The ASPHALT Jungle

Story and Photographs by Peter Del Tredici

For good and ill, weeds provide a glimpse of our future.

There's a tree that grows in Brooklyn. Some people call it the Tree of Heaven. No matter where its seed falls, it makes a tree which struggles to reach the sky. It grows in boarded-up lots and out of neglected rubbish heaps. It grows up out of cellar gratings. It is the only tree that grows out of cement. It grows lushly . . . survives without sun, water, and seemingly without earth. It should be considered beautiful except that there are too many of it.
—Betty Smith, *A Tree Grows in Brooklyn*

A native of China, *Ailanthus altissima*, or tree of heaven, was widely planted in the northeastern United States during the first half of the nineteenth century. It was later rejected by urban landscapers as uncouth and weedy. Despite concerted efforts at eradication, however, the species managed to persist by sprouting from its roots and scattering its wind-dispersed seeds, so that it is now one of the most com-

mon trees in virtually every northeastern city. Although widely vilified, *Ailanthus* is just as good at sequestering carbon and creating shade as our beloved native species or showy horticultural selections. Indeed, our cities would be worse off without it, given that it typically grows where few other plants can survive.

The ecology of the city is defined not only by the cultivated plants that require maintenance and the protected remnants of natural landscapes, but also by the spontaneous vegetation that dominates the neglected interstices. Greenery fills the vacant spaces between our roads, homes, and businesses; lines ditches and chain-link fences; sprouts in sidewalk cracks and atop neglected rooftops. Some of those plants, such as box elder, quaking aspen, and riverside grape, are native species present before humans drastically altered the land. Others were brought in intentionally or unintentionally by people, including chicory, Norway spruce, and Japanese knotweed. And still others, among them common ragweed, path rush (*Juncus tenuis*), and tufted lovegrass (*Eragrostis pectinacea*), arrived on their own, dispersed by wind, water, or wild animals. Such species grow and reproduce in many American cities, especially cities with faltering economies, without being planted or cared for. They can provide important social and ecological services at very little cost to taxpayers, and if left undisturbed long enough they may even develop into woodlands.

There is no denying that most people consider many such plants to be "weeds." From a utilitarian perspective, a weed is any plant that grows on its own where people do not want it to grow. From the biological perspective, weeds are opportunistic plants that are adapted to disturbance in all its myriad forms, from bulldozers to acid rain. Their pervasiveness in the urban environment is simply a reflection of the continual disruption that characterizes that habitat—they are not its cause. In an agricultural context, the competition of weeds with economic crops is the primary reason for controlling them. In an urban area, a weed is any plant growing where people are trying to cultivate something else (or keep clear of vegetation altogether). The complaints of city dwellers are usually based on aesthetics (the plants are perceived as ugly, or as signs of blight and neglect) or on security concerns (they shield illicit human activity or provide habitat for vermin).

A more recent label for a particularly aggressive weed is "invasive species," indicating a plant that displaces native vegetation in natural areas. In an urban context, where little of the original native vegetation remains, the term has little relevance. In any case, "invasiveness" is really just another word for successful reproduction, the ultimate goal of all organisms, including humans.

A biologically relevant definition of the term urban, as I see it, is any part of a city or town where more of the land is covered with pavement and buildings than not, and all traces of original native habitats have disappeared. The urban environment is also characterized by high levels of disturbance associated with pedestrian and vehicular traffic, infrastructure maintenance, and new construc-

*Opposite page, left: Black locust trees make a stand in Manhattan's Riverside Park. Originally limited to the Appalachian and Ozark mountain ranges, the species now grows spontaneously throughout much of eastern North America. Opposite page, right: Male tree of heaven has survived to maturity in Boston. The Chinese species, widely planted in the northeastern United States in the first half of the nineteenth century, is now widely despised. Left: Yellow toadflax flowers (*Linaria vulgaris*) inhabits the no-man's-land along a chain-link fence. The species was introduced from Europe as an ornamental. Below: Riverside grape, native to the eastern United States and Canada, takes over a Detroit telephone line. Right: Path rush, a widespread native American species also known as poverty rush, commonly occupies roadway cracks.*

tion. "Spontaneous urban vegetation" refers to plants that can survive and reproduce under such conditions. From a plant's perspective, it is not the density of the human population that defines the urban environment, but the abundance of paving (affecting access to soil and moisture) and prevalence of disturbance. In other words, a sidewalk crack is a sidewalk crack whether it is in a city or a suburb. Urbanization is a process, not a place—a process that tends to leave the soil in a compacted, impoverished, and often contaminated state.

Succession—the change in the composition of biological communities over time—is typically driven by disturbance. The initial stages are dominated by rapidly growing species that thrive in full sunlight. Over time, those plants give way to shade-tolerant species, which persist until the next cycle begins. Disturbance of vacant urban land tends to be cyclical. Structures are built, used, abandoned, torn down, and so on. Such disturbance is often tied to governmental approval processes that may take anywhere from five to twenty years for implementation, depending on a combination of economic and political factors. The disturbance cycle is generally faster than what is seen in natural areas, but nothing like the annual cycle imposed on agricultural fields.

The plants that grow and survive in derelict urban wastelands are famous (or infamous) for their ability to grow under extremely harsh conditions. Through a quirk of evolutionary fate, they developed traits in their native habitats that seem to have "preadapted" them to flourish in cities. One study, by biologists Jeremy T. Lundholm of St. Mary's University in Halifax, Nova Scotia, and his then student Ashley Marlin concluded that many successful urban plants are native to exposed

*Top left: Quaking aspen colonizes the roof of Detroit's Michigan Central Station, vacant since 1988. Middle left: Shrub-size willow grows in a moist microhabitat on the second story of an abandoned Detroit factory. Bottom, far left: Field pennycress (*Thlaspi arvense*) sprouts in a neglected concrete planter in Detroit. Bottom, near left: On a plaza in Cambridge, Massachusetts, tufted lovegrass seems to prefer the gaps between the short sides of bricks.*

cliffs, disturbed rock outcrops or dry, open grasslands, all of which are characterized by soils with a relatively high pH. Cities, with their tall, granite-faced buildings and concrete foundations, are in a sense the equivalent of the natural limestone cliff habitats where those species originated. Similarly, as the British ecologist and "lichen hunter" Oliver L. Gilbert noted in his classic book *The Ecology of Urban Habitats*, the increased use of deicing salts on our roads and highways has resulted in the development of microhabitats along their margins that are typically colonized by calcium-loving grassland species adapted to limestone soils or by salt-loving plants from coastal habitats.

In general, the successful urban plant needs to be *flexible* in all aspects of its life history, from seed germination through flowering and fruiting; *opportunistic* in its ability to take advantage of locally abundant resources that may be available for only a short time; and *tolerant* of the stressful growing conditions caused by an abundance of pavement and a paucity of soil. The plants that grow in our cities are a cosmopolitan array of species that somehow managed to survive the transition from one land use to another as cities developed. The sequence starts with native species adapted to ecological conditions before the city was built. Those are followed, more or less in sequence, by species adapted to agriculture and pasturage, to pavement and compacted soil, to lawns and landscapes, to infrastructure edges and environmental pollution—and ultimately to vacant lots and rubble .

The urban landscape of North America as we know it today grew out of the European colonization of the New World. The settlers from England and other nations brought their entire lifestyle along with them—not only their own personal belongings and food for the first year, but also seeds of their crop plants, livestock and the fodder to feed them, and medicinal plants. In addition, colonists inadvertently carried the seeds of weeds embedded in the hay they brought for their animals and mixed in with the grains they sowed. In his classic book *New-Englands Rarities Discovered* (1672), John Josselyn documented dozens of European weeds growing spontaneously in New England that flourished and spread as the native forests were replaced with towns and fields. In contrast, relatively few North American species have become naturalized in Europe, an asymmetry that no doubt reflects the one-sided nature of the cultural exchange.

After Japan was forcibly opened to the West in 1853, new plants from Asia—especially woody plants—began pouring into North America through ports on the U.S. West Coast. At first only wealthy estate owners and commercial nurseries could afford to import those exotic species. But with time and U.S. government support for plant exploration in China, large numbers of Asian plants were introduced into our horticultural and agricultural landscapes. Many of those so-called ornamental species—including kudzu, multiflora rose, Japanese barberry, and various honeysuckles—were widely planted from the 1930s through the 1970s, when (as a legacy of the Dust Bowl days of the Great Depression) using plants to control soil erosion was considered both ecologically and economically responsible.

Even as exotic species were being imported into North America, native species were moving from east to west and west to east as settlers moved inland from the Atlantic Coast. Perhaps the best example of that is black locust, originally limited to the Appalachian and Ozark mountain ranges and now growing spontaneously throughout North America—to such an extent that many states now classify it as an invasive species. In 1979 Viktor Mühlenbach of the Missouri Botanical Garden produced a monograph on the "synanthropic" (associated with humans) flora of St. Louis, documenting the significant role played by railroads in moving both native and introduced plants around the country during the nineteenth and twentieth centuries—to say nothing of the fact that the railroad bed itself provided an ideal corridor for the migration of disturbance-adapted species [*see "Weeds That Ride the Rails," August 1981*].

At the very local level, the movement of plants into cities was facilitated when soil from the countryside—usually loaded with seeds and rhizomes—was used to fill in coastal and freshwater wetlands for urban development. The most extreme example of such wholesale translocation, however, was due to the imbalance of trade between Europe and North America in the nineteenth century. European ships typically arrived filled with rocks and soil as ballast, which was then discarded on shore before cargo was loaded for the return trip. An amazing array of exotic species sprouted from the extensive "ballast grounds" that thus arose in many American port cities. Today, of course, this trend continues as people and commercial goods flow seamlessly around the globe, accompanied by a host of undetected weeds, pests, and pathogens.

The term *urban ecology* might seem an oxymoron. Nevertheless, cities do have their own distinctive ecology, dominated by the needs of people and driven by socioeconomic rather than biological factors. People welcome other organisms into cities to the extent that they contribute to making the environment a more attractive, more livable, or more profitable place to be; and they vilify as weeds or vermin those organisms that flourish without their approval or assistance. But regardless of human preferences, an

enormous variety of nonhuman life has managed to crowd into cities to form a collection of organisms that is every bit as diverse as the human population itself.

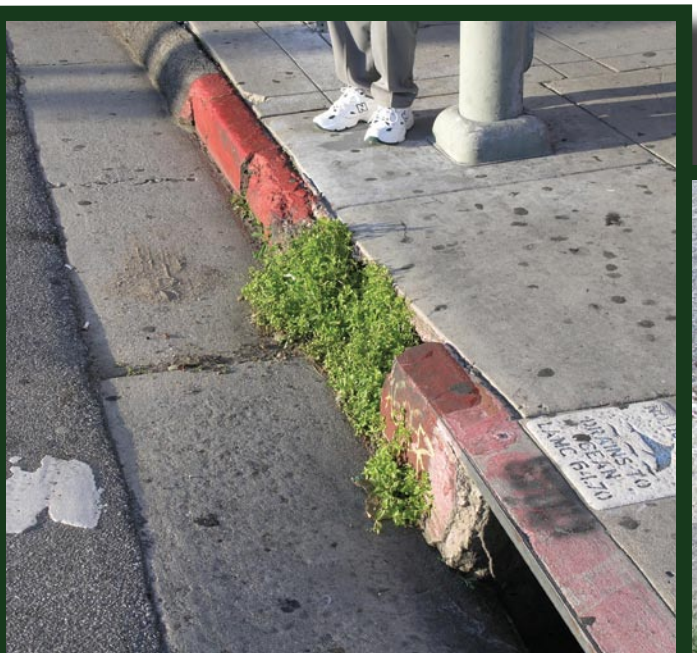
From a strictly functional perspective, ecologists generally recognize three categories of urban land. The first comprises residual, or leftover, native landscapes, such as patches of natural woodlands and wetland dominated by native species and undisturbed soil. Second, there are the intentionally planted or managed landscapes, including public parks, ball fields, cemeteries, residential and commercial gardens, and tree-lined streets—all areas dominated by horticultural plants growing in reasonably good soil. Finally there are *ruderal* (from the Latin for "rubble") landscapes, abandoned or otherwise neglected land, typically associated with urban infrastructure. This last category is the domain of plants spontaneously growing in low-quality soils. Sites include trampled lawns and worn-down ball fields, vacant lots in various states of succession, chain-link fence lines, channelized riverbanks, railroad beds and rights-of-way, exposed rock outcrops, and small pavement openings ranging from tree pits to sidewalk cracks.

To borrow a term from ecology, the urban environment is patchy. As everyone who lives in a city knows, it is always under construction: old buildings are being razed and new ones erected, infrastructure is being replaced, roadways are being repaved or put underground, and open land is being cleared for commercial expansion. Such periodic, unpredictable disturbance combined with the continual introduction of new species from outside sources—including nursery plants with their associated weeds, lawn-seed mixes, construction fill, and seeds carried by wind and migrating animals—provide all the components necessary to create a constantly shifting mosaic of plant associations dominated by stress-tolerant, early successional species. In a way this dynamism mirrors that of the human population of the city, as one ethnic group replaces another when the socioeconomic status of a given neighborhood shifts either upward or downward.

In the absence of intensive horticultural maintenance (planting, weeding, mowing, and watering), spontaneous vegetation will eventually come to dominate most urban landscapes. In fact, the amount of spontaneous vegetation in a given city is typically inversely proportional to its economic prosperity. As any observant resident of New York City has noticed, Manhattan—with its sky-high property values—has relatively little spontaneous vegetation, whereas Brooklyn and the Bronx are filled with it. Similarly, Detroit has become an epicenter of spontaneous vegetation as a result of the long, slow decline of the automobile industry.

While the history and distribution of urban vegetation has been the subject of research for several hundred years, ecologists have only recently come to recognize that these plants are actually performing important ecological functions in the urban environment. In a summary of the results to date of the long-term Baltimore Ecosystem Study, Steward T.A. Pickett of the Cary Institute of Ecosystem Studies in Millbrook, New York, and his colleagues have concluded that "both exotic and native species have functional value in urban systems." Based on the extensive literature on the ecosystem services provided by native and cultivated plants, one can easily generate an impressive list of the ways spontaneous vegetation makes cities more habitable for people as well as animals: temperature reduction, food and habitat for wildlife, erosion control on slopes, stream and riverbank stabilization, excess nutrient absorption in wetlands, soil building on degraded land, improved air quality, noise reduction,

*Below, left to right: Black nightshade (*Solanum nigrum*), common chickweed (*Stellaria media*), and spotted knapweed (*Centaurea biebersteinii*) are all adept at finding toeholds in the cracks of urban pavements.*



and, of course, carbon sequestration.

Edgar Anderson, of the Missouri Botanical Garden, noted in 1952 that many of the so-called weeds that populate North American cities were originally "dump heap" plants from Eurasia that gained a competitive edge by exploiting the nutrient-rich waste that people left behind. As human civilization has developed, a whole group of "camp followers" have been favored by natural selection because of their ability to take advantage of the waste that people inevitably create. Casting such plants in the role of "ecological thugs" makes it virtually impossible to recognize their positive contributions to making cities more livable.

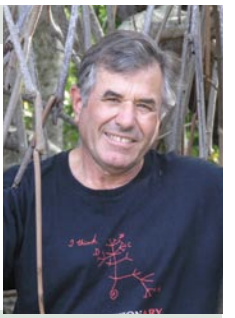
As many scientists have pointed out, modern climate change can be viewed as a massive, uncontrolled experiment on the impact of increased atmospheric carbon dioxide (CO_2) concentrations on Earth's ecosystem. Most people now realize that after more than two hundred years of heavy burning of fossil fuels, every corner of the globe will be affected, but impact at the local level remains unpredictable. And this is where the cities come in: they have already arrived at the future in terms of experiencing higher concentrations of CO_2 than the surrounding countryside. Plants in general thrive under such conditions, and because they also serve as a means for carbon sequestration, there is considerable enthusiasm for planting trees in urban areas. Considering that they grow on marginal sites and require no maintenance, spontaneous urban plants are providing a greater return in terms of carbon sequestration per maintenance dollar spent than most intentionally cultivated species.

As every sufferer of hay fever knows all too well, however, plants do not always enhance the quality of life for the human inhabitants of cities. If recent research is any guide, climate change could well make some of those negative interactions worse than they currently are. Controlled experiments with two infamous native plants—ragweed and poison ivy—have shown that elevated levels of CO_2 induce the former to produce significantly more of its highly allergenic pollen and cause the latter to produce higher concentrations of its rash-producing toxins. While such observations do not bode well for humans in a CO_2-rich future, they are a reminder of the innate capacity of "weeds" to capitalize on—and often, thankfully, remediate—the mess we have made of the planet.

Through a heat-trapping "greenhouse" effect, the increased levels of atmospheric CO_2 are expected to boost global warming. Here too, cities provide a model. All the impervious paving and buildings absorb and retain heat, and all the cars, air conditioners, and electrical equipment generate heat. In consequence, according to estimates by Timothy R. Oke, an emeritus professor and urban climatologist at the University of British Columbia in Vancouver, the annual mean temperature of a mid-latitude urban area with a population of a million can be up to 5.4 Fahrenheit degrees warmer than the surrounding nonurban zone. And in "ideal" calm, clear conditions at night, the hourly mean temperature differential may be as great as 21.6 degrees. The "heat island effect" means that the core areas of many of our larger cities have already warmed up to the levels predicted for the surrounding countryside some twenty to fifty years from now.

Over the next few decades, humans can be counted on to pump more CO_2 into the atmosphere and generate more chemicals to pollute the water and the soil. The worldwide migration of people from the countryside into cities is also contributing to environmental degradation because land that was once covered with vegetation is being covered instead by buildings and pavement. The confluence of climate change and urbanization—acting in concert with the global spread of invasive species—has set the stage for spontaneous vegetation to play a major ecological role in the future. These plants are well adapted to the world we have created and so are neither good nor bad—they are us.

This article was adapted from *Wild Urban Plants of the Northeast: A Field Guide,* by Peter Del Tredici, forthcoming from Cornell University Press in April.



Peter Del Tredici is a senior research scientist at the Arnold Arboretum of Harvard University, where he has worked since 1979. He is also a lecturer at Harvard's Graduate School of Design, where he teaches courses on plants, soils, and urban ecology. "The Other Kinsey Report," a previous article by Del Tredici, appeared in our July-August 2006 issue.