

Concluding Thoughts

Biophilia suggests that there is an evolutionary and biological need for contact with nature, even when we have become very clever at believing we can live without it. Nature in our lives is not optional but essential. We need it for our emotional health and well-being, and we need it for planetary health as well. It is not a thing or a place that we periodically visit but a surrounding condition, an ideally ubiquitous context that delights, relaxes, soothes, replenishes, inspires, and uplifts us in our daily urban lives. It is all around us, and we live in it. Luckily, investments in green and nature-ful cities are good investments on many levels, and there are few more effective ways in which cities can be improved and the quality of lives of residents profoundly enhanced, while ecological footprints are reduced. Too often the green urban agenda forgets the “green,” concentrating on energy efficiency and resource management (worthy and important subjects), for instance, to the neglect of the life-enhancing and wonder-expanding dimensions of nature itself.

Two

The Nature of (in) Cities

Several years ago an advertisement appeared in the real estate section of the *Washington Post*¹ promoting a new development: “The *NICE THING* about the city is that it eventually *ENDS*” (emphasis in original). The image juxtaposed sidewalks, a fire hydrant, and other essentially gray surfaces in the foreground (bad) with the bucolic images of forest and farm field in the distance (good). The implications were clear—if you want any meaningful exposure to nature, quickly exit the city. Unfortunately, this reflects the popular attitude toward cities and nature.

There are elements of truth to the sentiments expressed in this advertisement—there are in fact, too many bleak gray neighborhoods, too many cars, too much pavement—but the message is wrong in some profoundly significant ways. Cities are inherently complex ecosystems, nature is all around us in cities, and the extent of urban biodiversity is often quite considerable. The nature in cities is large and small, visible and hidden, intricate yet sweeping. It is amazing in its biological functioning, ever-present yet highly dynamic, and vastly underappreciated for its ubiquity in cities.

A biophilic city is a green city, a city with abundant nature and natural systems that are visible and accessible to urbanites. It is certainly about physical conditions and urban design—parks, green features, urban wildlife, walkable environments—but it is also about the spirit of a place, its emotional commitment and concern about nature and other forms of life, its interest in and curiosity about nature, which can be expressed in the budget priorities of a local government as well as in the lifestyles and life patterns of its citizens. In the next chapter, I discuss in more depth what a biophilic city entails.

There are many good reasons to learn more about and protect even the microscopic life around us, a biological storehouse of immense human value, of course, and wise sages from Aldo Leopold to Rachel Carson advise against the hubris of imperiling (or ignoring) even the most minute life-forms. Eric Chivian and Aaron Bernstein, of the Harvard Medical School, make a convincing argument in their important book *Sustaining Life* that

conservation of biodiversity is highly connected to human health.² Loss of biodiversity, they rightly argue, is about losing a host of actual or potential benefits and services—from ecological services, to food production, to the production of new medicines, biodiversity is essential, not optional, to our lives and our health and to our continuing to flourish as a species.

In understanding the nature of cities it is necessary to think beyond our usual approach to visualizing or imagining space and place, and to understand that we can see nature everywhere in cities: it is above us, flying or floating by, it is below our feet in cracks in the pavement, or in the diverse microorganic life of soil and leaf litter. Nature reaches our senses, well beyond sight, in the sounds, smells, textures, and feelings of wind and sun. Understanding the natural history of a city helps us to see cities as ever-changing, ever-evolving palettes of life.

The Nature Above

Many things in cities take to the skies, and we should begin to understand the airspace above buildings, roads, and parks as life routes used by birds and bats and insects that spend at least some of their life in the air. It would be an interesting visual exercise to chart the paths and pathways of birds in a block or square kilometer of space over the course of day (it might look denser than the historic maps of hurricane tracks in a coastal state like Florida) and would give a visceral sense of the presence of these creatures (underappreciated, I think) in daily urban life. Seeing (and hearing) birds offers urban residents a series of daily delights, pleasant momentary mental escapes into another world, experienced on the way to the subway or on one's balcony on a Saturday morning.

Cities harbor an impressive diversity of birds, both residents and migrants, though many species are in decline in urban areas. In Chicago, 5–7 million birds, some 250 species, pass through the city during peak migration times in fall and spring. The city sits smack-dab in the middle of the Mississippi Flyway, an amazing aerial superhighway that connects the Northern and Southern hemispheres. There are so many birds passing through that concerns about collisions with high-rise buildings have prompted the city to initiate a “lights out” campaign, aimed at turning off or dimming these disorienting lights. Studies by the Chicago Field Museum show that the program is effective in significantly reducing the mortality of migrating birds,³ and although participation in the program is voluntary, companies and building owners are clearly motivated to care for the birds. And of

course, there are other benefits, including reducing energy consumption and greenhouse gas emissions and, not least, saving money.

Toronto's lights-out program has an extensive advertising campaign with the tagline “Kill the lights, save the birds,” which appears on subway and bus stops and even recycling bins. Toronto released a set of bird-friendly development guidelines in 2007 also voluntary, that recommend a number of ways in which new buildings in the city can be designed to reduce collisions, including using glass with “visual markers and muting reflections”; using awnings, sunshades, and downward-angled glass to reduce reflections; minimizing unnecessary exterior decorative lighting; and designing buildings so that task lighting can be used during the evening.⁴

Perhaps most unusual, the City of Toronto has funded the development of a “bird-friendly rating system” for new buildings. As in other green-building rating systems, a building can accumulate a series of points for bird-friendly design elements, allowing it to qualify for one of three certification levels: Minimum, Preferred, and Excellent.⁵ Once certified, builders and developers who meet the standards receive recognition from the city and are able to market their buildings as “bird-friendly.” In Toronto, an NGO called FLAP (Fatal Light Awareness Program) has spearheaded these efforts to raise awareness of the need for more bird-friendly buildings. In 2007 FLAP organized an eye-catching exhibit of the more than 2,500 birds that were killed by flying into buildings and then collected by the group. It was a visible demonstration of both the diversity and the numbers of birds passing through the city and the urban perils faced along the way.⁶

Urban birding is a cherished hobby of many urbanites, a pursuit that takes people outside and places them in contact with the life around them. New York City's Central Park, for instance, is a perhaps unexpected epicenter for birding. There are an estimated 270 species of birds in Central Park, none more famous than the red-tailed hawks. Pale Male, a resident male red-tailed hawk who was made a celebrity through books and a PBS documentary, is avidly watched by residents and visitors alike. On a frigid March day, we found a group of Japanese tourists, mixed with strolling New Yorkers, lined up to get a glimpse through a telescope of Pale Male and his current mate, nesting on the ledge of a rather expensive apartment building along Park Avenue. Hawks and peregrine falcons can be found in many other places around the city and not necessarily in traditional parks. For instance, we found a pair of red-tailed hawks nesting high up in the Unisphere, the distinctive metal globe built for the 1964–65 World's Fair, in Flushing Meadows, Queens.



Figure 2.1 Peregrine falcon, the world's fastest animal.

Peregrine falcons have also returned to New York City, or more accurately have been reintroduced. The first pairs were introduced in the early 1980s, part of a larger effort to recover this species, and today there are more than thirty nesting pairs in the city. The dense city is in many ways quite suited to peregrine falcons. They have abundant food in the form of both resident birds and migrating ones, and the high-rise Manhattan buildings are not unlike the peregrine cliff habitat that provides a very good vantage for hunting. If you are lucky, you might witness a truly remarkable and wild act in a city: "The falcon will dive down onto its prey at speeds ranging from 99 to 273 miles per hour. . . . A City bridge or skyscraper provides a great deal of open air space and a unique perch for hunting."⁷ Peregrine falcons are the fastest birds on Earth, indeed the fastest animals, and it is remarkable that they can be found in cities. It is not commonly realized that such speed may be seen on one's walk to the market or subway, and one need not travel to the African savanna to watch running cheetahs.

For several years downtown office workers in Richmond, Virginia, have been captivated by the aerial antics and parenting escapades of nesting peregrine falcons. One worker with a window view says, "I see them every day. . . . It's great to have such wonderful entertainment while I'm

working!"⁸ A falcon recovery effort is being spearheaded by the Center for Conservation Biology at the College of William and Mary. One unique aspect is the use of video webcams at each of the nesting sites, including the downtown site, so anyone can log on to see the peregrines. Many residents of Richmond who don't have the same visual access as the worker quoted above are avidly following the birds through the Internet (www.dgif.virginia.gov/falconcam2008/). And these efforts help to expand the base of political and popular support for such conservation efforts. Conservation is not to be viewed as simply something that trained scientists and professional resource managers do in faraway places. Rather, it has very local relevance and, through these efforts, clear connections to where people live and work.

Cities compete quite impressively with many supposed more natural settings in nonurban areas when it comes to birds and bird counts. Several years ago San Francisco came in second in the America's Birdiest City Competition, a contest to see how many different species could be counted in a single weekend. The city lost to the decidedly nonurban Dauphin Island, Alabama, but not by much, and it racked up an impressive 178 bird species.⁹ San Francisco boasts a remarkable diversity of natural habitats and is home to nearly 400 bird species at some point during the year, a result in part of its critical position along the Pacific Flyway. About half the bird species in North America can be seen within the borders of this highly developed city.

The higher reaches of our cities—the rooftops and façades—also harbor nature, sometimes by design and sometimes by accident and natural volunteerism. New forms of nature are being created in cities all over the nation in the form of ecological rooftops and rooftop gardens, hosting grasses and sedums, which are increasingly found (over time and with the right design elements) to harbor great diversity in terms of invertebrates, birds, and plant life. We know, for instance, that butterfly species will visit rooftops on high-rise structures and that food, for humans and nature alike, can be grown there as well.

A visit to the Green Roofs Research Center, in Malmö, Sweden, shows the extent of possibilities—here they have planted and monitor hundreds of green roof test plots, testing different plant and soil combinations. Some of these plots are for so-called brown rooftops—places in the urban environments (there are many) where plants can be used to restore and even take up pollutants in highly contaminated and degraded settings (phytoremediation). And the Malmö center's immense research rooftop also shows the potential of different, sometimes surprising delivery methods. As Trevor Graham, who runs many of the center's green city efforts, explains, their

standard green roof is made from recycled polyurethane car seats, and in several places there are small mounted frames, with sedum growing vertically, showing the potential for a kind of natural artwork suitable for hanging in one's living room! These new forms of nature are catching on and are now encouraged and in some places mandated by codes—and we will see more of this happening in every city around the world. New creative developments in cities—such as Via Verde (the green way), a 200-unit complex of affordable housing planned for a 1.5-acre site in the South Bronx of New York—will find many ways to insert and grow nature. In this case, the nature takes the form of a connected multifunctional garden “that begins at street-level as a courtyard and plaza, and spirals upward through a series of programmed, south-facing roof gardens that end in a sky terrace.”¹⁰ Increasingly, we will understand rooftops, courtyards, and façades in cities as places to cultivate nature.

Urban trees are another important form of nature in cities. We know now that there is often a great diversity of life to be found at the tops of trees in the form of lichens, fungi, and mosses, many with unusual and little-understood life histories and biology. Richard Preston documents the tales of some of the more daring of the redwood tree climbers in a quest to understand this canopy life in his *New York Times* best seller *The Wild Trees*. These aerial botanists find amazing numbers of mosses and lichens, key parts of a canopy ecosystem few others have explored.¹¹

Lichens are perhaps one of the least-understood and least-appreciated forms of nature but some of the most unusual and wildest occupants of cities. Found on rocky outcrops and stones, even on gravestones in urban cemeteries, they are most often found on the bark and limbs of trees. There are more than 3,600 different species of lichen in North America alone, many found in and around cities.¹²

There are few things in the city, or anywhere, as wild and primordial as lichens, and their biology and chemistry are not clearly understood. Lichens are in fact the merging of two life-forms—a fungus and, usually, an alga—that survive through mutual coexistence. The alga is a symbiont in this partnership, providing through photosynthesis the nutrients the fungus needs to live. Sometimes the symbiont is a cyanobacterium, as in the case of lettuce longwurt (*Lobaria oregano*), which incredibly pulls nitrogen directly from the air and is a source of natural fertilizer for trees. The chemistry of lichens is complex, with an estimated 1,000 compounds produced by them, some thought to be promising human antibiotics.¹³

Some studies suggest a remarkable diversity of lichen in cities. A recent study of lichens in Singapore concluded there were more than three hundred species in that city. It appears that similar levels of lichen flora can

be found in other cities, such as Berlin and Hong Kong, for example.¹⁴ High sulfur dioxide levels in cities have kept the numbers of lichen down in the past, but with improvements in air quality lichens seem to be on the rebound in many urban settings. The Field Studies Centre (FSC) in the UK has now published a set of guides to urban lichens, a recognition that in many cities in that country there has been remarkable rebound of this form of urban nature.¹⁵

Even more biodiversity can be found on the lichens and mosses living on tree branches. One very unique creature likely to be found on a lichen sample is the so-called water bear (sometimes even more charmingly called a moss piglet). About a millimeter in size, they are just out of the range of the naked eye, and few people have seen them or even know of their existence. They belong to a unique phylum of invertebrates called Tardigrada. They are quite unusual looking—four pairs of limbs, with claws, looking not unlike a microscopic version of a dugong or manatee. They lumber along slowly, in a bearlike fashion, hence the name. Their most remarkable characteristic is their ability to profoundly change in response to harsh environmental conditions. In particular, they can induce a kind of hibernation, a form of cryptobiosis in which they virtually dry up and desiccate.¹⁶ Called anhydrobiosis, it results in an “almost complete loss of body water and the animal can stay in this state for an extended period of time.”¹⁷ Contracting and infolding its body, it does not seem to be alive, but even a hundred years later it can regenerate through rehydration. “The dry organisms may remain in this unique living state . . . for decades or perhaps centuries under favorable conditions. When water becomes available, they rapidly swell and resume active life.”¹⁸ What a remarkable creature to imagine inhabiting the branches of the trees in our urban and suburban neighborhoods!

We may learn much of practical value from the amazing biology of tardigrades, and already lichens, on which water bears are frequently found, are commonly used as bioindicators in urban environments. If lichens and water bears do not do well in cities, it is quite likely that human health is similarly impacted. And there is no clearer refutation of the belief that there are no more species left to discover than the story offered by Tardigrades. New species are being found and described all over the world, from Russia to Syria to the Great Smoky Mountains of North Carolina.¹⁹ More fundamentally, I believe our lives are the richer for knowing about water bears, and a little bit of the mystery and intrigue of the life of this invertebrate rub off on our own in the process. And our knowing that all around us in cities there is abundant, fascinating life imbues these spaces and habitats with a kind of new color, a different mental map that says at once

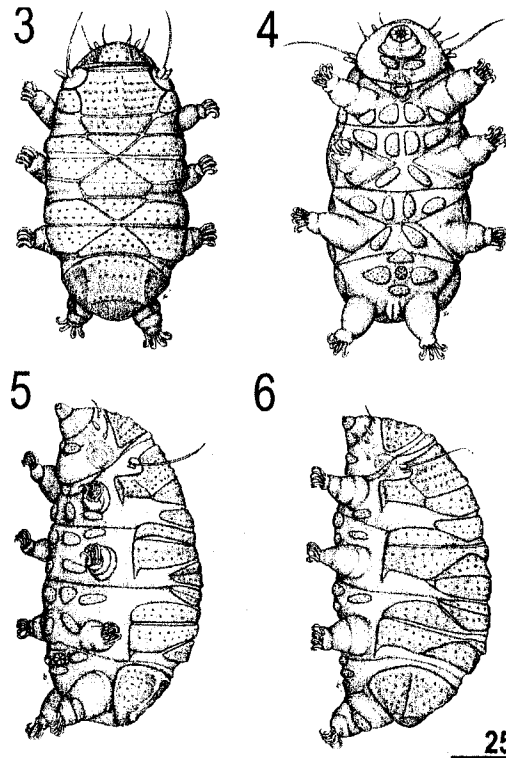


Figure 2.2 Water bears. Image credit: Reinhardt Møbjerg Kristensen and Birgitte Rubæk

we are not alone and that spaces that might at first seem vacant or empty are indeed not.

Even the more ephemeral occupants of the airspace above cities, notably clouds, can be found to harbor and sustain life. Our understanding of the biological dimensions of clouds has significantly increased in recent years. The usual image of clouds as inanimate phenomena is incorrect; they might more aptly be described as floating coral reefs, teeming with bacteria and other microorganisms. Several new scientific studies published in 2009 show the rich biology of clouds.²⁰ And these biological particulates—bacteria, fungi, algal material—are an important part of how a cloud produces rain and ice, which climatologists call *nucleators*. Our understanding is quite limited of so many things in nature, but the more we know about the biological or chemical complexity of, in this case, clouds, the greater the wonder coefficient.

The night sky is yet another form of wildness derived from an upward glance, though viewing the Milky Way, at least with the naked eye, is

difficult to impossible from many urban locations because of modern light pollution. Viewing the phases of the moon is another urban and suburban delight, and there are few things more enjoyable than walking, hiking, or jogging on the evening of a full moon. Many communities are now committed to savoring and protecting such nature experiences, and many of the efforts to reduce or mute the often excessive lighting of buildings also help in protecting views of our night sky. A number of cities have adopted dark sky ordinances and lighting standards, and some have even become certified “dark sky communities,” an initiative of the International Dark Sky Association.²¹

The Nature All Around

The spaces and habitats that occupy the city from ground to sky are in many ways the most familiar and the most noticeable to us.

Trees represent some of the most obvious forms of nature around us in cities—not simply the tips of the upper branches but the parts that are visually and tactilely accessible to us. Many city dwellers are rightly tree huggers and tree lovers. Some of the oldest and most impressive trees can be found in places like New York City, which has at least four groves of ancient trees, much older than most trees and forests found outside of the metropolitan area. It is counterintuitive perhaps, but as Mike Feller, the chief ecologist for New York’s parks department, explained to me, the high degree of agricultural land use and extensive land clearance outside the cities strip much of the floral diversity. In this way cities serve as biological refuges. In many places, of course, new development within cities and at the urbanizing edge is leading to the loss of trees and tree cover, moving cities in the wrong direction. We need to protect what we have, as well as replace and add to the stock of trees in cities.

One of these floral wonders—an ancient tulip poplar tree—can be found in Queens, not far from Alley Pond Park, and I visited the tree with Mike Feller. This tulip tree, as *Liriodendron tulipifera* is commonly called, is a whopping 134 feet tall and an estimated 450 years old, likely the oldest living thing in the city. Affectionately referred to as the Queens Giant, it stands not far from the roar of traffic and for the most part is not widely appreciated—and there is controversy about whether it is adequately protected. But this magnificent tree is a time portal, linking us to the city’s early settlement history and to a time before the Europeans arrived.²²

Trees even older than the Queens Giant exist in the center of Stockholm, Sweden, where large ancient oaks are found a stone’s throw

away from the city's dense urban center. Here people like to talk about the thousand-year life span of these distinctive trees—they grow for five hundred years and then take another five hundred years to die and decompose. Many of these ancient oaks can be found in the city's large and unique EkoPark, a 27-square-kilometer area made up of natural and cultural landscapes, pastureland and nature, forests and archipelago, in the center of this metropolitan area. The mosaic of nature here is remarkable: "alder fens, spruce woods, shoreline forest, open meadows, and wooded pastures with very large ancient trees. There is also great biodiversity, with over 800 wild species of flowering plant and at least 100 species of nesting bird."²³ And it is the dying and decomposing of these oak trees that turns out to be an important element of preserving biodiversity—many endangered invertebrates depend upon that decomposition for life. "In the spring, carpets of wood anemone blossom amongst the oaks, while stock doves and tawny owls nest in the hollows of the oldest trees."²⁴

Alley Pond Park, in Queens, is another example of a significant ecosystem and habitat in the city. It contains a system of remnant "kettle ponds," formed by the Minnesota Ice Sheet (this was the southern end of the glacier), which "dropped the boulders that sit on the hillsides of the southern end of the park and left buried chunks of ice that melted and formed the ponds."²⁵ Alley Pond is one of forty-eight sites in the Forever Wild program of the New York City Department of Parks and Recreation, which strives to protect ecologically rich land in New York City. Together the designated lands include almost nine thousand acres in five boroughs and represent a remarkable diversity of natural communities and habitat.²⁶

Not far from Alley Pond is Jamaica Bay Wildlife Refuge, more than ninety-one hundred acres of salt marshes, mudflats, and maritime forests—a unique unit of the larger Gateway National Recreation Area. It is a diverse and wild refuge abutting Queens and Brooklyn, on the edge of the nation's densest city. Under threat from sea level rise and other pressures (the refuge has seen a significant reduction in marsh area since the 1950s, for instance), it is still an important site of respite and recreation and is easily reachable by train and bus from Manhattan (and also by bike and, from some locations, even by kayak). It is a significant stopover point for migratory birds on the Eastern Flyway, with some 331 species recorded (almost half of the species found in North America).²⁷

Every city can and must find better ways to acknowledge, design within, and profoundly connect with the unique physical and ecological contexts in which they sit. Often the underlying topography, for instance, has been forgotten even though it likely shaped the city and region. In

some western cities like San Diego, which is defined by hundreds of surrounding canyons, these natural features are either forgotten or ignored, or worse, actively destroyed and degraded.

Fortunately the last several years have witnessed new efforts on the part of some local groups in San Diego to raise appreciation of these canyons and even link what remains of them into a San Diego Regional Canyonlands park. In March 2006, a provocative white paper further advocating and fleshing out the idea was released by the volunteer-led group San Diego Civic Solutions. While a short paper, the vision is a compelling one and sets out in text and renderings some of the main design ideas—limiting encroachment of development, increasing access (visual and physical) and connection, as through walking trails, designed in ways that discourage the "blocking-off" of canyons. San Diego's canyons can, as the white paper argues, provide emotional and psychological benefits, can be places where children learn about nature, and can be important elements in the region's strategy for protecting biodiversity.²⁸ While few tangible steps have yet been taken, this vision has helped to stimulate new interest in this immense local ecology.

Many groups in the city are working hard to raise awareness of the canyons, to organize cleanup and restoration work, and in some cases to repel city projects that would damage or destroy canyons. The Sierra Club's Canyons Campaign is helping to start and support some forty Friends of the Canyons groups. Friends of Rose Canyon, one of the largest with about twelve hundred members, is made up of people who care about and go to bat for this amazing canyon. And there is much to do, including vigilantly defending the canyons from various proposed encroachments, such as an insane proposal to build a road directly through and across Rose Canyon.

The female bobcat that resides in Rose Canyon is certainly a source of pride to residents there. We filmed a segment of *The Nature of Cities* in Rose Canyon early one morning, following two women on an urban tracking session looking for signs of wildlife, including the elusive bobcat, by searching for paw prints, scat remains, and other evidence of the movements and life of animals in this canyon. For several hours we looked carefully at every wet patch of mud, every broken branch, and every errant bird feather that might indicate the recent presence of life. At one point in following these women (this alone was a major feat), we heard yelps of joy as one of the trackers indicated having found a dead bird, very recent prey for the bobcat, the ultimate tracking prize on that day. Remarkably, these tracking experiences were all within a short distance of downtown San Diego, with the sights and sounds of the city all around us (even a fast-moving commuter train).



Figure 2.3 Bobcat, in Rose Canyon, San Diego.

One of the more interesting initiatives of the canyon campaign has been “Kids in Canyons,” a program bringing elementary students to visit and learn about the canyons, run in collaboration with the nonprofit group Aquatic Adventures. Kids are guided through canyons, learn about the flora and fauna there, and in some cases help to do some cleanup and planting. One day we followed a group of students from a nearby elementary school as they learned about the natural habitat of the canyons. Most striking was the fact that although the elementary school itself was perched on the edge of this canyon, which was essentially around the corner and behind the school, the canyon itself might as well have been in another city. The school offered little or no programming in which the canyon figured, and indeed the canyon was seen (by kids and adults alike) as a dangerous place to be avoided rather than celebrated. Once in the canyon the students learned much about nature and the unique canyons of this city, and their negative impressions melted away.

E. O. Wilson, in his beautiful book *The Creation*, argues that we need to foster this wonder and fascination at an early age. Looking at and discovering the things around them is an ideal activity for kids. I agree with him that encouraging the natural impulses kids have to collect things from

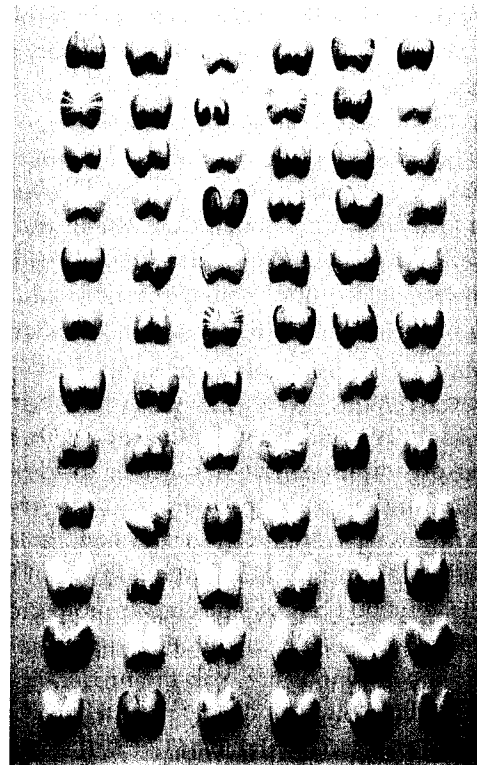


Figure 2.4 Coquina shells, collected off the Florida's gulf coast. Photo credit: Tim Beatley

nature is one step. I recall the delight my two young daughters experienced in collecting coquina shells in the sandbars off Sanibel Island, with the skyline of the city of Ft. Myers in the background. Coquina (*Donax variabilis*) show a remarkable diversity of color in their shells—purple, pink, blue, brown, seemingly every color and shade and design represented in nature. Collecting them takes a degree of delicate strategy in order to preserve the two halves in their attached form. This allows the mounting of the shells later, like so many butterflies, on paper or in a frame. The process of collecting coquina responds to several different values—for kids, of course, it is fun and involves running, diving, extruding handfuls of sand, and gleeful delight about what is discovered. There is a kind of hidden treasure, and one is never sure about what gem will be uncovered. It focuses the attention on the beauty and detail of nature—as the shells are washed, the true colors are uncovered. And there is much to be said for any family activity that keeps kids outdoors, hands and feet immersed in the natural world.

In San Francisco, a newly formed community group called Nature in the City has already produced a map of the parks and remnant patches of nature in that city, and the tally is surprising: gray foxes, alligator lizards,

mission blue butterflies, and California quail (some endangered, many plentiful), amid some dozen native plant communities and natural areas within the city.²⁹ As Peter Brastow, founder of the organization, declares, this city is “resplendent with biodiversity and scenic natural areas.”³⁰

There are many small patches of green, of course, as San Francisco is already heavily built-out, but there are large tracts as well, notably Golden Gate Park, the Presidio, and Glen Canyon Park. Golden Gate Recreation Area is an astounding seventy-five thousand acres, so there is more green and nature here than perhaps is appreciated, and of course the city is also surrounded by blue nature in the form of the Pacific Ocean and the San Francisco Bay.

In the U.S. Midwest, there remain significant amounts of native prairie and other remnants of pre-European settlement. In the late 1990s, a group of environmental and other organizations joined together to form the Chicago Wilderness Coalition, with the goal of partnering to save, restore, and educate about the nature in this region. This alliance of now more than two hundred diverse organizations has put forth a powerful image of a biologically rich urban region, some 250,000 acres of land already protected in parks and natural areas and comprised of globally important natural communities, including “tallgrass prairie, oak woodlands, oak savannas, sedge meadows, marshes, bogs and fens.”³¹ The group has already prepared a *Biodiversity Atlas*³² of the region and the first (and only) *Biodiversity Recovery Plan*³³ ever prepared for an urban region. The moniker of “Chicago Wilderness” is itself a clever attention-getter—to many an unlikely joining of these two words but a clear signal that there is much that is wild and primordial and natural amid the cars and buildings (see www.chicagowilderness.org).

In the Kansas City metro area, while little of the pre-European landscape remains, there is remarkably unique nature close at hand. An organization called Kansas City WildLands was formed in 2000 to watch over and to help repair this landscape. Larry Rizzo, one of the founders of WildLands and a biologist for the Missouri Department of Conservation, has written a useful guide³⁴ to Kansas City wildlands, which include a number of parks and natural areas in or near the city, drawing attention to what remains. These urban wildlands include bottomland hardwoods, prairies and open woodlands and savannas, and a remarkable diversity of life. Glades, for instance—rocky openings in the forest—along the Blue River are home to many wildflowers and birds, wild turkeys, and even scorpions. Remnant patches of prairie in the region harbor remarkable biodiversity: Kill Creek Prairie contains some two hundred species of plants, including the federally threatened Meade’s milkweed, and perhaps an astounding thousand spe-

cies of beetles.³⁵ All of this is within a few miles of downtown Kansas City, Missouri.

Some of the wildness in cities is large and obvious, as in the case of cities with a large visible mammal population that lives and moves in close proximity to urbanites. The city of Anchorage, Alaska, is one of the more dramatic examples of this in North America. There is remarkable wildlife within its borders, including as many as a thousand moose in winter, three hundred black bears, and sixty-five brown bears.³⁶ Visceral and direct contact with this nature is facilitated through the city’s extensive 400-mile network of urban trails. The trail network offers diverse ways to enjoy the city’s nature through all seasons of the year (hiking, biking, trails for cross-country skiing in winter, even dog-mushing trails).³⁷

Very near to the city is Chugach State Park (the country’s third-largest state park), a half-million acres of wildlands that are home to even more wildlife, including Dall sheep and mountain goats. There are also several packs of wolves in the metro area. Residents of Anchorage appear to be proud of the extent of the wildlife in and around their community and seem to understand its unique contribution to a sense of place. In a survey of attitudes about the city’s wildlife, 87 percent agreed with the statement, “While moose cause some problems, they make life in Anchorage seem interesting and special.”³⁸

Urbanites in many eastern U.S. cities are now discovering that coyotes have moved into their neighborhoods, offering an unusual new degree of wildness, though not without some consternation about the safety of children and pets. The fears are largely unfounded and easily dispelled with a little education. Coyotes are not a threat to humans, and their diet consists primarily of small rodents, plants, and berries, and rarely the family cat.³⁹ Known to Native Americans as “God’s Dog,” the coyote has now even become a resident of the nation’s capital, first sighted in Rock Creek Park in 2004. An estimated four thousand to seven thousand coyotes now live within the city limits of Los Angeles.⁴⁰ For many, an early morning sighting of a coyote is a magical gift and visceral evidence of the resiliency of nature and wildness.

Perhaps we need to look for ways to tap into the fun of looking for and finding things in nature at a community or collective level. One powerful process of this sort is the BioBlitz (or bioblitz), a 24-hour intensive search for all of the biodiversity, large and small, in a defined space or area, often a public park. BioBlitzes have been undertaken all over the world and have both a scientific and educational function. And sometimes they even result

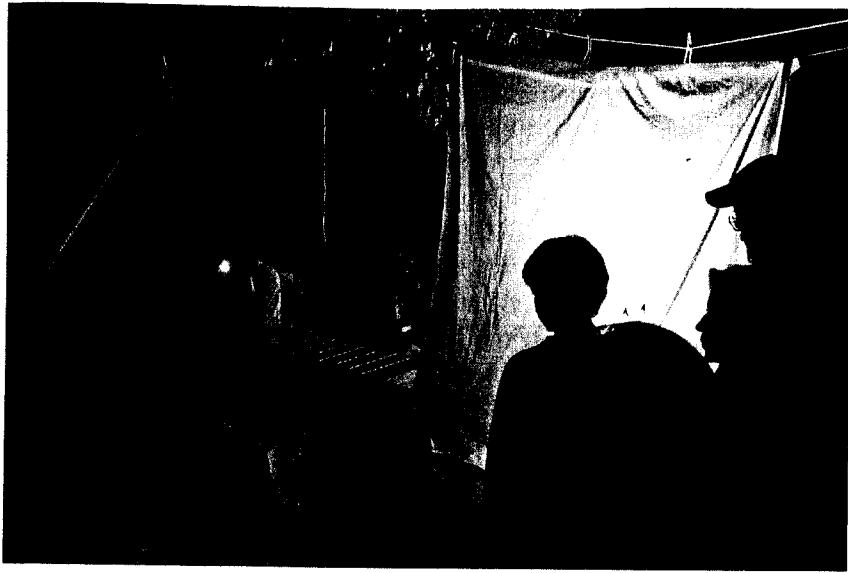


Figure 2.5 Kids manning the nighttime moth collection station at the Balboa Park BioBlitz, San Diego, California. Photo credit: Tim Beatley

in discovery of new species (such as the new species of centipede, *Nannarup hoffmani*, discovered in New York's Central Park).

The potential of a BioBlitz was brought home vividly to me last year as I watched (and filmed) one of these searches unfolding over a day and night in San Diego. Organized by the San Diego Museum of Natural History and focused on recording the biodiversity of Balboa Park, the evening directly involved kids. There was an opportunity for kids to spend the night at the museum, which many did, immersing themselves in the science and fun of this event. Several nighttime observation stations were set up, and especially entertaining was the moth station. Scientists from the museum draped a white sheet over several dangling lights, in an effort (largely successful) to attract moths. Many moths appeared that evening, and between the "oohs" and "ahhs" the kids learned a great deal, I think, about the biology of these species. Perhaps the most important benefit was the fostering of curiosity and fascination and the mystery the evening holds for what it will bring in the form of unusual-looking fauna. Moths impressed me that evening with their ability to evoke a sense of mystery and magic. When they hear that almost ten thousand different species of moths can be found in North America, kids and adults alike are amazed.

The tally from that day and night in San Diego was impressive—more than a thousand species were recorded at Balboa Park. I came away

appreciating how valuable such a process might be in service of community planning. The BioBlitz should be viewed as a useful source of information and insight about patterns of biodiversity in a community, and it is certainly helpful (if not essential) in developing a community plan that takes adequate account of nature and environment. Organizing one or more BioBlitzes as part of the community planning process would at once give visibility and importance to a process sometimes lacking in excitement or perceived relevance. Making the connection for residents between policies and actions in a plan and the fascinating and wondrous nature and life all around would be a positive thing. The BioBlitz helps to foster community—it is a biological block party, if you will.

The Nature Below

There is also much nature below—underfoot, underground, and underwater—in and around our cities. Much of this wondrous life in and around cities is hidden from view, and finding effective ways to highlight and make it visible is a major challenge for planners and designers.

In many American cities the biodiversity is aquatic and sometimes offshore, as in Seattle, which has abundant and wondrous life in the close-by depths of the bay and sound. Much of the biodiversity of King County, in which the city of Seattle lies, is found in the deep subtidal habitat of Puget Sound, in some places almost nine hundred feet below the surface and including "over 500 benthic and 50 pelagic invertebrates."⁴¹ And while some, such as the king crab, are known and recognizable to residents, many remain unknown. That the Seattle metro region is also home to such unique marine critters as the giant Pacific octopus and giant acorn barnacle suggests a wildness and mystery very close at hand. The region's marine mammals get a bit more attention and visibility, including killer whales, which are now on the federally endangered species list.

Underfoot the diversity in cities is quite impressive: Fifty-one species of ants were recently categorized in the city of Philadelphia, for instance, enough to make any urban myrmecologist proud. San Francisco harbors nineteen species of ants and sixty different species of native bees (though we certainly hope they are found hovering near the surface and not underfoot as we walk through the city).⁴²

One of my favorite examples of how the presence of these fascinating co-occupants of cities has been made more visible can be seen in the work of Walter Tschinkel, a Florida State University entomologist. Tschinkel uses orthodontic plaster to make casts of subterranean ant nests and to

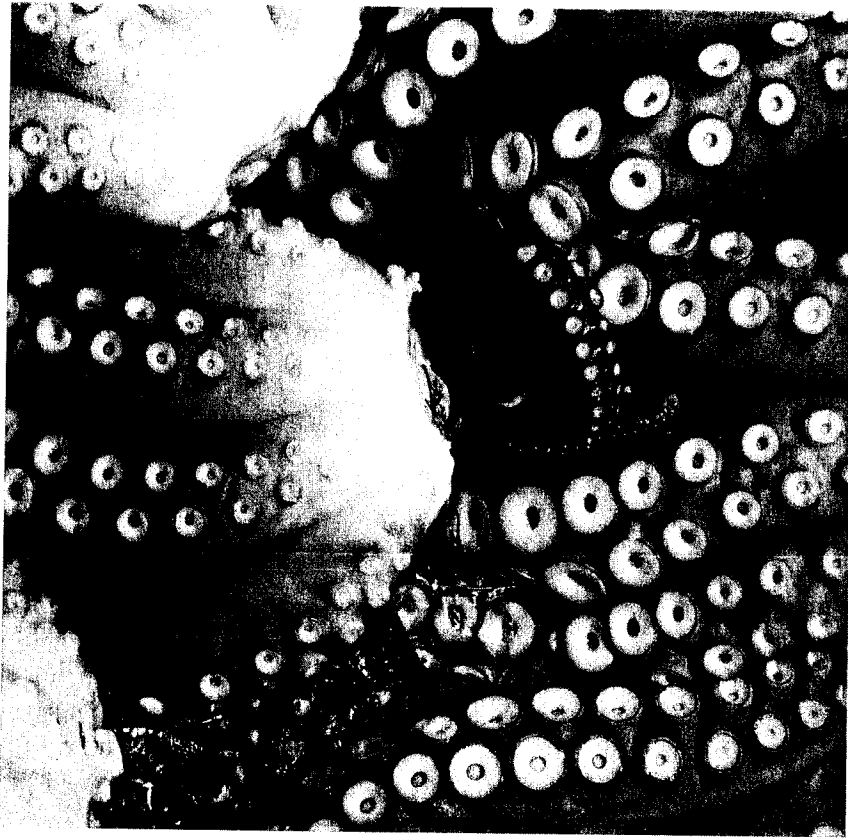


Figure 2.6 Giant Pacific octopus, a nearby underwater resident in Seattle, Washington.

render visible the nest architecture of species like the Florida harvester ant (*Pogonomyrmex badius*).⁴³ Reassembled as single, connected plaster models showing the shafts and chambers of these nests, they are, in Tschinkel's words, "undeniably spectacular." Tschinkel's research has already generated new knowledge about the biology of these ants (that there is a "vertical social structure by worker age and life stage"), but the functions of this elaborate nest architecture are mostly unknown. Nevertheless, the plaster casts—shafts 12 meters long, connecting some 135 different chambers—lend a sense of awe to ant biology that few of us are familiar with.

The work of scientists like Walter Tschinkel provides us with unusual windows into the natural world but also has the potential to teach us important design lessons from nature. Biomimicry suggests that we tap into the wisdom of the natural world and learn from the millennia of evolutionary trial and error when designing and planning. Office buildings have been

designed based on the cooling principles found in the design of African termite mounds, for instance, and scientists at the Max Planck Institute in Germany are designing new adhesive materials based on the dense network of "mushroom shaped micro-hairs" found on the soles of insects.⁴⁴ Nature is fascinating and wondrous but may also hold creative and unimaginable design solutions to many of our most pressing social and environmental (and urban) challenges.

E. O. Wilson, in *The Creation*, calls attention to the amazing biodiversity underfoot by referring to these areas as "micro-wildernesses." He seeks to muster our collective fascination at what exists there: "Each cubic meter of soil and humus within it is a world swarming with hundreds of thousands of such creatures, representing hundreds of species. With them are even greater numbers and diversity of microbes. In one gram of soil, less than a handful, live on the order of ten billion bacteria belonging to as many as six thousand species."⁴⁵ Wilson is an entomologist and an unabashed proponent of paying more attention to the smaller, less obvious or visually dramatic things in the world. "More respect is due the little things that run the world."⁴⁶

The biodiversity below is sometimes at the surface and can add much to the vitality and charm of the city. Such has been the case for the sea lions that several years ago arrived at Pier 39 in San Francisco. Originally viewed as a nuisance, they have become a tourist attraction and a convenient point of education about marine life. Staff of the Marine Mammal Center are present at the pier and use the sea lions as an opportunity to talk with visitors about this marine mammal and marine ecology. Recently, the sea lions disappeared (mysteriously) from the pier, setting in motion angst and disappointment on the part of many city residents who had become accustomed to seeing them and enjoying their presence. Finally in the spring of 2010, the sea lions began returning (from where is not clear), and a sigh of relief could be felt as residents monitored the action from a web-cam pointed at the pier. The story of San Francisco sea lions shows how viscerally engaged and caring and concerned residents of a major city can become when given the chance and how economically valuable such otherwise hidden life can be.

There are often a number of small mammals to watch for at ground level, and in many western American cities, these include prairie dogs. Last year I found myself sitting on the edge of a fence in Boulder, Colorado, watching a colony of black-tailed prairie dogs go about daily life, ever vigilant of my presence and occasionally issuing their characteristic warning barks. For me it was a visceral demonstration of the therapeutic and mesmerizing impact of nature, the fact that time essentially stood still in those

moments of observation, a brief emotional respite in the course of my urban day. These prairie dogs are generally not doing well and are on the verge of being listed under the federal Endangered Species Act. Their presence in the urban and suburban areas of Denver suggests the positive role that cities might play as biological safe spots, and of course a need to contain the low-density suburban sprawl that is threatening many of these colonies. What is especially interesting to see are the ways in which these black-tailed prairie dogs have already adapted to their urban settings. As biologist Seth Magle notes, their colonies have become denser, given the more limited space available, and they exhibit new forms of adaptive behavior, what Magle refers to as “street smarts,” including climbing shrubs for food and even swimming, behaviors quite uncommon in rural colonies.⁴⁷ Nature in cities often meets us halfway.

Multisensory Nature and the Enveloping Natural World

Experiencing nature in cities is as much about hearing, smelling, and feeling as it is about seeing. Touch and feel are often underappreciated as essential ways we experience nature around us. As brain scientist Jill Bolte Taylor notes, human skin is the largest of our sensory organs and intricately designed to sense and capture the feelings and sensations as we walk through a park or along a street. She explains that our skin is “stippled with very specific sensory receptors designed to experience pressure, vibration, light touch, pain, or temperature. These receptors are precise in the type of stimulation they perceive such that only cold stimulation can be perceived by cold sensory receptors. Because of this specificity, our skin is a finely mapped surface of sensory reception.”⁴⁸ The entire body has evolved, it seems, to have fine receptors of the many earthly sensory signals sent our way.

The biophilic qualities of cities include, for many of us, the feelings associated with changing daily and seasonal climate, the gentle and not-so-gentle breezes that strike our faces as we move outside. In some cities these breezes are valued and celebrated. Freiburg and other German cities map and protect the wind corridors that come down from the Black Forest and prevent the construction of buildings that would interrupt or block these replenishing flows. These winds provide the cooling and rejuvenating fresh air for the city, sending away pollutants and fostering an awareness of climate.

In what other ways could we design and plan American communities with greater sensitivity to weather and climate? How could weather

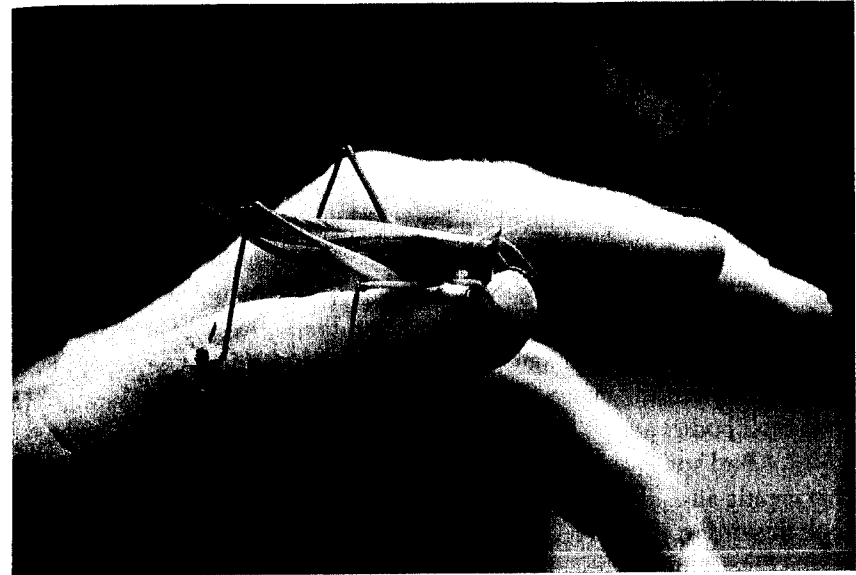


Figure 2.7 A katydid, one of the many producers of the lovely sounds that inhabit cities. Photo credit: Tim Beatley

and climatic conditions become aspects of places and regions in which we live, aspects of which we are cognizant and indeed proud?

Community sounds are a kind of aural portal or window into the complexity and diversity around us. In an age when so many things seem to be known or knowable, there are many sounds that convey a mystery and wildness that we lack in other dimensions of life. There are many significant and underappreciated natural sounds around us that are essential to our connection to nature and other forms of life, that are profoundly meaningful, and that are inherently therapeutic. I have come to relish the summer evening sounds of crickets, katydids, tree frogs, and night birds that lull me to sleep, and the melodic sounds of cicadas during the day that propel me forward with optimism.

The biophilic sounds in the city change over the course of the year and also help urbanites mark the seasons. A ubiquitous and beautiful sound along the east coast of the United States is the northern spring peeper (*Pseudacris crucifer*), a tiny tree frog that marks the spring and heralds the soon-to-be summer. Hearing a chorus of these frogs on a spring evening (only males sing, seeking to impress and attract mates) inserts an audible element of mystery and wildness to urban and suburban life—and the more we are accustomed to hearing their spring sounds (and the more we look forward to their arrival), the more they are a part of our urban community.

Greater knowledge of the peeper's biology in turn deepens the sense of fascination and wonder and respect. Peeper frogs, for instance, make their songs by inflating and deflating their "vocal sacs" right below their chins (when singing together, they are sometimes said to sound like jingling sleigh bells). We rarely see them singing, but we can imagine the movement when we hear the sounds. Equally fascinating, peepers produce glucose that acts as a sort of natural antifreeze, allowing them to enter a frozen state and thus protect their bodies during winter. It may be that such clever biological tricks can provide useful insights in designing for human space travel or life in similarly harsh environments on Earth, but the knowledge alone deepens appreciation of the mystery and magic of their songs. I imagine them in this frozen condition in January and February, waiting for the warm weather to melt their bodies and to release the torrent of natural sounds they make.⁴⁹

Bird songs and calls are for many of us living in cities joyous and therapeutic and, like the frog sounds, help to fix our place in the season. I look forward to the arrival of robins in the spring and the orchestral sounds of the diverse mix of spring and summer inhabitants. Some have even observed that the winter solstice, December 21, is marked by the beginning of bird songs. Donald Kroodsmas's book *Birdsongs by the Seasons* explores this in an interesting way by cataloging and recording the songs and vocalizations of birds over the months of the year. He uses sonograms and careful observation to understand the subtle nuances heard. His book provides advice about doing our own recordings of birds, but perhaps most important, it helps us to hear and understand in new ways the sounds around us. Perhaps more than anything, we urbanites must learn (again?) to become good and careful listeners of the many natural voices around us.⁵⁰

Another popular book of bird songs, written by Peter Marler and Hans Slabbekoorn, is *Nature's Music*.⁵¹ I'm struck by how the word *music* resonates in describing the many sounds we hear from nature, many in cities—the screech owl, the peepers, and of course the birds, among many others. Ironically, it seems that city building these days is often about major investments in the cultural infrastructure that centers around the more usual form of music we talk about—building new opera houses, concert halls, or music pavilions, rightly heralding the art and culture and uplifting and exhilarating experience of an orchestral concert or operatic aria. Yet few of us seem to appreciate the deeper primordial music that permeates the cities and suburbs in which we live and perhaps the need to invest in this natural musical infrastructure to an equal degree.

The new presence of coyotes in cities like Washington and Chicago and Los Angeles offers some promise of new auditory delight as well. While the yips and howls and barks of coyotes might elicit fear in some, for others

(and most urbanites, we would hope over time) the sounds are joyous declarations of the shared biological space and the persistence of wildness in even the most apparently tamed settings.

Smell is another powerful sense that connects us to nature in many ways. It is said that humans can distinguish as many as ten thousand distinct smells. Biophilic cities are fragrant cities. The *smellscape* will vary from city to city and region to region. The scents of flowers and flowering trees, from magnolias to dogwoods, are important smells in southern cities, for instance. In northwest cities Douglas fir and ponderosa pine create scents quite distinct from their urban counterparts in the Southwest, such as mesquite. It is hard to overstate the importance of natural odors, and they are not always the most obvious ones in cities: They include the seasonal scent of fallen leaves and the distinctive scent of rain and rain showers. In cities these odors are not always pleasant (e.g., think garbage, diesel fumes), but many are pleasant, essential place-fixing elements.

The Nature Behind (and Ahead)

Every bit of nature visible in cities today, every landform or hydrologic feature, is to some degree shaped by the life history of that point on Earth. The nature of cities is heavily informed by and to a certain extent viewed through the prism of ancient life, of a deeper, longer process of evolution and change and reformulation. There are often practical management reasons for wanting to know these things (what does the ancient geology of place tell us about why building pilings and foundations fail in earthquakes, for instance?), but there are many other reasons to understand the deep history of a place. It can be argued that we will never have a clear sense of who we are as a species, never completely understand ourselves, without understanding our longer history. Biophilia is the ultimate demonstration of this, in the sense that our present psychology and emotional health are dependent on an ancient evolutionary brain. A deeper understanding of geological and ecological history help answer the question of where we live and help to define a deeper, more meaningful understanding of home. We lack that in many American communities (most, perhaps) and in turn lack the rudder and stability and perspective that a longer history can provide us. This deeper knowledge can strengthen commitment and caring for the places in which we live. And it is just fun and enjoyable to spend time learning things about places that go beyond the superficial, beyond the surface.

In San Francisco much can be learned about current nature in the city by understanding the historic environment. Few residents appreciate

that nearly half of the San Francisco peninsula, the northern and western portions, is comprised of ancient sand dunes. It's an exotic and deeply interesting geologic context, and much of the city's development past has been about battling those dunes. Formed of material eroded from the Sierra Nevada mountain range, it has given rise to unique floral species, for instance, plants with deep roots and small flowers, an adaptation more common to desert circumstances. San Francisco has been described in the geology literature as comprised largely of high hills of bedrock poking through a blanket of sand dunes, with important areas of mudflats and tidal marshes (many of which have been filled to make room for development). These contemporary land and community alterations are important, of course, for understanding the extent of ecological loss or damage as well as the vulnerability of current residents and buildings to such dangers as earth liquefaction. These longer-term forces and circumstances have shaped and molded over millennia the nature that we see today and provide us with unusual perspective on where we have come and where we are going.

On a visit to Iowa City, Iowa, I had the chance to visit a very unusual park centered around the city's deeper geologic history. In the aftermath of the severe floods that occurred up and down the Mississippi watershed in 1993, a quarter-mile stretch of bedrock from the Devonian period of the Paleozoic (410–360 million years ago) was opened up near Iowa City for all to see. Later named the Devonian Fossil Gorge, it has become a popular state park and a local attraction of some pride to residents.

Any visitor spending any amount of time in Iowa City today will likely be taken to the gorge to see the visible fossils of an amazing assortment of critters and creatures. They include corals, crinoids ("a kind of ancient sea urchin with a somewhat cup-shaped body and five or more feathery arms"), and brachiopods ("marine invertebrates with a pair of arms bearing tentacles inside bivalve shells").⁵² It's a tactile experience that allows kids to touch the fossils and trace them with their fingers. They can take paper, as many do when visiting, and trace the critters, and then dart and jump among the boulders and rocks and splash in the environment in which the fossils are found. It's a prized destination for local kids, and it's not hard to see why.

Kids seem especially intrigued by the idea that these Iowa waters were populated by rather large fish. Most notable is the *arthrodire*, a rather fierce-looking armored predator with a complex-looking hinged jaw, and probably eight to ten feet in length. Fossils from one of these fish were found at the site and have since been moved to a Corps of Engineers museum not far away. There is something especially vivid and striking about

imagining such large fish in places now occupied by shopping centers and cornfields.

The park offers the community a common understanding of the fascinating geological and biological history of the city. Tom Dean, who teaches at the University of Iowa, speaks of the role of the gorge in helping residents to "sink taproots of connection into place with those closest to us through regular family visits."⁵³ It provides residents with a long-term fix on their origins and a very vivid reminder that their current position in time is but a tiny placeholder in the larger story of Earth. And another thing it may do is evoke in us a humbleness and thinking beyond ourselves, a kind of antidote to the hubris and self-centeredness that often characterize our view of environment, perhaps especially so in cities.

There is a very long tower inside the National Museum of Natural History, in Washington, D.C., that visually presents the history of Earth: The time of humans is a minute sliver at the very top, and that is a very useful image to keep in mind. As a species, humans have been cultivating the earth and growing crops, for about 10,000 years, yet leaf-cutter ants have been cultivating and gardening fungi for some 40 million years.

The longer arcs of history and geology are great ways to frame present-day cities. Leslie Day, in her *Field Guide to the Natural World of New York City*,⁵⁴ frames the discussion of the abundant nature in New York in terms of its fascinating geological and natural history. The story for her begins 400 million years ago, when the site of modern-day New York was then "towering mountain peaks," the gradual erosion of which has left behind many of the landscape features visible today. Glaciation and the advance and retreat of ice sheets are much of the story. At the end of the last ice age, the flora and fauna we know today began to emerge:

As the climate warmed, new plants took root in New York, replacing the arctic willows and grasses. Conifers such as spruce, pine, and fir trees dominated the area until seven thousand years ago, when hemlocks and broadleaf deciduous trees such as oaks and chestnuts created mixed forests. Humans first arrived in the area about this time and, with the warming climate, the Ice Age mammals disappeared. Five thousand years ago, about the same time that human villages became more common, hickories replaced hemlocks, and holly and birch grew in the oak and chestnut forests.⁵⁵

Who knew that Manhattan was such a biologically rich place when Henry Hudson arrived on September 12, 1609? Thanks to the work of landscape ecologist Eric Sanderson, of the Wildlife Conservation Society

at the Bronx Zoo, we now have a much better idea of what Manhattan was like at that time. Through painstaking research, a combination of analyzing historical maps, soil profiles, hydrologic and topographic conditions, and even the settlement patterns and history of the native Lenape people who inhabited the island, Sanderson has constructed an intricate and enlightening natural history of this now densely developed city.⁵⁶ The result is, among other things, a new appreciation for the biological and ecological diversity of the island. Boasting fifty-five different ecological communities ("more than is found on the average coral reef or in most rainforests of similar size"⁵⁷) and a unique ecological setting (e.g., positioned on an estuary at the southern extent glaciation), *Mannahatta*—the Lenape word for the island, meaning "Island of Many Hills"—was a wealthy place indeed.

Sanderson and his colleagues, through the creative use of GIS and digital imaging, have managed to generate a fascinating set of renderings depicting what Manhattan might have looked like in 1609, as contrasted with modern views from the same vantages. The result is a very successful effort at, as Sanderson says, "draping" this urban landscape "with a forgotten ecology."⁵⁸ This is a useful exercise by which to stoke the imagination and stimulate thinking about future nature in this city. And indeed that is what he does in the last chapter of his study, imagining what Manhattan and greater New York might look like four hundred years into the future. "Infused with the spirit of Mannahatta," the future city is one where much food is grown locally, where energy is produced from local renewable sources (e.g., capturing tidal energy), where buildings capture solar energy and breath (not unlike wigwams or longhouses), where the urban environment is abundant with green rooftops and rain gardens and permeable paving, and where residents reconnect with their extensive waterfront. And future urbanization patterns, influenced by commitments to sustainability and the dynamics of climate change, will result in dense settlements with farms and forests and natural habitats in between.⁵⁹ Taken together, the vision is not unlike the future sketched in the pages to follow.

Concluding Thoughts

The *wildness* of cities, the *nature* of cities, extends well beyond the usual areas we tend to think of. It is not just the established public parks or green areas in a city but much more: the trees on streets, courtyards, rooftops, creeks, and hydrological features, many of which have been hidden and highly altered. We can see signs of this remnant nature everywhere we look.

Thinking about the presence of nature in most spaces and dimensions that permeate a typical city offers a fuller view of urban biodiversity and wildness: fish and aquatic species living and traveling in the rivers and streams that move through a city; microorganisms living in the clouds; birds and bats in flight at various altitudes; ants, invertebrates, and fungi underfoot; innumerable micro-wildernesses inhabiting the spaces and crevices and soil on every corner. The city is a wild place indeed, teeming with life and wondrous for the resilience and adaptability of this life. This is, at least for most Americans, a different way of seeing and understanding cities and urban life. The everyday nature, to borrow Stephen Kellert's language, is all around us and is precious indeed.