom, set its own goals: to cut greenhouse gas emissions by 40 percent of 1990 levels by 2030, and by 2050 to reduce those same emissions by 80 to 95 percent. It set a target of 30 percent renewable energy by 2030 on the way to phasing out carbon emissions entirely by 2050 or shortly thereafter.

At the H+N+S studio in a renovated rail storage yard on Piet Mondrian street in Amersfoort, about an hour or so south of Amsterdam, Sijmons had been thinking about what this ambition would mean. The former professor of landscape architec-

ture at Delft University of Technology’s urbanism department has a similarly broad-minded colleague in the nearby university town of Utrecht. The political scientist and public policy expert Maarten Hajer had recently taken on a new role as the urban futures chair in geosciences at Utrecht University and, at nearly the same time, the Netherlands was due to take over the rotating presidency of the Council of the European Union. It is a largely ceremonial thing, but the European capitals do take it seriously. They organize and host political decision-making congresses and launch or highlight cultural events during the six months of a term, eager to be on the good foot in front of their peers from around the continent. Industrial Rotterdam, Holland’s second-largest and often-overlooked city, the site of Rem Koolhaas’s Office for Metropolitan Architecture and one of the largest container ports in the world, was due to produce its biennial architecture expo. Hajer got a call to curate it. The Paris Agreement happened as Hajer considered a climate-neutral economy as the dominant theme for the biennial. He decided to see what it would actually take to achieve these goals, to build a model and present it in the context of Paris, the historic climate deal. Sijmons would design the presentation. It would be something that would grab a viewer’s attention.

Research in motion

“The predominant way we advise government on these issues is by handing them a report. This is a million euros worth of science, and I hand it to them, and something mysterious should happen,” the tall, suave Hajer says while sitting in a glass-enclosed quiet cube in the middle of the



LEFT
Noise-dampening earthworks from H+N+S and a sculptural touch at Buitenschot.

BELOW
A room-sized Odyssey exhibit at the Rotterdam biennial.

new urban futures lab, then under construction in Utrecht. Hajer is a former director general of the PBL Netherlands Environmental Assessment Agency, which advises the cabinet on climate change and urban planning issues. For a long time he's been interested in Sijmons's methods for short-circuiting and bypassing political impasse and building consensus among disparate interests involved in a problem or situation. Hajer even wrote a book with Sijmons called *A Plan That Works*.

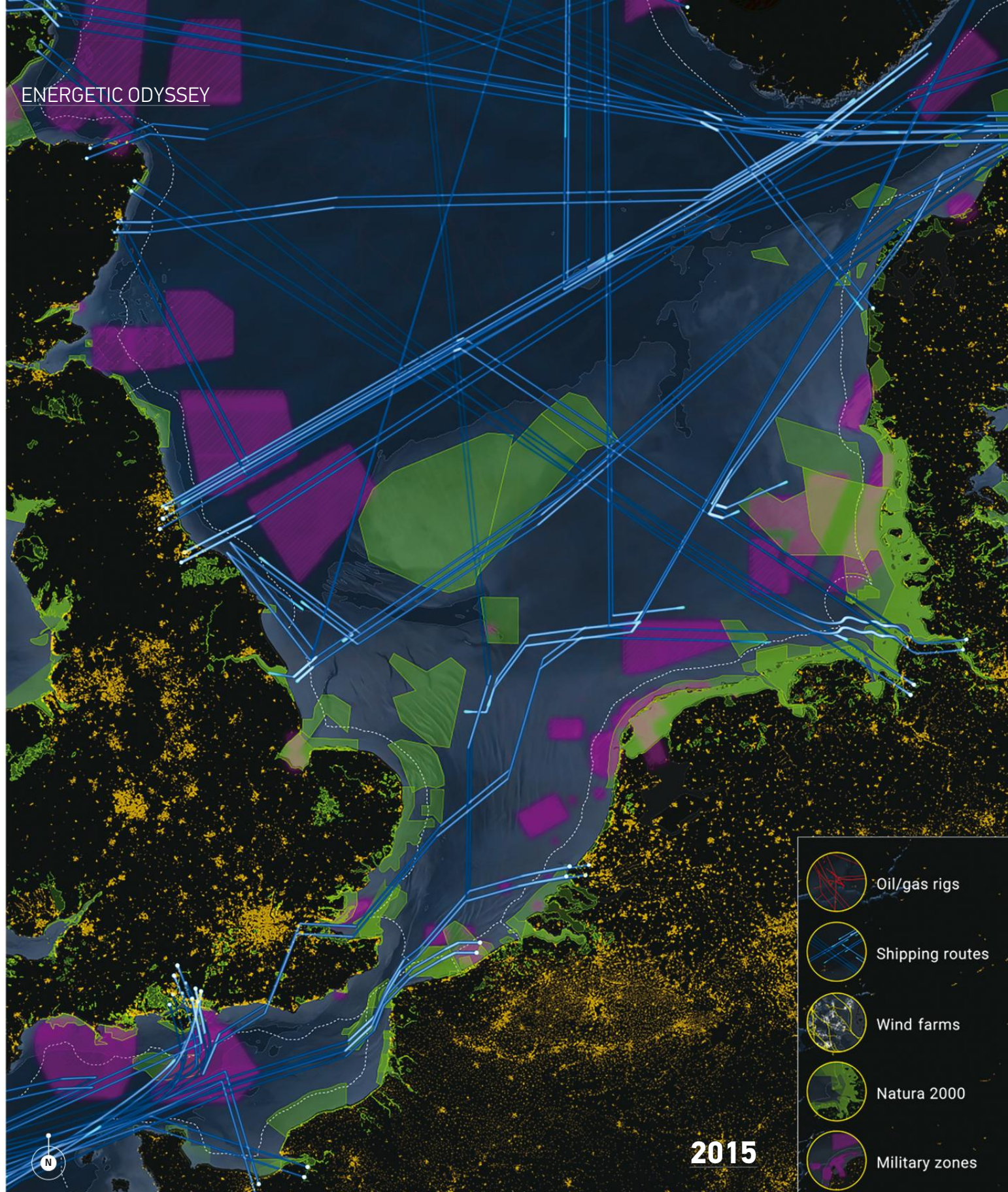
This kind of talent is necessary in making any progress with climate change policy, where even solar- and wind-powered do-gooders might be at each other's throats at times. With its projects, H+N+S shows a kind of soothing creativity, compromising without being compromised. As Hajer says, it's not necessarily the boldest, like a Koolhaas lightning bolt, but H+N+S employs a difficult-to-pull-off subtlety that results in lasting solutions. A good example is in a field near the huge Schiphol airport, where a new runway was going up. Residents in the approach weren't happy about the anticipated noise. Spurred by findings about tilled fields and noise reduction, the H+N+S idea was to build a large park filled by sound-dampening earthworks: the Buiten-

schot. Now residents walk their dogs on dew-filled mornings in an extraordinary, grassy space. If they stroll up the side of these rod-shaped earthworks, it's just possible to see cargo 747s on their takeoff runs. On the housing sides of the park, though, you won't hear much of them.

Going back to his reports, Hajer says a tool that Sijmons employs well is delivering concepts in word and image. "A report is very clumsy. Especially with climate science, where you work with these forecasts in order to reach targets: 'Years from now, this is what you have to do.' It's very complex and cognitive," Hajer says. With Sijmons on board, they could create a vision of these complexities, displayed using design power. "It's about creating an 'imaginary' of a positive future. Look around you: Donald Trump, Brexit, everything is negative about the future. People are afraid of the future. This is a time we need to use design in a new context. For the biennial, I wanted to use the background study—the hi-res report—and make it an immersive experience. A thing that you could stand around."

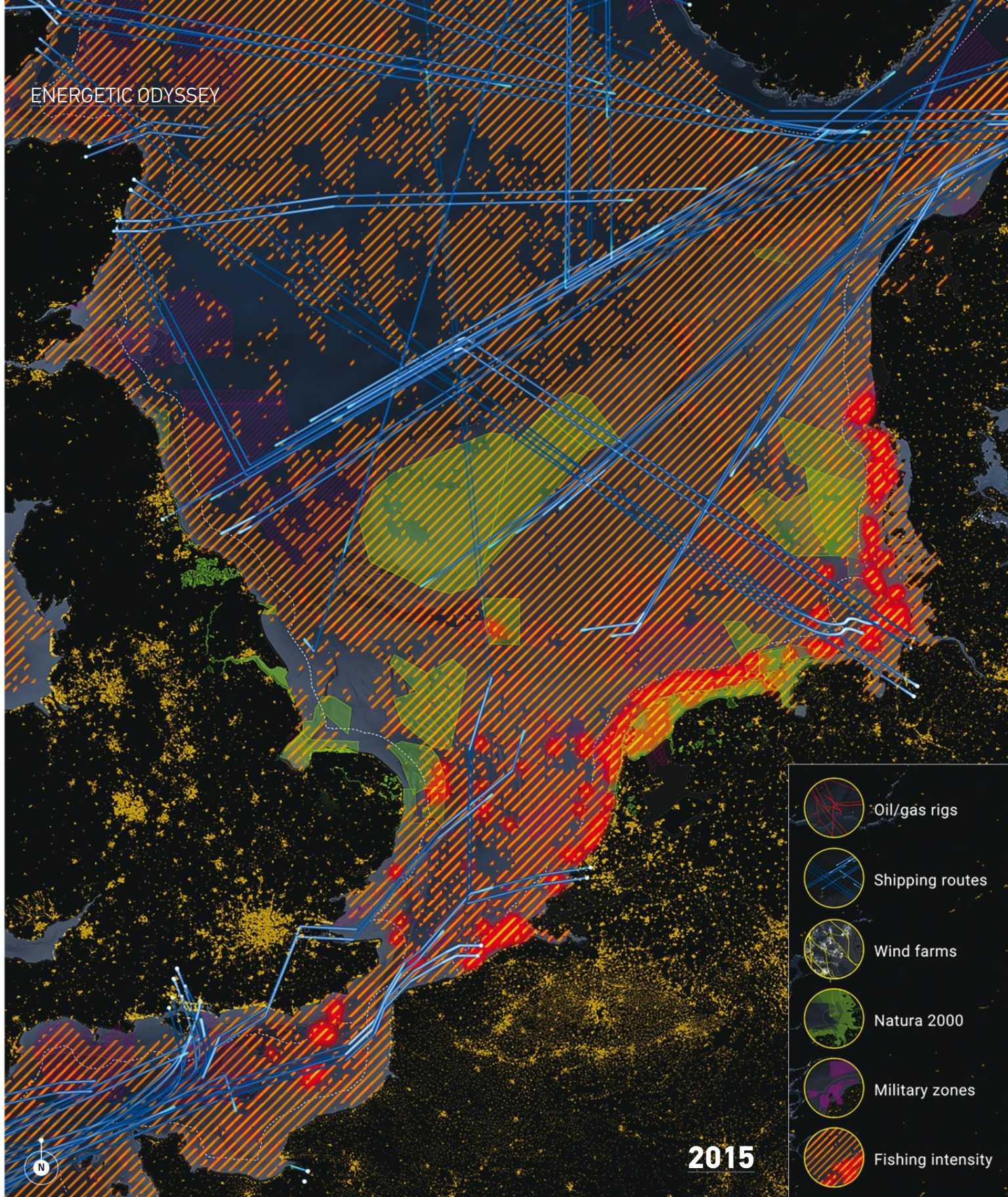


ENERGETIC ODYSSEY



COURTESY IABR / H+N-S

ENERGETIC ODYSSEY



COURTESY IABR / IHN-S



LEFT AND OPPOSITE

The Energetic Odyssey animates a vision of an entire clean energy infrastructure over decades.

➔ Such an experience would give the public a benchmark from which to measure the future. Much of Europe accepts that humans are contributing to climate change and strongly supports (at least theoretically) measures to counter it. This would be a benchmark the public could see, and so could their elected or appointed representatives. So often large multilateral projects are made in the abstract. Then time slides by. The United Nations, for example, will still be pursuing its millennium goals two decades into the millennium.

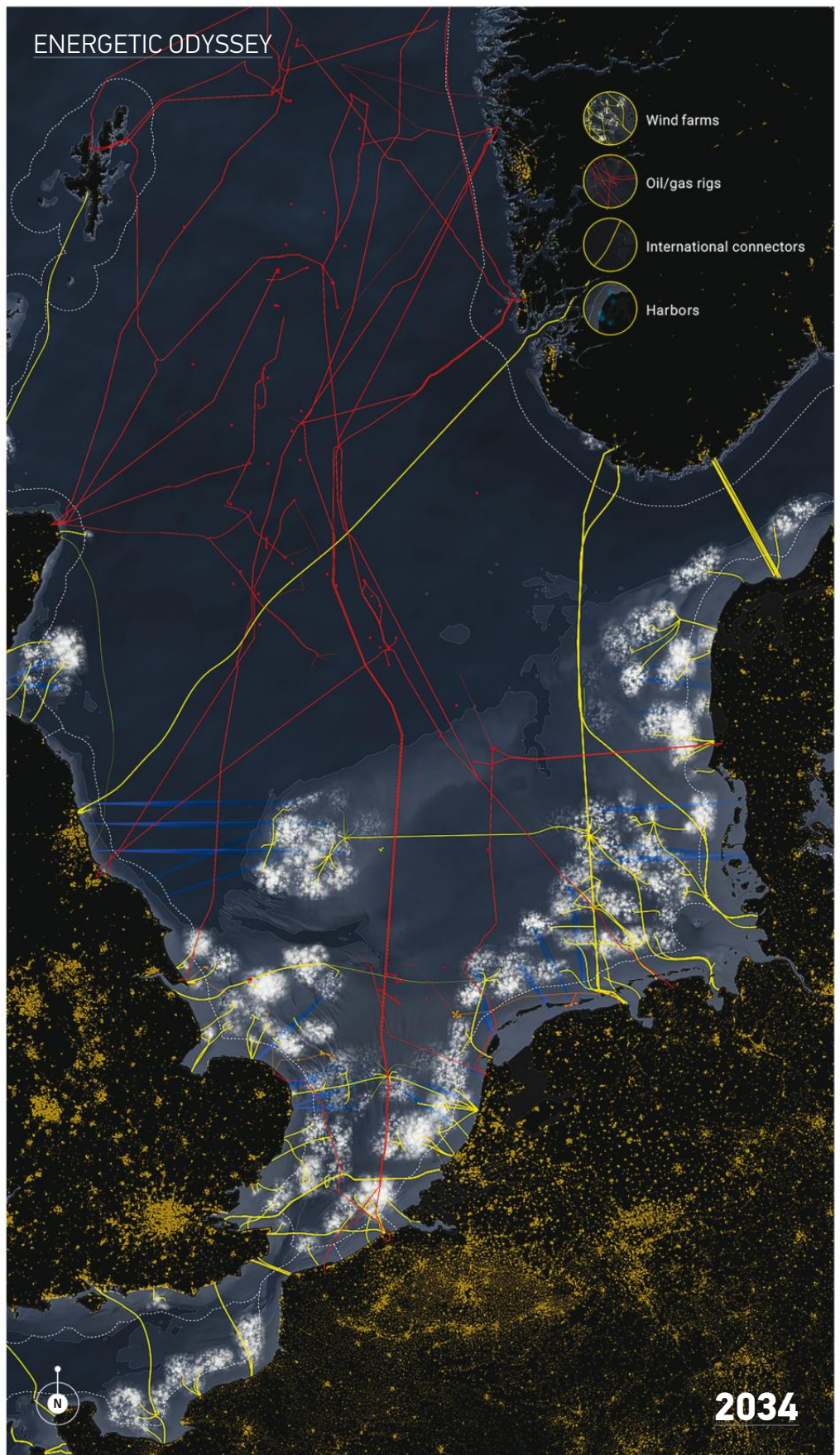
The benchmarking project focused on the North Sea states: the Netherlands, Belgium, Denmark, Norway, the UK, and Germany. These six countries consume 5,500 terawatt hours (TWh) of energy every year in electricity, heat, and fuel. This sounds like a lot, and it is: It converts to roughly 518 million U.S. tons of oil, about 470 times what Kenya consumes in a year, and at a cost of about \$175 billion. On the other hand, it is not astronomical: 5,500 TWh of energy is about the current total production annually of global renewables.

Ecofys, a Dutch think tank and consultancy that builds models for energy-use scenarios, compiled and delivered research for the scenario development. Hajer spent a year raising money for it from government and private sectors. "The provocation was this: Everyone talks about a green 'next economy' in terms of *Small Is Beautiful*," he says, referring to the influential writing of the

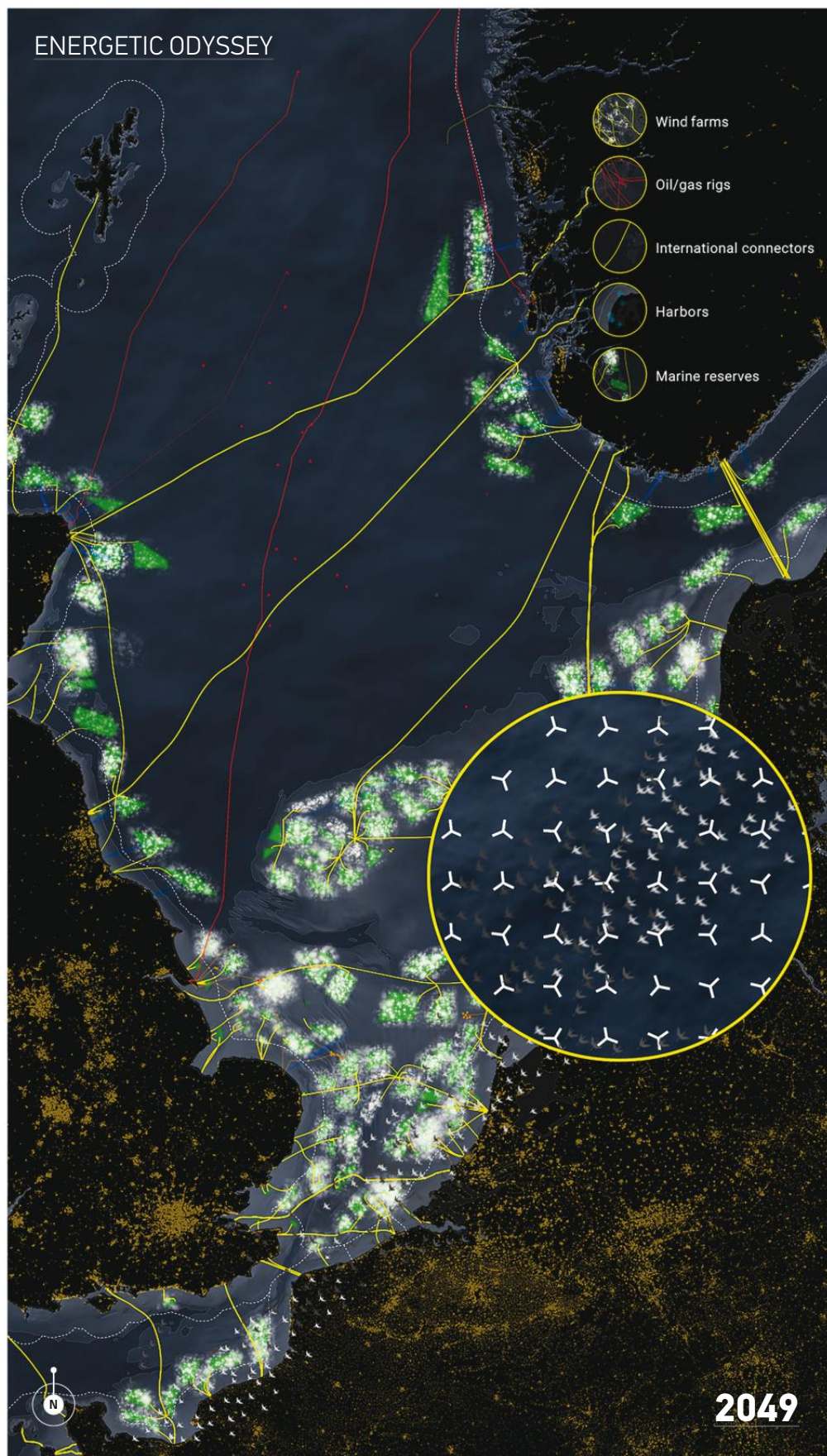
late statistician and economist E. F. Schumacher. “But small is beautiful doesn’t add up. Big is beautiful.” Hajer thinks the big offshore fossil-fuel industries, the bad guys, should become the heroes. Only that, in his view, opens the possibilities of scale. Sijmons came in for his part and began designing animations based on the pool of information and expertise assembled. Hajer, by this time, was setting up workshops with the unlikely consortium that bought into the idea: firms like the oil and gas company Royal Dutch Shell, the contractor and engineering operation Van Oord, the big German power utility RWE, the ecological nongovernmental organization Natuur & Milieu, and the Port of Rotterdam. These players chipped in money, but Hajer also wanted their expertise to help detail the story. Energetic Odyssey took shape.

Incoming cables

An indeterminate English female voice intones over the long table at the H+N+S studios. Well-enunciated, curious, enthusiastic, and soothing, she could be a robot. She’s the narrator of the Energetic Odyssey animation playing on screen, and she is talking about the journey that’s going to happen. To tamp down CO₂, an entire energy system will be assembled and routed in wide-ranging environments: underneath the seabed, connecting with the coast, floating on the turbulent North Sea surface. Reaching the EU targets set at Paris requires nothing less than the complete transition from fossil fuels to carbon-neutral energy sources. The Energetic



ENERGETIC ODYSSEY



LEFT

As data projections roll through the presentation, graphics indicate where wind farms would grow. Note cluster over the Dogger Bank (center, to the left of enlarged portion).

OPPOSITE

Wind farms get connected.

Odyssey, 14 minutes of flowing lines for wind currents, moving maps, NASA carbon data imaging in rusty reds and yellows projected at gym floor size, essentially names the components of a regional energy system based on renewables rooted deeply in the sea.

There are wind farms. There are cables within these farms through which electricity is transported. There are connectors at sea where the cables from the wind farms converge. There is the landing cable that leads to the coast, ending at a point where electricity can be tapped. "There are pipeline corridors that currently transport gas and will subsequently take carbon monoxide to underground storage facilities," the voice says cheerily. The ports and industrial estates where wind turbine components are manufactured and then shipped out to sea also feed into the system, plugging in at the periphery.

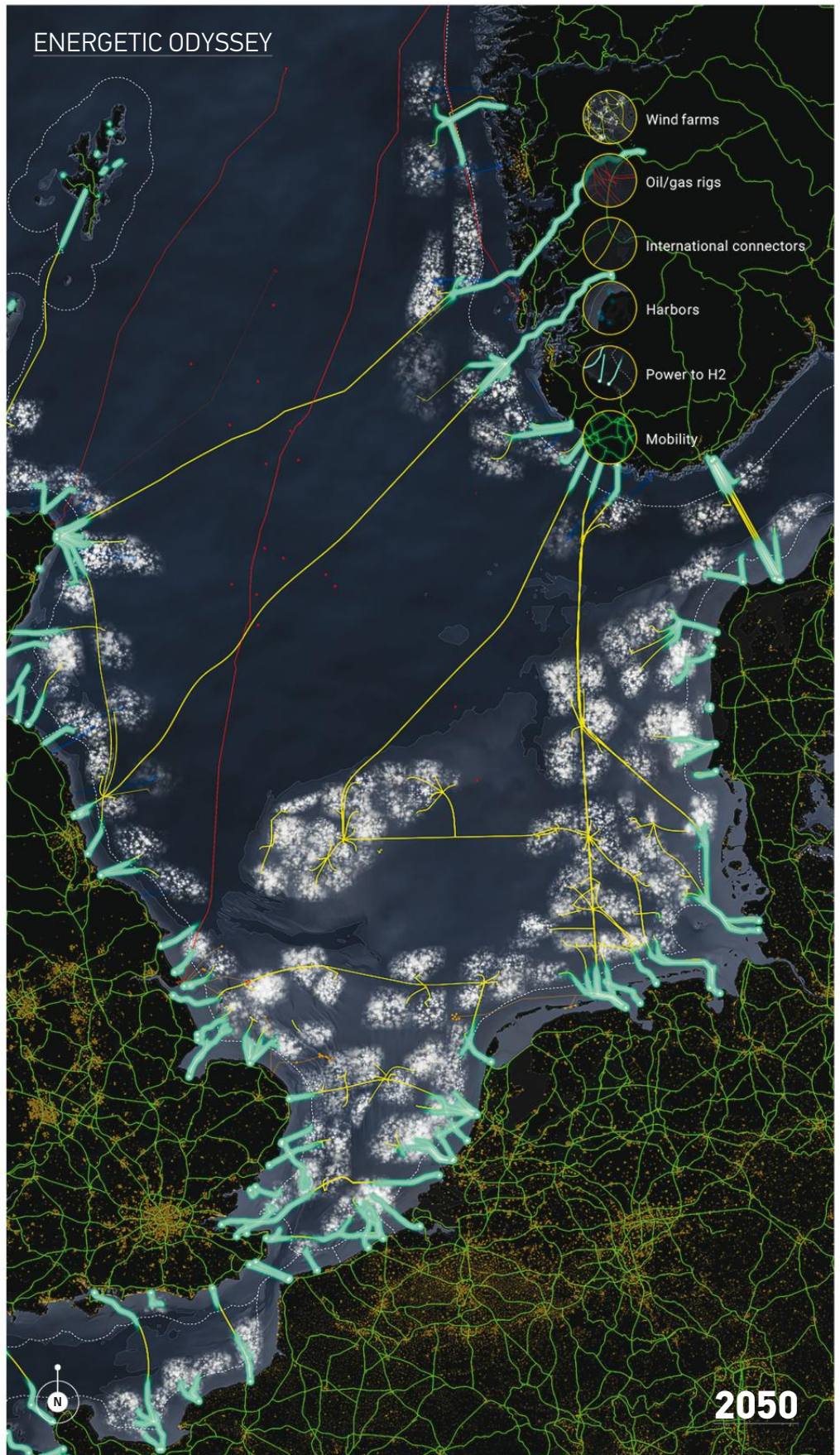
All of these things (and more) are already mobilized in the North Sea, some fledgling, some weather-beaten and proved by years spent breaking the waves. Where the Energetic Odyssey begins breaking with convention, as Hajer alludes, is in terms of scale. The Odyssey presented here has countless links to the coast but largely takes place in deeper water, the connections unseen. One result might be that a dog-walking beachgoer looking out to sea would have an unspoiled view. The turbines needed for large-scale offshore wind energy will be wound and hugely torqued by massive blades, and that means they will not be

ENERGETIC ODYSSEY

anchored close to shore. This answers a common complaint about wind power, that the structures ruin the look of a place. Here the turbines would be in fields 12 miles off the coast, showing as just a far-off white mist as the tips of wind blades peek over the horizon.

Big energy, in its clean iteration, will be well out into the water. The real production will come on line over the next three decades. If the six North Sea countries consume 5,500 TWh a year, renewables are going to need to make a quantum leap in production to come anywhere near clearing the bar agreed to in Paris. Renewables currently supply about 8 percent of the energy in North Sea countries. Offshore wind will need to become much more muscular, and soon. At the same time, as our Odyssey narrator purrs (perhaps a little sotto voce), reduction in energy consumption must be part of the picture.

Big turbine makers such as Vesta, Arwen, and Siemens are expected to build larger and larger; contract players, like MacArtney in Denmark and Prysmian in Milan, to push advances in cabling such as better seabed linking and higher-voltage lines. Ports such as Rotterdam and Hull must all build, destroy, and deploy. Long cables must carry direct current instead of alternating current. That means transformers and more. Odyssey nods to CO₂ sequestration (as well as a stable and well-accepted cap-and-trade-and-tax system for carbon). Both of these items pose intense challenges: Germany scrapped an EU-backed





ABOVE
The Bligh Bank wind farm off the coast of Zeebrugge, Belgium.

effort on sequestration in 2013. Energy savings on a large scale, for its part, has all the charm of requiring any savings on a large scale. The Odyssey has obstacles everywhere it looks.

To make construction and deployment of the turbines easier, someone's going to need to build an island.

In the North Sea.

On Dogger Bank.

Preexisting conditions

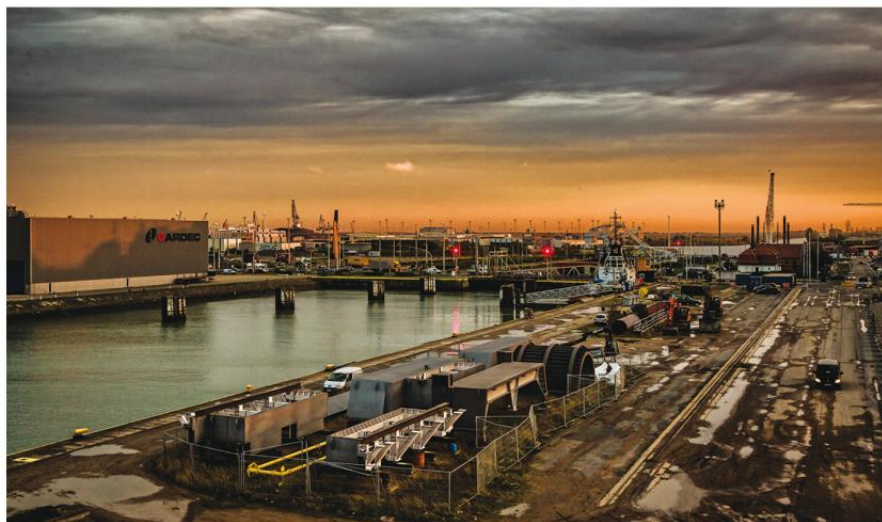
The North Sea arrived slowly in Europe, but once there it made an outsize impression. There used to be tundra between England and the Netherlands and Jutland, and a land bridge called Doggerland. Mammoth and elk and bison roamed. Flooding put that to rest at the end of the last Ice Age, first rising to leave low-lying islands and archipelagos, then putting the shelf under for good in the glacial flood that created the English Channel. The North Sea covers 220,000 square miles and is shallow compared with other seas, with its 13,000 cubic miles of water ranging from

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the Norwegian trench at 2,300 feet deep to an average of 300 feet and to the moraine shallows of 50 to 100 feet over sandbanks and glacial pileups.

It has always seen human traffic, trading and harvesting, transport and war. Some of the busiest shipping lanes in the world are in the North Sea. The Vikings came to Scotland, the British and Norwegians came for oil and gas fields, the U-boats came to hunt for cargo convoys and the Royal Navy for cruisers, and everyone came for cod, herring, mackerel, and haddock from the thriving fisheries spinning off from the 160-mile sandbar



called Dogger Bank. In his recent book *The Naked Shore: Of the North Sea*, Tom Blass describes the water as saturnine and quick-tempered. Maybe it's under the influence of hard-sounding words like *Skagerrak* or *Humber* or *Sylt* or a ferry-crossing experience on an ill-chosen night. The North Sea wields a mercurial reserve of power, with much going on beneath the surface. If the place is going to be the beneficial heart of a powerful clean energy system connecting six countries and supplying the energy needs of 200 million people, it's pretty busy already. There used to be rock-covered plains and cold-water reef in the now mostly sandy sea, says Nathalie Strookman, the energy project leader at Natuur & Milieu, in Utrecht. Although there are still more than 200 species of fish, three species of seal, and 16 species of whale calling it home, and 10 million seabirds including skua and puffin and auks and terns on any given day, this is also one of the most industrialized environments in the world.

"The North Sea is one of the crucial areas in Europe where we will win or lose the battle for renewable energy," the Odyssey voice asserts. "But the North Sea is not empty. Our story is set in the most intensively used coastal waters in the world. With fishery and shipping routes cutting right across, it contains designated nature reserves and military zones, oil rigs the size of skyscrapers, countless oil and gas pipelines, and there are already several wind farms. Moreover, the North Sea is used as a sink for pollutants and residual heat from our industries."

ABOVE

The Zeebrugge port dates from medieval times. Its challenge would be to keep up with a clean energy future, powered by offshore wind.

OPPOSITE

View from the captain's deck: The 100-yard-plus *Volantis* is tasked with cable transport, creating connections in this case to Bligh Bank.

The North Sea also touches roughly 7,000 miles of coastline, from Zeebrugge, Belgium, and the Maasvlakte flats around the Hook of Holland to steep goe canyon inlets along the far north Scotland coast around Wick and the Orkneys and the rugged rocks north of Stavanger, Norway. If there are to be 25,000 10-megawatt-plus turbines taken to sea in what would be the latest of North Sea flotillas, all of these interlocking parts, blustery beach and Dogger Bank alike, will feel it.

Blow, wind

There are already nearly 40 wind farms in the North Sea, nearly all of them in about 40 feet of water or shallower. There are slightly more than 2,300 turbines with a capacity of about 6.4 gigawatts (GW), enough to power a million households at an installation cost of about \$24 billion.

It's difficult to measure in any simple way the potential capacity and patterns of wind blowing across the North Sea. It seems impossible to say there's x amount of wind over y portion of sea, therefore deploying z turbines in that place should produce an expected amount of energy. Thomas Winkel, a Paris-based energy and sustainability consultant and a former member of the Ecofys team on Energetic Odyssey, says the European Commission draws on wind speed variation data and long-term surveys to estimate the North Sea's potential for wind power. The Odyssey team based its findings on this commission data as well as previous Ecofys reporting. Engineering research probes further with common factors such as barometric pressure as well as the more exotic, such as mesoscales and Monin-Obuhkov length, making calculations using meters per second, regional changes, and standard deviations on a given day.

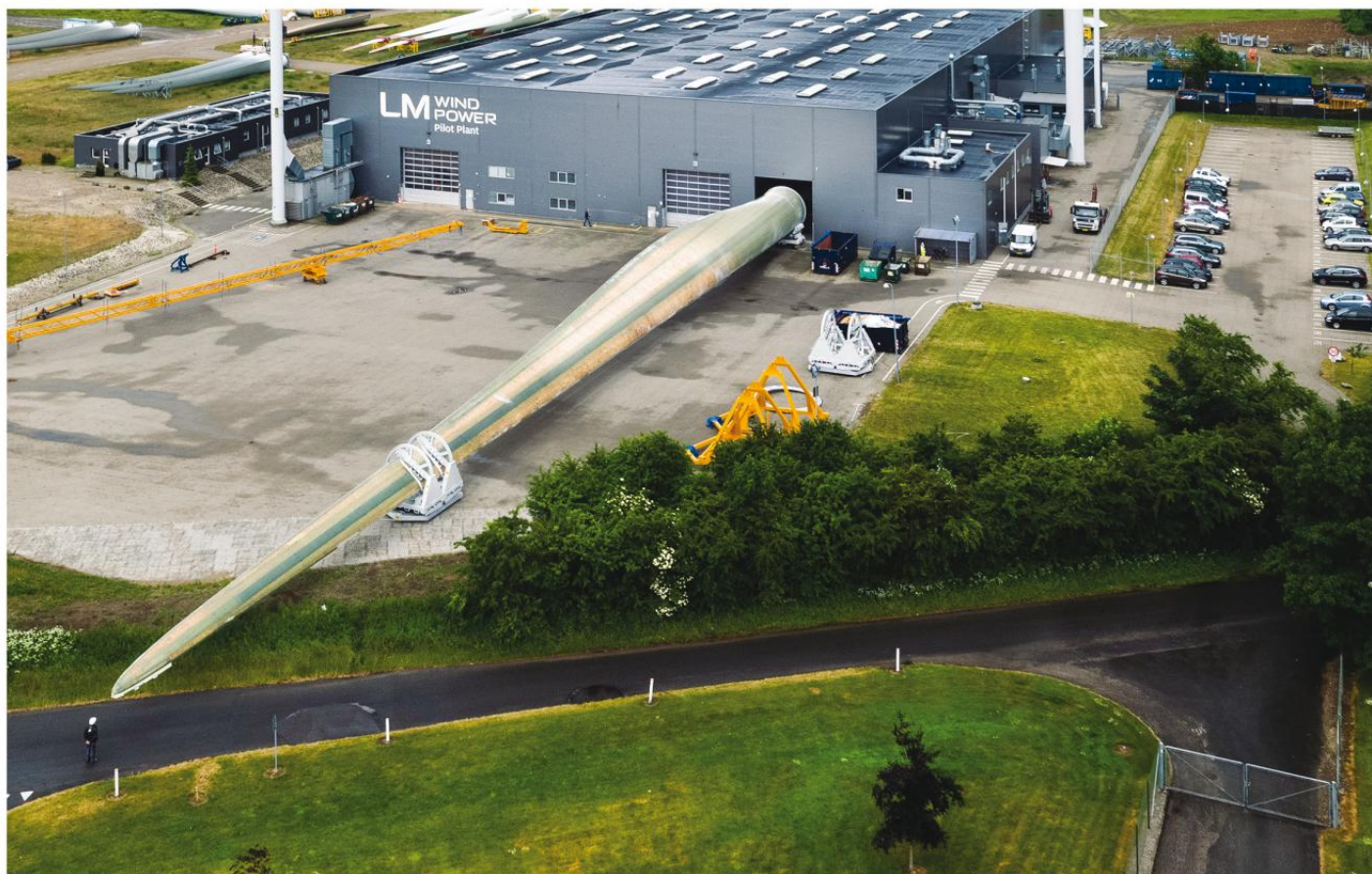
Industry is optimistic about the near-term future for this kind of North Sea power. The European Wind Energy Association sees production increasing by about four additional GW of wind power annually, with 40 GW capacity reached by 2020 and 150 GW by 2030. That would move North Sea wind power to about 7 percent of the total electricity pie for Europe. It's a step forward, but not certain to be big enough to help the region reach the 2050 goals from Paris.

"In the context of substantial greenhouse gas reduction by 2050, renewables play a pivotal role and would need to supply at least 75 percent of all the energy that we consume," says the voice of Energetic Odyssey. That breaks down like this: With 10 percent of North Sea national power already coming from renewables, energy savings need to be part of the picture. She's marked this at a 30 percent reduction relative to 2015: a savings of 1,500 annual TWh of energy. The research also indicates it is feasible—with the right ambition—to generate 1,200 TWh of energy annually using offshore wind. That's 90 percent of the electricity used by all six North Sea countries and a third of all energy they consume. This is what adds up to the 25,000 turbines at 10 MW. That means turbines covering an area of 22,000 square kilometers, or 8,500 square miles, which is the size of Lake Erie or Massachusetts.

Is that even possible?

In a test bed near the German coastal city of Bremerhaven, the French-Spanish wind energy company Adwen is putting its new giant through trial paces. Last summer, Adwen's production partner in Denmark produced the turbine's blades at a fabrication hub in Lunderskov. At 288 feet





ABOVE

Adwen's big new turbine blades come on line from Danish partner LM's factory in Lunderskov.

long and weighing 35 tons, a finished blade nearly stretched over the fab's perimeter fence. Each blade needs an escort to be transported on the highway, and it can't be taken everywhere.

The turbine, also a monster at about 80 tons and an absurd level of torque capacity, is new on the block as well. A production model debuted at the end of last year. Together they are being kitted and having the kinks ironed out by research and development experts in Bremerhaven.

This is an 8 MW turbine.

The engineering multinational Siemens also has plans for a new 8 MW engine, as does Vestas, which is already installing some in Liverpool Bay in the UK. Siemens officials have already said they plan a scale-up to 10 MW in the next four years.

"It's challenging, but not orders of magnitude away from where we are now," says Henk Polinder, an electrical engineer and assistant professor of

electrical machines and drives at Delft University of Technology. He's part of a long-term EU research project called INNWIND, which with several partners in Denmark, Germany, Greece, Italy, the UK, Spain, Belgium, and the United States is providing fundamental research into better design of large-scale wind machines. Results are continuously encouraging, Polinder says, in terms of materials, torque, stability, connections, weight, and output. But getting bigger does mean getting bigger. Polinder expects to see turbines topping 440 tons, with 300-foot blades, heavy concrete anchoring, and deep shafts. Designing floating platforms for deeper water is considered the industry answer for big turbines. There's only one right now in the North Sea, a prototype operated by Norway's Statoil, anchored in 600-foot waters off the Stavanger coastline. The firm does plan on launching five more platforms 15 miles off Scotland by the end of this year, and a floating farm off Block Island, Rhode Island, came online last December.



But getting to a point where every day four or five 10 MW assemblies leave European harbors bound for the North Sea is pretty ambitious.

The Odyssey would have these bound for a new artificial island, to be specially constructed on Dogger Bank. The island would be outfitted for assembling wind turbines and distributing them for installation. It would also provide support services and voltage conversion.

It's a natural place to consider, because Dogger Bank is the North Sea switchboard, a Grand Central sandbank where all lines converge. The ancient land bridge is the least submerged here, with waters shallowing from 120- to 50-foot depths. Even so, the world's largest artificial island, the crescent of Palm Jumeirah in Dubai, United Arab Emirates, sits in 35-foot water at its deepest, though at least one experimental drilling island rose in 38 feet of Arctic water in the early 1980s.

The Dutch engineering company Boskalis recently started work on one of the largest island-building projects in the world, the Marker Wadden restoration in Markermeer Lake, which lies between Amsterdam, the outer IJsselmeer, and the North Sea. It's an impressive feat, but it's in sheltered waters at 15 to 20 feet, tops.

Dogger Bank, though shallow, is deeper than that. As a central space, it's already the site of a planned 5 GW wind farm, scaled down from 10 GW, to be owned by UK and German utilities SSE and RWE, Statoil of Norway, and the Norwegian state hydro/wind company Statkraft.

It also was the epicenter of the UK's only serious earthquake.

Before shipping to the artificial island, the big turbines will need to travel to harbors after manufacture. A place like Maasvlakte will need to handle the traffic. Rommert Dekker, a logistics professor at Erasmus University in Rotterdam, thinks it could. "Inland barges can be 400 feet long on the Rhine. They should build these blades along a river," Dekker says. "It is still a lot. There are not that many ships. Even if we take 20 years to build them, we need four of those ships per day, and as they would make a round trip of I guess seven days, we would need 28 of them. That is a large number, also because the North Sea would not allow working year around. So my first impression is that if it takes three years to build just one wind park of now 100 MW, we really need to scale up, and I have some doubts whether we can

ABOVE

Enough blades of this size would be needed for five new turbines every day on the way to the North Sea.

BELOW

A new island rises in the Markermeer. Dredgers would need to make new land on Dogger Bank for wind farms.





LEFT

Adwen installs a 5 MW turbine off the German coast; 10 MW farms would be deeper, and bigger.

BELOW

An Adwen production facility in Bremerhaven, Germany. The Franco-Spanish joint venture has installed more than 600 MW of capacity offshore.

realize that. That is only a first guess, though. More detailed calculations need to be done.” For its part, Siemens, the German engineering firm, just started producing wind turbine blades in a new factory built directly by the Port of Hull in the UK—a port that used to trade in coal.

Demand and supply

Another set of numbers taken far from the sea will need to add up for this Odyssey to go anywhere, and that is in calculations of the parliaments and

ministries from Whitehall to the Tweede Kamer to Berlin. If the political waters were choppy when Sijmons and Ecofys and Hajer started Energetic Odyssey, at this point cold waves are coming over the gunwales.

The UK is pulling out of the European Union. Similar forces to those that created Brexit are swirling in the Netherlands. The Belgian government is unstable and stricken by security concerns. There are public concerns about wind farms off the coastline and about subsidizing clean energy sources.

The Trump administration has taken office across the Atlantic. If it hasn’t taken note of the Paris Agreement yet, surely it will soon enough. Key Trump officials have already marked Paris as dead. It’s a matter of time. If the United States pulls out, what then?

From the start, Sijmons and Hajer felt the political element in all of this. It is probably the first and greatest hurdle. When the team showed the big version of the Odyssey animation to the 29 assembled energy ministers of the European Union in Rotterdam, some paid more attention to their mobile phones than what was happening in front of them. “There’s a lot of denial,” Sijmons says. “And now you have the denialist in chief in office with Mr. Trump.”



RIGHT

An Adwen servicing team on the Global Tech farm.

BELOW

Installing a blade for a 5 MW Adwen turbine. The company's new blades for its 8 MW machine are 60 feet longer.



OPPOSITE

Thanet Wind Farm, seven miles off the coast of Margate, UK, is one of the world's largest. With 100 turbines and 300 MW capacity, the farm switched on in 2010.

Sijmons sees placing real numbers in front of decision makers in a comprehensive manner as a way to break through a “crisis of the imagination” that obscures the vision of decision makers, even on the side of clean energy.

“This is not a plan. It is a narrative,” he says. Sijmons is pursuing something here he calls “research by design,” and H+N+S has been relying on it for a long time. It’s why a 30-year-old project to restore stork habitat in southern Holland, one of the first projects produced by the landscape architects that founded H+N+S, reminds him of the task at hand. The Plan Ooievaar, as it was called, viewed a river area as an object of design, where artificially created environments spurred new nature (and in this case, the return of the black stork to southern Holland). The approach guides Sijmons to let geography steer the planning of interventions or structures, which then create new environments on their own.

In this case, the will to create meshed grids, the basic but complex electric infrastructure that would route power among the North Sea nations, and the show of collaboration among even a subset of fractious European countries can and will develop organically. At least that’s the idea. “Actually the political climate in Europe is advantageous,” says Winkel, the energy consultant and former Odyssey team member for Ecofys. “Countries don’t do this to fulfill their climate change targets, but because they see they can actually make money with it.” Offshore wind is becoming more competitive. “Climate change targets are under pressure and will always be so. But from an economic perspective it starts to make sense here,” Winkel says. “In that case it doesn’t matter what the United States will do. If Trump pulls out of the climate change agreement, it will not matter so much for renewable energy here.”

Building a sense of urgency—what Sijmons calls the “Chinese building speed”—is hard. But the meshed grid among North Sea nations will happen, Sijmons contends, because it’s the best way to make wind farms work. Already there is a 360-mile-long power cable linking Norway and Holland. When the Netherlands produces too much energy, the overflow goes through the cable to the coast near Fedaa, Norway. If Norway has too much on its grid, the extra can flow to Eemshaven, Netherlands.

It’s natural enough that Sijmons should name-check Jan Bijhouwer, a pioneering landscape architect who was instrumental in designing another Dutch landmark, the long dike on the IJsselmeer that opened a new generation of the polders, those quintessentially Holland plots of protected, reclaimed land. The structure worked. Sijmons has more than one of these to his credit.

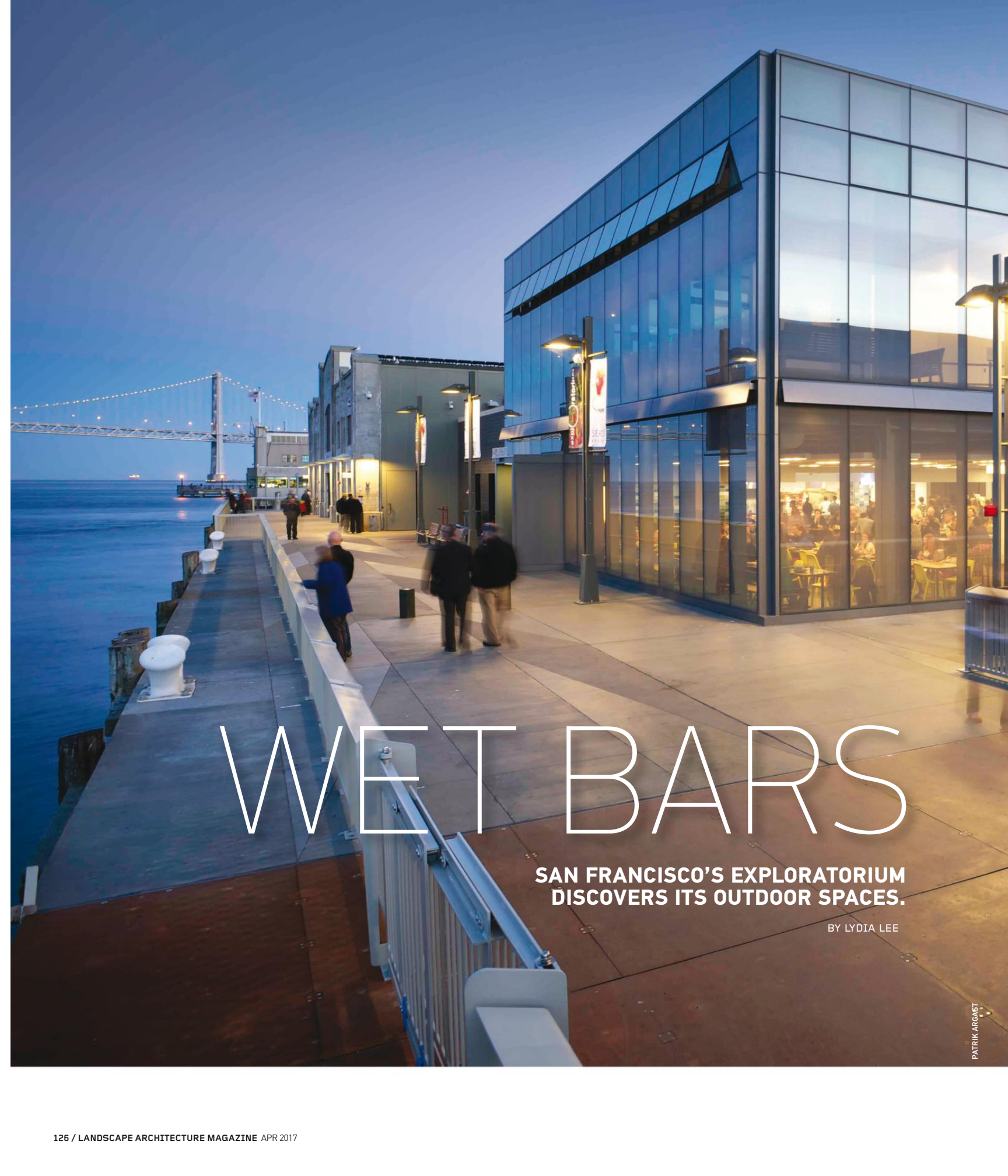
Dog-walkers are normal at the Dutch seaside, but the beach lagoon near Kijkduin is an unusual feature. It opens up as the beach itself becomes a wider, delta-shaped expanse edging into the sea.

This is the Zandmotor. It is something of a companion piece for Sijmons to the Maasvlakte. Here as elsewhere coastal sands are always migrating and moving around, eroding the strands up the coast near The Hague and Scheveningen. Every few years the government has to restock the sand on the coast. Sijmons and his crew created an artificial peninsula widening into the waves as a delta-shaped sandbar holding 71 million cubic feet of the stuff. The Zandmotor, or sand engine, works by managing that migration, currents and waves directing granules to where they need to go, no restocking required. This process happens by itself, powered by the energy of the North Sea waves, every other second. ●

MICHAEL DUMIAK WRITES ABOUT GLOBAL SCIENCE, ARCHITECTURE, DESIGN, AND ENGINEERING AND IS BASED IN BERLIN.

MICHAEL DUMIAK, OPPOSITE





WET BARS

**SAN FRANCISCO'S EXPLORATORIUM
DISCOVERS ITS OUTDOOR SPACES.**

BY LYDIA LEE



PIER 15

A public walkway at the farthest end of the museum pier is open to everyone—museumgoers, tourists, and locals alike.



ONE OF THE MOST POPULAR EXHIBITS at San Francisco's Exploratorium is an immersive experience of the city's iconic fog. When you walk along the 150-foot-long *Fog Bridge* by the artist Fujiko Nakaya, you disappear into a white mist generated by 800 tiny nozzles. "When everything is fogged up around you, it's a wonderful 'noticing' tool," says Tom Rockwell, the Exploratorium's director of exhibits and media studio. "You notice the change in temperature, the air currents, the light."

It's fitting that the Exploratorium, one of the original hands-on museums, encourages visitors to engage directly with the wild. The foundation for its outdoor exhibits is a series of broad decks

around the waterfront museum—more than an acre of hardscape—designed by the San Francisco firm GLS Landscape | Architecture. Notably, most of the outdoor areas are accessible by the public and don't require a ticket for admission. They fulfill a state mandate for public waterfront access, but they are also an important part of the museum's mission to connect with a much wider community beyond its paying attendees. The spaces are testing grounds for outdoor installations destined for other parts of the city and even other towns: little placemaking ambassadors for science and culture. The multiplicity of uses for the Exploratorium's outdoor spaces is a reminder that the landscapes of today can be fertile ground, even without a single plant in sight.

ABOVE
The glass-walled Observatory building contains exhibits about the environment and climate change.

BRUCE DAMONTE



The Exploratorium's outdoor extension is a recent development. Founded in 1969 by the physicist Frank Oppenheimer, the museum pioneered the concept of hands-on exploration of scientific

phenomena; among its most well-known exhibits is the *Tactile Dome*, a completely dark, three-dimensional environment that you crawl your way through. Its longtime home was at the Palace of Fine Arts, an ornate, beloved landmark located at the northern edge of town. In the 1990s, museum management began planning a much-needed renovation and expansion, including its first outdoor exhibit area. But concerns about renewing the lease and the long-term viability of the site prompted a search for a completely new locale. San Francisco's eastern waterfront, known as the Embarcadero, had some compelling advantages: considerably more space in a central location and easy access to public transit.

However, the new site at Piers 15 and 17, stretching 850 feet into the bay, had its own set of challenges. Like many modern metropolises, San Francisco got its start as a port city, and its old industrial

ABOVE

During construction, the parking lot between the two piers was removed in stages.

LEFT

Hundreds of pilings had to be reinforced to support the pier's change from industrial use to general assembly.





LEFT

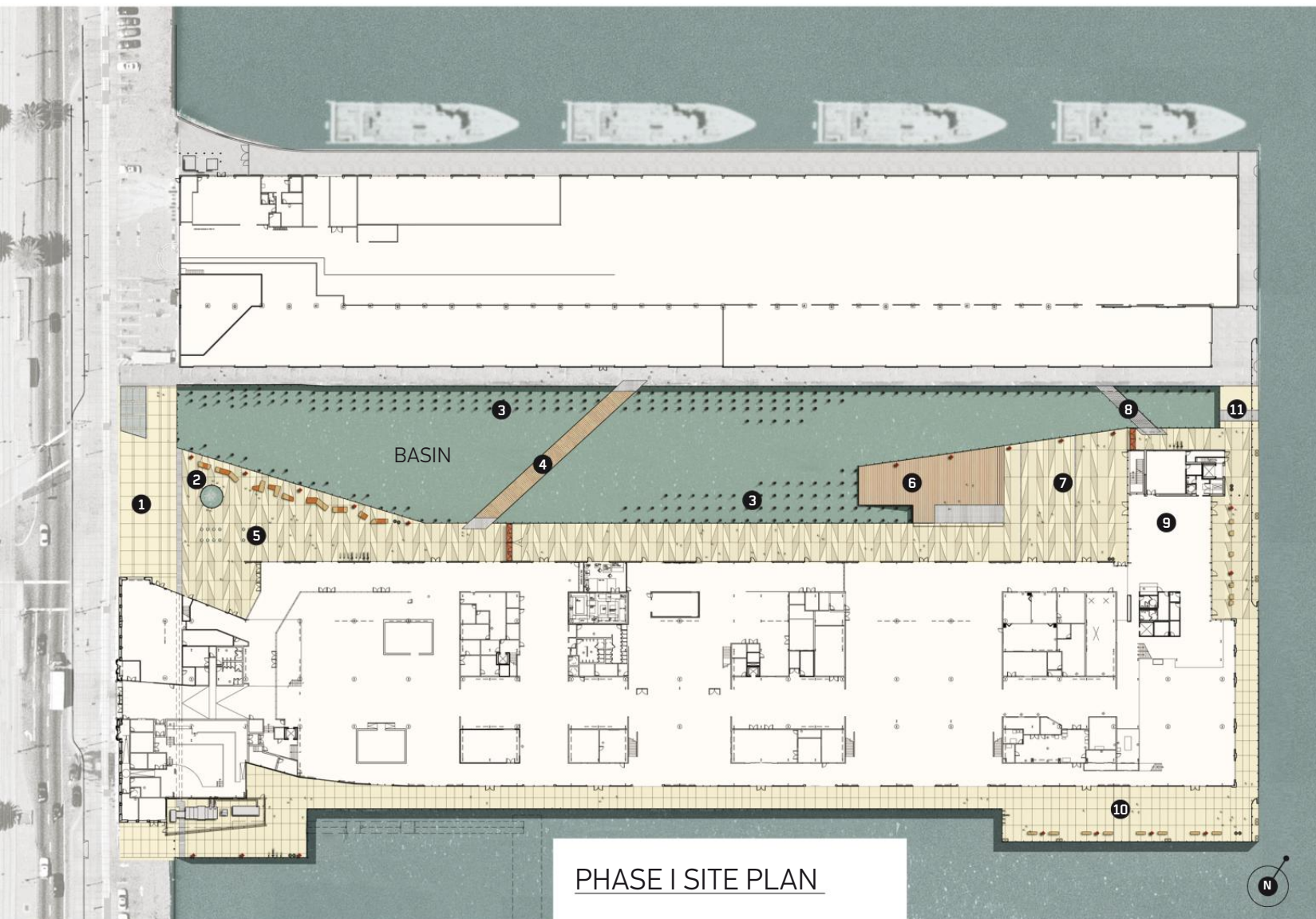
An early working model showing a concept for daylighting the bay with an island connected by bridges.

waterfront is slowly being revitalized. The dismantling of the double-decker Embarcadero Freeway in 1991—damaged after the 1989 Loma Prieta earthquake—reconnected the city to the water and the Embarcadero’s 18 remaining old piers and their bulkhead buildings. The three-mile stretch of maritime infrastructure, built in the 1920s and 1930s and made obsolete by modern container shipping, is listed on the National Register of Historic Places. Last year, the National Trust for Historic Preservation named it one of the 11 most endangered historic places in the United States, based on threats from earthquakes and sea-level rise. Pier 17, designated for back-of-house museum functions, needed relatively little work. However, to handle more than one million visitors a year, Pier 15 needed a major seismic upgrade. Of the \$220 million bill for the entire adaptive reuse project, \$100 million was just for the pier retrofit.

To meet guidelines for historic preservation, the new exterior spaces were designed to blend in with the existing building and waterfront. They appear subdued, but they represent a major change to the original site. Previously, there was no open space between the two piers; instead, there was a large parking lot between the two warehouses and a building at the far end that obscured the view of

the water from the Embarcadero. The directive of the San Francisco Bay Conservation and Development Commission (BCDC), a state regulatory agency charged with providing “maximum feasible public access” to the shoreline, coupled with the enormous expense of refurbishing the pilings, made it an easy decision to remove the parking lot. In consultation with EHDD, the architecture firm responsible for the museum buildings, GLS developed a plan to remove the concrete apron and create a lagoon between the two piers. The open water invites exploration, crisscrossed by two pedestrian bridges and a dock for visiting ships at the far end. “It creates a little back eddy, a node where people can get off of the main circulation route [the Embarcadero] and be in a real place,” says Gary Strang, ASLA, the founder and principal of GLS.

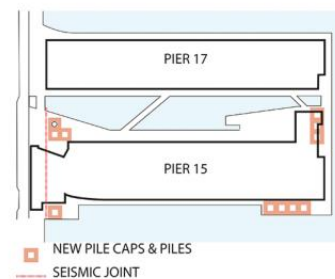
The large majority of the outdoor space is freely accessible, thanks to a convergence of interests. In addition to BCDC’s requirements for public shore access, the Port of San Francisco’s master plan called for a continuous promenade along the waterfront, and the Exploratorium wanted the public to be able to engage with some of its exhibits without purchasing a ticket. (When Oppenheimer first opened the doors to his new museum in 1969, there was no entrance fee.)



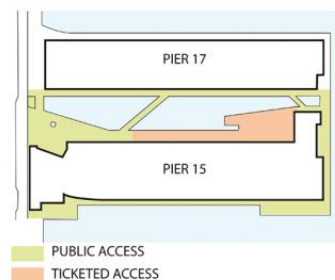
PHASE I SITE PLAN

- | | |
|------------------------|------------------------------|
| 1 EMBARCADERO PLAZA | 7 EVENT PLAZA |
| 2 TIDAL FOUNTAIN | 8 PEDESTRIAN BRIDGE |
| 3 EXISTING PILES | 9 BAY CAFÉ & THE OBSERVATORY |
| 4 MAIN BRIDGE | 10 BAY CONTEMPLATION PLAZA |
| 5 BLOW HOLES | 11 VEHICULAR BRIDGE |
| 6 OUTDOOR EXHIBIT AREA | |

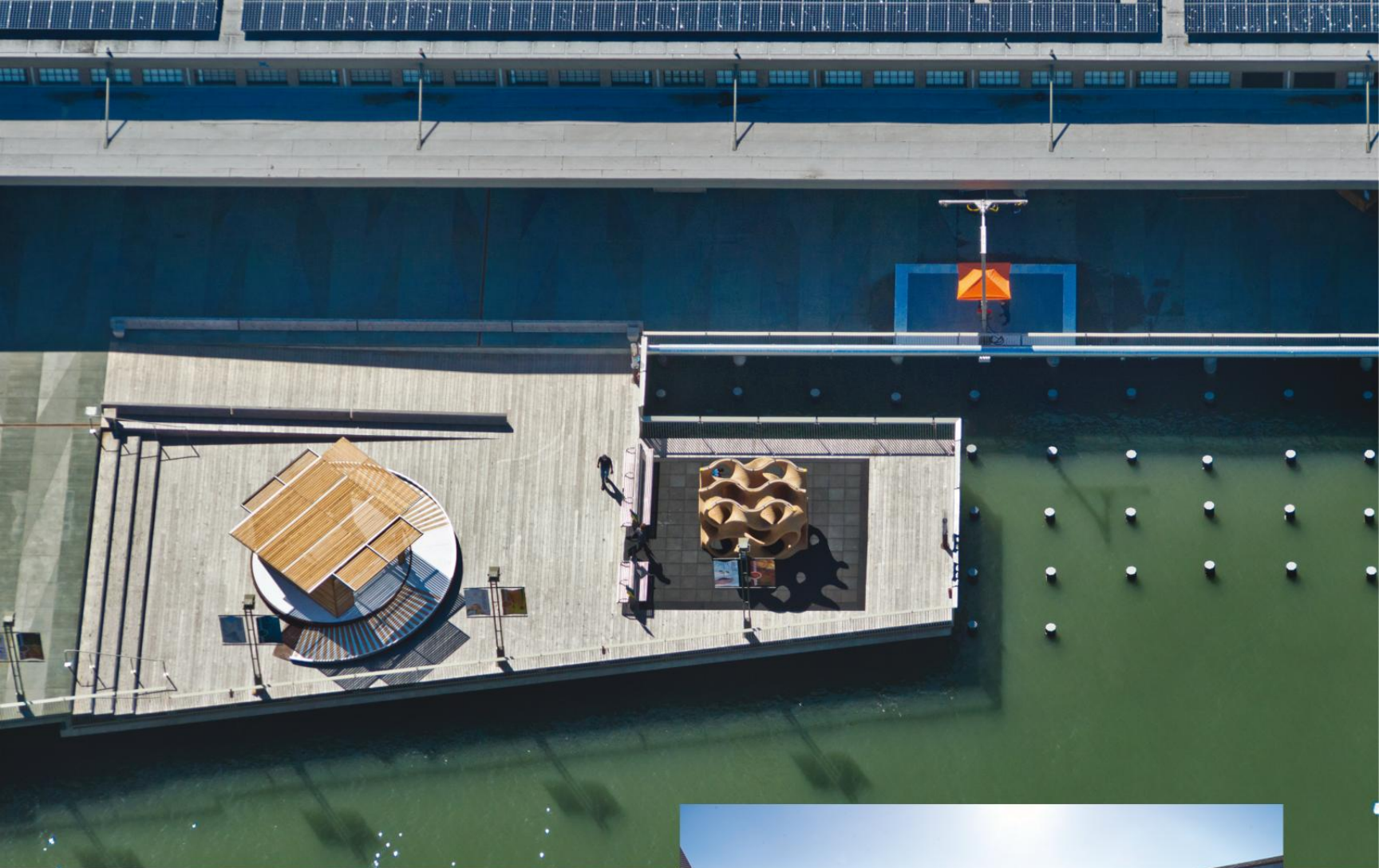
structural



public access



LEFT
The original site had a 2.5-acre parking lot between the two piers.



TOP

A museum area outside the restaurant has exhibit space and serves as a stage.

INSET

A play sculpture developed from 10 years of Exploratorium prototyping and research.

From the Embarcadero, a perpendicular walkway between the Pier 17 building and the lagoon takes you straight to the water's edge for an expansive view that includes Treasure Island and the Bay Bridge. The path continues around the back of the museum on Pier 15, and runs along the south side of the museum, where it connects back up to the Embarcadero. There's also a sizable public plaza right next to the museum entrance. The only outdoor area that is restricted to ticket holders is another small plaza next to the museum restaurant, which is used for events.

The detailing of the space reveals the hand of the designer. The railings are in eight-foot sections, instead of a more typical five feet. "The intention was to emphasize the horizontality of the pier and relate to the large scale of the sky and the Bay. In addition, the posts and pickets are similar so the verticality of the post is not expressed,"

Strang says. The railing is side-mounted so that it extends halfway down the thick concrete deck. "It helps to make the slab look a little thinner—otherwise it would look like a giant pancake that the building sits on," says Wendy Mok, a GLS associate. The concrete paving features a subtle pattern of triangles, with three different finishes (sandblasted, troweled, and broom) that mimic the effect of flickering patterns of light on the water. GLS also designed the public plaza's



ABOVE

An installation called *Fog Bridge* allows visitors to experience San Francisco's characteristic weather, even along the sunny Embarcadero.

seating as simple concrete forms with recessed wood panels.

"Architecturally it had to be very quiet, allowing the historic structures and natural environment to be the bigger show," says Dan Hodapp, ASLA, a senior waterfront planner for the Port of San Francisco. "I think the design is very successful in how it fits the historic character and yet is modern."

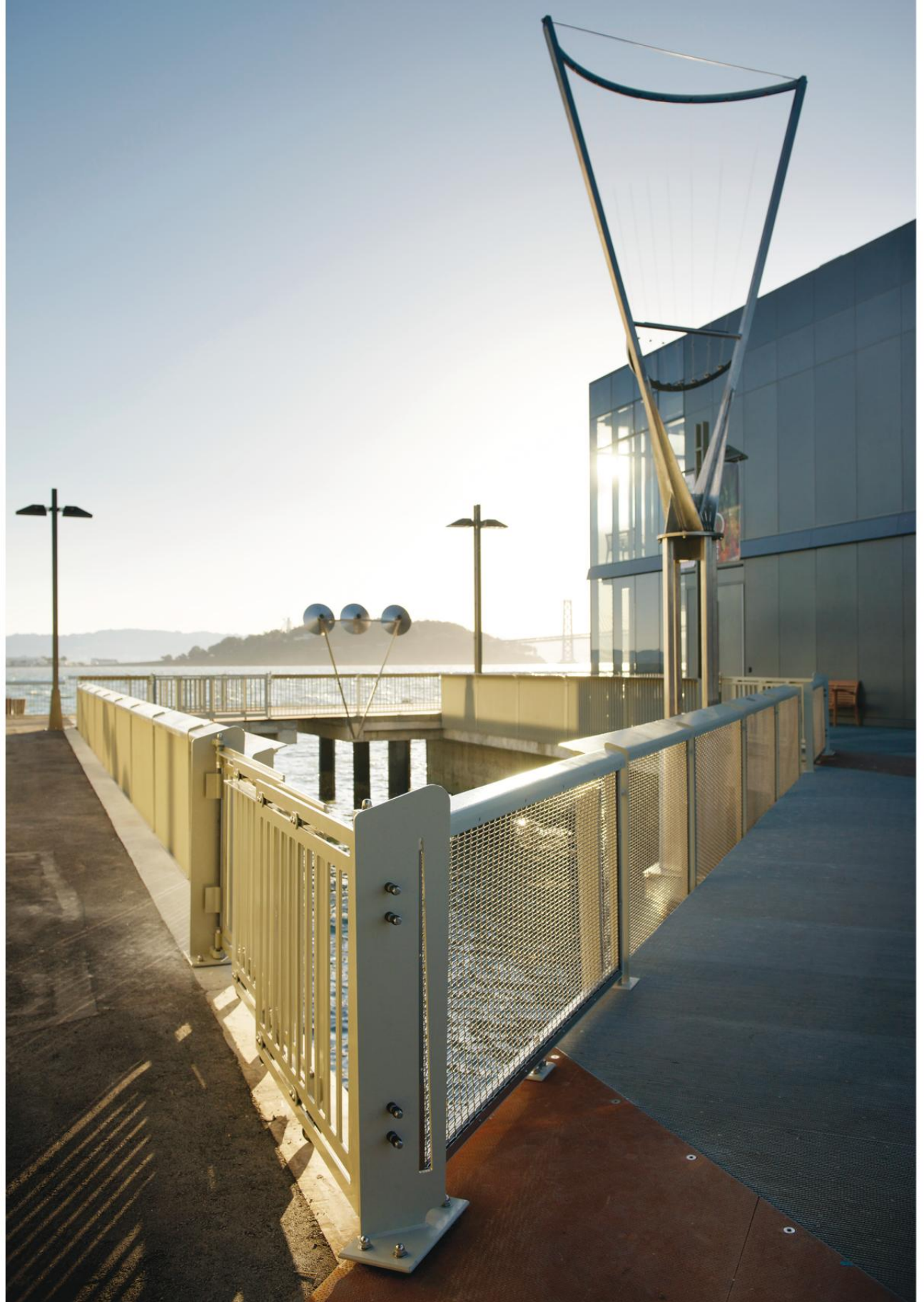
While it was in between homes, the Exploratorium staff had its first experience with outdoor exhibits, creating 20 of them for the Outdoor Exploratorium at San Francisco's Fort Mason Center in 2009. "It's very difficult to work in outdoor settings, and specifically urban settings," says Shawn Lani, the Exploratorium's director of the Studio for Public Spaces, which does all of the museum's outdoor exhibits. "We learned if we don't have the professions of architecture and

landscape architecture represented on our team to address scale, traffic flow, and permits, we cannot do this work."

GLS worked closely with the Exploratorium staff on the railing design to confirm that it would provide many options for attaching exhibits. Before the powder-coated steel railings were produced, the Exploratorium staff built a full-scale mock-up out of wood to see how they would work. The cap angle of the railing is set at a slight 107-degree angle to make it comfortable for leaning and has also been quite successful in discouraging seagulls from perching on the railings.

The railings are also bolted together in sections so they can be removed. For instance, Exploratorium staff replaced several sections on the south side with an interactive display called *Bay Windows*: five transparent disks that contain sediment from

RIGHT
Previously installed
on the roof of the
Exploratorium's
former home, the
wind-triggered
Aeolian Harp by
Doug Hollis is much
more visible in its
new location.





ABOVE

A Bay Bridge model demonstrates seismic movement and structural principles.

LEFT

Telescoping railings accommodate movement between piers during earthquakes.

BELOW

The *Bay Windows* exhibit shows how waves carry sediment.



various parts of the bay. Visitors can see how different the composition of the bay floor is, and rotate the disks to mimic wave forces. “We wanted to see how we could leverage the architecture to create a learning environment,” Lani says. “By integrating the exhibits into the architecture, they are not only more functional but more pleasing—they’re more conducive to getting people to look out at the bay, instead of separating them from the experience.”

The old pilings beneath the parking lot, which were left in place to support potential future expansion, have also proved to be an economical way to mount exhibits. They include *Color of Water*,





a row of color chips suspended between pilings close to the water, which prompt the user to find the closest match to the water below them. And one of the museum's newest exhibits, *Pier Piling Pivot*, is a piling that visitors can raise out of the water for 30 seconds to see the different creatures and plants that have colonized it.

There are about 20 outdoor exhibits currently on display, but the site could easily accommodate many more. "The site is so big that even a relatively large piece doesn't have as much presence

as it does indoors," says the Exploratorium's Rockwell, who anticipates that the number of outdoor exhibits will increase gradually over the next five years.

There is a design for a second phase—albeit with an unspecified implementation date—that includes a floating dock at the edge of the lagoon. Phase two also calls for a planter filled with salt-tolerant grasses to replace a long section of railing, a reminder of the marshlands that used to occupy the area. "We'd like to introduce more greenery,



LEFT

The event plaza's flexibility is enhanced by cast iron cable trays set into the concrete.

RIGHT

By varying the finish of the concrete deck, GLS created an effect of light shimmering on waves.



provide more usable square footage to serve as a destination along the promenade, and allow the public to get closer to the surface of the bay," Strang says.

Perhaps most notably, the outdoor spaces have helped the Exploratorium expand into an entirely new direction. "Using the canvas that we have here, we can think about extending the museum experience to public spaces in the urban environment and serving a more complex social function," Rockwell says.

Soon after its move to the new location in 2013, the Exploratorium launched the Studio for Public Spaces, which partners with city agencies and community groups to create public installations. These outdoor installations incorporate educational elements, but are more broadly focused on creating a sense of place. The largest of these projects to date has been *Sound Commons* at the city's UN Plaza, the goal of which is to build community in an area known for crime and drug use. The sound-making devices, which were installed last year and will continue in place through

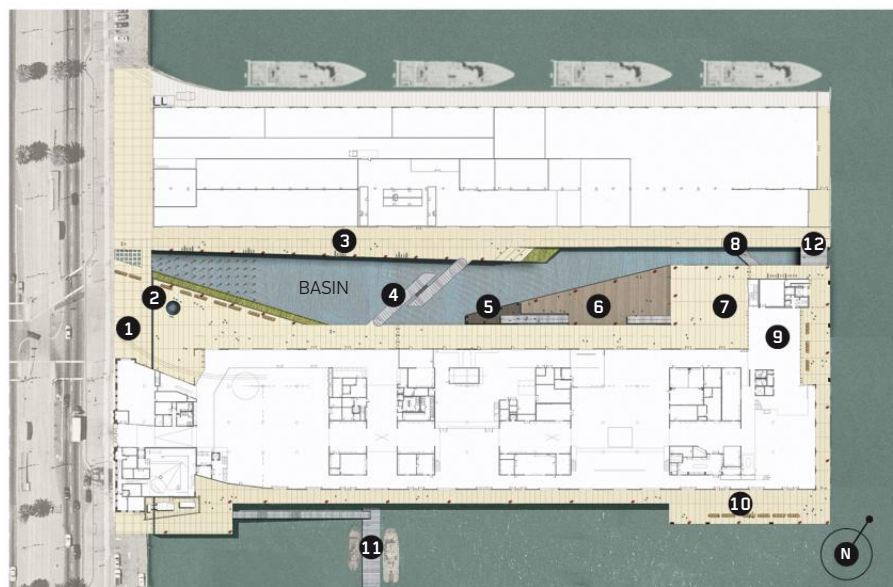
TIDAL FOUNTAIN

Repeating the museum's "O" logo, an oculus lets visitors see down into the pier's seismic adaptations.



PHASE II SITE PLAN

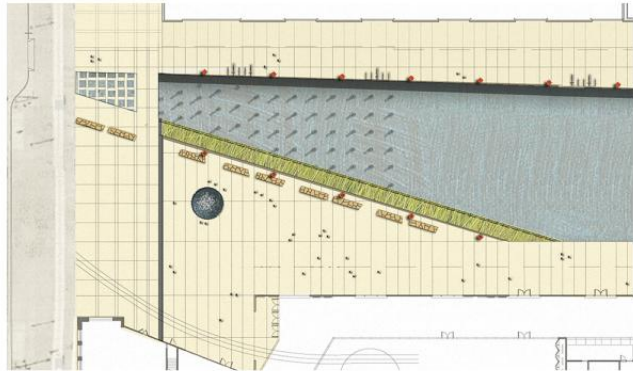
- | | |
|------------------------|------------------------------|
| 1 EMBARCADERO PLAZA | 7 EVENT PLAZA |
| 2 TIDAL FOUNTAIN | 8 PEDESTRIAN BRIDGE |
| 3 BAYWALK | 9 BAY CAFÉ & THE OBSERVATORY |
| 4 EXHIBIT BRIDGE | 10 BAY CONTEMPLATION PLAZA |
| 5 FLOATING PLATFORM | 11 WATER TAXI |
| 6 OUTDOOR EXHIBIT AREA | 12 VEHICULAR BRIDGE |



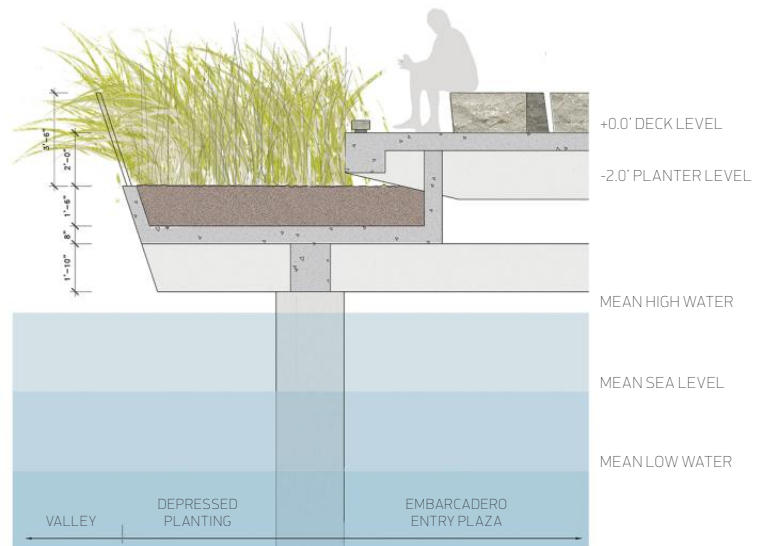
BRUCE DAMONTE, TOP; GLS LANDSCAPE ARCHITECTURE, BOTTOM AND OPPOSITE



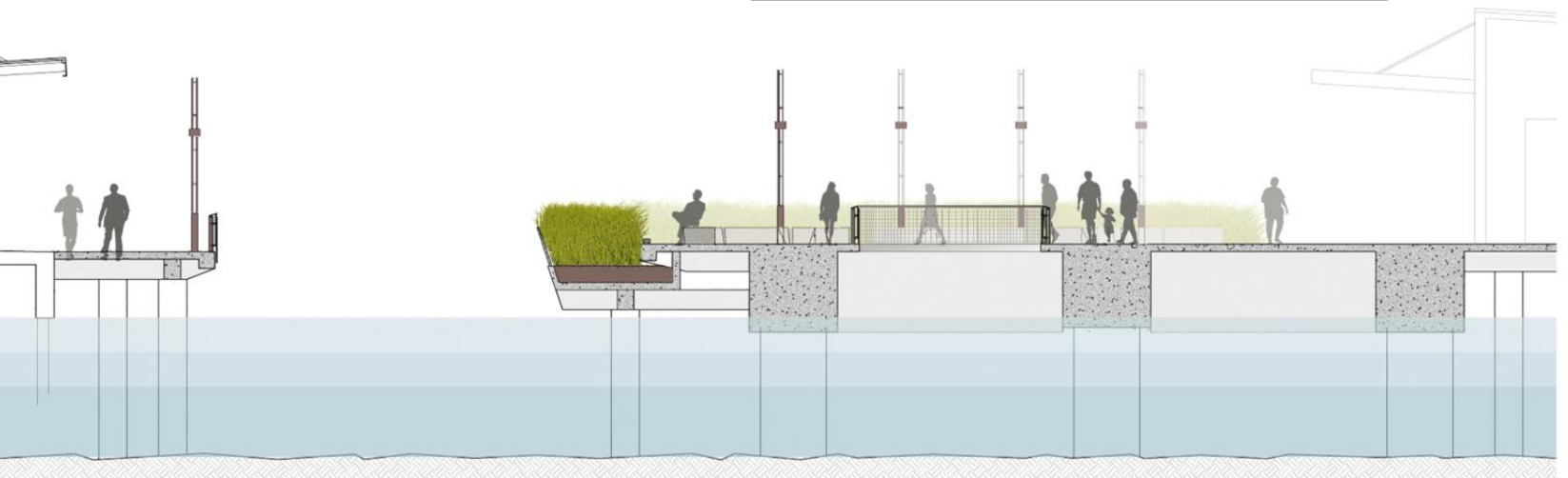
EMBARCADERO PLAZA, PHASE II



STEPPED PLANTING DETAIL, PHASE II



EMBARCADERO PLAZA SECTION, PHASE II





BRUCE DAMONTE



LEFT

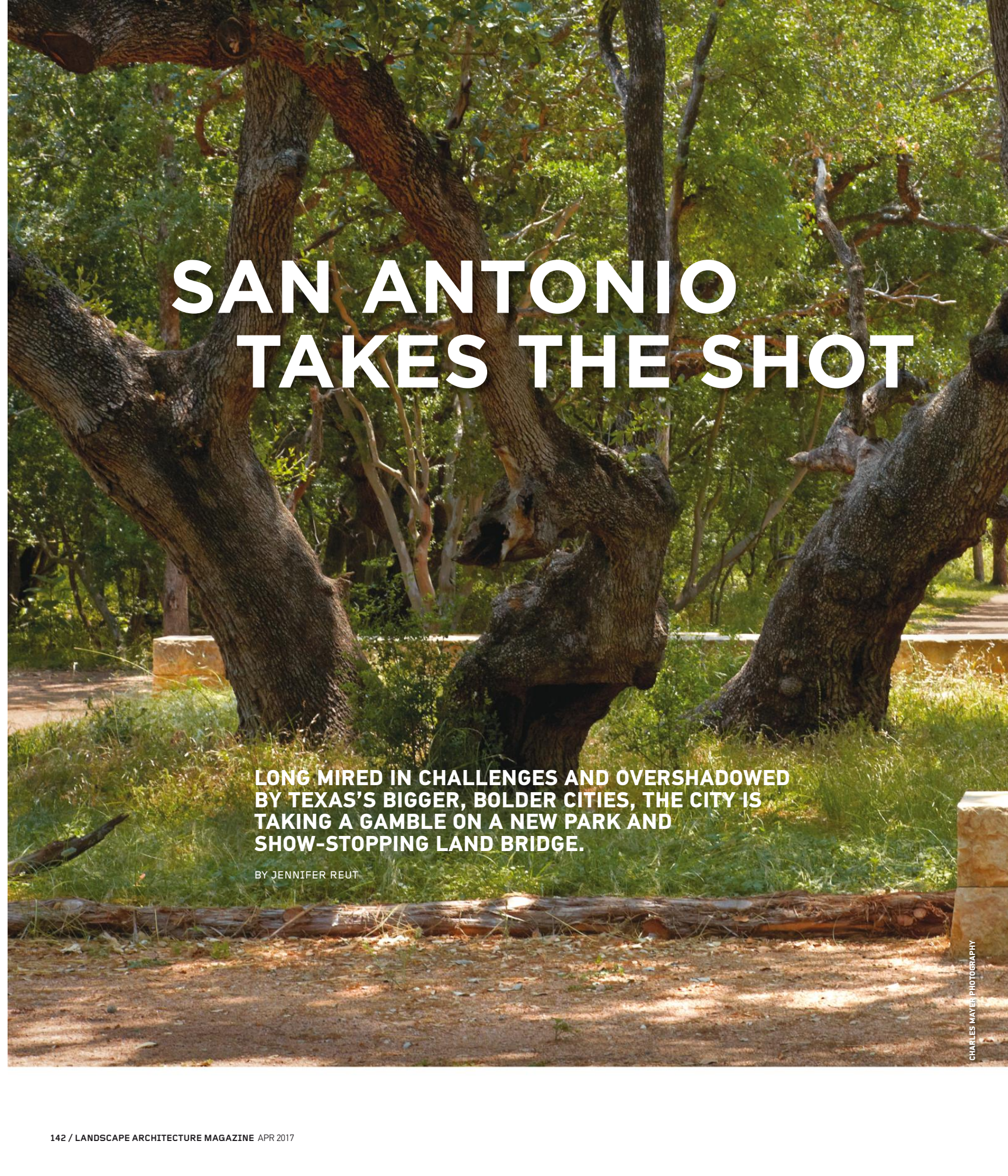
Future expansion of the outdoor space will include a deck extension over the pilings.

→ 2018, include immense “echo tubes” and a giant curtain of chimes. For this and its other installations, the Studio for Public Spaces used the public plaza next to the museum as a prototyping area. The process is particularly useful as a gauge for how the general public, compared to paying visitors, will interact with the installations, according to Lani. “This scale is not our normal bailiwick,” he says. “We’re chasing the notion of being less like a museum and engaging the public in ways that we haven’t even imagined yet.” ●

LYDIA LEE IS BASED IN THE SAN FRANCISCO BAY AREA AND WRITES FREQUENTLY ABOUT URBAN DESIGN AND ARCHITECTURE.

Project Credits

CLIENT/OWNER THE EXPLORATORIUM/PORT OF SAN FRANCISCO. **LANDSCAPE ARCHITECTURE** GLS LANDSCAPE | ARCHITECTURE, SAN FRANCISCO. **ARCHITECTURE (BUILDING STRUCTURE ONLY)** EHDD ARCHITECTURE, SAN FRANCISCO. **HISTORIC ARCHITECTURE** PAGE & TURNBULL, SAN FRANCISCO. **CIVIL ENGINEERING** KENNEDY/JENKS CONSULTANTS, SAN FRANCISCO. **STRUCTURAL ENGINEERING** RUTHERFORD + CHEKENE, SAN FRANCISCO. **ELECTRICAL ENGINEERING** CAMMISA + WIPF CONSULTING ENGINEERS, SAN FRANCISCO. **MECHANICAL/PLUMBING ENGINEERING** RUMSEY ENGINEERS, OAKLAND, CALIFORNIA. **GENERAL CONTRACTOR** NIBBI BROTHERS GENERAL CONTRACTORS, SAN FRANCISCO. **LIGHTING DESIGN** DAVID NELSON & ASSOCIATES, LITTLETON, COLORADO. **ACOUSTICAL CONSULTING** CHARLES M. SALTER ASSOCIATES, SAN FRANCISCO. **IT/AV CONSULTING** TELADATA, FREMONT, CALIFORNIA.

A photograph of a park with large, gnarled trees and a stone bridge in the background. The trees are thick and have a rough, textured bark. The ground is covered in dry leaves and grass. The bridge is made of stone and is partially visible in the background.

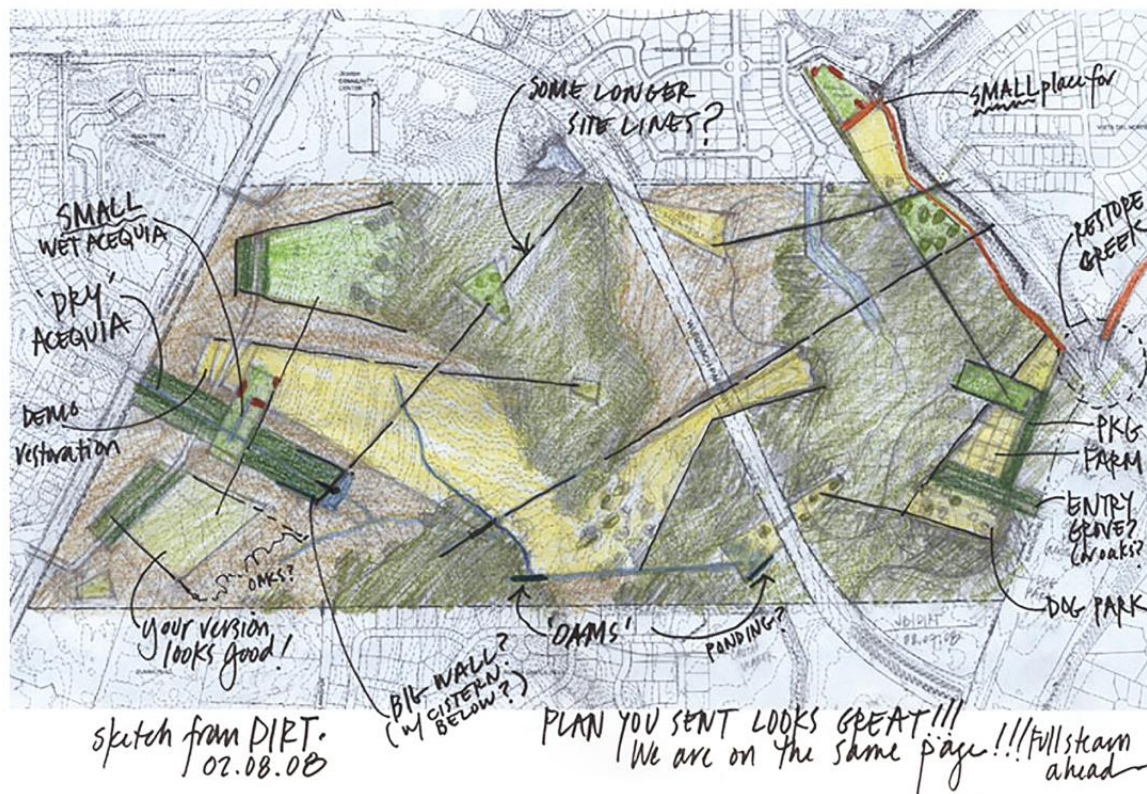
SAN ANTONIO TAKES THE SHOT

LONG MIRED IN CHALLENGES AND OVERSHADOWED BY TEXAS'S BIGGER, BOLDER CITIES, THE CITY IS TAKING A GAMBLE ON A NEW PARK AND SHOW-STOPPING LAND BRIDGE.

BY JENNIFER REUT

CHARLES MAYER PHOTOGRAPHY





Minnie and Max Voelcker knew a different Texas.

At the time when their dairy farm, located on what is now Phil Hardberger Park on the north side of San Antonio, was thriving, there would have been pasture and woodland, and not too many neighbors. Before that, swaths of open prairie.

The native landscape, framed by clusters of live oak and Ashe's juniper, was primarily grassland, kept in check by cycles of grazing of bison and periodic burning. By the time the Voelckers were running their farm, overgrazing by livestock and fire management had begun



to upset that balance, allowing the juniper to overtake the grassland. The juniper's thick evergreen foliage filled in the canopy and kept water from reaching the understory. Development, along with changes to

the ecosystem, gradually erased the estimated 20 million acres of prairie that once characterized the state. According to the Native Prairies Association of Texas, less than 1 percent of the Texas prairie now remains.

TOP

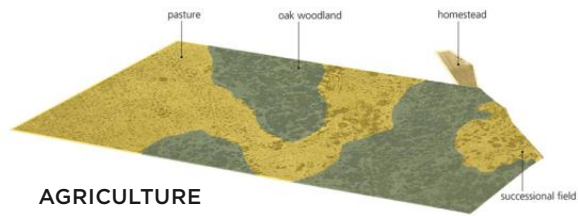
Julie Bargmann, ASLA, says she and Stephen Stimson's firm exchanged "mad, mad drawings back and forth" in the park's concept phase.

BOTTOM

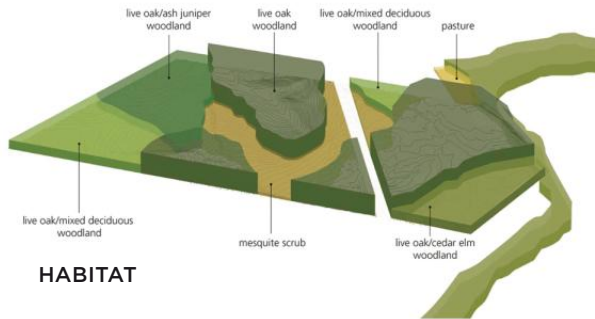
Remnants of the site's former life as a dairy farm were evident when Tom Lee, ASLA, (now of TL Studio) and Stimson visited in 2007.

DESIGN STRATEGY

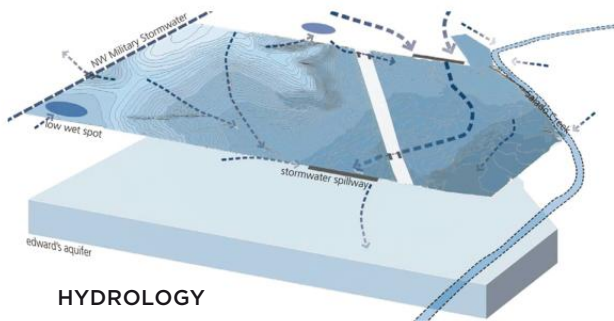
EXISTING



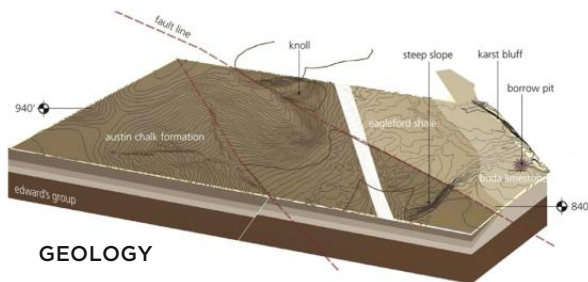
AGRICULTURE



HABITAT



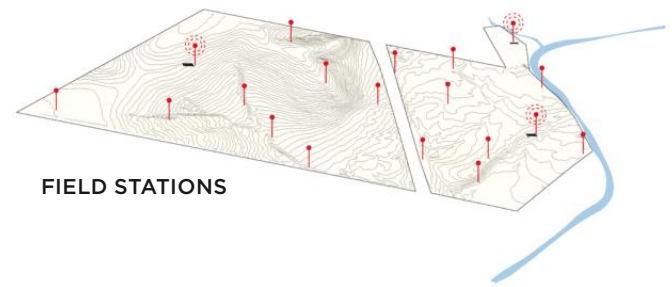
HYDROLOGY



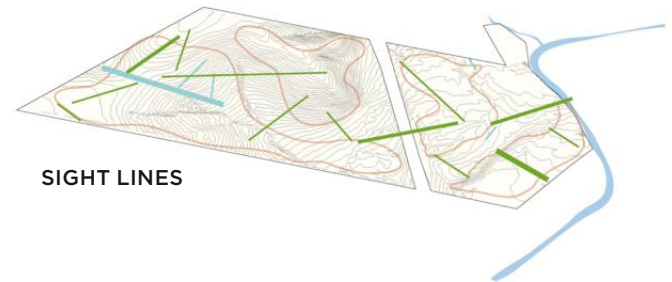
GEOLOGY



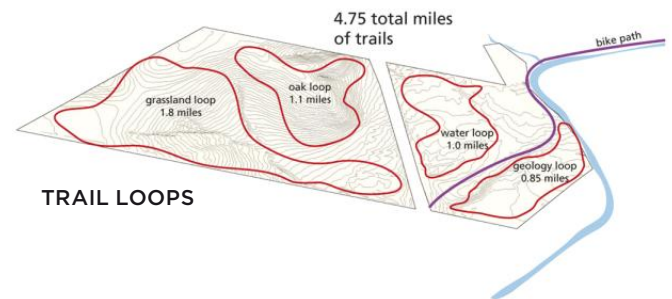
CONTEXT

PROPOSED

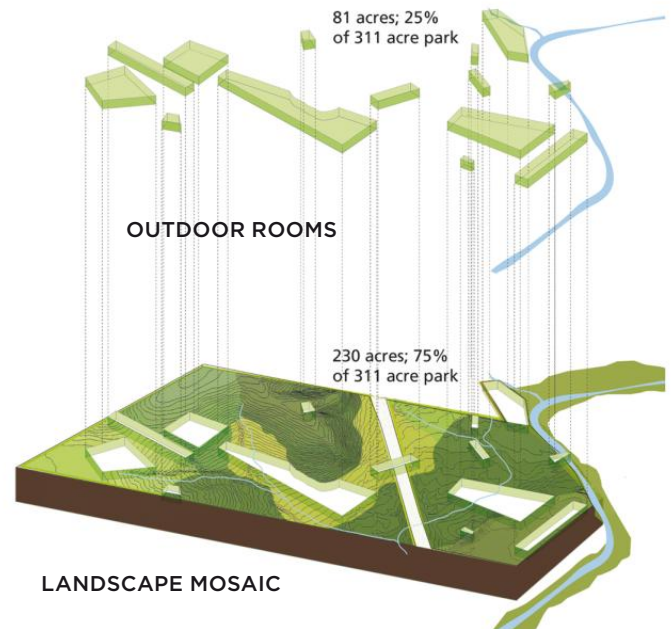
FIELD STATIONS



SIGHT LINES



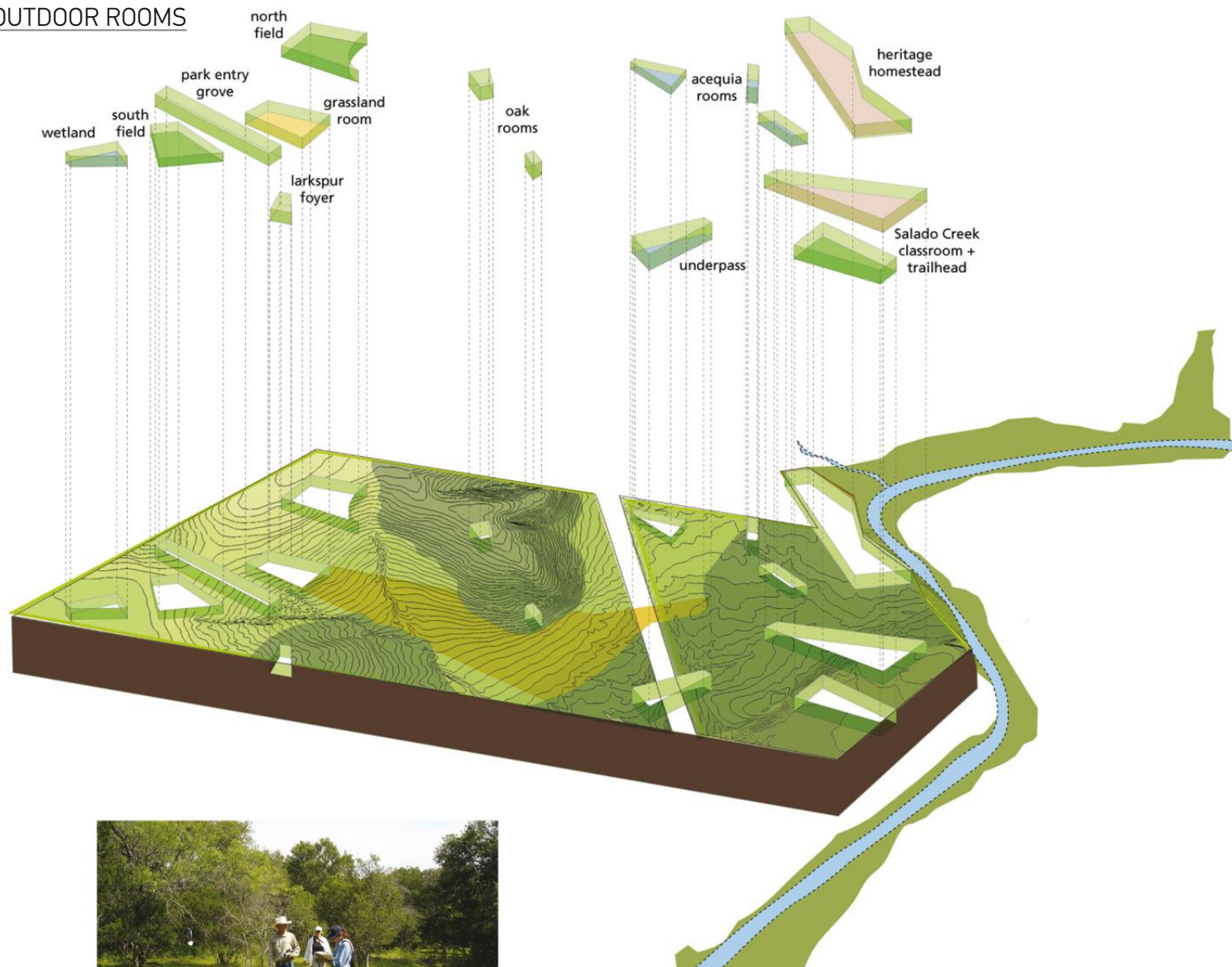
TRAIL LOOPS



OUTDOOR ROOMS

LANDSCAPE MOSAIC

OUTDOOR ROOMS



TOP

The designers envisioned programmed "rooms" in the larger landscape mosaic.

BOTTOM

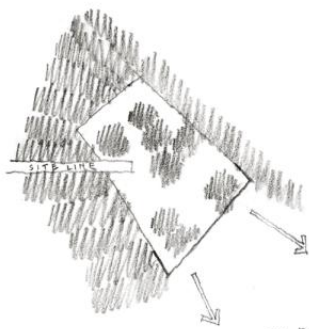
From left, Bill Neiman, a consultant from Native American Seed, Julie Bargmann, ASLA, and Lauren Stimson, ASLA, in the clearing of the oak savanna on their first site visit.

You can see a little of the old Texas if you walk the seven-plus miles of unassuming trails that wend through Hardberger Park. Here and there, the dense oak mottes open up like a curtain parting and you can view the restored oak savanna dotted by common prickly pear cacti. Their appearance in what is otherwise a classic prairie landscape is unexpected to an East Coaster, but perhaps not to someone from Texas, where it's the state plant.

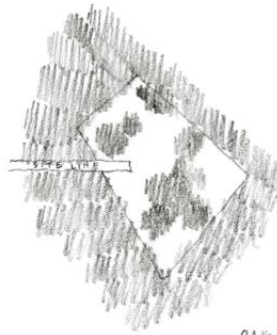
Like most well-done "naturalistic" design, it seems as if it has always been there, and that's partly because it has. The park's design, by Stephen Stimson Associates, is whittled out of 311 acres purchased mostly from the old Voelcker homestead, which was by then almost entirely impenetrable woodland. "A lot of it is in how you edit," says Stephen Stimson, FASLA, who is a principal of the firm along with his wife, Lauren Stimson, ASLA.

Hardberger Park's defining feature isn't easily visible when you're in it. The park is bisected by the busy Wurzbach Parkway, an east-west

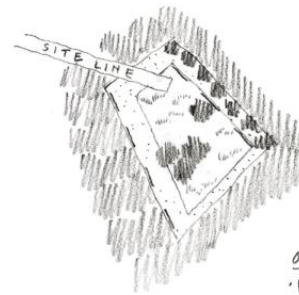
road that, somewhat confusingly, divides the park into east and west precincts. The partition is an opportunity and an obstacle. The east and west sides of the park have distinct characters, and, Stephen Stimson says, even climates. The west side is drier, and animals migrate for water toward the east, which has the Salado Creek and pooling stormwater from the karst topography. Water pours down the east side of the site, says Stimson, drawing wildlife and washing out paths. From the first concept, the idea of a land bridge that carries people and wildlife safely across the parkway was the project's capstone.



OAK ROOM
AS PROSPECT



OAK ROOM
AS ENCLOSURE

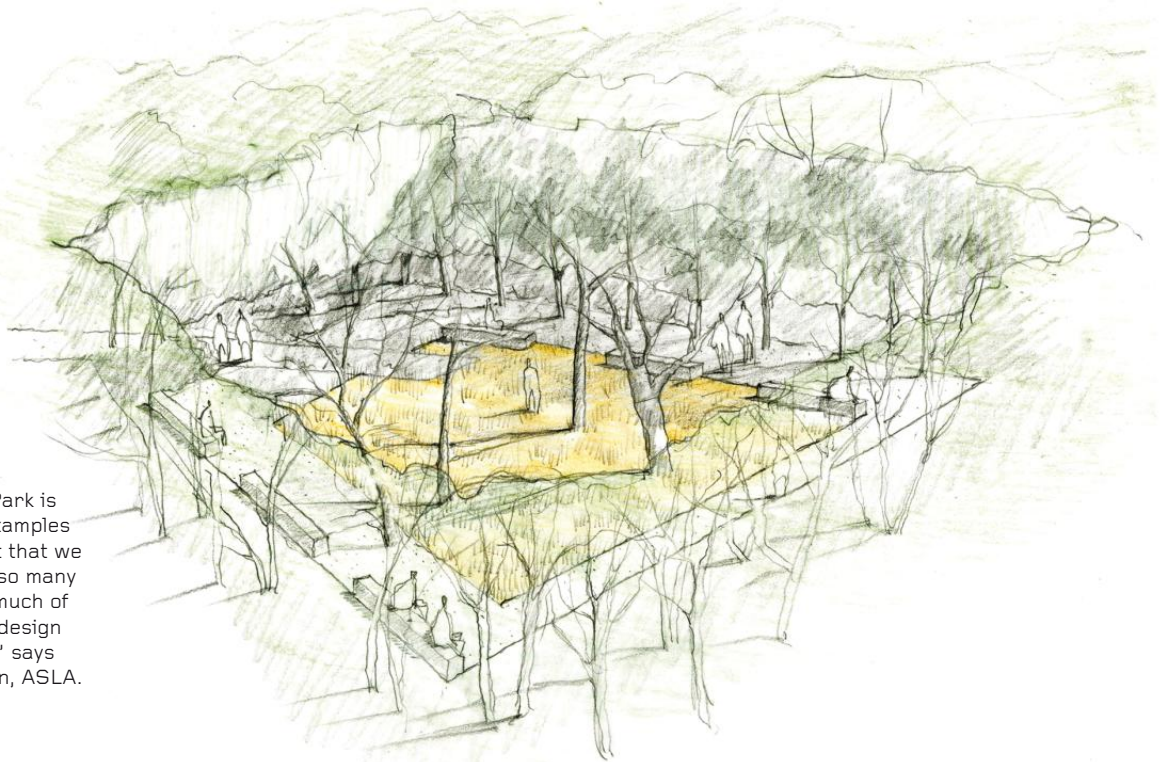


OAK ROOM

- RESTORE NATIVE SPECIES
- REINFORCE EDGES
- MANAGEMENT MADE VISIBLE

OAK ROOM

"Hardberger Park is one of these examples of a big project that we worked on for so many years, and so much of that project is design study by hand," says Lauren Stimson, ASLA.



MASTER PLAN





UNDERPASS TO
WET MEADOW
For Wildlife + Drainage

HERITAGE HOMESTEAD

Restoration of Historic Voelcker Farm

EAST

SALADO CREEK OVERLOOK

ACEQUIAS

Sustainable Stormwater
Management

SALADO CREEK
CLASSROOM + TRAILHEAD

Parking + Picnic + Play

WURZBACH PARKWAY

EAST PARK ENTRY

LAND BRIDGE
Or Alternate Pedestrian Bridge

UNDERPASS
For Wildlife + Drainage

CEDAR ELM WOODLAND
Restored Understory





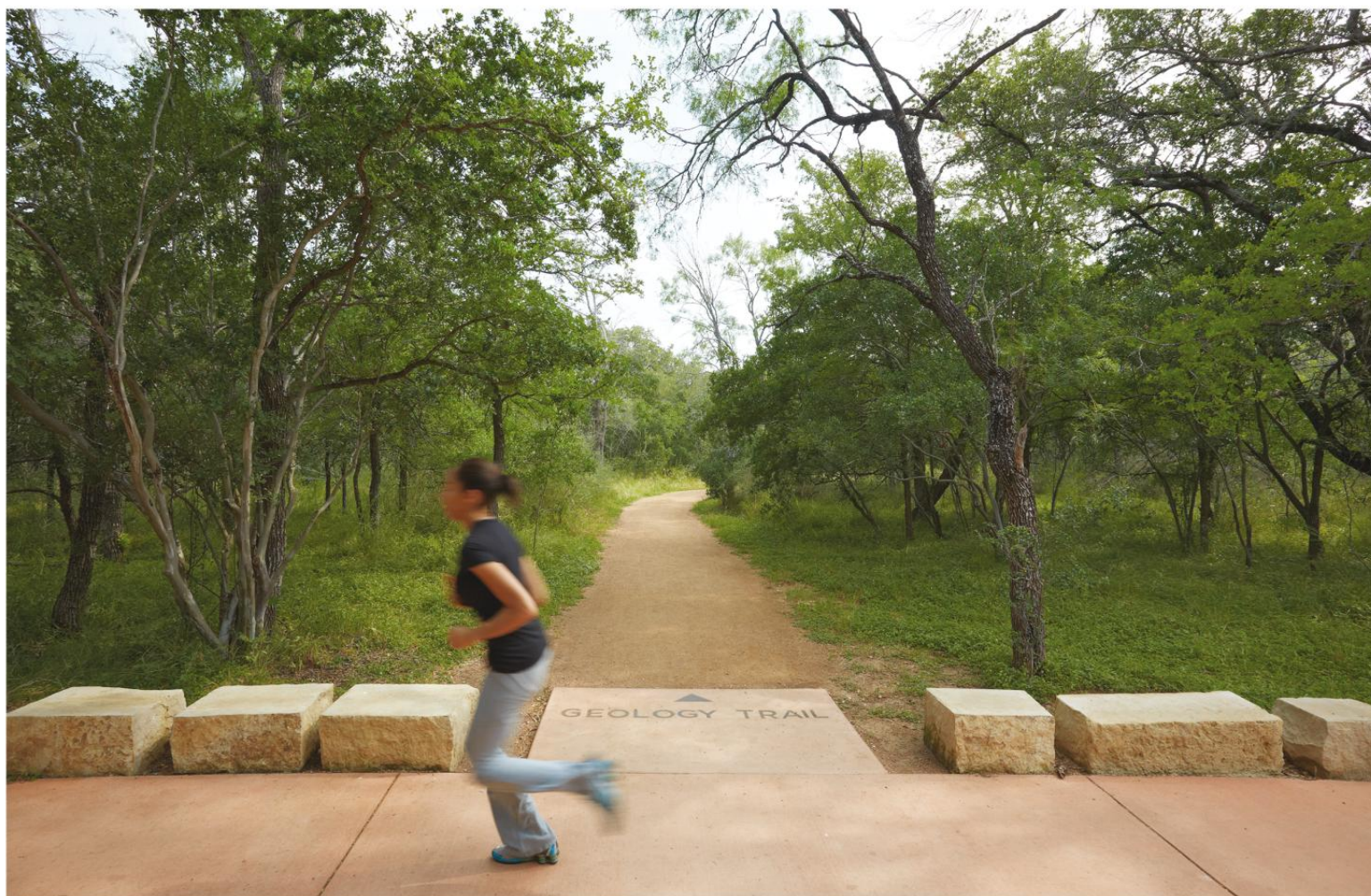
**CLOCKWISE
FROM TOP LEFT**
Interpretive signage
around the park is
minimal; shadows cast
by the branch pergola;
the Salado classroom
building, designed with
Fisher Heck Architects;
the picnic areas on
both sides of the park
are very popular.

→ Stimson and Julie Bargmann, ASLA, of D.I.R.T. studio, designed the park after winning a national design competition with a concept called the “Cultivated Wild.” Stimson’s approach is archetypally, if self-consciously, New England: thoughtful, regionally sensitive design that’s situated in the climate, ecology, and culture of the Northeast. Bargmann’s take on regenerating industrial landscapes by revealing, rather than capping and concealing, the degraded site conditions has been hugely influential on an emerging generation of practitioners and educators interested in postindustrial conditions. She’s the wild; he’s the

cultivated. Their respective tactics seem to have the makings of an awkward shotgun team. The reality is something else.

“This is our, what, 30th anniversary of being friends?” Bargmann says, thinking back to when she and Stimson met in graduate school in 1987 and formed a studio cabal with Anita

Berrizbeitia, ASLA, now the chair of landscape architecture at Harvard’s Graduate School of Design. “We would talk about collaborating, yet our work and our practices were kind of very distinct directions,” Bargmann says. When Stimson invited Bargmann to be part of the competition, she hesitated. “When he called me to say, ‘Hey, there’s this competi-



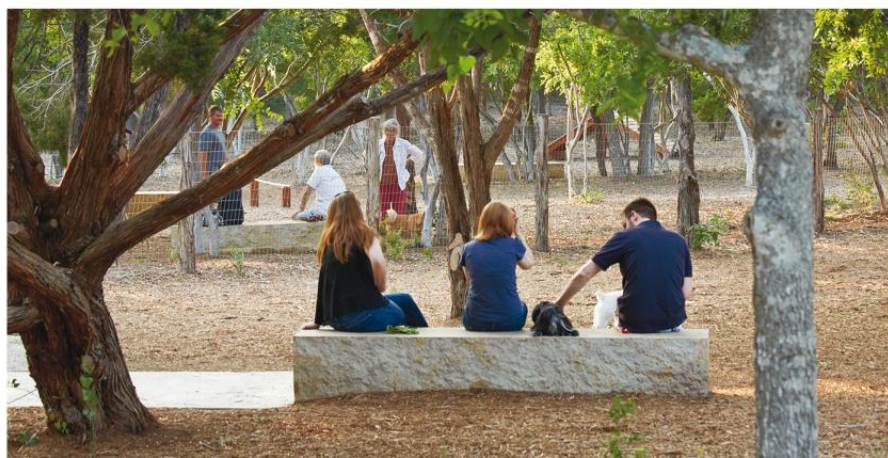
tion for this park,' I basically said, like I say a lot with projects, 'Oh, it's not dirty enough,' Bargmann recounts. "He just said, 'Oh, yes it is.'" They entered with a master plan concept for the park that emphasized the native ecology and historic cultural

landscape, and included something new—a land bridge.

The win was unexpected. But they threw themselves into getting to know the place, logging countless connecting flights to San Antonio

from Boston. "We really embedded ourselves into the Texas psyche and the culture," says Stephen Stimson. "We had to basically prove to them that we were worthy of designing in Texas, because we were from New England."

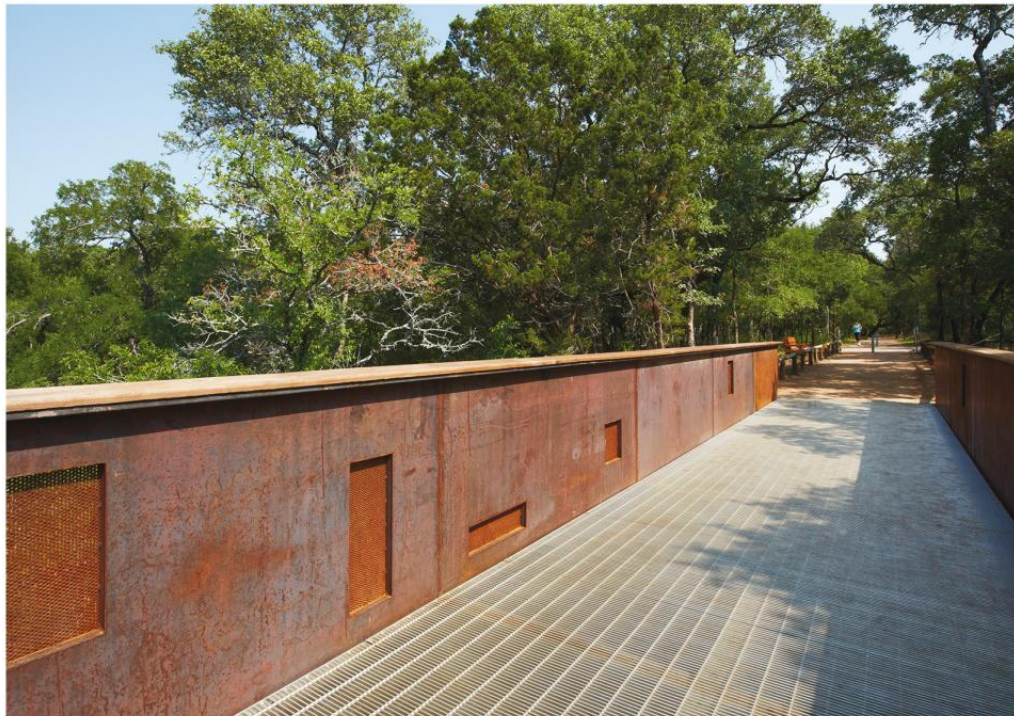
CLOCKWISE FROM TOP Scenes from the park's east side: on the Geology Trail; a small escarpment reveals the soil layers; trees provide much-needed shade for a dog park.





ABOVE
Though seating is abundant in the park, it rarely takes the form of traditional benches.

BELOW
Open grating provides a view of the seasonally dry creek bed below.



James Gray Jr., FASLA, principal of the San Antonio-based Rialto Studio, saw the competition entries when he was on the city zoning commission and says he understands why the “cultivated wild” plan got the go-ahead. Rialto was the local landscape architect for the Urban Ecology Center, on the park’s west side, and is now the prime on the land bridge. “It had the strongest environmental ethic about the land. It had the strongest design. ‘Motif’ would be the right word. The land was formerly a dairy farm, so there were very deep agrarian roots in the use of the land. Stephen’s plan really highlighted that and brought that out, in terms of the form that the design project took,” he says.

The idea of the cultivated wild carried over from the design competition, Bargmann says, though they more or less threw out the early formalist



CHARLES MAYER PHOTOGRAPHY, TOP LEFT AND BOTTOM;
STEPHEN STIMSON ASSOCIATES, TOP RIGHT



design once they spent some time on site. What was retained was the original concept, reconceived to more closely respond to the actual site conditions, particularly the degraded postagricultural landscape, perceived as “natural” by locals, that intrigued Bargmann, and the idea of the land bridge. The final design encompasses a recognition and elevation of the park’s native ecology, made accessible and comprehensible to San Antonio’s nearly one and a half million citizens. In 2015 the park won an ASLA Honor Award in General Design.

The park is 75 percent cultivated wild, primarily savanna and woodland, and 25 percent active. The active areas are clustered around the entrances on the eastern and western edges, and include picnic areas, dog parks, playgrounds, a classroom building, and the Urban Ecology Center, by the architects Lake | Flato. The Voelcker homestead, restored and interpreted, is tucked into the northern edge where it abuts the Salado Greenway, a trail along the Salado Creek that connects to the park along the eastern edge.

Karst geology is visible at the edges, near the Salado Creek Overlook and along, fittingly, the Geology Trail, where visitors are invited to see the porous limestone formations beneath the relatively thin soil layer. Concrete at the Urban Ecology Center has a rock salt finish that breaks up the surface, reproducing the limestone’s natural variegation from centuries of water filtering through. It’s one of the places around the park where design is intentionally perceptible.

ABOVE
The Overlook
cantilevers over
the Salado Creek.

CLOCKWISE FROM BELOW

Extra-long picnic tables were designed to accommodate extended families; loping paths take advantage of the dense shade provided by the oak mottes; prickly pear cactus is abundant in the park.



The park, now 330 acres, is big, but the relatively limited woodland diversity makes it feel edgeless, and endless in places. When the design team first encountered the site, it was disorienting, an unnavigable thicket of Ashe's juniper and pla-

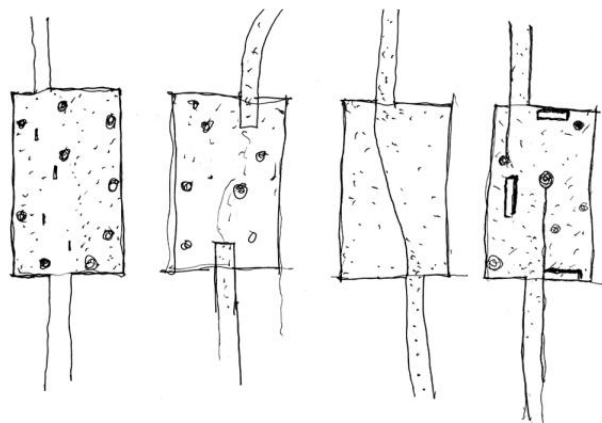
teau live oaks as well as invasives, native and not. Order was imposed, lightly, through the incision of trails that circle within the park: the Oak Loop, Water Loop, Savanna Loop, and Geology Trail. The trails wind through the oak mottes, halting here

and there to cede the way to an existing tree too impressive to edit out of the way.

The live oaks are charismatic and deeply satisfying to look at. Their burly, figural branches invite admiration, and even, in a well-circulated photo of then-mayor Phil Hardberger, an embrace. "I think one of the things that strikes people about our landscape is that it's pretty gnarly, if that's a word," says Gray. "It's not the beautiful, tall pine forest, or hardwoods, and so on. It has a different visual character."

Working within the site's own patterns of vegetation, "The first thing we did was do what every landscape architect does—they draw a curve on paper that looks beautiful, and you go to lay it out on site and then we were into trees and not exactly feeling like it fit the site," says Stephen Stimson. The team, which included D.I.R.T. studio's David Hill, ASLA, a landscape architect and architect now at Auburn University, looked for ways to enhance the feeling of being alone on the trail despite the proximity of other people.





TOP LEFT
Wooden planks bridge seamlessly over wet areas of the park.

TOP RIGHT
Drawing studies consider places where trail meets tree.

LEFT
Accommodations of trees became opportunities to vary the trail design.

You might not be able to see or feel the shift in the topography without walking it and observing where the rain goes when it falls, but managing the stormwater on the east side of the park meant that gravel trails had to be concrete in places. Rain, when it comes, comes fast and hard, says Stephen Stimson.

"It's 33 inches a year in this region. In New England, we're in the 40s. But here, you get it in intervals that are very intense when they come." Boot scrapers, a common enough feature in Texas but unknown in the public parks of New England, are dotted around the park to help remove the mud.

Stormwater also offered a way to deepen the park's educational mission. "Julie wanted to build field stations and check dams and be able to measure sediment, transport, or deposition, and have a series of weirs as part of the educational piece," Stephen Stimson says, though that idea ended up being shelved for the time being.

WATER DIAGRAM



ABOVE
Runners and walkers flock to the park's nearly eight miles of shaded trails.

RIGHT
Playgrounds in south central Texas need adequate shading and cool play surfaces.





The park's educational showpiece is the Urban Ecology Center, with visible stormwater collection and filtering, native planting, and a classroom and event space. "One of the huge purposes of the Urban Ecology Center is to help educate the citizens of San Antonio about things like plant materials, and about the ecological systems that they reside within," Gray says. It can't hurt that, with an event space that offers gorgeous views out over

the savanna, the center is a natural moneymaker for the city.

The park is in the northern part of the city in an area that Lauren Stimson says is fairly affluent, a fact that hovers behind the public conversations about funding the park. San Antonio has been rated the most unequal city in the United States according to both the Pew Research Center and the Economic Innovation Group. This means



OAK SAVANNA RESTORATION

TREES

Carya illinoensis (Pecan)
Quercus muehlenbergii (Chinquapin oak)
Ulmus crassifolia (Cedar elm)

OAK SAVANNA RESTORATION

Agalinis heterophylla (Prairie false foxglove)
Andropogon gerardii (Big bluestem)
Aphanostephus spp. (Dozedaisy)
Argemone albiflora (Bluestem prickly poppy)
Asclepias asperula (Spider milkweed)
Bothriochloa barbinodis (Cane bluestem)
Bouteloua barbata (Sixweeks grama)
Bouteloua curtipendula (Sideoats grama)
Bouteloua dactyloides (Buffalo grass)
Bouteloua gracilis (Blue grama)
Bouteloua hirsuta (Hairy grama)
Bouteloua rigidiseta (Texas grama)
Bouteloua trifida (Red grama)
Callirhoe digitata (Winecup)
Centaurea americana (American star-thistle)
Chasmanthium latifolium (Indian woodoats)
Chloris cucullata (Hooded windmill grass)
Coreopsis lanceolata (Lanceleaf tickseed)
Coreopsis tinctoria (Golden tickseed)
Cucurbita foetidissima (Missouri gourd)
Dalea candida (White prairie clover)
Delphinium carolinianum ssp. *virescens* (Carolina larkspur)
Digitaria cognata (Fall witchgrass)
Dracopis amplexicaulis (Clasping coneflower)
Echinacea angustifolia (Blacksamson echinacea)
Elymus canadensis (Canada wildrye)
Elymus virginicus (Virginia wildrye)
Eriochloa sericea (Texas cupgrass)
Gaillardia pulchella (Indian blanket)
Glandularia bipinnatifida (Dakota mock vervain)
Helianthus maximiliani (Maximilian sunflower)
Ipomopsis rubra (Standing-cypress)
Oenothera lindheimeri (Lindheimer's beeblossom)

NATIVE SEED MIXES

Eco-Mix for Edges, Eastern Savanna Seed Mix, Apache Plateau Mix, Understory Seed Mix, Shade Friendly Grass Mix

TOP

Open meadows and savannas were critical to the park design's emphasis on reestablishing the historic Texas landscape features.

BOTTOM

Design of the parking areas near the South Field and flat terrain help make the park's playgrounds accessible.



ABOVE

A sketch from Stephen Stimson Associates begins to articulate the Urban Ecology Center's native plantings.

BELOW

The planting design, by Rialto Studio, is set against the blank wall of the center, meant to evoke the enclosure of the area's historic missions.



STEPHEN STIMSON ASSOCIATES, TOP; DANNY WATSON, ASLA, BOTTOM



that income disparity is compounded by income segregation—the very rich and the very poor live, work, and play in separate spheres in San Antonio that are mostly traversed by car. But the city is trying to come out from under that mantle. A new planning vision, SA Tomorrow, was adopted

in 2016, detailing multimodal transportation, sustainability goals, and a new comprehensive plan for the city, which anticipates one million new residents by 2040.

San Antonio's former mayor, Phil Hardberger, is the park's heart and

soul. He is a native Texan, though not a native San Antonian, but he is the kind of on-message and dogged booster that every city park should have. He spearheaded the purchase of the land and oversaw the design competition and construction during his two tenures as mayor, and he has done most of the fund-raising through the park's conservancy—\$8 million so far, says Betty Sutherland, the conservancy's executive director. In and now out of office, the park is Hardberger's mission, and now, his namesake. The park, originally Voelcker Park, was renamed for him in 2009.

ABOVE AND INSET
The 800-foot-long Grand Acequia manages stormwater from the center's parking lot with native plantings edged by gabion walls.



ABOVE
Spacious views of the restored oak savanna stretch out from the deck of the Urban Ecology Center.

Hardberger sees the park as an important economic magnet for the city. It's not always an easy sell in a city that has significant social and economic issues, but the former mayor is indefatigable on the subject. "Everybody wants to have a great city. You really don't have a great city if all you have to say is, 'You ought to see our street,'" Hardberger says. "You've got to have a beautiful city if you want to attract significant business involvement from outside."

In order to get and maintain funding, the citizenry would have to be persuaded that it wasn't just an amenity for the adjacent neighbors. "We wanted to make sure it became a citywide park," says Lauren Stimson, and one way in, she says, was through food. Community meetings and other input the designers gathered from residents revealed a local culture that lives its holidays and family gatherings outside. Lauren Stimson says it was the Mexican American families they met at restaurants such as Mi Tierra after their

meetings who offered a local view. "We learned about the food and the culture and festivals, and they said, 'You know, when Easter rolls around, or Cinco de Mayo, we want to be able to be in the park, celebrating. So we need outdoor barbecue pits,'" she says. It was a moment of Yankee insight. "We're in New England, and on Easter sometimes it snows," says Stephen Stimson. "But we realized that the local folks, they really wanted to be in the park for the holiday."

The park picnic areas have more space for extended family gatherings that might last all day. Extra-long tables near the parking area on the east side are now claimed by families well in advance of the holidays and weekends, and the picnic areas are interspersed among large oaks that provide shade and branches from which to hang decorations. Hardberger says attendance is better than expected—the conservancy estimates something like 1,000 people a day come through the park.

URBAN ECOLOGY CENTER

TREES

Platanus mexicana (Mexican sycamore)
Ulmus crassifolia (Cedar elm)

UNDERSTORY AND SHRUB

Ilex decidua (Possumhaw)
Ilex vomitoria (Yaupon)
Morella cerifera (Wax myrtle)
Rhus aromatica (Fragrant sumac)
Sophora secundiflora (Mescal bean)

PERENNIALS AND VINES

Adiantum capillus-veneris (Common maidenhair)
Asclepias tuberosa (Butterfly milkweed)
Equisetum hyemale (Scouringrush horsetail)
Echinacea purpurea (Eastern purple coneflower)
Ficus pumila (Climbingfig)
Galphimia glauca (Rain of gold)
Hymenocallis lirisome (Spring spiderlily)
Malvaviscus arboreus var. drummondii (Wax mallow)
Oenothera lindheimeri (Lindheimer's beeblossom)
Zizania texana (Texas wild rice)

GRASSES AND FORBS

Chasmanthium latifolium (Indian woodoats)
Coreopsis tinctoria (Golden tickseed)
Elymus canadensis (Canada wildrye)
Muhlenbergia lindheimeri (Lindheimer's muhly)
Panicum virgatum (Switchgrass)



With the park open and thriving, attention has turned to the next piece, and prospects for building the land bridge look good. Rialto Studio is now the prime on the land bridge, and the Stimson office is working on the design development. The conservancy puts the price currently at \$23 million, with \$5 million raised already. A bond measure passed by the city council in January to fund a number of improvements throughout the city included \$13 million for the land bridge. A vote on the bond measure is scheduled for next month. And then there is good old-fashioned competition, in the form of other land bridge projects in development in Dallas and Houston. “You know there’s another

one on the radar, and they’re like, ‘We have to get there first,’” says Lauren Stimson. The appetite for bringing a marquee project like the land bridge to San Antonio is strong, and the prospect of being the first in something other than inequality is a powerful motivator.



TOP

A rendering of the land bridge that would span the east and west sides of the park and provide safe passage for people and wildlife.

ABOVE

An early concept sketch for the bridge.



CHARLES MAYER PHOTOGRAPHY



LEFT

Heritage live oaks are now in balance with invasive Ashe's juniper that once threatened to overtake the park.

There is some grumbling in the press about the spending of public money on a park when there is great need elsewhere in the city, but Hardberger and the park's supporters believe a big vision is necessary to push San Antonio forward. Private funding spearheaded by the conservancy will make up the \$5 million not covered by public money. Hardberger acknowledges that the road ahead is steep. "Right now, we've got a setting, but we need to drop the diamond in there. Then we will actually be through, and when you consider what we've done, that's pretty good." ●

Project Credits

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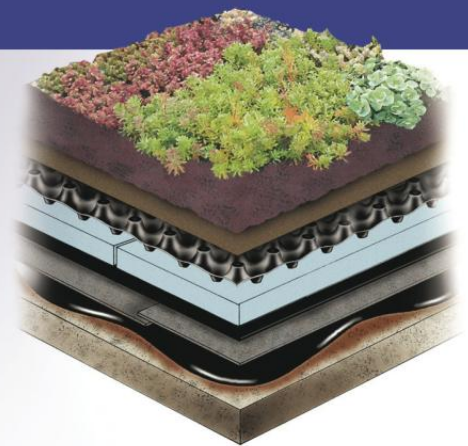
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THE BACK

**SUCCULENTS: THE ULTIMATE GUIDE TO
CHOOSING, DESIGNING, AND GROWING
200 EASY-CARE PLANTS**

By Robin Stockwell; New York: Time Inc. Books,
2017; 288 pages, \$24.95.

Water-wise plants are the linchpin of environmentally friendly design. In *Succulents*, the author and nursery professional Robin Stockwell makes the case for these plants with dozens of vibrant and texturally striking planting designs. The book is divided into sections with design tips for rooftops, containers, and even meadow plantings, as well as technical details such as ideal soil compositions and dormant season care. A visual glossary of succulent varieties along with planting requirements caps this extensive resource.

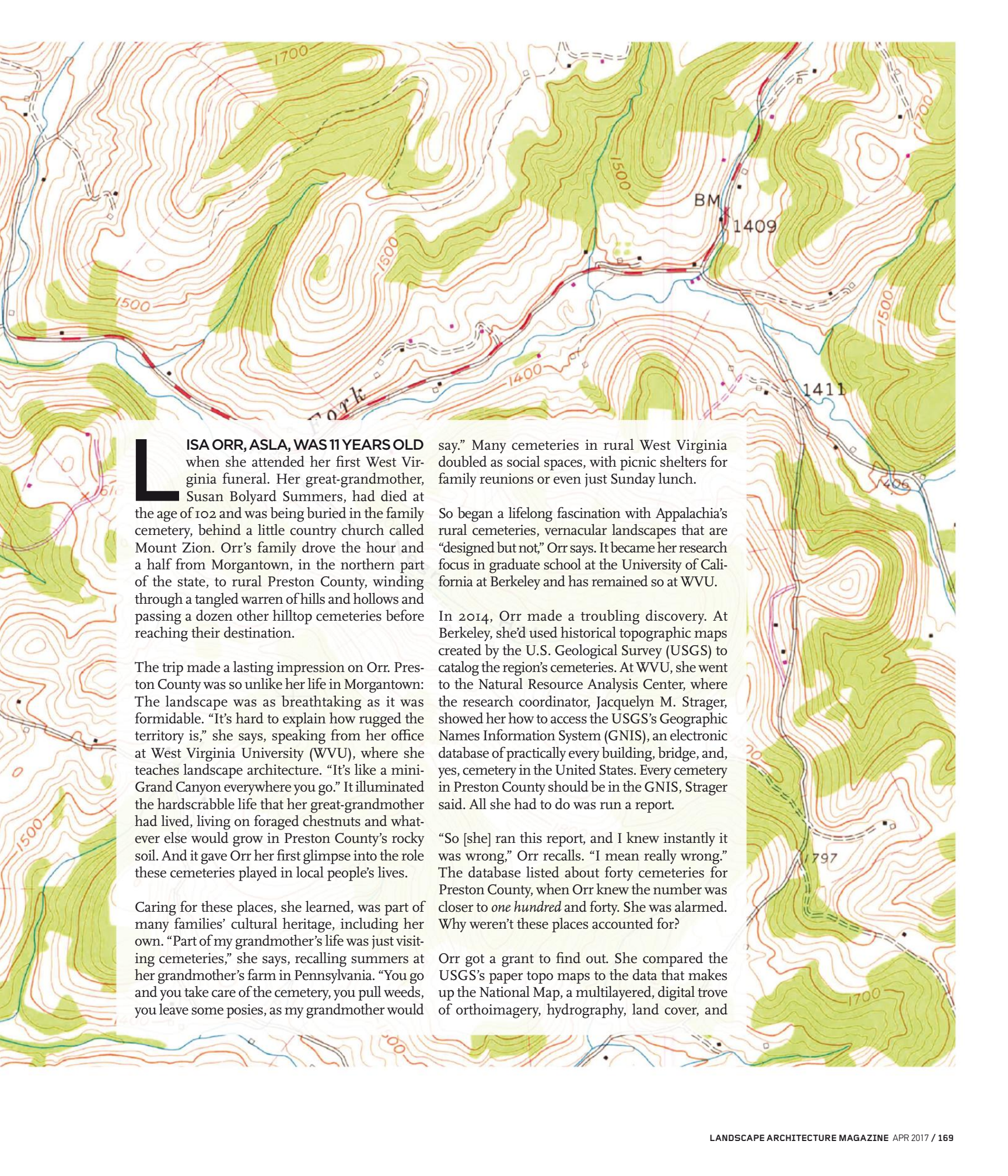
REQUEST NOT FOUND

**THE NATIONAL MAP IS A FEAT
OF MODERN-DAY CARTOGRAPHY.
IT ALSO REVEALS OUR COUNTRY'S
SHIFTING PRIORITIES.**

BY TIMOTHY A. SCHULER

RIGHT

A topographic map from 1976 includes the location of Mount Zion Church and Cemetery in Preston County, West Virginia. Years later, it and other cemeteries would disappear.



LISA ORR, ASLA, WAS 11 YEARS OLD when she attended her first West Virginia funeral. Her great-grandmother, Susan Bolyard Summers, had died at the age of 102 and was being buried in the family cemetery, behind a little country church called Mount Zion. Orr's family drove the hour and a half from Morgantown, in the northern part of the state, to rural Preston County, winding through a tangled warren of hills and hollows and passing a dozen other hilltop cemeteries before reaching their destination.

The trip made a lasting impression on Orr. Preston County was so unlike her life in Morgantown: The landscape was as breathtaking as it was formidable. "It's hard to explain how rugged the territory is," she says, speaking from her office at West Virginia University (WVU), where she teaches landscape architecture. "It's like a mini-Grand Canyon everywhere you go." It illuminated the hardscrabble life that her great-grandmother had lived, living on foraged chestnuts and whatever else would grow in Preston County's rocky soil. And it gave Orr her first glimpse into the role these cemeteries played in local people's lives.

Caring for these places, she learned, was part of many families' cultural heritage, including her own. "Part of my grandmother's life was just visiting cemeteries," she says, recalling summers at her grandmother's farm in Pennsylvania. "You go and you take care of the cemetery, you pull weeds, you leave some posies, as my grandmother would

say." Many cemeteries in rural West Virginia doubled as social spaces, with picnic shelters for family reunions or even just Sunday lunch.

So began a lifelong fascination with Appalachia's rural cemeteries, vernacular landscapes that are "designed but not," Orr says. It became her research focus in graduate school at the University of California at Berkeley and has remained so at WVU.

In 2014, Orr made a troubling discovery. At Berkeley, she'd used historical topographic maps created by the U.S. Geological Survey (USGS) to catalog the region's cemeteries. At WVU, she went to the Natural Resource Analysis Center, where the research coordinator, Jacquelyn M. Strager, showed her how to access the USGS's Geographic Names Information System (GNIS), an electronic database of practically every building, bridge, and, yes, cemetery in the United States. Every cemetery in Preston County should be in the GNIS, Strager said. All she had to do was run a report.

"So [she] ran this report, and I knew instantly it was wrong," Orr recalls. "I mean really wrong." The database listed about forty cemeteries for Preston County, when Orr knew the number was closer to *one hundred* and forty. She was alarmed. Why weren't these places accounted for?

Orr got a grant to find out. She compared the USGS's paper topo maps to the data that makes up the National Map, a multilayered, digital trove of orthoimagery, hydrography, land cover, and

other geographic information that in 2002 began to replace those paper maps. (Digital scans of the USGS topo maps are still available for download.) Orr looked first for Mount Zion, finding the church on maps from 1926 and 1977 but not on the National Map, which also is managed by the USGS. She repeated the process for all of Preston County. It was just as she feared; she found 97 cemeteries missing.

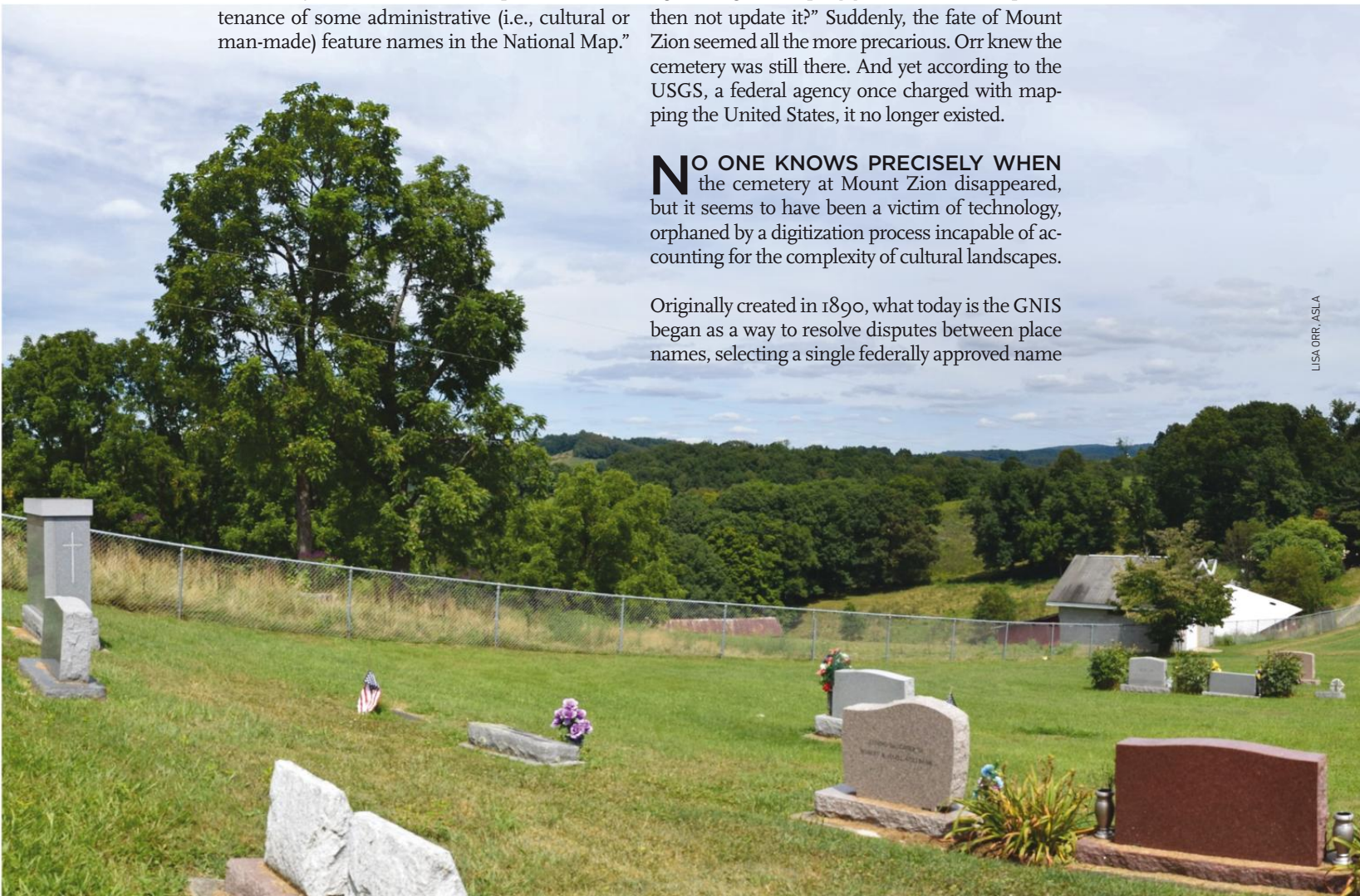
As Orr learned the inner workings of the National Map and began to compile her research, she made an even more startling discovery. Beginning October 1, 2014, the USGS would “suspend the maintenance of some administrative (i.e., cultural or man-made) feature names in the National Map.”

Those features that would be maintained, a list that included cemeteries but not churches, would be done solely through the work of volunteers, who could submit changes as part of the National Map Corps, a group of about 500 volunteers who help edit and augment the USGS’s data. When she read that, Orr was dumbfounded.

“I’m sure that I yelled something,” Orr says. She immediately shared the news with her colleagues in the department, many of whom were just as incredulous. “It’s not accurate!” Orr remembers thinking. “You’re going to take this information that wasn’t right to begin with, put [it] in the National Map, and then not update it?” Suddenly, the fate of Mount Zion seemed all the more precarious. Orr knew the cemetery was still there. And yet according to the USGS, a federal agency once charged with mapping the United States, it no longer existed.

NO ONE KNOWS PRECISELY WHEN the cemetery at Mount Zion disappeared, but it seems to have been a victim of technology, orphaned by a digitization process incapable of accounting for the complexity of cultural landscapes.

Originally created in 1890, what today is the GNIS began as a way to resolve disputes between place names, selecting a single federally approved name



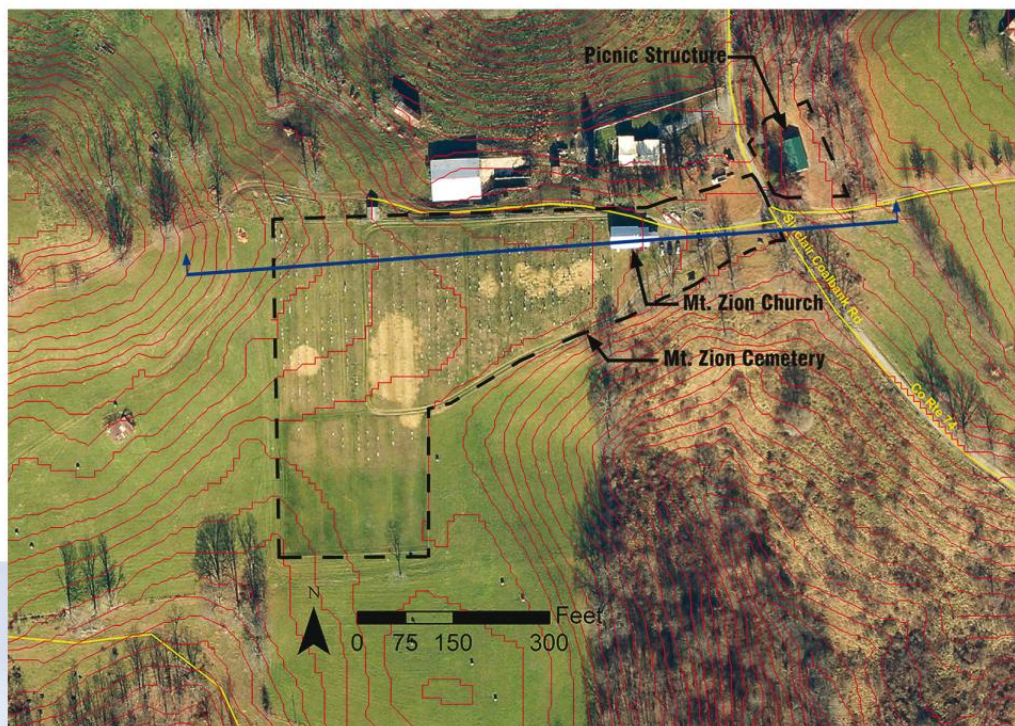
LISA ORR/ASLA

RIGHT

An analysis of Mount Zion Cemetery reveals characteristics it shares with other rural West Virginia cemeteries, including a picnic shelter.

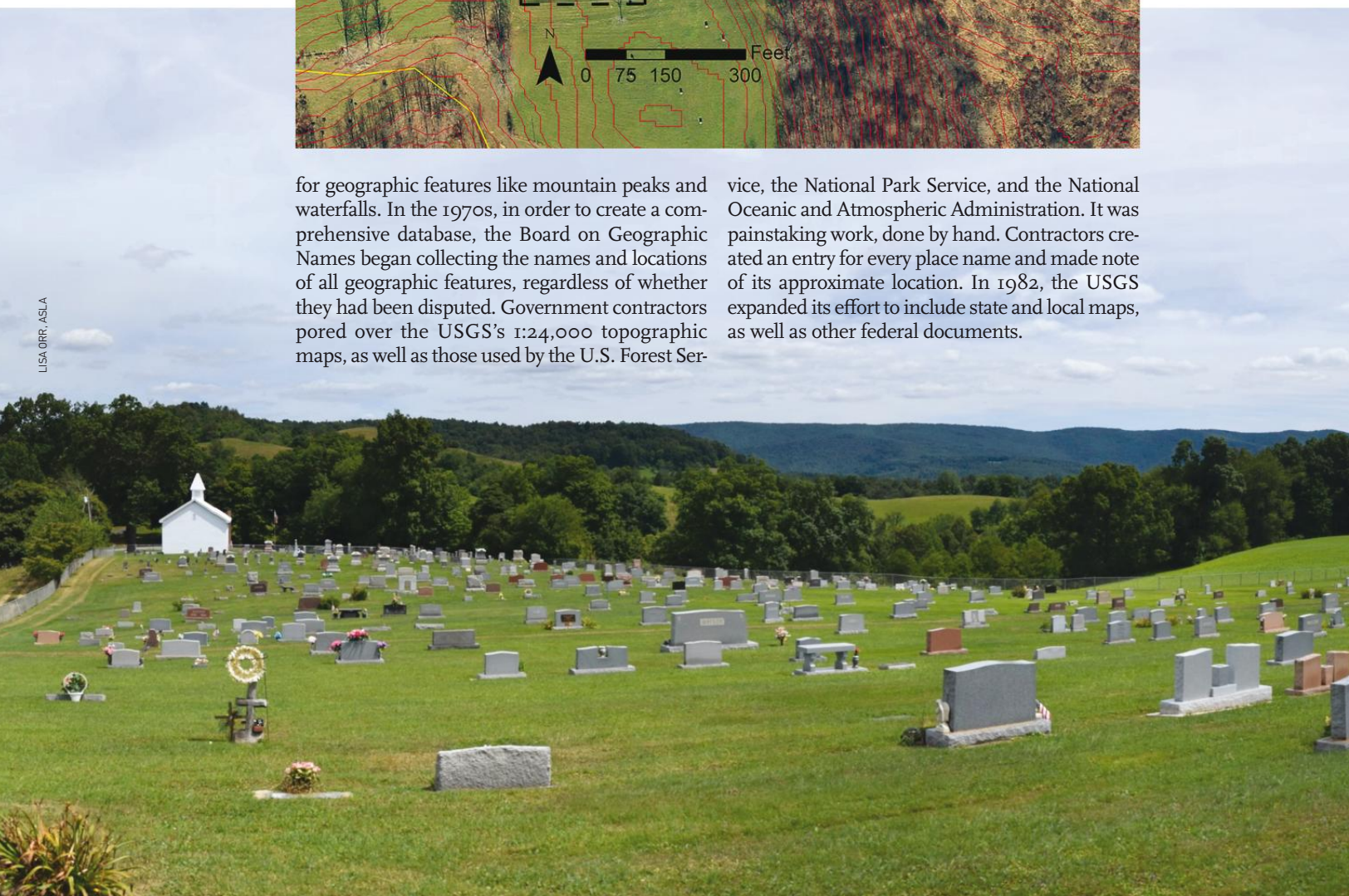
BELOW

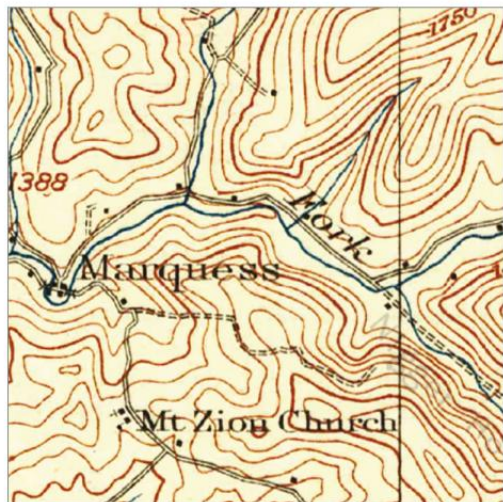
As is often the case, the cemetery grounds climb the hill behind the church building.



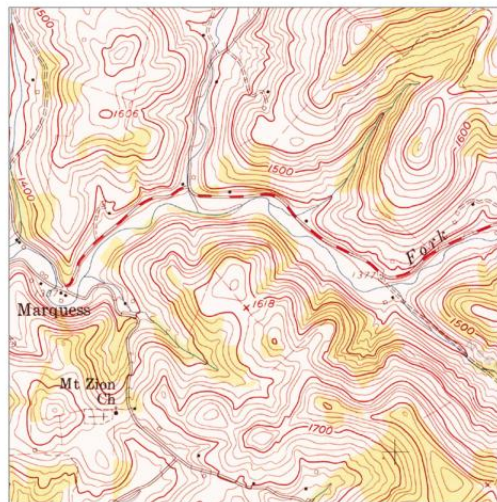
for geographic features like mountain peaks and waterfalls. In the 1970s, in order to create a comprehensive database, the Board on Geographic Names began collecting the names and locations of all geographic features, regardless of whether they had been disputed. Government contractors pored over the USGS's 1:24,000 topographic maps, as well as those used by the U.S. Forest Ser-

vice, the National Park Service, and the National Oceanic and Atmospheric Administration. It was painstaking work, done by hand. Contractors created an entry for every place name and made note of its approximate location. In 1982, the USGS expanded its effort to include state and local maps, as well as other federal documents.

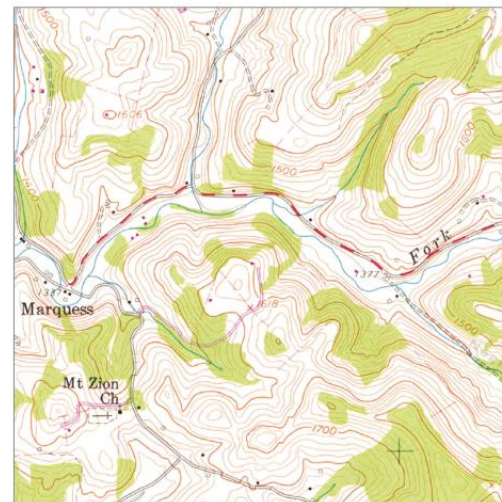




1926



1958



1958/PHOTO REVISED 1976

It's impossible to know for sure why certain places never made it into the database, but Orr suspects the issue was technological: "I can imagine a really cumbersome database that didn't allow for the flexibility that landscape features require," she says. "Maybe Mount Zion could only be one or the other—it could only be a church or a cemetery—so they just decided to make it a church." Because church data is not being maintained by the USGS, in such a scenario, Mount Zion would no longer appear on the National Map, despite its closely associated cemetery.

Mount Zion is not an anomaly. Maria McCormick, who manages the GNIS, says she sees discrepancies more often than she expected to. "It's kind of odd, because you'll go and see this historical map, and you'll go, well, why isn't that name brought forward [into GNIS]?"

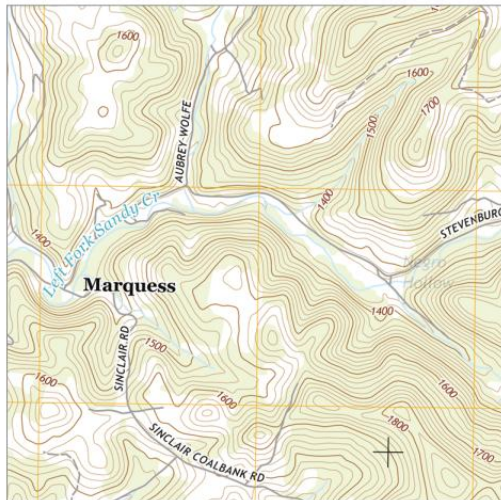
Members of the National Map Corps, the group now responsible for maintaining map data, have run into the same issue. Most corps members are anonymous (the USGS requires only an e-mail address to sign up as a volunteer), and one of its most active volunteers goes by the name Queen of the Dead. She focuses almost exclusively on cemeteries, and her work has led her to the same realization as Orr: Many of Appalachia's cemeteries have disappeared.

Queen of the Dead (who agreed to speak only on the condition of anonymity) has edited more than 6,000 data points over the past four years, earning the corps' highest distinction, the Squadron of Biplane Spectators. (Other volunteer honors include the Society of the Steel Tape, Circle of the Surveyor's Compass, and Theodolite Assemblage.) Queen of the Dead has mapped cemeteries in California, Connecticut, Michigan, Kentucky, and West Virginia, among other places. In Wayne County, West Virginia, just 173 cemeteries of 255 survived the transition from paper maps to digital.

Queen of the Dead says the data also reveals regional disparities. In some parts of the country, historical map data matches that of the National Map, even in rural areas, such as Michigan's Upper Peninsula. "Virtually all of the cemeteries with names in states like Minnesota or Connecticut or Arizona are in the digitized database," she says. "The thing that's really different about Appalachia, and definitely West Virginia, is that a lot of the cemeteries are family cemeteries, and they're up in out-of-the-way hollows. I think there was a definite decision made not to go after that level of detail, to not try to get those cemeteries on the National Map."

West Virginia has had a complicated relationship with its cemeteries. Many have fallen victim to coal mining's mountaintop removal. Others have

ABOVE
A study of historic topo maps reveals the omission of Mount Zion Cemetery on the National Map (opposite, top left). Also visible in the 1926 map is an offensive place name that later became Negro Hollow.

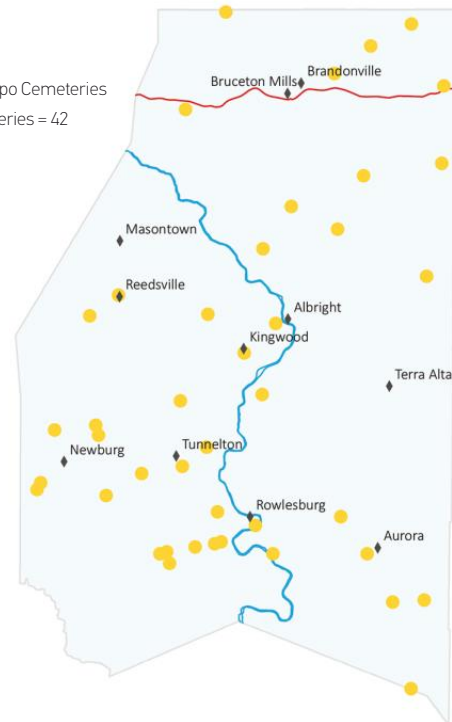


2016

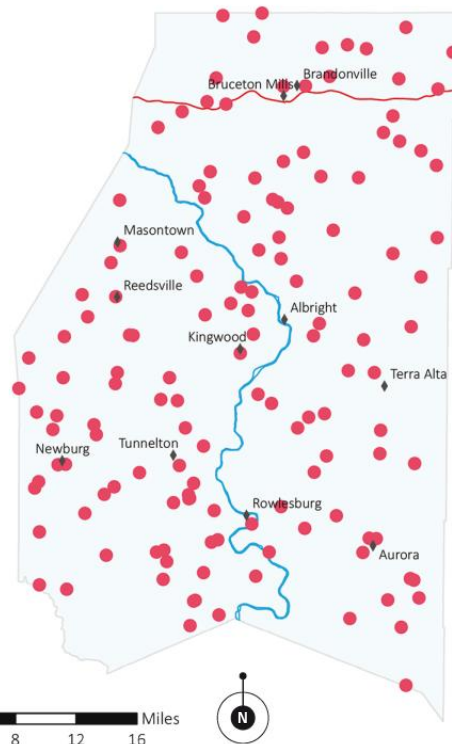
PRESTON COUNTY, WV Geographic Names Information System (GNIS)

LEGEND

- ◆ Towns
- Historical Topo Cemeteries
- GNIS Cemeteries = 42
- Interstate 68
- Cheat River



PRESTON COUNTY, WV USGS Historical Topographic Maps

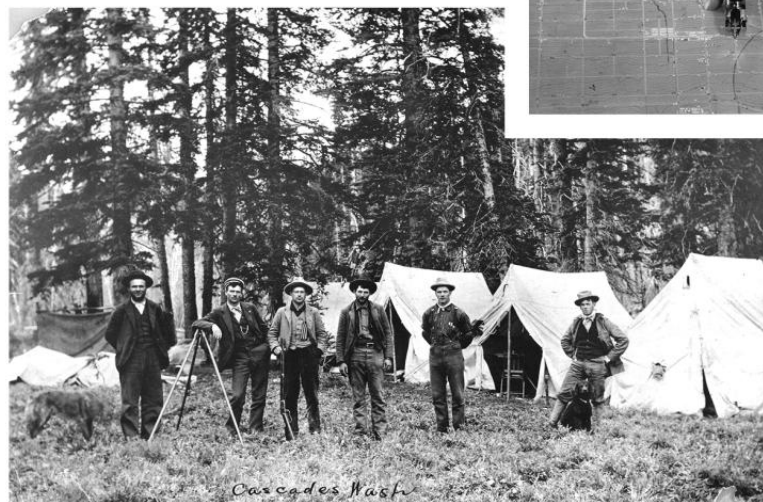


survived but are surrounded by active mines, remnant slivers of country landscapes surrounded by heavy, extractive industry. Of the features the National Map Corps members can add—schools, colleges and universities, fire stations and EMS facilities, law enforcement facilities, prisons, hospitals, cemeteries, and post offices—cemeteries are the most time-consuming to verify, says Erin Korris, who oversees the National Map Corps for the USGS. Unlike a school or hospital, cemeteries rarely have websites or contact persons, especially those like Mount Zion.

The USGS's decision to maintain just 10 structures was a budgetary one. Resources, including people, are spread thin these days. Korris manages the corps' mapping efforts with just two employees and three students. McCormick, in charge of the GNIS, is just as short-staffed. But the agency's mission has also shifted over the years, evolving from a cartographic enterprise to one focused on scientific inquiry. Mapping now falls into just one of six mission areas, which include climate and land use change. The USGS plays a role in the Department of Homeland Security's critical infrastructure program, and has its own disaster response mandate, exemplified by the Earthquake Hazards Program. In 1997, the agency changed its motto to "Science for a Changing World."

RIGHT

Orr has mapped close to 100 cemeteries in Preston County that do not appear in the Geographic Names Information System.



CLOCKWISE FROM TOP
Early mapmaking tools included the swivel graver; USGS surveyors in West Virginia in 1921; a field crew in Washington's Cascade Mountains in 1903.

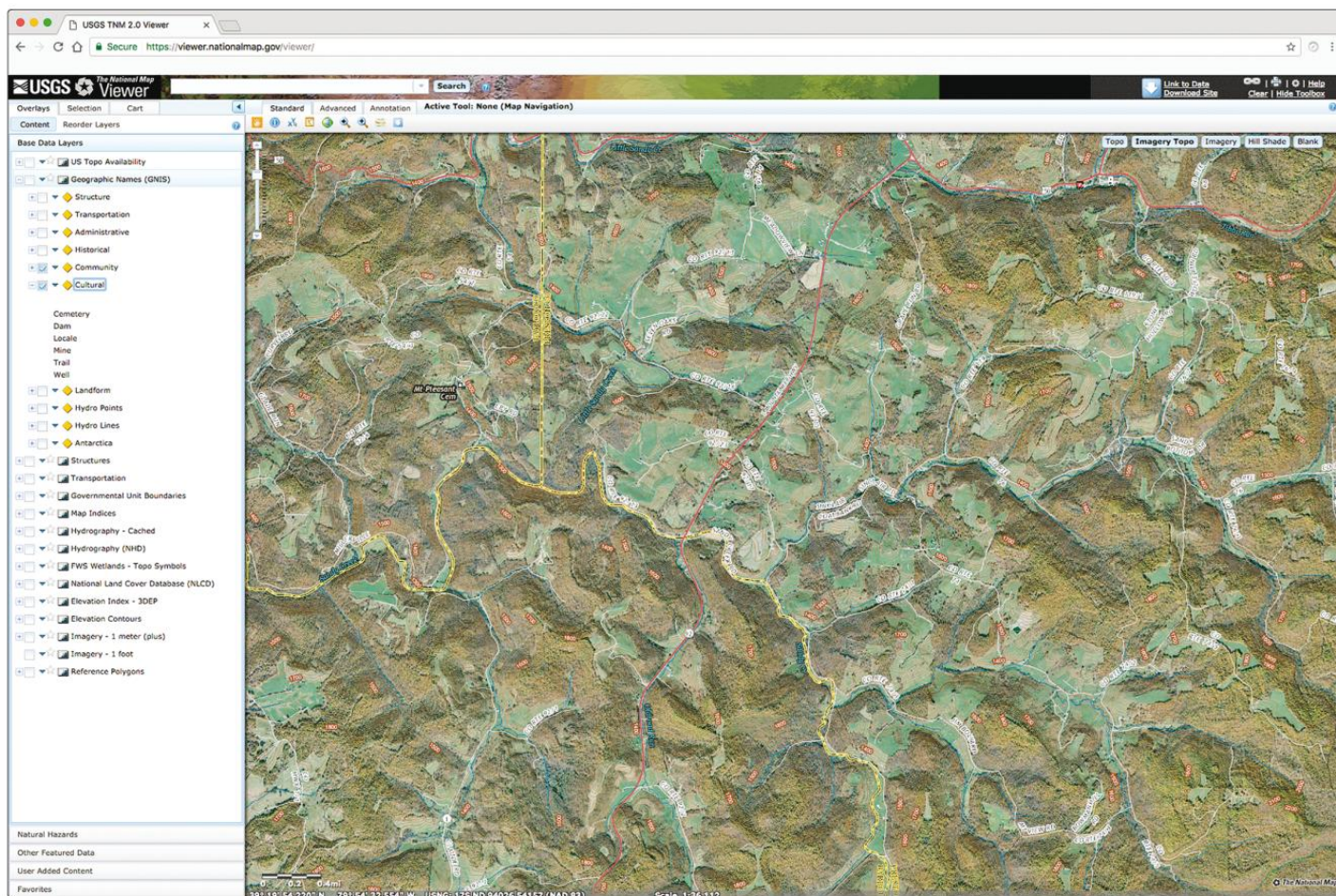


When Orr, who for several years worked for the Red Cross, considers the feature classes being prioritized today on the National Map, she sees a focus on national security and disaster management. "In a post-9/11 world, that's what it looks like to me," she says.

Laurie Temple, who oversees the Structures Unit of the National Geospatial Technical Operations Center, which eventually receives the information being updated by corps members, says the National Map is necessarily a work in progress. US Topo, the ongoing series of quadrangle topographic maps created from national GIS databases, began as an image and a grid, she says. Then came contour lines. Then roads. "It's been a gradual building of the content of US Topo since the time the program began," she says. It wasn't until 2011 that the first structures, fire stations, even appeared.

Through the work of the corps, Temple says, the National Map will continually improve, getting bigger and better, and more and more accurate, with time. However, "the USGS is not intended to be the database of the whole United States," she says. "The features we collect are for our mission."

Orr says she supports the agency's efforts to combat climate change and other environmental issues. Cultural resources are not a priority, "and I wouldn't necessarily argue that they should be," she says. But she is concerned that historians, geographers, and other professionals who in the past have relied on USGS maps are unaware of the agency's change in mission. "They call it the National Map, and then they say to you, 'Well, we're not really responsible for mapping the United States,'" she says. "But landscape architects need to know what we have and what we don't have."



ABOVE

The multiple data layers that make up the National Map are updated on a three-year cycle.

CEMETERIES ARE MANY THINGS, including a window into the past—a reflection of early Americans' lives and values and as important to preserve as the ruins of past civilizations. Both Orr and Queen of the Dead believe this fervently. And mapping, they say, is a crucial first step in protecting these places. "My position is, if it was there, and it was on the historical topo maps, we need that as part of the national archive," Queen of the Dead says.

Given the fate of some of West Virginia's country cemeteries, Orr feels an urgency to educate other designers about these vernacular landscapes and their inherent fragility. Appalachian cemeteries have been moved to make way for mining and, in extreme cases, bulldozed into oblivion. "You might think that all cemeteries have some sort of magical protection," Orr says, "but that isn't true."

Currently, Orr is mapping the mining towns that multiplied throughout West Virginia in the late 1800s. The ad hoc—and racially segregated—cemeteries that accompanied these towns have fared even worse than most. Orr hopes that by mapping them, she can return them to the public memory. "I really believe these places are intrinsically important," she says, "and that if we walk away from paying attention to this, we are going to be very sorry." ●

TIMOTHY A. SCHULER WRITES ABOUT LANDSCAPE ARCHITECTURE, ECOLOGY, AND URBAN DESIGN. HE LIVES IN HONOLULU.



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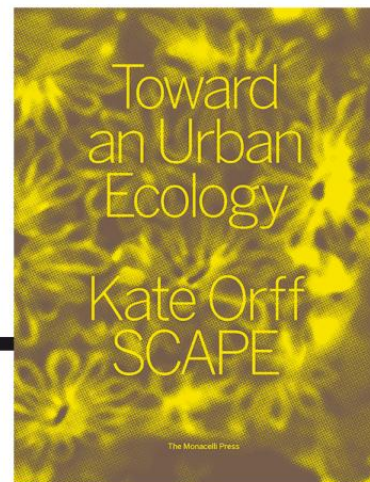
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CONSTRUCTING NATURE

TOWARD AN URBAN ECOLOGY

BY KATE ORFF/SCAPE; NEW YORK: MONACELLI PRESS, 2016;
272 PAGES, \$50.

REVIEWED BY ELISSA ROSENBERG



“The city is part of nature.”

Anne Whiston Spirm, FASLA, wrote these words some 30 years ago in her influential book, *The Granite Garden: Urban Nature and Human Design*. There she argued for a new approach to urban design that would take into account the complex interaction between social and natural processes. “Nature” and the “city” could no longer be thought of as polar opposites. The 19th-century view of nature as a pastoral refuge from the city that had come to operate as a default mode in urban landscape design was replaced by a more integrated conception where city and nature are inextricably connected. This is the basic shift that occurred with the rise of the discipline of urban ecology, which Ian McHarg, Spirm’s mentor, drew from and popularized in his groundbreaking book *Design with Nature* (1969). McHarg applied ecological principles not only to the planning of the seemingly pristine landscapes of his early practice, such as Maryland’s horse country and New Jersey’s coastal dunes, but later, and perhaps more significantly, to the disturbed, complex, and constructed “nature” in the city. The key lesson from McHarg’s planning method and Spirm’s case studies is that the design of the city cannot be separated from the natural systems on which its stability and survival depend.

In *Toward an Urban Ecology*, Kate Orff, ASLA, offers a contemporary look at the meaning of urban ecology for landscape practice. Orff is the founding partner of SCAPE; an associate professor at the Columbia University Graduate School of Architecture, Planning, and Preservation, where she has been serving as director of the Urban Design Program since 2015; and a co-director of the Urban Landscape Lab, a research incubator. She is a coauthor, with Richard Misrach, of *Petrochemical America* (see “What Kate Orff Sees,” *LAM*, May 2012) and a coeditor and author of the book *Gateway: Visions for an Urban National Park*. Her newest book, a “manifestograph,” as she calls it—“part monograph, part manual, part manifesto”—documents the work of SCAPE, the landscape architecture and urban design practice that she founded in 2005. This hybrid characterization of the book’s format and goals reflects Orff’s identity as both practitioner and academic; it also reflects the book’s ambition. In her introduction, she acknowledges the recent developments in landscape architecture theory and practice that have taken place as a result of the work of McHarg and Spirm, who made ecological thought central to the work of landscape architects. She cites the emergence of landscape urbanism, landscape as art, and landscape infrastructure as examples of the field’s reinvention. But Orff does not directly align her work with any



Photo : Bryant Park, New York

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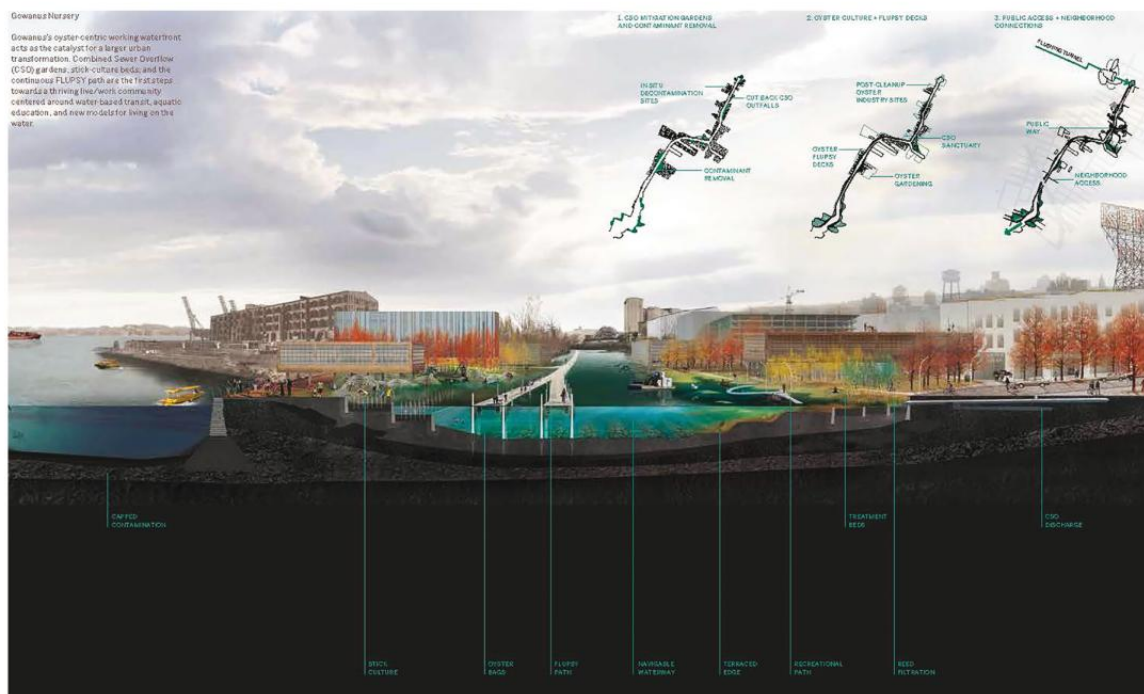
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ABOVE AND BELOW

For the Museum of Modern Art's *Rising Currents* exhibition, oyster farming was proposed to filter the contaminated water of Brooklyn's Gowanus Canal. A series of floating chambers that circulate nutrient-rich water encourages the growth of the juvenile oysters.

of these approaches. The book's polemical tone and manifesto-like format set the work off from these frameworks, arguing for a vision of the urban landscape that is distinct, transformative, and urgent. This vision stresses the social and cultural potential of urban ecology, based on an idea of landscape that is "design driven, participatory, and science based." The firm's work is presented as a broad call to action.

What is most innovative in SCAPE's practice is the way that these three aspects—design, science, and community participation—are engaged to create an activist, collaborative methodology. The practice is fundamentally research driven, but also animated by a strong design ethos. Ecological issues are seen as a driver for community involvement. They are not part of an abstract agenda but touch on everyday lived experience in the city. SCAPE's mission is based on a "collaborative, community-stewardship-driven methodology that acknowledges change and uncertainty." A wide array of techniques is used to generate citizen engagement, including mapping, storytelling, and community organizing.

The book is divided into four chapters: "Revive," "Cohabit," "Engage," and "Scale." The hybrid form of monograph, manual, and manifesto is held together by the book's tight, though unconventional, format. Each chapter follows a consistent structure that contains some of each: a short introductory text; a single project presented through extensive plans, perspectives, and photographs; a manual of one-page "strategies" that outline specific themes such as "water harvesting," "bay nourishment," or "consensus building," each illustrated by a single

project; two interviews with varied project participants, including scientists and politicians; and a critical essay by contributing academic authors. This eclectic mix of genres and registers adds conceptual richness and visual density to the book. The effect is to convey a sense of energy through the multiple voices that are represented, stressing the dynamic and collaborative quality of the work through the range of people, ideas, and processes that have created it. Overall, the projects cohere into an impressive body of work that has come together in a little more than a decade.

The academic contributions offer a critical discussion of the projects and their larger themes: urban ecology, infrastructure, and the meaning of public landscapes. The authors include Jane Hutton, an assistant professor in landscape architecture at the Harvard Graduate School of Design; Thaisa Way, ASLA, an urban landscape historian and professor at the University of Washington; Emily Eliza Scott, a postdoctoral fellow in architecture at ETH Zurich; and Brian Davis, an assistant professor of landscape architecture at Cornell University. Interviews with diverse figures such as Mayor



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TOP LEFT
Polypropylene “fuzzy rope” panels were installed off the Brooklyn waterfront in March 2013.



TOP CENTER
By June the ropes supported colonies of blue mussels and a variety of other species.

TOP RIGHT
The rope installation demonstrates that even simple materials can be used to help promote habitats in urban settings.

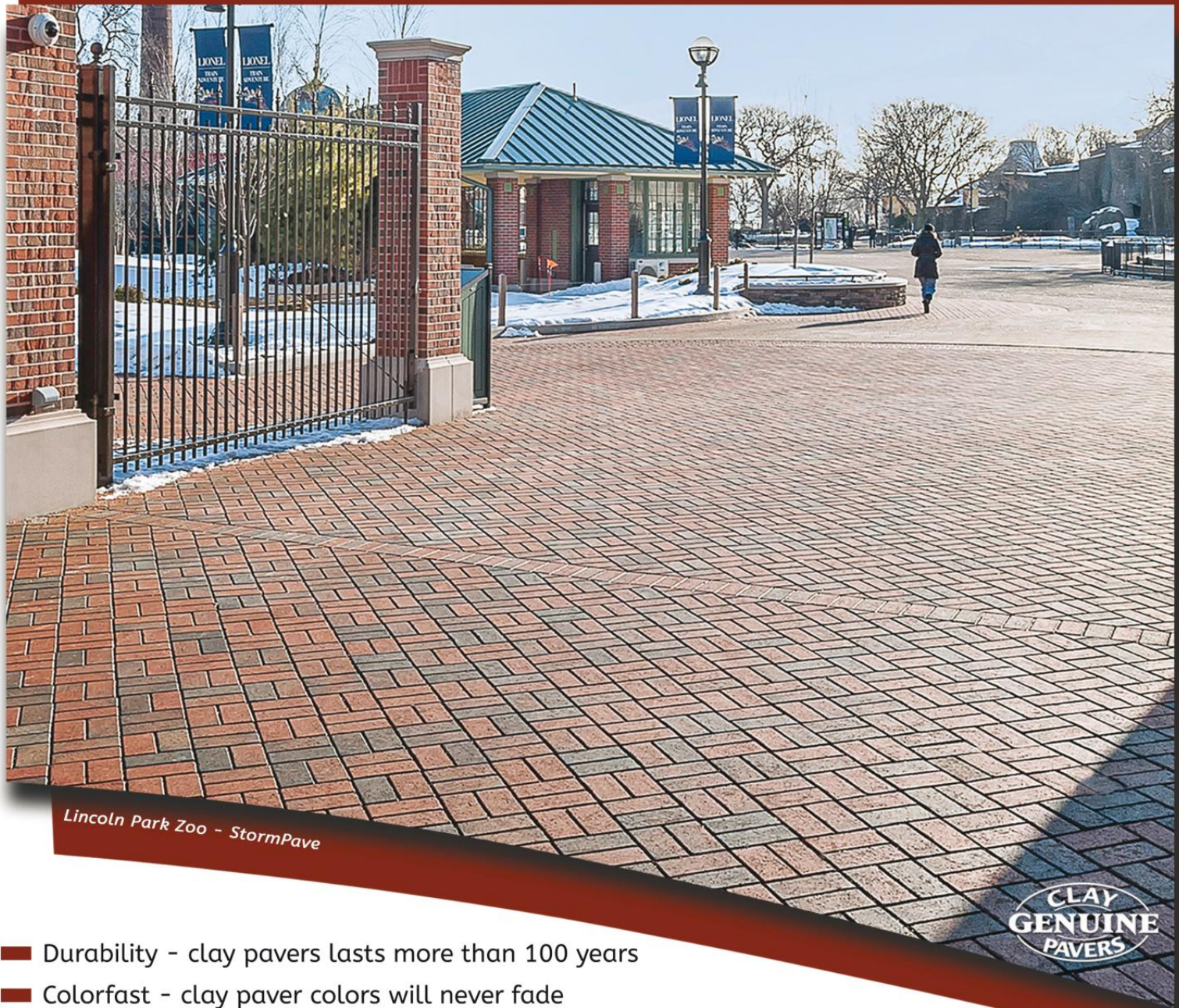


Jim Gray of Lexington, Kentucky; Bart Chezar, a citizen scientist involved in ecological restoration; and Eric Klinenberg, a professor of sociology and social infrastructure advocate, provide fascinating background on the ways in which the projects have taken shape.

SCAPE's largest and perhaps most innovative project is known as *Living Breakwaters* in Staten Island, New York, which was developed to provide coastal resilience and prevent flooding associated with predicted sea-level rise. This was one of six winning proposals in the *Rebuild by Design* initiative, a global competition launched in 2013 by the federal government in partnership with local organizations after the devastation of Hurricane Sandy. The project, designed by an interdisciplinary team (with Parsons Brinckerhoff, Philip Orton, SeArc Ecological Consulting, LOT-EK, MTWTF, the Harbor School, and Paul Greenberg), reimagines how coastal infrastructure could act as a social and ecological catalyst in addition to reducing flood risk. A new system of breakwaters is proposed as part of a larger urban network that engages the waterfront neighborhoods located along the shoreline in order to strengthen their historical connection to the bay. The network includes a series of “water hubs,” or neighborhood facilities for recreational activities and educational programs. The breakwaters are designed not only to reduce wave action and slow erosion but also to restore marine ecosystems by providing new habitat. By using configurations and materials that mimic the “micro-complexity” of the historic reef habitats of the Raritan Bay, the breakwaters are able to provide shelter and feeding areas for local populations of finfish, lobsters, and shellfish. The project was planned in collaboration with the Billion Oyster Project

and the Harbor School, whose goals are to restore one billion oysters to the New York Harbor and train local school groups to monitor their growth and survival.

The oyster was already the subject of an imaginative proposal developed by SCAPE for the Museum of Modern Art's 2010 *Rising Currents* exhibition that addressed climate change and the prospect of rising sea levels in New York City. Oyster-tecture, the somewhat tongue-in-cheek title of the project, proposed recultivating the historic oyster beds that once covered one quarter of the New York Harbor. A massive new reef would be created by seeding young oysters into a large armature of coarse rope floating in the New York Bay. The oyster larvae would be transferred from the contaminated, nutrient-rich Gowanus Canal in Brooklyn, where they would be raised in floating rafts located along the edges of the canal. These fantastical aquatic landscapes are also working landscapes; the reef would protect the shoreline, filter the harbor water, and provide a new public space for boating, walking, and marine habitat. Significantly, the proposal envisions oyster production as an incremental and community-based enterprise, based on a cottage industry of weavers and knitters. The MoMA installation included a mock-up of the rope armature that was created in a community “knitting party.” This crowdsourcing approach was also used in an experimental pilot project at Sims Habitat Pilot Pier in Brooklyn that tested the cultivation of new aquatic habitat in an industrial zone. Fourteen polypropylene panels woven by volunteers in a “Fuzzy Rope Weaving Evening” were used as “habitat probes” that successfully created new habitat for colonies of blue mussels, green crabs, and other species.



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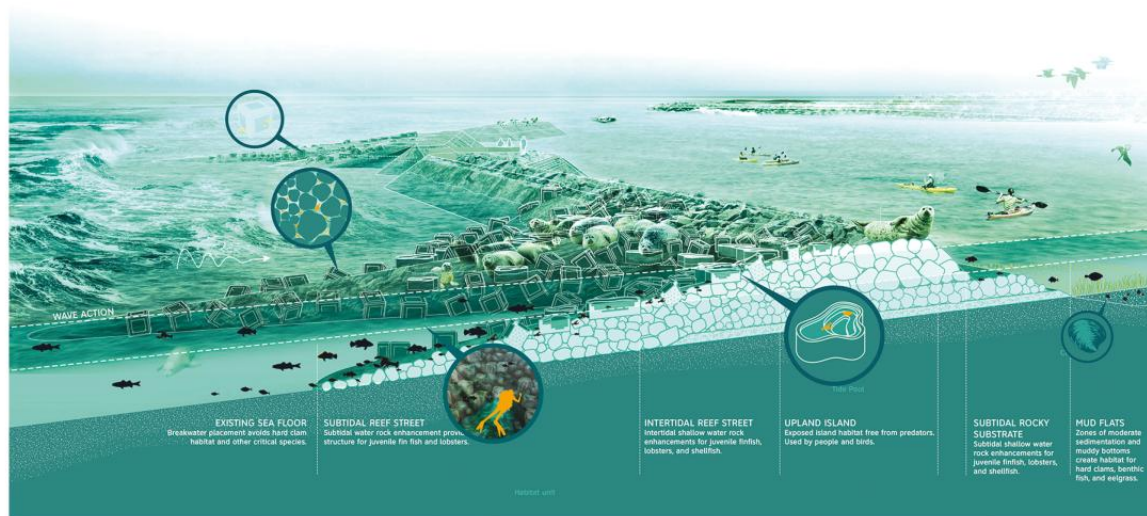
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ABOVE
Living Breakwaters mimics the microcomplexity of natural reefs to provide diverse aquatic habitat.

BELOW
Located on Staten Island's southern shore, the project uses social and ecological elements in its coastal protection scheme.



Other SCAPE projects promote a kind of citizen science through the creative use of mapping and educational tools, suggesting that greater environmental literacy is the key to developing both stewardship and a more entrepreneurial or activist civic society. These take the form of manuals, urban walks, and community workshops that all serve to raise awareness about diverse ecological issues. They are intended to spur local engagement that may take the form of citizen monitoring of urban natural systems or debating alternative solutions to pressing urban environmental problems at the neighborhood scale. One particularly ambitious program is Safari 7, a project conceived through Columbia University's Urban

Landscape Lab (with Janette Kim and Glen Cummings of MTWTF) for commuters traveling on New York City's 7 subway line. The Safari is a self-guided tour of urban wildlife and vegetation, using maps and podcasts to transform the subway into an urban classroom as it passes through New York's little-known landscapes—for example, the artificial U Thant Island in the East River, a nesting site for the

double-crested cormorant, or the Queens cemeteries and their decomposition cycles. Urban ecology crosses over into guerrilla art. Similar platforms have already been replicated in other cities such as São Paulo and Beijing.

SCAPE's emphasis on the performance of the landscape presents a transgressive and inventive take on the relationship of city and nature, based on the productive crossover of

constructed and natural elements. Urban ecological restoration is premised on interventions that blur these boundaries, as in SCAPE's constructed osprey nest structures, or mussel colonies forming on woven polypropylene rope. In contrast to the abstraction that characterizes many of the projects identified with landscape urbanism, these projects

locate "urban ecology" in everyday experience and urban processes. They depend on the immediacy of the granular microscale while addressing large-scale natural systems. The firm's research orientation is hands-on and field based, stressing empirical study and experimentation. These are the "safe-to-fail" experiments that the ecological planner Jack Ahern, FASLA, claimed, in the journal *Landscape Ecology*, are the key to expanding the knowledge base of adaptive design, which he defines as "a process/approach where selected urban plans and projects explore innovative practices and methods, informed by landscape ecology knowledge and research design, open to design innovations and creativity, and monitored and analyzed to learn from the experiment—with the goal of gaining knowledge to apply to future projects."

Experimentation is defined by its open-ended quality, and the unpredictable results that often challenge the initial hypothesis. In his interview, Bart Chezar, the citizen scientist/marine biologist who individually initiated a number of small-scale restoration projects in the New York Harbor, attributed his successes to his ability to work "on the edge." Orff noted that this metaphor is more accurate than thinking in terms of "top-down" or "bottom-up" dynamics. SCAPE embraces the ethos of experimentation, and, like Chezar, seems to inhabit the edge—mining a zone of fruitful exchange and overlap among diverse disciplines and players. This collection of recent work will inspire all those who love the city and believe in the unique ability of landscape to contribute to solving its urgent problems. ●

ELISSA ROSENBERG IS ASSOCIATE PROFESSOR EMERITA IN THE LANDSCAPE ARCHITECTURE DEPARTMENT AT THE UNIVERSITY OF VIRGINIA, AND CURRENTLY TEACHES IN THE GRADUATE URBAN DESIGN PROGRAM, BEZALEL ACADEMY OF ARTS AND DESIGN, JERUSALEM.

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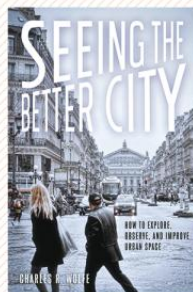


THINKING THE CONTEMPORARY LANDSCAPE

EDITED BY CHRISTOPHE GIROT AND DORA IMHOF; NEW YORK: PRINCETON ARCHITECTURAL PRESS, 2017; 288 PAGES, \$45.

This compilation of 17 essays on the modern meanings of landscape architecture is largely academic but does occasionally surprise. The chapter by Kongjian Yu, FASLA—"Think Like a King, Act Like a Peasant: The Power of a Landscape Architect and Some Personal Experience"—provides fascinating perspective on China, where rapid development and industrial degradation make for much to do. Yu points out that while Chinese landscape design has traditionally been associated with elites ("creating a paradise for entertaining and pleasure making"), its real value lies in the good it can do for the masses. ●

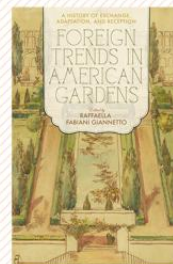
AMERICAN LANDSCAPES,
IT TURNS OUT, ARE AS MUCH A
PRODUCT OF OTHER COUNTRIES
AS AMERICANS THEMSELVES.



SEEING THE BETTER CITY: HOW TO EXPLORE, OBSERVE, AND IMPROVE URBAN SPACE

BY CHARLES R. WOLFE;
WASHINGTON, D.C.: ISLAND PRESS,
2016; 245 PAGES, \$30.

Looking—really looking—at a city and recording what you see can reap many rewards but takes only a few tools: a cell phone camera, something to write with, and shoe leather. With this book Wolfe has created a detailed how-to for personal urban observation—for whatever reason the observer chooses. "Not every urban diary will be used for advocacy purposes, or as part of a public process or the adjudication of a dispute," he writes. But, "it is enough to have an urban diary act only as a prompt to help you look differently at your city and think more about what you see." ●



FOREIGN TRENDS IN AMERICAN GARDENS: A HISTORY OF EXCHANGE, ADAPTATION, AND RECEPTION

EDITED BY RAFFAELLA FABIANI GIANNETTO; CHARLOTTESVILLE, VIRGINIA: UNIVERSITY OF VIRGINIA PRESS, 2016; 311 PAGES; \$29.50.

American landscapes, it turns out, are as much a product of other countries as Americans themselves. The book covers early international influences (imported British plants, conveyed status of Italianate garden design) as well as later ones (Japanese displays at World's Fairs in 1915 and 1939). America's design debt to immigrants is emphasized with a chapter on the Austrian American architect Richard Neutra, whose work symbolized California modernism. Critic Sigfried Giedion is quoted, saying of Neutra in the New World: "Human nature is sometimes like an apple tree which has only to be grafted with the right stock to change completely the quality of its fruits." ●

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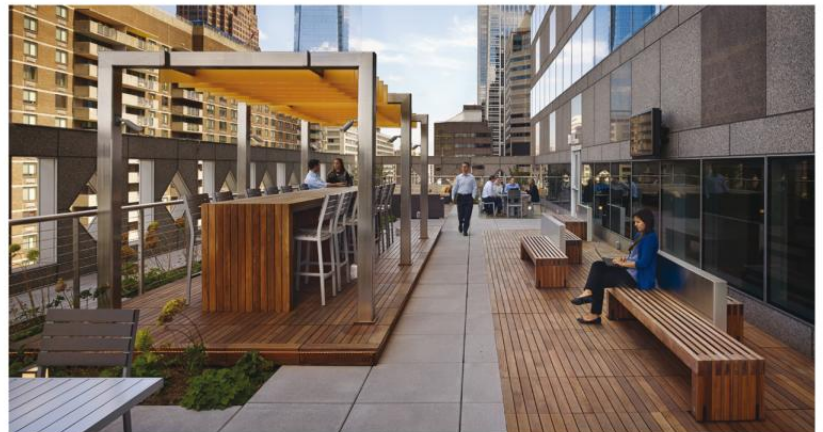
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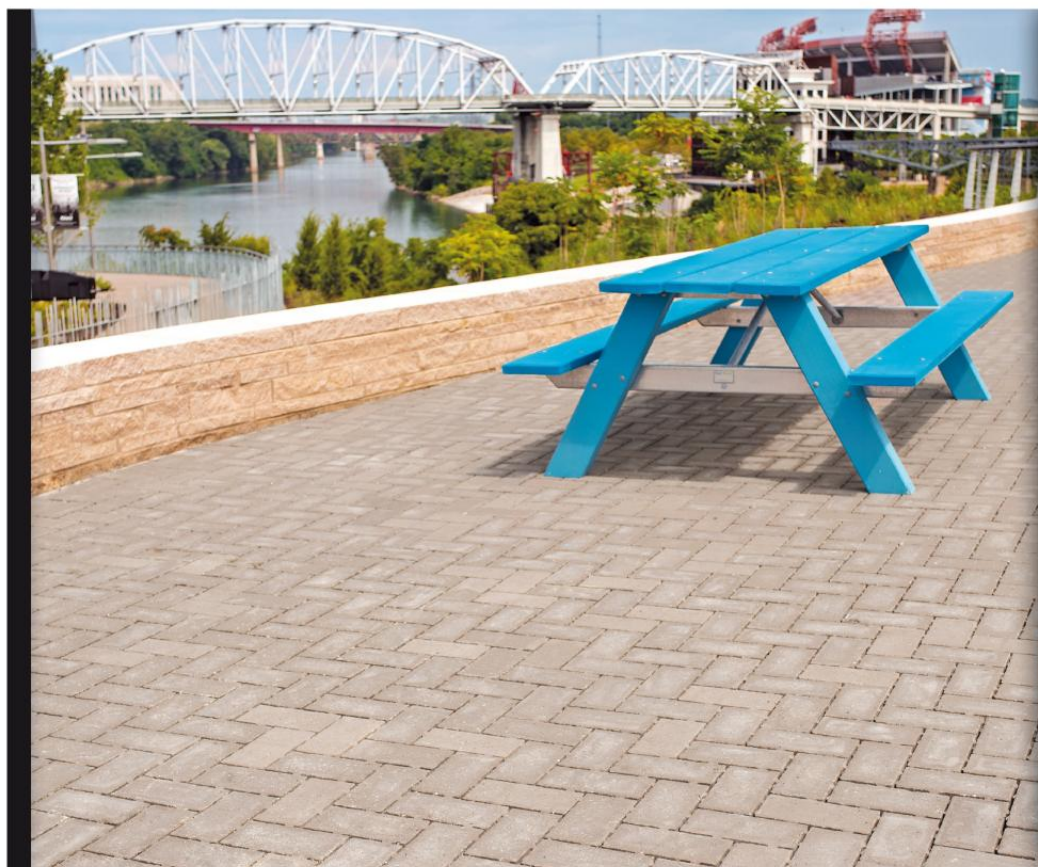
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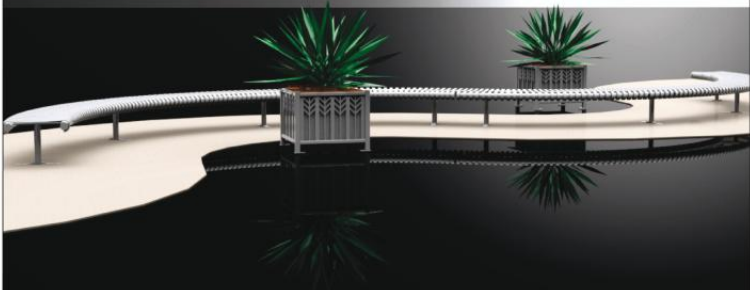
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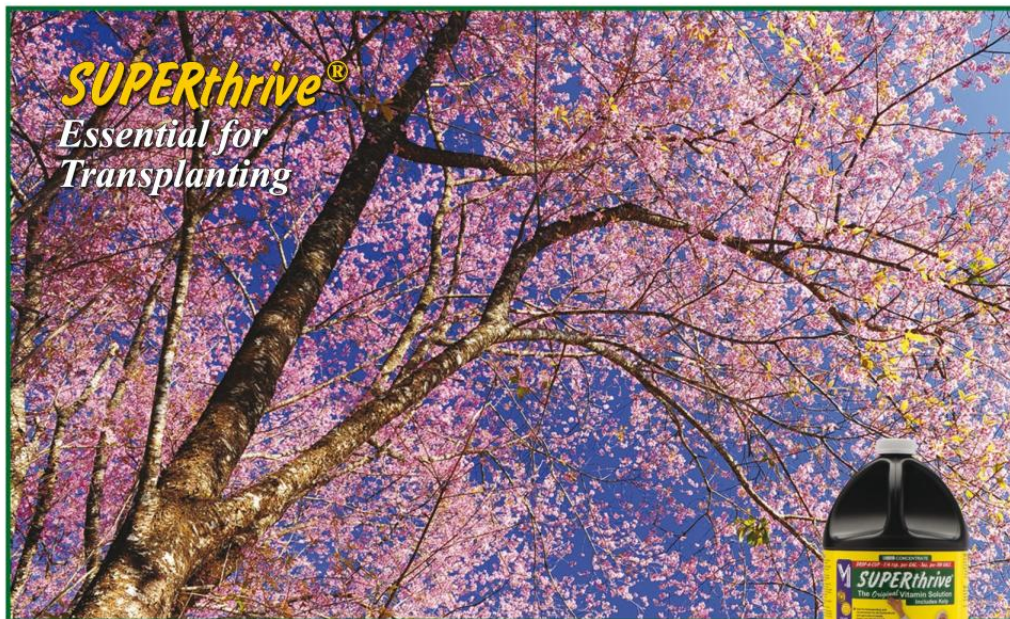
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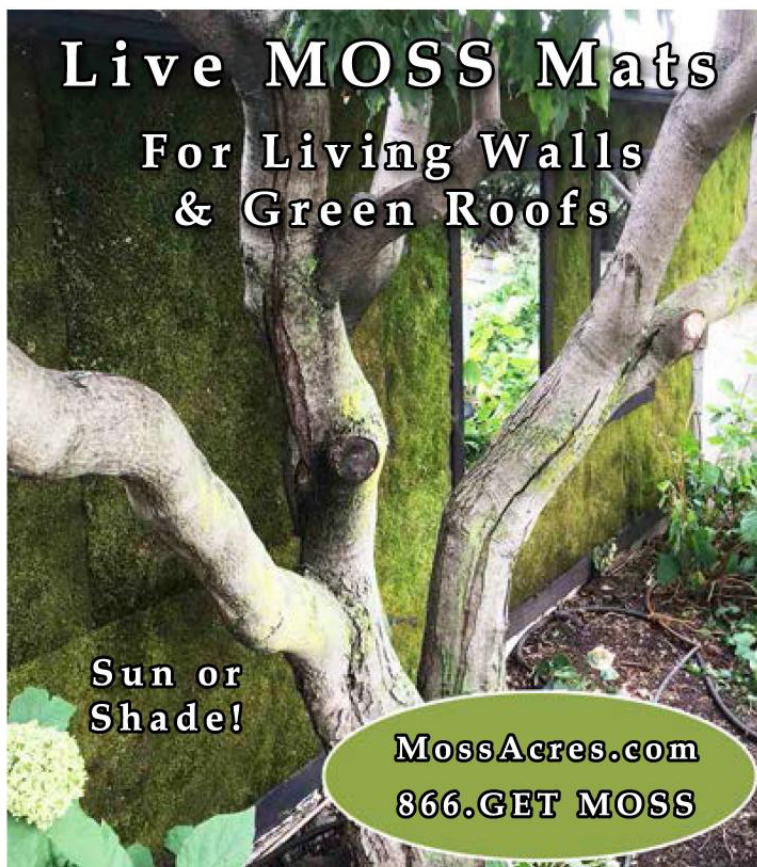
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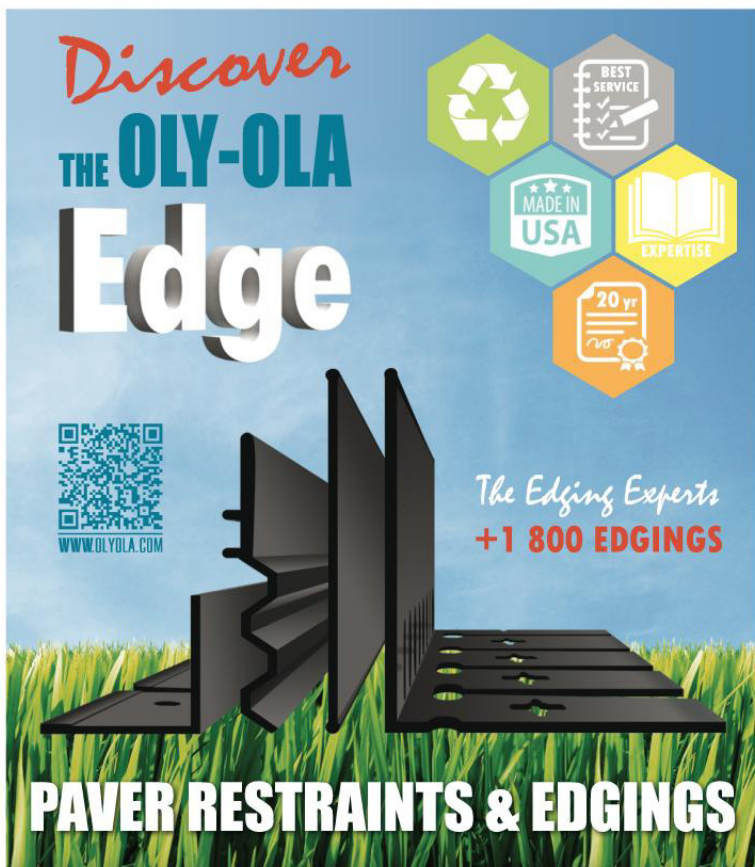


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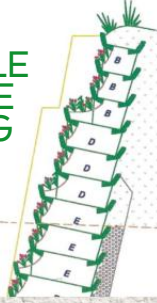
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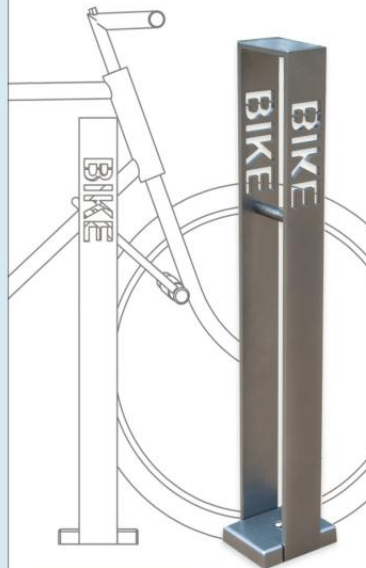


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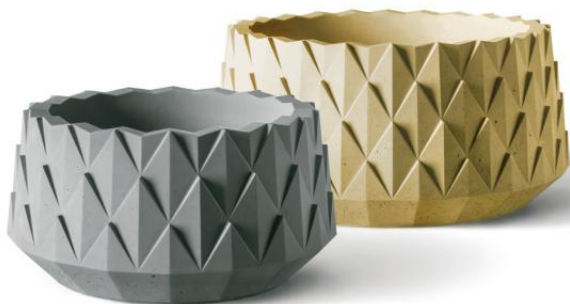
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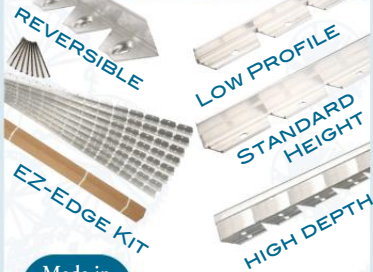


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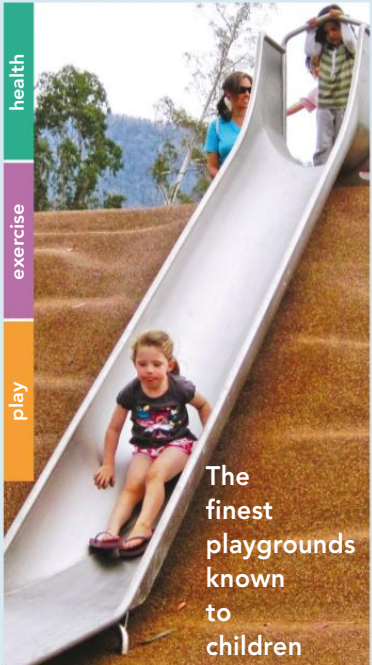


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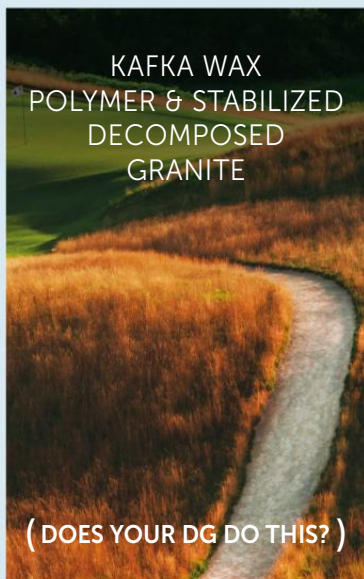


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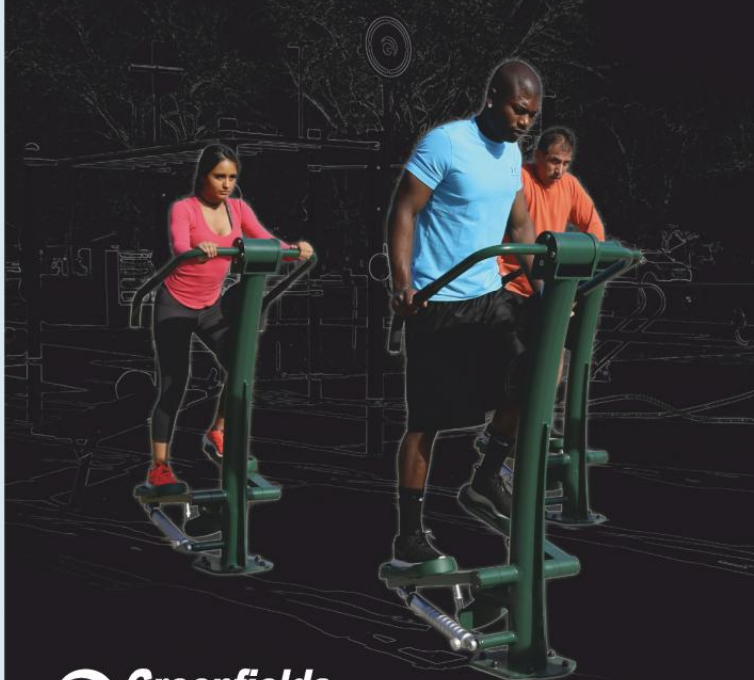
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On June 10-11, 2016, over 700 landscape architects with a shared concern for the future were assembled by the Landscape Architecture Foundation (LAF) at the University of Pennsylvania in Philadelphia. Inspired by LAF's 1966 Declaration of Concern, we crafted a new vision for landscape architecture for the 21st century.

THIS IS OUR CALL TO ACTION.

Across borders and beyond walls, from city centers to the last wilderness, humanity's common ground is the landscape itself. Food, water, oxygen – everything that sustains us comes from and returns to the landscape. What we do to our landscapes we ultimately do to ourselves. The profession charged with designing this common ground is landscape architecture.

After centuries of mistakenly believing we could exploit nature without consequence, we have now entered an age of extreme climate change marked by rising seas, resource depletion, desertification and unprecedented rates of species extinction. Set against the global phenomena of accelerating consumption, urbanization and inequity, these influences disproportionately affect the poor and will impact everyone, everywhere.

Simultaneously, there is profound hope for the future. As we begin to understand the true complexity and holistic nature of the earth system and as we begin to appreciate humanity's role as integral to its stability and productivity, we can build a new identity for society as a constructive part of nature.

The urgent challenge before us is to redesign our communities in the context of their bioregional landscapes enabling them to adapt to climate change and mitigate its root causes. As designers versed in both environmental and cultural systems, landscape architects are uniquely positioned to bring related professions together into new alliances to address complex social and ecological problems. Landscape architects bring different and often competing interests together so as to give artistic physical form and integrated function to the ideals of equity, sustainability, resiliency and democracy.

As landscape architects we vow to create places that serve the higher purpose of social and ecological justice for all peoples and all species. We vow to create places that nourish our deepest needs for communion with the natural world and with one another. We vow to serve the health and well-being of all communities.

To fulfill these promises, we will work to strengthen and diversify our global capacity as a profession. We will work to cultivate a bold culture of inclusive leadership, advocacy and activism in our ranks. We will work to raise awareness of landscape architecture's vital contribution. We will work to support research and champion new practices that result in design innovation and policy transformation.

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A NEW EXHIBIT EMBEDS ARTISTS IN MILITARY LANDSCAPES.

BY MIMI ZEIGER

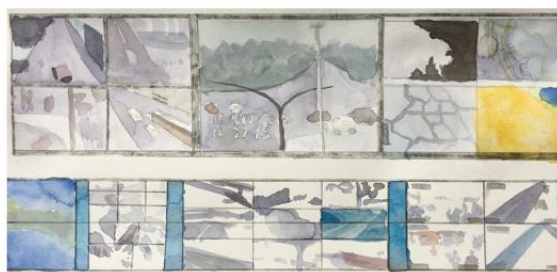
ABOVE LEFT

Linewatch Training at the Border Patrol Academy, El Paso, Texas, 1938.

ABOVE RIGHT

Control Room Main Screen Array, C4i4, Mexico City, Mexico, 2014–2015.

“Landscapes are both places we live in and the pictures of them,” says Hillary Mushkin. The Los Angeles-based artist has been exploring and documenting landscapes, especially as they relate to war, since the early 2000s. Her latest exhibition, *Project Series 51: Incendiary Traces*, is on view at California’s Pomona College Museum of Art until May. “Pictures of landscapes are used for political purposes,” Mushkin continues. “Maps are political. That’s what they are for—to control spaces, to understand a territory, and to do things with what you understand about it. When I talk about landscapes, I am trying to bring the two meanings—place and pictures—together.”



To do this, Mushkin began *Incendiary Traces* in 2011. It’s an ongoing collaborative project that involves field visits and multimedia recordings of the active militarized sites in our midst. She brings groups of artists, scholars, and students to these places and asks them to make visible, to “trace,” what they observe. The results are often simple and neutral—quick portrayals of unspectacular buildings and terrain. But that’s the point. The documents aren’t critique or celebration; the artists and scholars are there to bear witness.

At Pomona, the exhibition brings together images of six sites of military and geopolitical importance, including drawings of the 29 Palms Marine Corps Base and sketches of the U.S.–Mexico border pulled from notebooks. “Sketches are the meat of [the exhibition]—the tattered edges, the erasing, the blotches of water,” Mushkin says. Six large table-like vitrines fill the gallery. She and the se-

nior curator Rebecca McGrew assigned each one a military tactic or technology term.

“Situational Awareness,” for instance, refers to a 2013 visit to the University of Southern California Institute for Creative Technologies, a U.S. Army research laboratory that is developing gaming software to train soldiers in maneuvers to counter improvised explosive devices in remote conflict zones. As part of a simulation of a rural landscape in southern Afghanistan, on display in the gallery are graphite sketches of a market stand and the low buildings of the virtual village. They represent a kind of blurring between what is real and what is the game. A video by Scott Polach, however, looks at the limitations of the artificial landscape. His 2013 work, *Untitled #11013 (ICT)*, captures the edges of the environment where the design trails off into abstraction.

Mushkin’s own 2012 watercolors of the San Clemente Island Naval Weapons Testing Range, made while on a fishing boat off the coast of the Channel Islands, illustrate the term “Coastal Profile.” It’s a prephotographic method of representing remote landforms and topographic signifiers. The waters off San Clemente are where Navy SEALs and other special ops forces train for air–sea scenarios, but Mushkin’s blue and purple paintings reveal only waves and bluffs. Included in the selection of images is a sonar recording by the artist Tom McMillin. Titled *The Earth Is Not Flat: Sonar Recordings from the Bottom of the Sea* (1987), the piece uses sound recording with data output on carbon paper (a now obsolete method) to visualize a seabed wasteland of spent material.

The ways landscapes are represented are less important than the fact that they are represented. “All the pictures we generally see of war are of the front lines,” Mushkin says. “But this is our local landscape, and we are at war.” ●

MIMI ZEIGER IS A CRITIC, EDITOR, AND CURATOR BASED IN LOS ANGELES.



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