

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/294228931>

Brave new ecology

Article in *Landscape Architecture* · February 2006

CITATIONS

2

READS

49

1 author:



Peter Del Tredici

Harvard University

72 PUBLICATIONS 2,019 CITATIONS

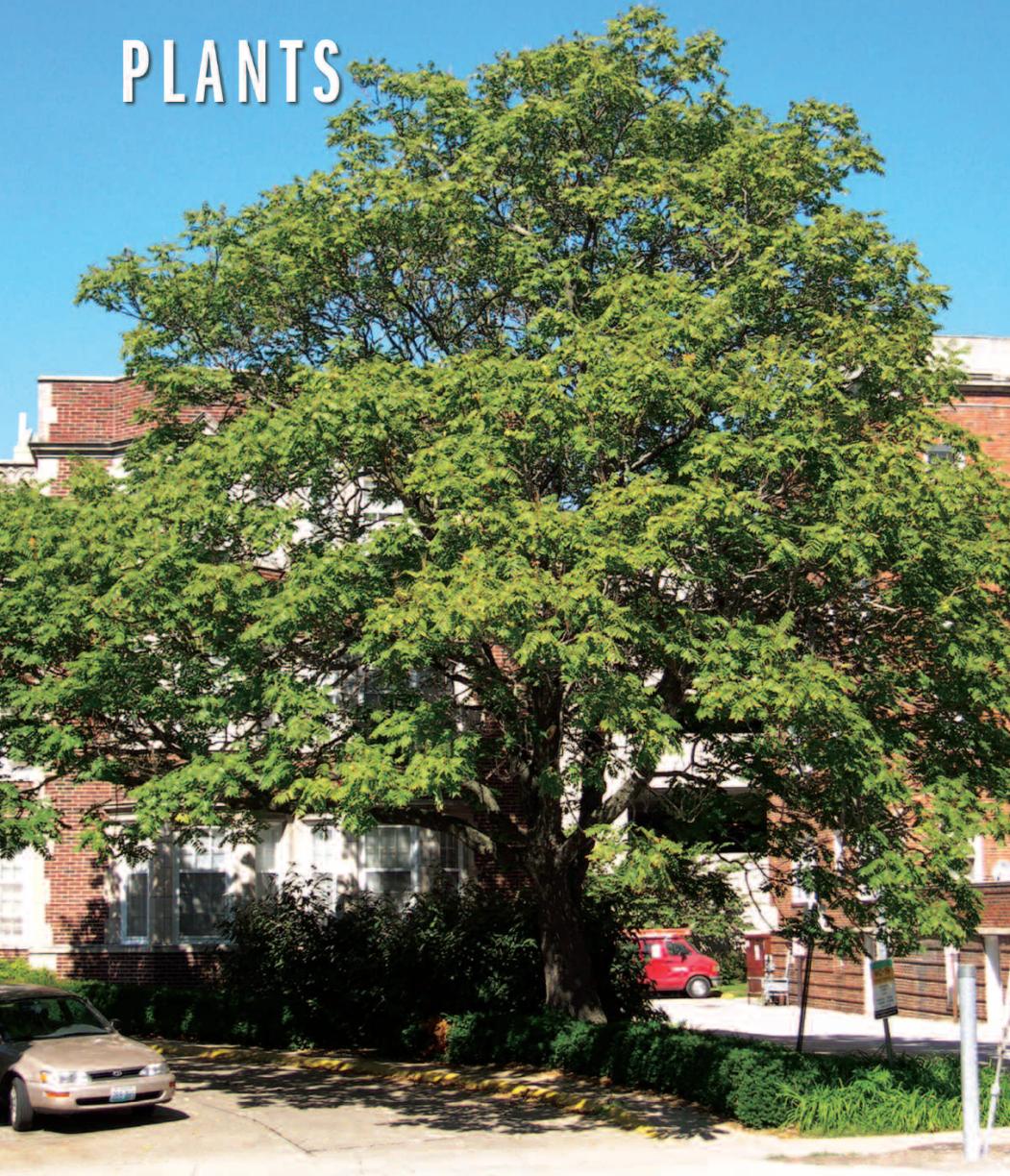
SEE PROFILE

Some of the authors of this publication are also working on these related projects:



Vegetative Regeneration in Trees [View project](#)

PLANTS



Tree of Heaven, *Ailanthus altissima*, left, is undoubtedly the most common unplanted tree in urban environments of the East Coast. It is perfectly adapted to growing in the interstitial spaces between buildings and pavement.

good against evil, with little regard for facts.

Within the field of plant ecology, the issue of using exotic or native species in designed landscapes seems to bring out the worst in people, not unlike the debates over gun control and abortion. As a representative of the Arnold Arboretum of Harvard University, I have served as a member of the Massachusetts Invasive Plant Advisory Group, a voluntary collaboration of nursery professionals, conservationists, botanists, land managers, and representatives from various government agencies that reports to the state's Office of Environmental Affairs. Over the course of the past three-plus years, the group produced a list of species that are invasive in "minimally managed" habitats, and it developed a set of recommendations for how to cope with the problem. Based on these findings, the Massachusetts Department of Agriculture has banned the sale of Norway maple, Japanese barberry, and winged euonymus after January 1, 2009.

Implicit in the proposals that call for eradicating or banning exotic invasive species is the assumption that native vegetation will return to dominance once invasives are removed. That is the theory; the reality, of course, can be quite different. Land managers and others who have to deal with the invasive problem on the ground know that more often than not the old invasive species comes back following removal, or else a new invader moves in to replace the old one. The only treatment that seems to change this dynamic is cutting down the invasives, treating the stems with herbicides, and planting native species in the gaps where the invasives once were. Following this, the site requires weeding for an indefinite number of years, until the natives are big enough to hold their ground without human assistance.

What's striking about this so-called restoration process, with its ongoing need for planting and weeding, is that it looks an awful lot like gardening. Call it what you will, but anyone who has ever worked in a garden knows that planting and weeding are endless tasks. So the question becomes "Is 'landscape restoration'

BRAVE NEW ECOLOGY

On the road to more sustainable urban landscapes, the natives-versus-exotics controversy, says one plant scientist, is a dead end. **By Peter Del Tredici**

T'S EASY TO ENUMERATE hot-button issues in contemporary American culture: Gun control, abortion, globalization, intelligent design, and immigration reform are just a few. One thing that the debates about these issues have in common is that they are highly polarized, with neither side paying much attention to what the other is saying. Another is that they often have an overarching moralistic tone that pits

CHRIS STARBUCK, UNIVERSITY OF MISSOURI

Peter Del Tredici is the subject of this month's Shared Wisdom (page 96).

really just good horticulture dressed up with jargon to simulate ecology, or is it based on scientific theories with testable hypotheses?" To put it another way: Can we ever really put the invasive-species genie back in the bottle, or are we looking at a future in which nature as we know it becomes a cultivated entity?

The answer to this question lies in an understanding of the concept of ecological succession, which describes changes in the composition of plant and animal assemblages over time. Prior to World War II, ecologists generally viewed succession as an orderly process leading to the establishment of a "climax" or steady-state community that, in the absence of disturbance, was capable of maintaining itself indefinitely. I like to refer to this as the Disney version of ecology, stable and predictable, with all organisms living in harmony. Following World War II, a younger generation of ecologists began challenging this orthodox view, eventually formulating what is now known as the theory of patch dynamics, which views natural disturbances as an integral part of an unpredictable succession process. A key concept in the new ecology is that the nature, timing, and intensity of the disturbances are critical factors—together with climate and soil—in determining the composition of successive waves of vegetation.

Can we ever really put the invasive-species genie back in the bottle, or are we looking at a future in which nature as we know it becomes a cultivated entity?

FROM THE PERSPECTIVE of modern ecology, the apparent stability of current plant associations is an illusion; the only certainty is that things will be substantially different 50 years from now. When one broadens the traditional definition of disturbance to include the effects of acid rain on soil biology and of carbon dioxide enrichment of the atmosphere on climate systems, it becomes clear that all places on Earth have experienced some level of disruption as a result of human activity.

Despite mountains of data documenting the planetary scale of human-induced environmental change, much popular writing on the subject of ecological restoration assumes that the plant and animal communities that existed in North America prior to European settlement can be returned to some semblance of original composition. The fact that the environmental conditions that led to the development of these pre-Columbian habitats are long gone—and can never be re-created—does not seem to matter to strict restorationists,



***Paulownia tomentosa*, the princess tree, arrived in North America from Asia in the early 1800s. In New London, Connecticut, it has made itself at home in a typical urban “cliff niche.”**

successful comebacks, they tend to function differently in the present than they did in the past because the ecosystem as a whole has changed. This is best exemplified by white-tailed deer, whose populations were once controlled by the hunting activities of Woodland Indians. The deer roam the countryside in large herds, selectively browsing native species while ignoring the invasives. In the process, they manage not only to annoy home owners but also to alter long-established patterns of forest succession.

The concept of ecological restoration in an urban or suburban context is particularly problematic, given the abundance of pavement, road salt, reflected heat, air pollution, and soil compaction that characterize our metropolitan centers. As I see it, the critical question faced by the professionals who design, build, and maintain our urban landscapes is not what plants grew there in the past, but which ones will grow there in the future?

Our cities are characterized by an ecology that is essentially of the people, by the people, and for the people. We welcome other organisms into our world to the extent that they can contribute to making it a more beautiful, livable, or profitable place to be. And we vilify as weeds those organisms that

whose “faith-based” notions of restoration have more to do with ethical values than with ecological reality.

Recent experience in eastern North America has shown that even when the individual components of past ecosystems make

PLANTS

flourish without our approval or assistance. Some of them are native to eastern North America, but well over half of them have been introduced from Europe and Asia.

Regardless of how we feel about the unique assemblages of plants that populate our sprawling cities, they have become the de facto native vegetation of the urban environment. As such, we need to acknowledge that they are actually performing significant ecological functions including water and air filtration, heat absorption, mineral cycling, and carbon storage. A good example of this is the common reed (*Phragmites australis*), which is native to Europe and central Asia as well as to North America, where it grows in brackish wetlands up and down the East Coast. While *Phragmites* is often portrayed as the ultimate invasive species because of its capacity to displace other vegetation, it is actually mitigating pollution by absorbing a great deal of the nitrogen and phosphorous that typically accumulate in such degraded wetlands. In the jargon of landscape architecture, *Phragmites* is one of the all-time great phytoremediation plants.

From a functional perspective, the presence of *Phragmites* in disturbed landscapes is a symptom of environmental degradation rather than its cause. Research has shown that a number of invasive plants have a similar kind of "Jekyll and Hyde" impact

on the local ecology, pushing out some native plants while providing food and shelter for a wide variety of native animals, especially pollinating insects and migrating birds. Like so much else in the modern world, the designation of a species as invasive is a relative concept that depends on the context in which the plant is growing.

In a very real sense, the diversity and spontaneity of these new "immigrant" biological communities mirror those of our own society. Indeed, the very same processes that have led to the globalization of the world economy—unfettered trade and travel among nations—have also resulted in the globalization of our environment. And rest assured that the globalized environment is every bit as difficult to control as our globalized economy, if not more so. It's ironic that the real ecology of the city is all about the dominance of invasive species, while the cultivation of the native species that once grew there seems as artificial as a French-knot garden.

SO WHAT CAN LANDSCAPE ARCHITECTS do to cope with the widespread environmental devastation and ecological uncertainty that have become such an integral part of the modern world? Over the course of my 13 years of teaching at the Harvard Graduate School of Design, I have developed a three-step approach that combines sound horticulture with applied ecology to cover the design, construction, and maintenance of built landscapes.



***Phragmites australis*, or common reed, is prevalent in disturbed wetlands up and down the East Coast and is native to both Eurasia and North America. In Boston's Back Bay fens, it can grow to more than 12 feet tall.**

The first step of my program is to acknowledge that the heavy equipment used during the construction process inevitably compacts the surrounding soil to a density approaching concrete. Such compacted soils, with their low oxygen tensions, high-bulk density, and impeded drainage, are lethal

to many plants, especially native species that come from upland habitats. Without adequate remediation of the compaction and drainage problems that abound in urban landscapes, invasive species are pretty much the only plants that will survive.

My second recommendation is not to limit planting designs to native species that once grew on the site. Imposing such a limitation reduces not only the aesthetic potential of the landscape, but also its overall adaptability to future environmental change. Instead, I propose that "sustainability" be the standard for deciding what to plant. According to my definition of this overused word, sustainable landscape plants are tolerant of the conditions that prevail on

a given site; require minimal applications of pesticides, herbicides, and fertilizers to flourish; have greater drought resistance and winter hardiness than other plants; and display minimal tendencies to spread aggressively into surrounding natural areas. Landscapes that are designed with plants that fit the above criteria—including both native and introduced species—will not only be less costly to maintain over time but will also be better able to tolerate the unpredictable weather patterns that loom in the future. In this regard, American designers have much to learn from their European counterparts, who have a long tradition of using cosmopolitan plant associations to create naturalistic landscapes.

My third and final recommendation is to recognize, at some point in the design process, the ongoing need for maintenance on all constructed landscapes. All too often the concept of sustainability is misinterpreted to mean self-sustaining, a fantasy that is as false in horticul-

The real ecology of the city is all about the dominance of invasive species, while the cultivation of the native species that once grew there seems as artificial as the French-knot garden.

ture as it is in ecology. Landscape maintenance is necessary to promote the successful establishment of new plantings, as well as to counteract the effects of disturbances—both natural and human—that continually threaten the integrity of mature plantings. From a horticultural perspective, a truly sustainable landscape design is one that is in balance with the financial resources available to maintain it.

A brave new ecology is taking shape before our very eyes. Regardless of how one feels about these changes, we need to develop forward-looking landscape forms that acknowledge this new reality rather than simply falling back on romantic notions of bringing back the past. LAM

Peter Del Tredici is senior research scientist at the Arnold Arboretum of Harvard University and Harvard Graduate School of Design. He presented this article at the ASLA annual meeting in Fort Lauderdale, Florida. It is an abbreviated version of "The Role of Horticulture in a Changing World," which will be published in Botanical Progress, Horticultural Innovations and Cultural Changes, edited by Michel Conan and W. John Kress (Washington, D.C.: Dumbarton Oaks).