THE AGE OF THE MEGA-ECO PROJECT

KELVIN VU AND PRIYANJALI SINHA

CAN LARGE LANDSCAPE INFRASTRUCTURE PROJECTS DELIVER ECOLOGICAL TRANSFORMATION BETTER THAN THEIR INDUSTRIAL PREDECESSORS?

BY ROBERT LEVINTHAL AND RICHARD WELLER

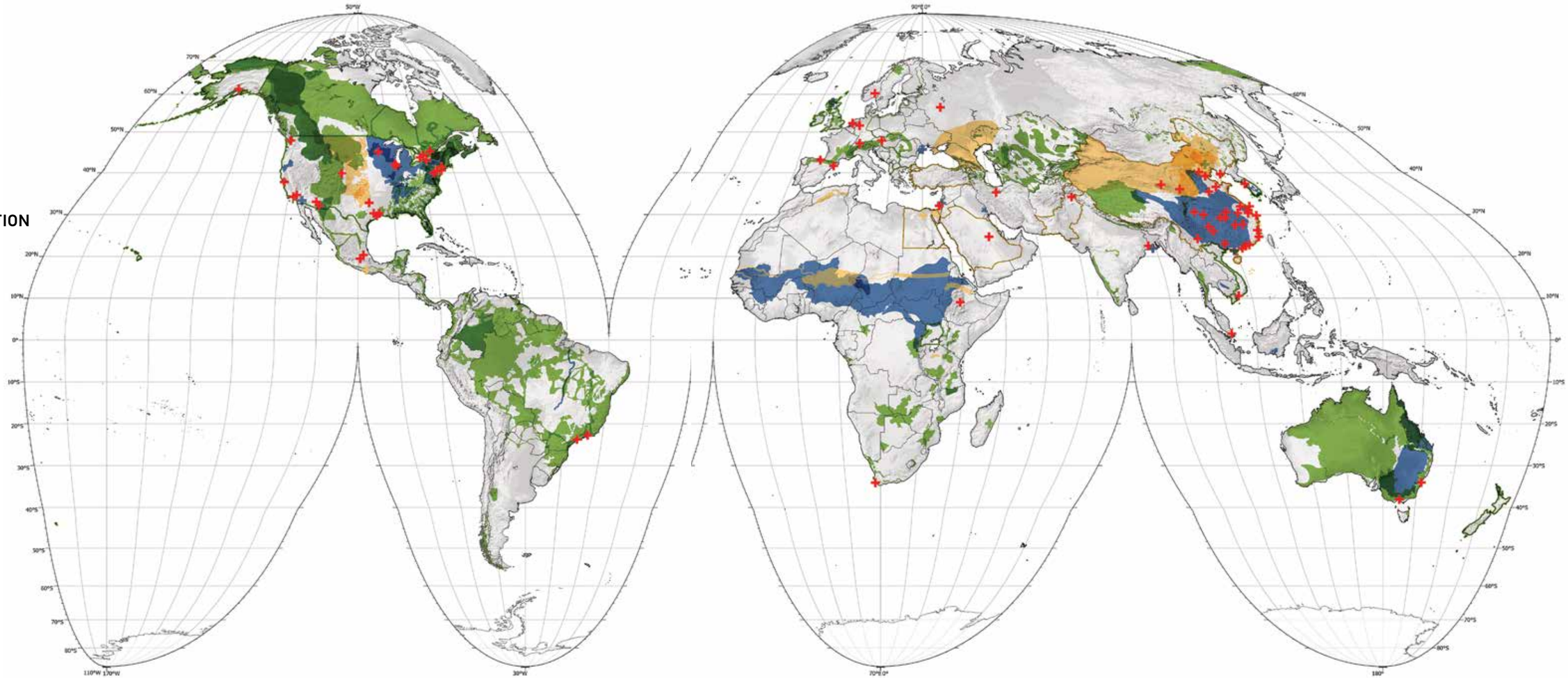
For nearly a century, a new breed of megaproject has gone unrecognized, and it is now proliferating. These projects, which we have named "mega-eco projects," are different from old-school megaprojects in important ways: They seek to address biodiversity loss, land degradation, and climate change while simultaneously improving the living conditions of the planet's now eight billion inhabitants. We have documented nearly 250 of these mega-eco projects currently under construction and believe there is a big opportunity for the profession of landscape architecture to participate in them and better fulfill its mandate to steward the land.

The term megaproject first appeared in academic literature in the 1970s to describe major postwar projects such as dams, power plants, airports, factories, tunnels, stadiums, highways, railroads, and large tracts of housing. The Danish economic geographer Bent Flyvbjerg defines megaprojects as "large-scale, complex ventures that typically cost a billion dollars or more, take many years to develop and build, involve multiple public and private stakeholders, are transformational, and impact millions of people." After analyzing hundreds of such projects, his research concluded that megaprojects typically share three key characteristics: They almost invariably run over budget and over schedule, and they often underperform in their intended functions. Moreover, megaprojects have developed a reputation for being designed and built according to standardized engineering specifications with little regard for local ecology or culture, often resulting in adverse environmental and social impacts that were either not foreseen or not disclosed at the time of their implementation.

Even though "mega" is a measurement of millions (not billions as per Flyvbjerg's definition), we have chosen to retain its use insofar as "mega" pertains to something very large. We are not, however, using Flyvbjerg's billion-dollar threshold to define mega-eco projects. Instead, we primarily

MEGA-ECO PROJECTS BY TYPE

- CONNECTIVITY
- ANTIDESERTIFICATION
- WATERSHED
- METROPOLITAN



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use spatial parameters to demarcate whether a project qualifies as a mega-eco project. Just as the "mega" prefix is used somewhat loosely, so too is the prefix "eco." The insertion of "eco" suggests that the mega-eco project seeks not only to perform mechanically, but also ecologically. This means the mega-eco project is, at the very least, environmentally benign or, at best, contributes positively to a range of ecological processes within which it is embedded. Most important, mega-eco projects aim to restore vital ecosystem functions.

The mega-eco project differs from the traditional megaproject in several significant ways. First, whereas the megaproject is typically singular in its function and designed exclusively for humans—a bridge, for example—the mega-eco project is multifunctional and designed for both humans and nonhumans. Second, whereas the megaproject is constructed of inert materials such as concrete and steel, mega-eco projects are composed mainly of organic materials; the landscape itself is the fundamental component of the mega-eco project. Third, whereas the megaproject is generally proffered as a direct solution to a single issue, the mega-eco project is couched in more experimental terms broaching especially difficult problems that defy single solutions. Finally, whereas the megaproject is delivered within a profit-based financial model, the mega-eco project often also requires alternative and ongoing not-for-profit funding with an open-ended timeline. In short, unlike megaprojects that are extractive, the mega-eco project strives to be restorative.

In these ways, mega-eco projects are similar to so-called nature-based solutions, only much larger. The main reason we insist on calling them mega-eco projects, however, is to avoid the righteous connotation that they are "natural" and that they can therefore automatically solve all our problems. By analyzing these projects in contrast to the megaproject, we underscore the fact that, while we are generally supportive of large-scale landscape projects, we are also approaching them critically. Only in this way can we separate greenwashing from genuinely positive ecological works.

Along the lines of Flyvbjerg's megaproject, we define mega-eco projects as complex, landscape-scale environmental restoration and construction endeavors that aim to promote biodiversity and help communities adapt to degraded ecosystems and climate change. When we applied this definition along with our established spatial, financial, and impact parameters, it resulted in the set of nearly 250 works, which we have mapped according to available project boundaries. Through our analysis of these mega-eco projects, we have found that these works are a global phenomenon that tends to fit into four categories: connectivity projects, antidesertification projects, watershed projects, and metropolitan projects.

MEGA-ECO PROJECT LEGEND

- NATIONAL BOUNDARIES
- STATE/PROVINCE BOUNDARIES
- ETHNIC/AUTONOMOUS BOUNDARIES
- ROADS
- RAILWAYS
- RIVERS
- PROJECT BOUNDARY
- PAST PROJECT BOUNDARY
- URBAN FOOTPRINT
- CROPLAND
- RANGELAND
- FOREST 2017
- DEFORESTATION
- LAKES

PROTECTED AREAS

- IUCN I-IV
- IUCN V-VI
- NOT ASSIGNED
- INDIGENOUS TERRITORY

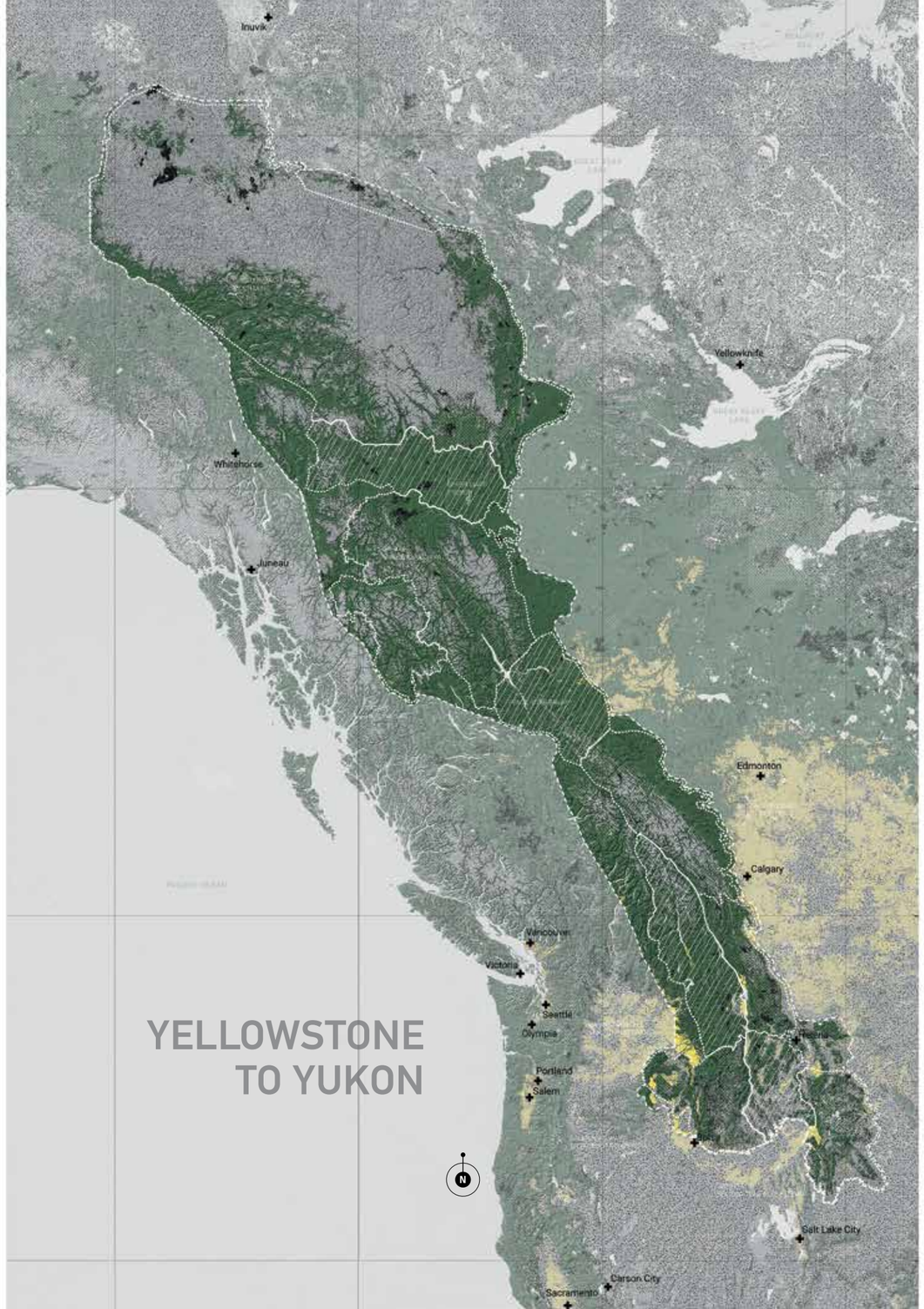
CONNECTIVITY PROJECTS

Connectivity projects are the most common form of mega-eco project. These projects aim to combine extant patches of habitat into large patches and contiguous landscape corridors so species can expand their ranges. Landscape ecologists consider connectivity essential to preventing mass extinction and allowing species migration to keep pace with the shifting temperature bandwidths of global warming.

Connectivity projects cross district, state, and even national boundaries and involve many different constituencies with different values. This, along with the fact that they also typically have small budgets run by nonprofits, makes them among the most complicated mega-eco projects to implement. Not only is land amalgamation difficult, but the exact design of the corridors themselves is also still very much a case of trial and error. Learning by doing can take a long time, and the monitored results are not always clear-cut.

Investments in connectivity projects relate to land acquisition, habitat restoration, and the design and construction of safe passage for fauna across hard infrastructure such as roads and railways. Many of the techniques used by this type of mega-eco project date back to 19th-century landscape architects such as Frederick Law Olmsted and Charles Eliot. Olmsted is recognized as laying the intellectual foundation for the U.S. National Park System, which serves as the mosaic of habitat patches for today's connectivity projects. In addition, Olmsted and Eliot first proposed links, corridors, and hubs for connecting green space in cities. Eliot also created the modern land trust, which is the standard mechanism for conserving private lands worldwide. The regional planner Benton MacKaye's Appalachian Trail (1921) is important because it successfully combines human recreational values with ecological values. Finally, a collection of landscape architects including Ian McHarg led to the widespread use of the layer-cake method and geographic information systems essential to the spatial planning of nearly every mega-eco project taking place today.

One of the best and most mature examples of a mega-eco connectivity project is the Yellowstone to Yukon (Y2Y) project, which stretches nearly 2,000 miles from Yellowstone National Park in the United States to the Yukon in Canada and covers some 502,000 square miles of territory. Founded in 1993, the Y2Y Conservation Initiative is a nonprofit agency that collaborates with local and Indigenous governments, landowners, other nonprofits, and corporations to create interconnected landscapes between extant protected areas. To date, the initiative and its many partners have spent millions of dollars on landscape conservation and restoration to aid species movement. Another prominent connectivity project is the Giant Panda National Park in Central China. This mega-eco project stretches over 10,425 square miles and has a price tag of $2 billion; it will connect 67 existing habitat preserves containing 80 percent of the wild panda population. Though this project does have serious conservation ambitions—at least for one species—it is also driven by tourist revenue, and when it is completed later this year, more than 170,000 people will have been displaced from their homes to make way for the park.



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THESE PROJECTS HAVE BEEN BASED ON A PERCEPTION OF ARID AND SEMIARID ENVIRONMENTS AS WASTED LAND.

THE GREAT GREEN WALL INITIATIVE

KELVIN YU AND PRIYANJALI SINHA

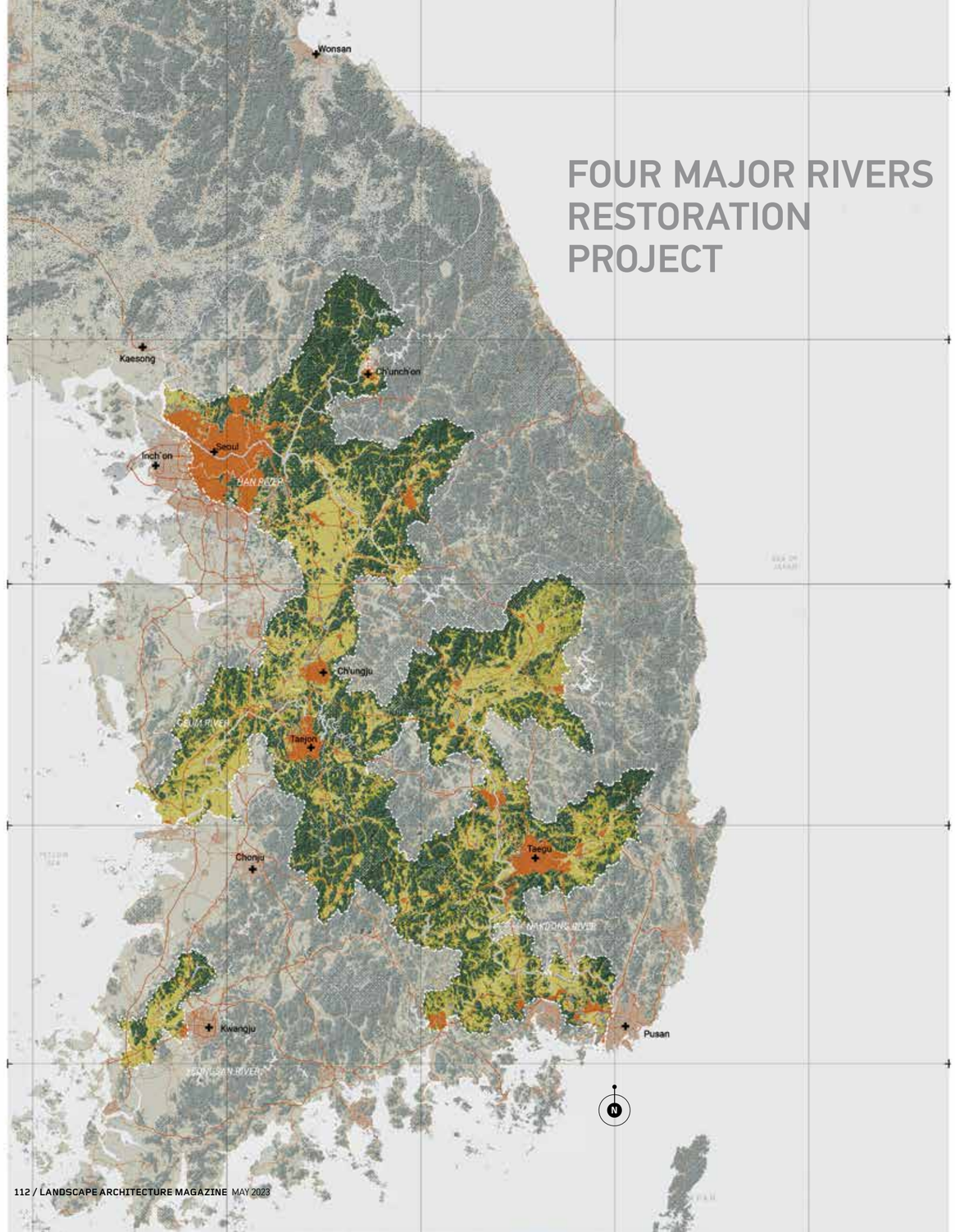
ANTIDESERTIFICATION PROJECTS

Of all four mega-eco project types, antidesertification projects are perhaps the most established and best known. These projects have typically been top-down and based on a perception of arid and semiarid environments as wasted land and couched in terms of nation building. As such, investment in antidesertification often eclipses the billion-dollar threshold. With mixed results, antidesertification projects often start with ambitious tree planting plans to combat soil erosion and land degradation.

In the United States, a mega-eco antidesertification project arose in response to the Dust Bowl in 1934. This project created more than 200,000 miles of windbreaks from North Dakota to the Texas Panhandle, and despite successfully combating the immediate erosion crisis, it introduced invasive species and strengthened colonial claims over Native American lands. Similarly, in the 1940s, the Soviet Union planted thousands of hectares of trees throughout the Russian South's sparsely settled and arid lands. This initiative would reach epic proportions in the late 1950s through Joseph Stalin's so-called Great Plan for the Transformation of Nature. Though only partially implemented because of his death, Stalin's antidesertification project dammed and redirected waterways to irrigate 13.8 million acres of trees in eight enormous shelterbelts and agricultural areas, leading to the drastic decline of the Aral Sea. Following Russian precedent, China took a similar approach with mega-eco antidesertification projects throughout its arid and semiarid lands beginning in the 1950s. Its most well-known project continues to this day as the 2,500-mile Three North Shelter Forest Program and has an estimated deadline of 2050. Again, results have been mixed; issues with pest outbreaks because of extensive monocropping of an alien species coupled with drastic aquifer decline have plagued the project.

Another prominent contemporary mega-eco antidesertification project is the Great Green Wall initiative (GGW) across sub-Saharan Africa. Founded in 2007, the GGW received $14.3 billion of additional funding through the World Bank and France in 2021. This project exemplifies many of the growing pains, setbacks, and unintended consequences of this type of mega-eco project. The vision of a barrier of trees at the edge of the desert derives from an antiquated understanding of the process of desertification, where the desert grows from a front line rather than the entire adjacent biome, which is at risk of becoming nonarable due to a combination of human activity and climate change. Consequently, in its first few years, millions of trees in the GGW died. Such top-down interventions have also ignored local land practices, creating tension between farmers and pastoralists. After a decade of misguided work, there is, however, hope that the project is moving toward greater citizen participation and a more nuanced understanding of restoring local ecological integrity.

Despite their uneven history, as climate change intensifies and the need for arable land expands, antidesertification projects are multiplying. Pakistan is implementing a Ten Billion Tree Tsunami program after the completion of its first Billion Tree Tsunami in 2017. Saudi Arabia is pouring money into its Saudi Green Initiative and a regional plan called the Middle East Green Initiative. And Algeria is rebuilding its Green Dam mega-eco project from the 1970s.



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WHEN THE CRISIS OF CLIMATE CHANGE SEEMS OVERWHELMING, IT IS TEMPTING TO HAIL THE MEGA-ECO PROJECT AS A FORM OF ENVIRONMENTAL SALVATION.

WATERSHED PROJECTS

Watershed projects are an emerging type of mega-eco project characterized by their mission to restore water quality and flow as well as the productivity of freshwater and estuarine environments. These projects can take numerous forms; some involve a single intervention, such as removing a dam, and others require multiple interventions that include restoring a riparian buffer, re-creating damaged wetlands, and softening hard infrastructure throughout a catchment. These works seek to replace rigid megaprojects with natural and nature-based features that are more resilient to the new climate regime of severe flooding and drought while also facilitating other ecological benefits.

A prominent and early example of modifying an entire watershed arose during the New Deal under the Tennessee Valley Authority (TVA). Because the TVA was conceptualized and created as a large-scale economic development initiative and an environmental restoration project, it is possible to understand it as a mega-eco project and not just a collection of megaprojects (dams). While successfully providing potable water and electricity, the TVA must, however, be seen as a failed mega-eco project because the constructed dams drastically altered ecosystems and caused biodiversity loss. Despite this, the TVA also protected and reforested vast areas of land that had incurred logging in the decades prior to its creation. MacKaye was an important influence in the early stages of the TVA, pushing grand ambitions for conservation and social wellness in the program, but he was ultimately pushed out or ignored by engineers and bureaucrats in favor of a more streamlined megaproject approach.

Nearly every major river in the world has one or more large dams blocking movement. Because many of these barriers are approaching their expiration date, a movement to remove dams is occurring throughout many industrialized countries. For example, the Elwha River Restoration Project in Washington is the first mega-eco project to remove two large dams, at a cost of around $350 million. In addition to removing old megaprojects, the Elwha River Restoration Project is embracing natural processes to restore its catchment and fish stock.

Dams are not the only hard infrastructure being retrofitted or removed; dikes, canals, seawalls, and levees are all now subject to reevaluation. In the Netherlands, the Room for the River Programme is a $2.5 billion mega-eco project developed in response to the deadly floods of the 1990s. In this program, more than 30 projects removed hard infrastructure and restored the floodplains of four Dutch rivers in the Rhine delta. Another example is the Four Major Rivers Restoration Project (FMRRP) in South Korea, completed in 2011 for $18 billion. This project has its fair share of advocates and critics, arguing respectively that the project has created positive or negative environmental and social consequences; there are also widespread accusations of corruption. Like the TVA, the FMRRP also constructed dams, but it was delivered under the pretext of being a forward-thinking green megaproject as part of the country's Green New Deal launched in 2009.

METROPOLITAN PROJECTS

The last type of mega-eco project occurs around and inside major cities. These projects focus on alleviating environmental degradation associated with urbanization and its related infrastructure. Though they often have the smallest footprint of any mega-eco project, these mega-eco projects are some of the most expensive due to their land value and construction costs. Common mega-eco projects in this typology look to curb the growth of sprawl with greenbelts, restore polluted urban rivers and their floodplains, and provide safety from sea-level rise and natural disasters through green infrastructure and nature-based solutions. While their individual components can be small—for example, waterfronts, vacant lots, or streetscapes—these projects become "mega" by virtue of their multiplication across large urban areas.

The recent history of this type of mega-eco project begins with 19th-century parks and greenbelts built to alleviate the impacts of industry and population growth. While successful in providing residents with urban amenities, these works have typically been unsuccessful in their mission to negate urban sprawl. That said, many cities do have, or are attempting to implement, landscape structure plans that mitigate sprawl, ensure some measure of landscape connectivity, and secure watershed protection along with other ecosystem services at a metropolitan scale. An example of a grassroots attempt to end reckless development and protect a megacity's surrounding environment is the massive (roughly two million acres) São Paulo Green Belt Biosphere Reserve, which first began as a protest in the mid-1980s and is now supported by the government.

River restoration projects in cities and metropolitan regions can take many forms. The cities of Oslo and Zurich are leaders in this regard as they progress with daylighting their rivers and streams to provide flood zones and green space for residents. Another leader is Philadelphia, where the city is pursuing a $2.5 billion plan to use green infrastructure to combat the contamination of its rivers by combined sewer overflows. Instigated by the landscape architect Anne Whiston Spirn, FASLA, in the 1980s, this project has since come under scrutiny as to whether it is delivering on all its promises. In China, the Sponge City concept by the landscape architect Kongjian Yu, FASLA, has a budget of $57 billion for implementation in 30 cities; the plan is to expand floodplains and store water for reuse. Should these pilot projects work, funding could reach $1.5 trillion when expanded across the country.

In a cultural moment when the environmental crisis of climate change seems overwhelming, it is tempting to hail the mega-eco project as a form of environmental salvation. And yes, within the mega-eco project, there are real signs that humans can work together to design environments that work with natural forces for the greater good, that we can be a constructive and caring part of nature. But it is also crucial to approach these emerging and rapidly proliferating projects with a degree of circumspection and criticality, to analyze their motives dispassionately, and, more important, to monitor their impacts. Only in this way will we avoid replicating the failings of megaprojects and historical mega-eco projects. History shows that landscape architects and regional planners have played leading roles in relation to mega-eco projects. It's high time we reclaim that role. ●

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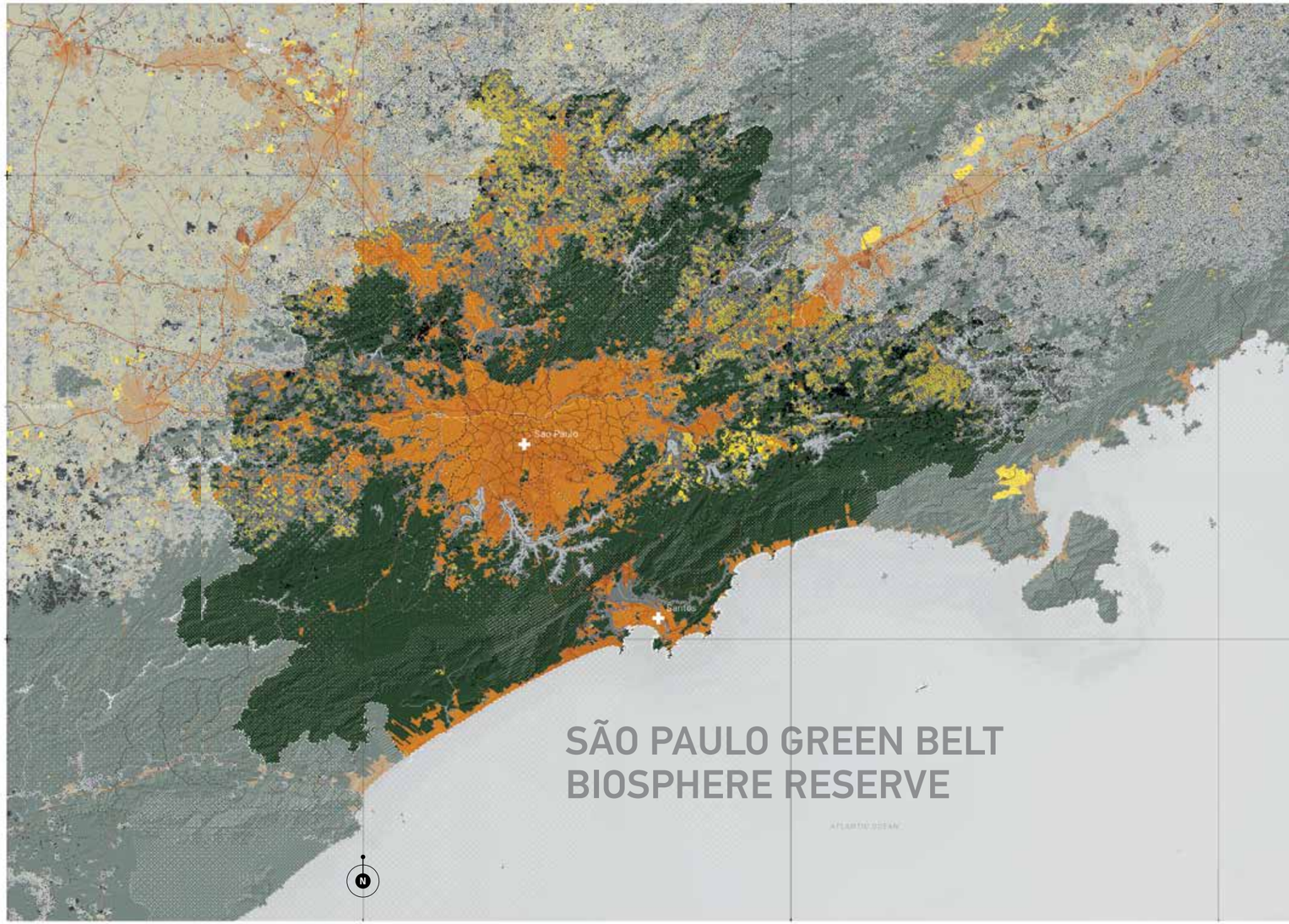

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