

New Shrubs / Spring Trials Part 2 / Weighed Down by Scales?

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From Cityscapes to Plantscapes

Urban areas are using more green and less concrete to make room for pollinators and manage stormwater.

COVER STORY

Abuzz in the Big City



40 The role of pollinators and plants in urban landscapes.

Story by Emily Minor, David Lowenstein & Kevin Matteson

ON THE COVER

In this month's issue, we're focusing on different aspects of what the term "landscape" could mean, including the role it plays for pollinators in urban areas. The Lurie Garden in downtown Chicago is a great example of turning part of a "concrete jungle" into a haven for bees and butterflies. Turn to page 40 to read more.

Photo by Mark Widhalm.

IN EVERY ISSUE

- 8 Inside Look
- 10 Webinars
- 12 In Brief
- 22 SAF: In the Lobby
- 32 Under an Acre
- 35 Directory
- 36 Classifieds
- 78 New Products



FEATURES

Shrub Club

44 From additions to tried-and-true series, to new shrubs with vibrant colors and interesting forms, this year's newcomers are sure to spice up any outdoor space.

by Allison Westbrook

Using Plants to Manage Stormwater

48 Hundreds of cities are ripping out concrete and going greener.

by Debbie Hamrick

Pallin' Around with Paul

52 Paul Westervelt of Saunders Bros., and friend and *GrowerTalks* contributor, wanted to see the perennial and botanic gardens around Chicagoland, northern Illinois and Wisconsin, and he allowed me to tag along.

Story & photos by Jennifer Zurko

More of What We Saw

56 We continue with the second half of our California Spring Trials coverage with perennials, potted plants, a few shrubs and some miscellaneous stuff that doesn't fit into a specific category.

Story & photos by Chris Beytes, Ellen C. Wells, Paul Pilon & Jennifer Zurko

Utilizing PGR Best Practices, Part 2

66 Taking a closer look at PGR use in annuals and overcoming overdoses.

by Jim Scruggs



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Reader Service Number 27



Abuzz in the Big City

Emily Minor,
David Lowenstein
& Kevin Matteson

The role of pollinators and plants in urban landscapes.

The world is becoming increasingly urbanized. Cities are centers of culture and civilization; they foster economies of scale and agglomeration. But city life can be stressful—fast-paced, noisy, congested.

Furthermore, human well-being has been linked with green space and biodiversity, both of which are somewhat lacking in cities. Nevertheless, many urban dwellers have found ways to connect with nature right in their own backyards (so to speak). Gardening—whether growing vegetables, tending a flower bed or simply managing a few terracotta pots on a balcony—has been shown to lower stress hormones, reduce risk of strokes and heart attacks, and improve mental health. What's more, gardening can increase urban biodiversity, contributing to conservation and sustainability within cities.

Pollinators in the Concrete Jungle

Urban biodiversity might sound like an oxymoron. Cities are often perceived as “concrete jungles” or “biological deserts.” And it's true that urban biodiversity is almost always lower than biodiversity in adjacent natural lands. But in some cases, a surprising number of native species can persist in cities.

For example, more than 150 species of wild bees once lived in northeastern Illinois. That land is now largely covered by Chicago, the third largest city in the United States, and its many suburbs. Many bee species that once lived there have been extirpated from the region and even the state, while oth-

ers persist only in small isolated pockets of natural habitat. But within the city limits of Chicago, at least 68 bee species have been recorded in the last decade—many of which reside in, and depend on, gardens in heavily developed neighborhoods.

Similar trends have been seen in other cities. Not all of these urban bees are native species; in Chicago, at least 10 species—including the European honey bee—have been imported to the region intentionally or unintentionally by humans. But the majority of these bees are native wild species that persist in urban areas in spite of, and perhaps sometimes because of, human activities.

Why should we care about wild pollinators? Although the European honey bee gets most of the attention and credit for pollinating our crops, wild bees can be equally or more important for pollination. Wild bees include those that aren't deliberately managed in hives by humans, with many species inconspicuously nesting in soil or cavities in plants. More wild pollinators, and higher pollinator diversity, leads to better pollination of crops. This issue is not just relevant to rural farmers, as urban agriculture has been rapidly growing over the last decade. Urban bees can benefit from vegetable production in private gardens, community gardens and urban farms, as well as community-supported agriculture within and around cities.

It's also important to note that bees aren't the only pollinators in urban areas. Insects such as flower flies are a diverse and abundant group that pollinate a wide range of plants. Butterflies are less efficient pollinators than bees or flower flies, but are an essential part of the ecosystem and a delight to most urban residents. ►

In just a small sampling of Chicago residential neighborhoods, front yards and gardens contained more than 400 plant species. Backyards likely contain at least twice that number.



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A metallic green sweat bee collecting pollen from a prairie sundrop flower. ■ A flower fly on a yarrow.



The need for more urban gardens

Many pollinators have been declining across the globe over the last several decades, prompting attention from conservation scientists, politicians and the media. In addition to pollinators, many other beneficial insects rely on plants for pollen and nectar. Although urbanization itself—especially the habitat loss and concrete that accompanies it—may be partly to blame for the loss of these insects, urban gardens can be part of the solution.

In just a small sampling of Chicago residential neighborhoods, front yards and gardens contained more than 400 plant species. Backyards likely contain at least twice that number. Many of these plants provide valuable nectar and pollen resources for pollinators. Not all of these plants are intentional: weeds make up about one quarter of the observed flowering plant species and may comprise more than half of the floral resources available for pollinators in certain neighborhoods. What's fascinating from a social perspective, but also notable from an ecological perspective, is how these plants and floral resources vary from one neighborhood to another across the city.

Some flowering plants are abundant and widespread. These are mostly weeds, such as dandelions and clover, which are found in all but the wealthiest Chicago neighborhoods. Intentionally planted ornamental plants tend to vary more from neighborhood to neighborhood, although a few, such as hostas and roses, are also very widespread.

Both intentional plants and weeds are

visited by pollinators, some more than others. Certain pollinators are very specialized and visit only a single or a few plant species, while others are generalists. The existence of specialists means that a diversity of plants is needed to support a diversity of pollinators. Because the same weeds are found almost everywhere, the plants intentionally grown by humans are primarily responsible for the diversity of floral resources in the city and, thus, diversity of urban pollinators.

The decisions that individual residents make about their yards and gardens are complex and difficult to predict. But at the neighborhood scale, certain trends emerge. In Chicago, moderately dense urban neighborhoods tend to have a higher diversity of floral resources compared to less dense neighborhoods. This non-intuitive observation is likely due to the varied preferences and aesthetics of individual residents, which creates more diverse plant communities in neighborhoods with more people. However, taken to the extreme of very densely populated neighborhoods with many homes and tall buildings (e.g., downtown Chicago), concrete increases and sunlight decreases, reducing residents' ability to grow as many plants as they want and resulting in lower plant diversity.

Interestingly, racially- and ethnically-diverse neighborhoods in Chicago also have a higher diversity of floral resources compared to neighborhoods that are predominantly white, black or Hispanic. The underlying explanation for this trend is unclear and it's unknown if similar patterns exist in other large cities.

A bumblebee on a gaillardia. ■ A red admiral butterfly on a purple coneflower.



Household income affects neighborhood biodiversity as well. While income isn't related to number of plant species or diversity of floral resources, high-income Chicago neighborhoods have different plant communities compared to low-income neighborhoods. For example, plants generally considered as weeds are more prevalent and diverse in low-income neighborhoods. Among the intentionally planted flora, a few plants, such as Russian sage and nepeta species, are strongly associated with higher-income neighborhoods.

The implications for pollinators are compelling. Research indicates that those same moderately-dense urban neighborhoods also have higher bee diversity compared to their less dense counterparts. This is a direct outcome of the higher diversity of floral resources in those neighborhoods. Because higher bee diversity is linked with better crop pollination, it's likely that moderately dense neighborhoods also have more productive urban agriculture. It's also reasonable to assume, although not yet known, that neighborhoods with different income levels and different racial and ethnic compositions would host different dominant bee species. Future research might find that multicultural cities with highly heterogeneous neighborhoods actually support higher bee diversity than more homogeneous cities.

This is not to say that cities, in and of themselves, are sufficient for pollinator conservation across regions. Clearly, large areas of natural habitat located outside of cities are critical for pollinator

conservation. However, cities are often overlooked in terms of their ability to contribute to conservation efforts. Particularly for pollinators, which are relatively small and have correspondingly small habitat needs, urban gardens offer opportunities for modest actions to yield large benefits. Simply by adding some flowering plants that are attractive to pollinators, even in pots on a porch or balcony, urban residents can have an important influence on the ecology and biodiversity of their neighborhoods. 6

More details about the research described in this article can be found in the following publications:

(1) Lowenstein & Minor. 2016 Diversity in flowering plants and functional characteristics: Integrating humans as a driver of urban floral resources. *Urban Ecosystems* doi:10.1007/s11252-016-0563-z.

(2) Lowenstein, Matteson, & Minor. 2015. Diversity of wild bees supports pollination services in an urbanized landscape. *Oecologia* 179 (3), 811-821.

(3) Lowenstein, Matteson, Xiao, Silva, & Minor. 2014. Humans, bees, and pollination services in the city: the case of Chicago, IL (USA). *Biodiversity and conservation* 23 (11), 2857-2874.

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