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The Residential **Macrosystem**

Managed collectively, backyards could become more biodiverse landscapes

By Courtney Humphries

Cities around the United States are setting ambitious environmental goals to boost their tree canopy, clean up waterways, and adapt to climate change. Much of this attention on urban sustainability is, not surprisingly, focused on parks, rivers, street trees, and other visible public spaces. But take a look at

any metropolitan area from above and you'll realize that much of the land is private—fenced away in thousands of individual yards.

What goes on in a yard is seen as a personal decision by homeowners. But all of those individual decisions add up. “We think it’s just our house,” says Sharon Hall, an ecosystem scientist at Arizona State University. “But forty or fifty percent of a city is people’s yards. If you put us together and replicate it across the country, it’s a very large area.”

Researchers like Hall are making the case that these vast yardscapes should be studied as ecosystems in their own right. The idea of backyard science has always seemed intimate in scale. But Hall is talking about something bigger; she calls it the “American residential macrosystem.”

Recently, Hall and a team of scientists in six cities, funded by a National Science Foundation grant designed to address continental-scale science, studied to what extent this residential macrosystem is the same from place to place. “We had this hypothesis that when humans settle into areas, they create these residential landscapes that are pretty similar to each other,” says Peter Groffman, a microbial ecologist at the Cary Institute of Ecosystem Studies, who leads the group. This “homogenization hypothesis” makes sense intuitively. “You can look at a Google Earth image of a neighborhood in Phoenix and it doesn’t look all that different from a neighborhood in Baltimore,” he says.

The team has collected evidence that residential areas are more alike than the natural environments outside those cities. Miami and Phoenix, for example, have temperatures and humidity levels that are closer to one another than to their surrounding ecosystems. Residents of different cities tend to water and fertilize their yards at about the same rates, regardless of the natural conditions. “We have reduced the heterogeneity across the country,” Groffman says. That has larger environmental implications, since it requires resources to keep these ecosystems the same, whether they are embedded in deserts, forests, or plains.

Ecologists are also tackling the question of whether residential landscapes can support the richness and diversity of species seen in natural landscapes. Groffman says that studying species dynamics can shed light on the growing number of ecosystems that are shaped by human activity. “We argue that the ecosystems of tomorrow are being assembled in the cities of today,” he says. Although we tend to dismiss urban and suburban nature as a diminished version of the real thing, research shows that these areas are more biologically active than assumed. Cities can have greater biodiversity than surrounding natural areas, Groffman says, because people tend to keep native vegetation while introducing other species.

And there’s evidence that yards have the potential to be more interwoven with natural ecosystems when we choose to manage them less aggressively. For instance, Susannah Lerman, an ecologist at University of Massachusetts at Amherst, has found that weedier lawns allow flowers to bloom that could provide habitats for bees and butterflies.

Perhaps most importantly, researchers are beginning to understand how the chemical cycles of carbon, nitrogen, and phosphorous operate differently in these highly managed areas. For instance, Boston University researchers have found that urban trees grow twice as fast as trees in nearby forests, storing away carbon at a quicker rate. At the same time, they also found that biological activity in the rich, mulched soils in yards in suburban Boston emit more than two times the carbon dioxide as rural forest soils. “People think that cities are a biological black box, that nothing’s happening in cities,” says Steve Decina, a graduate student who led the carbon dioxide research. But in fact, humans deliberately create enriched environments for the plants around them, and these can have positive and negative environmental consequences. But the gardeners themselves can’t be ignored: understanding residential landscapes as ecosystems also requires studying the people who own them. Urban ecologists are working alongside social scientists to study individual, social, and economic forces behind landscape choices. “Yards are really symbolic of people’s identity,” says Morgan Grove, a research forester with the US Forest Service who studies homeowners in Baltimore. “They’re how we assert our membership in the group and our relationship with land.”

Grove says that environmentalists' "finger-wagging" over people's lawn-care practices and pesticide use doesn't always help. First we need to understand what drives those choices. Case in point: Americans value neatness; they prefer plants in rows or in bordered beds, with trees and shrubs like solitary islands in a sea of mulch. Joan Nassauer, a landscape architect at the University of Michigan, uses the term "cues to care" to describe what people most value in a landscape. These cues "connote that other people have been there and return regularly to take care of it," she says. For instance, neighborhoods in Detroit where grass is regularly mown are perceived as safer and more worthy of investment. Nassauer believes that anthropogenic environments won't thrive unless humans care about them. So the trick is for designers to strike a balance—creating landscapes that support pollinators but also show signs of human care.

Though often overlooked as natural spaces, yards are a front line for studying human-dominated environments, and a test case for making those environments more sustainable. Homeowner associations, neighborhood groups, and developers of planned communities have the potential to reshape yardscapes and the residential macrosystem into more a thriving ecosystem—one block at a time.