Making Peace *With* Mother Nature

Friendlier approaches to waterfronts and coastlines. *By* Chris Tramutola

A great blue heron and a lone duck at sunset at San Francisco's Heron's Head Park, where more than 100 bird species can be found.

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CITIES

LOVE THEIR WATERFRONTS AND COASTS. THAT'S OBVIOUS. WHAT'S A LITTLE less obvious is the lesson we've collectively learned regarding their large-scale urban development over the past 150 years: Working against nature is a difficult and possibly endless task. This lesson was learned the hard way, and the ramifications of our mistakes are still being dealt with today. ¶With only a few exceptions, coastlines in their natural state contain a buffer landscape, typically a wetland, estuary, or series of dunes. The varying topography, spongy loose soils, extraordinary ability to transfigure or adapt, and incredibly productive vegetation of wetlands and dunes make for an effective natural buffer for inland developments and landscapes. Any coast that lacks a natural ecotone, or transitional, landscape such as these is most likely the result of human development.

Here is the question we face: How can planners and landscape architects align our communities' needs and goals more closely with the roles of natural ecologies?

A natural landscape that is occasionally inundated is generally referred to as a wetland, but a built urban landscape that occasionally floods is called a problem. These situations are not the fault of Mother Nature or her seemingly chaotic tendencies, but the result of our planning, design, and implementation. Our biggest challenges arise, not surprisingly, where we have developed the most intensely: dense urban areas with long stretches of coastline.

New York City's once robust natural landscape, consisting of roughly 86 to 100 square miles of wetlands, has shrunk to less than 15 percent of its original area. Aside from their aesthetic value, these sensitive landscapes perform vital natural functions, such as buffering the land from the ocean—something that New York City as well as New Orleans and other Gulf Coast cities have learned the hard way.

Even the urban parks that we call natural are often strictly controlled environments, like machines painted green. Man-made open spaces do have their place, of course; the problem arises when we rely on them to the exclusion of natural services.

In the West

We now find ourselves in a precarious yet hopeful situation. We have the technology and information to learn from our errors and are excited to move forward, but in the meantime we've also destroyed landscapes that provided vital natural functions. Adjacent to our waterways are small oceans of concrete, asphalt, mowed lawns, and polluted soils—all inhabiting the space of former wetlands and productive ecologies.

The challenge in protecting the remaining of these landscapes often comes with the lack of quantification of their services. Promising advancements have been made, though. San Francisco, an environmental leader, is taking steps to restore its natural waterfronts. Starting in 2000, the city began assessing and enhancing many wetland waterfronts and continues to set an example for dense urban areas.

San Francisco's key waterfront developments concentrate on wetland and shoreline restoration. With more than 90 percent of its original wetlands destroyed, the city issued a Waterfront Land Use Plan in 1997. This effort was enacted to restore some of these sensitive and important landscapes. The city has recently implemented three influential waterfront projects that align with the plan's goals.

In 2001, Crissy Field in the Presidio of Golden Gate National Park showed how a riparian ecological design can thrive even with heavy pedestrian traffic in close proximity. The second and third projects, completed in 2006 and 2010 respectively, are the Pier 94 Wetlands restoration and the nearby EcoCenter at Heron's Head Park.

PHOTOS COURTESY PORT OF SAN FRANCISCO

The Pier 94 restoration was less concerned with pedestrian access than with enhancing the space as ecologically as possible. More than 60,000 square feet of new wetlands were constructed, and the project includes a long-term plan to study the changing landscape, providing invaluable data for future projects. Just next door, the Heron's Head EcoCenter combines the goals outlined by ecologists, landscape architects, and urban planners with hands-on education for visitors. Both projects will provide easily understood quantitative data to professionals and the general public, a resource we have missed for far too long.

In accordance with its Waterfront Land Use Plan, San Francisco's next notable project is the Pier 70 development—a 69-acre historic industrial waterfront, where coastal buffer landscapes will line the water's edge and community spaces will inhabit the inlands.

In the East

On the opposite coast, New York City also has recognized the importance of its waterfront ecology. In March 2011, before both Hurricane Irene and the much more devastating Superstorm Sandy, New York City released its Comprehensive Waterfront Plan, entitled Vision 2020 (it received APA's Daniel Burnham Award for a Comprehensive Plan in 2012). It attempts to build on the San Francisco examples by providing a 10-year plan for the city's 520 miles of shoreline.

The plan outlines areas of waterfront to restore; targets key environmental areas; and proposes innovative technologies to prevent continued erosion, flooding, stormwater surge, and nonpoint source pollution. This was long overdue: Congress declared the Hudson-Raritan Area (New York City's surrounding waterways) an Estuary of National Importance in 1988.

Only months after Vision 2020 was issued, New York City was hit by Irene, its first hurricane in decades, and although damage far less drastic than expected, the following year Sandy more than made up for Irene's light punches. These environmental catastrophes made the goals of the plan even more compelling. As a result, both professionals and the public took a more proactive look at our coastal situation.

Vision 2020 compiles a complete analytical survey of New York's vast shoreline and makes three distinctions among coastal landscapes. The analysis categorized the waterfront conditions as: special natural waterfront areas, significant coastal fish and wildlife habitats, and coastal erosion hazard areas. Each condition depends on a number of factors, including toxicity, biodiversity, proximity to infrastructure, and natural service potential.

In some cases these areas overlap. New York's extensive coastlines have been so heavily developed that Vision 2020 was needed to address, and attempt to reverse, the ongoing impact.

Just months after the release of the comprehensive plan, Harlem River Park in uptown Manhattan was unveiled; it displays many of the plan's initiatives in action. Although it was planned and designed before Vision 2020 was issued, the park uses ecological technologies such as "soft" seawalls (a semiporous land-water interface that allows for fish and wildlife habitats as well as wetland plant productivity) and stepped bulkheads, which create a pseudo-wetland landscape that helps clean water, promote growth, and prevent flooding.

Another key example of waterfront reclamation and soft edge design is Hunts Point Landing in the Bronx, completed in 2012. Designed by Mathews Nielsen Landscape Architects, this project brought a natural edge to the South Bronx coastline while still allowing pedestrian access to the waterfront via kayak launch and fishing piers. By designing a soft edge with tidal pools and biofiltration for stormwater, this project uses the landscape not only as an aesthetic feature but as a functional one as well. These and other innovative waterfront designs and details are ecologically enhancing New York City's coastline.

The ongoing challenge of balancing ecological goals and economic or development concerns is still a considerable challenge. But with smarter design, applying technology to ecological systems, and viewing the landscape as a tool, the situation can only improve.

On the edge

Still farther east, some interesting techniques have been implemented at the beachfronts of Long Island. Unlike the landscapes already discussed, which were formed by geological movements, Long Island is a young landform of sand and erratics created by the last terminal moraine only 21,000 years ago.

In the context of waterfront development, the lack of bedrock means tidal forces and erosion could permanently alter or completely wash away patches of coastline. The town of Southampton saw this happen during the Great Hurricane of 1938, when tidal forces broke through the barrier island, creating the Shinnecock Inlet. Despite the sensitive nature of the South Fork of Long Island—and its vulnerability—development has continued lining the waterfronts.

Heavy waterfront development means that dune landscapes on the south shore and wetland bays on the north shore are constantly threatened. This, coupled with the high water table and persistent flooding, means that development must be carefully planned and selectively approved. The extremely strict design process for development in these areas has helped protect the dune buffer landscapes protecting the inlands from the Atlantic Ocean. Some new ideas have also been used to prevent flooding and ecological destruction as well.

In high-risk areas, automated pumps have been placed in dry wells to rapidly pump out intruding floodwaters. Creative manipulation of topography is also used to preserve valuable structures while essentially sacrificing the roads and landscape to flooding. The native coastal landscapes are acclimated to consistently inundated conditions and are minimally affected.

Directly on the beachfront, access walkways to the water are now built on pilings, raising them above the dunes to prevent disturbing the native dune grasses. Long Island shoreline development certainly will continue, but with new ideas in design, and the preservation and enhancement of the ecotones (south shore dunes and bay wetlands), communities can count on the preservation of their landscape.

Rethinking some assumptions

Ecologically friendly techniques are emerging and evolving, thanks to increased data and a greater understanding of the natural systems at work along our coastlines. Coastal geology and ocean mapping are two endeavors where science and planning intersect. So, too, is the study of ecological functions or natural services.

Volunteers from the Golden Gate Audubon Society at Pier 94 in 2013. Some 60,000 square feet of wetlands were constructed there in 2006.

The constructed soft edge of Hunts Point Landing buffers development in the South Bronx from the East River while still allowing public access.

BOTTOM PHOTO COURTESY MNLA; TOP PHOTO BY LEE KARNEY

Natural services encompass all of the processes and capabilities of primary productive species—that is, various plants—as well as the insects, animals, and birds that promote their sustenance. These services also include categories such as biodiversity, food production, filtration of pollutants and toxins, adaptability to adverse conditions, and carbon sequestration.

A complete ecological model uses these categories to determine which beneficial actions its primary producers perform. Many of them are somewhat obvious, while others are not; the latter include buffer landscapes, use of natural energy, establishment of ecotones, and so on, but all of them play a vital role in the health of the local ecology.

In total, there are 20 distinct services that can be evaluated and measured. Experts who measure these services on existing sites find that coastal and inundated landscapes are far more productive per square foot than almost any other similar natural ecology.

These wetlands are often called "sensitive landscapes," which is appropriate when they are being compared to human development, but when the conversation is about the environmental impacts of storms, droughts, tidal surges, and erosion, wetlands and dunes are extremely resilient, adaptable, and valuable.

Depending on the location, activity of the water body next to it, and other external stresses applied to it, the buffer type will vary. With greater tidal activity, native grass sand dunes provide protection from wind and wave erosion; in areas of less turbidity, freshwater or brackish water wetlands help prevent flooding and droughts. For urban areas, wetlands are even more valuable because they slow down surge waters in flooding situations, as well as stormwater on its way to a river, lake, aquifer, or ocean.

This has the potential to prevent flooding downstream. A prime example exists along the Mississippi River, where adjacent wetlands at one time could contain up to 60 days of floodwater. Now having mostly been drained and filled in, the remaining wetlands can only hold 12 days' worth.

The impact of that development was clear when the Mississippi floods of April and May 2011 caused the mandatory evacuation of more than 25,000 houses. For the first time in almost four decades a relief spillway was opened, deliberately flooding 4,600 square miles in order to prevent catastrophic flooding in New Orleans and Baton Rouge.

The floods resulted in 20 deaths and about $4 billion in damage. This terrible event showed that the environmental services of certain landscapes (as dismal as they sometimes appear) are considerable and quantifiable. Advancing toward a design tool based on clear scientific data that show the true roles of different ecological landscapes and their resiliency should be one of the main goals of our profession.

It is hard to think of a large urban area without some type of coastline. We now have the technology and knowledge to protect these important landscapes as we grow, and it is our responsibility to reclaim, revitalize, and reconstruct the natural services that have been destroyed. ■

Chris Tramutola is a licensed landscape architect specializing in academic and recreational landscapes. His interest in the history and evolution of landscapes has led to an exploration of the future of analysis and design.

ON A RELATED TOPIC

The Dutch Deliver

Given the geography of their low-lying country, the Dutch have no choice but to think creatively: Roughly one-third of the Netherlands lies below sea level, and two-thirds is vulnerable to flooding from the North Sea and major rivers. Most of the population lives in flood-prone areas.

This May, participants in APA's Professional Study Tour to the Netherlands explored the innovative approaches to water management for which the Dutch are famous. When asked which practices are most notable, the Dutch pointed to their overall approach: hard, soft, and hybrid infrastructure projects working in concert to protect the land, people, and economy.

A renowned example of hard infrastructure is the Delta Works, the world's largest flood protection scheme, which took $7 billion to build and almost 50 years to complete. It was completed in 1997, although the official opening did not occur until 2010. Comprised of storm-surge barriers, dams, levies, and dikes, the Delta Works protects southwest Netherlands from the North Sea. The storm surge barriers are especially impressive. Among them is the Eastern Scheldt Barrier, made up of 65 separate concrete-form piers, each weighing over 18,000 tons. When closed, the pieces fit together to create giant protective gates.

A softer solution can be found in Amsterdam, whose Watergraafsmeer neighborhood is more than five meters below sea level and extremely prone to flooding. To address the challenges, an interdisciplinary group of stakeholders has embarked on projects that rely on water to enhance the quality of life rather than detract from it. Public art, floating gardens, greenhouses, and innovative rainwater sewerage maintenance are examples of small-scale techniques that help keep the community green but relatively dry.

Finally, there are hybrid techniques. The newly renovated Scheveningen Boulevard includes a multimodal coastal boardwalk, populated with public art and cafes. This once weak link in the Dutch coastline left some communities, including the country's third largest city, The Hague, susceptible to flooding. Now the boulevard has been reengineered with a widened beach and a curved underground seawall dike that was integrated into reinforced sand dunes. The result is not only a more secure coastline but a beautiful public space.

Jennifer Graeff
Graeff is the international program manager for the American Planning Association.

The Designed Coast

Kim Mathews is a landscape architect and a founding principal of Mathews Nielsen Landscape Architects, a firm that has planned over 37 miles and designed over 11 miles of waterfront in New York State, most of it in New York City. One example is the Hunts Point waterfront project mentioned in this article. What follows is an edited interview conducted by *Chris Tramutola*.

CHRIS TRAMUTOLA: Urban waterfront parks often make human access the top priority, leaving ecological concerns a distant second. As we learn more about the functions and services of landscapes at the edge, do you think this attitude should change?

KIM MATHEWS: This is often an interesting discussion during a project as the drivers are typically the economic realities of development and the cost of infrastructure. Access to the waterfront is extremely important but must be placed in context with ecological needs that have been undervalued.

The inland depth of a project is a significant factor when discussing this issue, as soft edge waterfronts typically eat into the land side, not out into the water. The client needs to be willing to repurpose property for this important cause.

Our firm's master plan for Shoelace Park on the Bronx River involved moving infrastructure out of the floodplain and restoring its natural functions. This move will help lower risk for valuable structures as well as increasing natural waterfront processes, setting an example of how economic and ecological goals can align.

CT: New York City's Vision 2020 debuted two years ago. How has it affected the planning process?

KM: The plan has made the priorities that we just spoke about more visible, and more importantly, addresses larger scale community issues.

It is hard to judge how well it will be received in the long term, as the economic realities of waterfront development still outweigh ecological initiatives to most developers.

CT: How has the planning and design profession changed after Sandy?

KM: After such an extreme event, the most efficient path is often found if you take a step back. Planning for long-term actions is important for our profession, especially when considering large public projects and public processes. The design community is excited about the publication in June of New York's Special Initiative for Rebuilding and Resiliency (SIRR). This plan takes a proactive look at areas affected by Sandy as well as our overall infrastructure. City and state agencies can be a great force for improving our waterfront; Sandy made it clear how important their coordination is. The [New York City] Parks Department has made soft edges and natural waterfronts a clear goal moving forward, and their plans push for a reformed waterfront design process.

Acting preemptively, it is important to bring more science into our profession and work with quantitative data. Without clear scientific information, our goals of preservation and reconstruction of these landscapes will fall short of implementation.

CT: New York City retains only 15 percent of its original wetlands. Is their restoration or replacement feasible?

KM: Yes, not only is it feasible, but it must be a top priority for New York to restore its waterfront ecologies. Numerous projects including Hunts Point Landing and our master plan for Flushing Creek properties show that it is possible, and that there is public interest to do so.

CT: What's next for planners and landscape architects in how we approach waterfront design?

KM: When moving forward, it is important to see where we came from. The last big step in ecological design came in 1969 with Ian McHarg's *Design With Nature* philosophy.

These strategies have gradually gained steam over the decades, but [we] need more quantitative information moving forward. With our current technologies for gathering data, we should be able to incorporate more scientific information [to use with] design tools [and] to educate our clients.

In [professional] education, we need to stress better data mapping and analysis techniques. Learning how to read a landscape is a skill that needs to be instilled in students early. It is our job to create a smarter generation of planners and landscape architects that can continue to advance the profession.

RESOURCES

SAN FRANCISCO	Pier 94 Wetlands restoration: www.sf-port.org/index.aspx?page=220; Heron's Head Park: www.sf-port.org/index.aspx?page=210; Crissy Field: www.parksconservancy.org/visit/park-sites/crissy-field.html.
NEW YORK CITY	Vision 2020 Plan: www.nyc.gov/html/dcp/html/cwp/index.shtml; Harlem River Park: www.harlemriverpark.com/edge_news.pdf; Hunts Point Landing: www.mnlandscape.com/project_page.php?cat_id=4&pr_id=128.; NYC SIRR: www.nyc.gov/html/sirr/html/home/home.shtml.