From potential to practical: conserving bees in urban public green spaces

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The documentation of many rare or declining bee species in urban green spaces has led to a recent focus on cities as conservation targets. However, for pollinator conservation to succeed long term, we argue that the opinions and values of local community members must be prioritized more explicitly. In our experience, conservation is difficult to achieve when the aesthetic and safety concerns of urban residents are not reconciled with the goals and habitat designs of conservation practitioners. Similarly, from a bee ecology perspective, many questions concerning optimal design and management practices for pollinator habitats in cities remain unresolved. It is our hope that frank discussion of the challenges associated with urban pollinator conservation in public green spaces will inspire thoughtful consideration of how best to implement new initiatives in cities.

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Public green spaces are interwoven throughout every urban landscape. These habitats are an important resource for the provision of ecosystem services, and benefit both biodiversity and human well-being in cities. We define "public green spaces" here as land owned and/or managed by public organizations or municipal governments, including parks, vacant lots, unoccupied land held in trust, rights-of-way (eg roadside verges, powerlines, railways), and grounds associated with government facilities, schools, or museums. Despite the challenges of urbanization, public green spaces have considerable potential for conservation (Gardiner *et al*. 2013; Baldock *et al*. 2015; Hall *et al*. 2017). High bee richness is frequently documented in cities (Senapathi *et al*. 2017; Theodorou *et al*. 2017), highlighting the ability of many bee species to overcome stressors associated with urbanization (Harrison and Winfree 2015). However, we contend that the potential of urban green spaces for bee conservation is jeopardized by collective underestimation of the complexity involved in translating research into practical implementation. Landscape manipulation that is carried out without co-establishing goals with urban residents and following community-driven design processes (Nassauer and Opdam 2008; Nassauer 2012) may be short-lived, if realized at all.

In a nutshell:

- Urban pollinators are challenged by habitat loss, degradation, and fragmentation
- Nevertheless, cities often support rich bee faunas, and public green spaces such as parks, gardens, and vacant land offer tremendous potential if managed as bee habitats
- When designing urban bee habitats, ecologists must optimize pollinators' needs in a manner that both is economically feasible and respects societal norms and values
- Co-designing public green spaces with a diverse team of stakeholders is therefore necessary to achieve long-term pollinator conservation in cities

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Several forms of public green space are candidates for pollinator conservation, including urban parks, public lawns, and gardens (Larson *et al*. 2014); community or allotment gardens and farms (Matteson and Langellotto 2011); green roofs (Tonietto *et al*. 2011); and vacant lots (Figure 1; Gardiner *et al*. 2013; Sivakoff *et al*. 2018). Recommendations to maximize the quality of these green spaces for bees often focus on reducing management frequency or intensity, as well as increasing the abundance of flowering vegetation (Garbuzov *et al*. 2015a; Wastian *et al*. 2016; Hall *et al*. 2017). However, there are many gaps in our understanding of these strategies, which, if not addressed, will continue to impede effective bee conservation in cities. For example, not all "pollinator friendly" plant lists are verified by empirical studies that quantify bee visitation or evaluate pollen/nectar nutritional content. Furthermore, there is little information available regarding how factors such as bee reproduction, survivorship, dispersal, and population connectivity are influenced by these interventions.

These gaps in scientific knowledge can be addressed with future investment in urban pollinator research, but translating scientific recommendations into practices that meet the expectations for public green spaces held by urban residents is more complex and challenging. When planning future green spaces, it is important to be mindful of the perspectives of local residents and to recognize that a city's unique context may influence such preferences. In cities undergoing economic expansion, green spaces are often viewed positively by residents (Ives *et al*. 2017), even when they incorporate relatively tall meadow plants (Southon *et al*. 2017). Conversely, in shrinking cities that are experiencing popula-

Figure 1. (a) The shrinking city of Cleveland, Ohio, has lost over 50% of its peak population, resulting in an overabundance of infrastructure that is eventually torn down, thereby creating vacant lands. (b) Across the city, over 27,000 vacant lots are maintained with monthly mowing; these lots are dominated by non-native turf grasses and common weedy plant species. (c and d) In 2013, we initiated a large-scale field experiment to determine if management or landscape context influenced the conservation value of these habitats for arthropods. Our study compared eight vegetation treatments across a network of 64 vacant lots; four treatments were "pocket prairies" that incorporated native Ohio forbs and grasses at varying levels of species richness.

tion decline, an overabundance of green spaces in the form of vacant land can be perceived as a symbol of blight (Nassauer and Raskin 2014). Conservation outcomes therefore depend on ecologists recognizing and incorporating the diverse goals and perspectives of people living nearby (Gobster *et al*. 2007; Hunter and Hunter 2008; Nassauer 2012). If residents disapprove of a conservation site, they may undermine it through vandalism (Figure 2), whereas if residents support the development of a green space, they may advocate for its funding, vote for local green initiatives, or volunteer to help with management of local pollinator habitats.

In moving beyond a paradigm of ecology *in the city* and toward the ideal of ecology *for the city* (Pickett *et al*. 2016), we agree with the proposals of Nassauer (2012) that urban ecologists must include all human players within the urban system in transdisciplinary decision making and planning. This raises a fundamental question: how can public green spaces be co-designed to meet the needs of both urban pollinators and city residents? We first examine the social and ecological considerations for designing public green spaces as pollinator conservation habitats, and then provide a roadmap to advance the long-term success and sustainability of conservation sites for the benefit of both pollinators and human communities.

Social and ecological considerations for designing public green space

To support bees in cities, most initiatives begin with a goal to enhance the abundance and richness of floral resources within a targeted conservation space, as this is well recognized to promote pollinator richness (Senapathi *et al*. 2017; Theodorou *et al*. 2017; Threlfall *et al*. 2017). Achieving this requires a substantial investment in ecological research, which could include evaluation of the existing vegetation as bee forage, assessment of alternative plant communities as bee habitat, and comparisons of habitat management strategies (eg mowing frequency) and costs. However, the design of a conservation site should equally prioritize sociological considerations (eg local residents' perceptions of safety and aesthetics), which are based on local demographics, knowledge, values, and attitudes, as well as the surrounding landscape and economic/political context (Gobster *et al*. 2007;

Nassauer and Raskin 2014). This information is often lacking when projects break ground, jeopardizing long-term bee conservation.

Selecting plants for urban bee forage and aesthetic concerns

Currently, most foraging resources for bees within urban green spaces consist of non-native plants (Lowenstein and Minor 2016), and urban bee conservation will likely continue to rely heavily on these abundant plant species (Hinners and Hjelmroos-Koski 2009; Larson *et al*. 2014; MacIvor *et al*. 2014). Common sources of nectar and pollen include many naturally regenerating woody plants and weedy forbs that occupy lawns and vacant lots (Larson *et al*. 2014; MacIvor *et al*. 2014; Sivakoff *et al*. 2018), along with non-native ornamental plants growing in public parks and gardens (Hinners and Hjelmroos-Koski 2009). Although non-native flowers are often considered to be inferior foraging resources (Larson *et al.* 2014), their attractiveness to bees varies widely (Garbuzov *et al*. 2015b), and is highly dependent on the volume and accessibility of their nectar or pollen (Potts *et al*. 2003; Garbuzov *et al*. 2015b). The nectar and pollen produced by some commonly planted non-native species are largely inaccessible to many pollinators, and several plants that feature extensive floral areas (eg petunias [*Petunia* spp] and impatiens [*Impatiens* spp]) produce only small quantities or low-quality nectar and pollen (Lowenstein and Minor 2016). However, other non-native plants can make up a substantial proportion of resources used by urban bees (Hanley *et al.* 2014; Larson *et al*. 2014; MacIvor *et al*. 2014). For example, weedy species, such as white clover (*Trifolium repens*), red clover (*Trifolium pratense*), and Queen Anne's lace (*Daucus carota*), are the most frequently visited flowering plants in vacant lots in Cleveland, Ohio (Sivakoff *et al*. 2018). Furthermore, the seed banks that build within the soils of vacant lots ensure that weedy species will remain important nectar and pollen resources even if those lots are later converted into conservation habitats (Figure 3). Certainly, planted ornamentals (eg Dutch lavender [*Lavandula* × *intermedia*]; Garbuzov and Ratnieks 2014b) are widely accepted as being both aesthetically attractive and beneficial to biodiversity, but maintaining public gardens can be expensive. As such, any large-scale urban conservation plan must recognize the value of low-maintenance, low-cost habitats consisting of naturally occurring weedy vegetation.

Reducing management intensity of weedy forage has clear benefits for bees. Frequent cutting of vegetation has demonstrated detrimental effects on bee communities due to the elimination of foraging resources and nesting habitat, as well as through direct mortality (Wastian *et al*. 2016). However, tall stands of non-native, weedy vegetation can be highly controversial among the public as these habitats often lack many of the visual cues associated with regular maintenance (eg trimmed edges, fences, trash removal) that are deemed to be critical for community acceptance of landscape design (Nassauer and Raskin 2014). Despite the conservation value of species such as clovers and dandelions (*Taraxacum* spp), demonstrated "neatness" within residential areas is highly valued (Ignatieva and Stewart 2009). Shorter turf grass plantings that lack weedy species still dominate urban and residential aesthetic preferences regardless of socioeconomic status, since clear edges and mown grass suggest regular upkeep (Wolfe and Mennis 2012; Nassauer and Raskin 2014).

Figure 2. Negative interactions can occur between urban conservation projects and communities when the goal of developing new habitat is not effectively communicated and/or does not align with the values held by neighbors. (a and b) Urban conservation plantings are common sites for illegal dumping of tires and household goods, as well as vandalism of (c) sampling equipment, signage, and (d) even seeded plantings by unauthorized mowing.

Some urban bee conservation efforts have addressed this public preference for neatness by extending beyond management of existing non-native weedy vegetation and establishing intentionally seeded native plants. These planting investments include installations such as beds within urban agroecosystems (Matteson and Langellotto 2011) and seeding of vacant lots to create urban "pocket prairies" (Figure 1, c and d). Many specialist herbivores rely on these native host plants, and their re-establishment can provide resources critical to arthropod conservation (McKinney 2002). Moreover, green space designs can meet broader conservation gains simply by re-establishing native plant species that are locally and regionally rare (McKinney 2002).

Public green spaces composed of native plants support a greater richness and abundance of bees than those dominated by non-native plant species in some (Threlfall *et al.* 2015) but not all (Matteson and Langellotto 2011) cases. For example, the occurrence of some ground- and cavity-nesting wild bees was higher in public parks, golf courses, and residential habitats that had a greater proportion of native vege-

Figure 3. Urban pocket prairies established on vacant land are likely to contain a mixture of seeded species (eg gray-headed coneflower [*Ratibida pinnata*]; bee balm [*Monarda fistulosa*]) and weedy plants that are sometimes viewed unfavorably by neighbors (eg chicory [*Cichorium intybus*]; Queen Anne's lace [*Daucus carota*]). In our experience, weedy species are ecologically beneficial because they are key resources for urban bees, especially in shrinking cities. We have documented 98 bee species using weedy plant species as forage, which represents approximately 20% of Ohio's known bee fauna (Sivakoff *et al.* 2018).

tation (Threlfall *et al.* 2015), whereas adding patches of native vegetation to community food gardens in New York City did not influence bee community composition (Matteson and Langellotto 2011). When evaluating the relative attractiveness of plants to bees based on plant origin, it is important to recognize that the designation of forage as "native" rarely takes into consideration a bee's native range (Hanley *et al.* 2014). For instance, most bumblebees in the UK are Palearctic species, as are many common garden plant species (Hanley *et al.* 2014), so comparing bumblebee visitation to British native and Palearctic plants is not necessarily illustrative of native versus exotic forage preferences (Hanley *et al.* 2014). In addition, non-native forage may prove sufficient for a diverse community of polylectic bee species (ie generalist species that consume pollen from a variety of unrelated plants), whereas promoting range-restricted specialist species may require reintroduction of native plant communities (MacIvor *et al.* 2015).

Safety concerns regarding bee conservation

Regardless of whether conservation efforts focus on establishing new plantings for pollinators or reducing management of existing vegetation, it is important to understand how residents' perception of safety may shift in response to changes in green space design. Safety is one of six "human dimensions" that characterize how people perceive and use urban green spaces (Gobster and Westphal 2004), and is therefore critical to a community's support for a pollinator habitat. Urban greening can lead to reductions in crime rates (Branas *et al.* 2011; Wolfe and Mennis 2012; Garvin *et al.* 2013b), and urban green spaces can also increase perceptions of safety if the sites are considered well-manicured and invite greater passerby visitation or more "eyes on the street" (Wolfe and Mennis 2012; Garvin *et al.* 2013a). However, common pollinator conservation practices, such as infrequent mowing, or seeding of green spaces with grasses and wildflowers, can result in tall and/or dense vegetation, elements that often have negative consequences for both perceived and actual safety (Garvin *et al.* 2013a; Jansson *et al.* 2013). Many urban residents perceive tall vegetation as a hiding place for weapons (Garvin *et al.* 2013a), and dense areas as a screen for criminals intent on assault or robbery (Jansson *et al.* 2013). To add to the complexity, an individual site can inspire both positive and negative feelings from community members. For example, although our pocket prairie research sites have hosted positive experiences during community outreach days, some residents have found the tall flowers threatening to their personal safety (Figure 4). Understanding these perceptions and threats is an important component of urban conservation, as installations will almost certainly fail when people fear violence near a pollinator habitat planting site.

Beyond criminal activity, residents may also be concerned about urban bee conservation due to the increased risk from stinging insects near their homes. In a South Asian survey, 70% of urban dwellers valued bees as "important for city plants", but only 41% thought that bees should be "allowed to live in cities" (Sing *et al.* 2016). Bees may provide value through pollination, but acceptance of nature diminishes rapidly when urban wildlife comes into conflict with humans. For individuals with bee sting allergies, or parents of children with bee sting allergies, we have found that the perceived risks of being stung are more salient than the potential conservation benefits. Moreover, because most people cannot identify bees correctly (Wilson *et al.* 2017), any negative encounter with a biting/stinging insect could be blamed on nearby urban bee conservation sites.

Toward community-guided bee conservation using public green spaces

Due to their size, relatively limited functional requirements, and ability to thrive in urban environments, pollinators are feasible conservation targets in cities (Hall *et al.* 2017; Senapathi *et al.* 2017). However, conservation of urban pollinators will be far more likely to succeed if practitioners employ the transdisciplinary and iterative design processes that have been adopted by many landscape designers and ecologists (Hunter and Hunter 2008; Nassauer 2012). Using this approach encourages scientists to connect with a diverse group of stakeholders and professionals in order to cooperatively design a shared landscape, and to iteratively review and solicit feedback from each other. The ideal outcome of this process is to co-create more sustainable green spaces that reconcile pollinator needs with the interests of the local community (Figure 5).

(a)

Neighbors are *"...afraid to walk to the bus stop in the early mornings due to the height of the plants in your research project. Residents are afraid of getting robbed or worse by someone hiding in the plants."*

- email excerpt from concerned citizen

Figure 4. An individual site can inspire both positive and negative feelings. (a) We received an email from citizens expressing concern about their safety (b) when walking by our pocket prairie research site pictured here. (c) In that same week, parents and children enjoyed searching for insects at an outreach event. To address safety and aesthetic concerns, we established "cues of care" by fencing and mulching the front of each site, adding informational signage, mowing a 1-m-wide border around the front and sides of each pocket prairie, and removing trash on a biweekly basis (Nassauer and Raskin 2014). Management must be dynamic and time-sensitive, as well as address when sites are less aesthetically pleasing (eg flowers are not in bloom).

Research themes for urban bee success

To better support urban pollinator conservation, further research must be conducted on the floral and nesting preferences of bees. Although recent reviews have identified many knowledge gaps, including the effects of urban drivers such as thermal pollution, environmental contaminants, and pollinator phenology (Harrison and Winfree 2015; Gill *et al.* 2016; Senapathi *et al.* 2017), basic nesting and foraging resources are common management targets that also require further study. While nesting and foraging resources are often manipulated when creating new pollinator habitat, conservation practitioners still struggle to obtain research-based information about bee's preferences. Considerable efforts have been made to guide managers' plant selection through recommended plant lists and pollinator-friendly labeling programs, but many such lists are based on anecdotal or observational evidence or fail to cite data sources (Garbuzov and Ratnieks 2014b). Plant lists informed by research are often based solely on pollinator visitation frequency (Tuell *et al.* 2008) rather than the nutritional content of the plant or the functional role it plays in the population growth of a bee species. Moreover, few such lists include information about the pros and cons of weedy species that provide substantial proportions of bee foraging resources in cities, perpetuating the belief that these plants have no conservation value. There is also typically little overlap among recommended plant lists for any given region, resulting in unnecessary confusion over which plant species to select. For instance, only three of 395 genera were on all ten published British plant lists for pollinators, and one-third of the plant species appeared only on a single list (Garbuzov and Ratnieks 2014a). Even though climatic conditions and author disagreement can account for some variation, this vast dissimilarity in recommendations impedes decision making. Finally, while limited planting guides exist for much of Canada, Europe, and the US, additional efforts are needed to resolve bee foraging preferences in other parts of the world.

Research could also further clarify how the nesting resources of urban bees can be enhanced (Gill *et al.* 2016), especially for ground-nesting bees, which can be particularly affected by urbanization (Geslin *et al.* 2016). Soil nesting resources are limited by high proportions of impervious surfaces, contamination from heavy metals and other pollutants, mulching, and the establishment of dense vegetation (Cane *et al.* 2006; Sivakoff *et al.* 2018). Yet, commonly recommended interventions – such as including small patches of bare soil or specifically prepared substrates like pebbles, sand, and heavy clay (Cane 2015) in pollinator habitats – have not been thoroughly assessed in cities. By contrast, cavity-nesting bee species can remain abundant in cities (Geslin *et al.* 2016) due to their opportunistic use of unconventional nesting resources in urban environments, such as fissures in fences, wood structures, and brick walls (Cane *et al.* 2006), although incorporating supplementary cavity nesting substrates (eg bee hotels) into urban conservation designs may still fulfill an important role (Everaars *et al.* 2011). Community-led programs that include the installation of artificial nesting habitats for both cavity- and ground-nesting bees can engage the public in conservation efforts and encourage participants to learn more about bees (Everaars *et al.* 2011), but additional research is needed to assess the ecological impacts of such installations. For example, enhanced top-down pressure from parasitoids on native versus exotic bees highlights one potential shortcoming of this conservation strategy (MacIvor and Packer 2015).

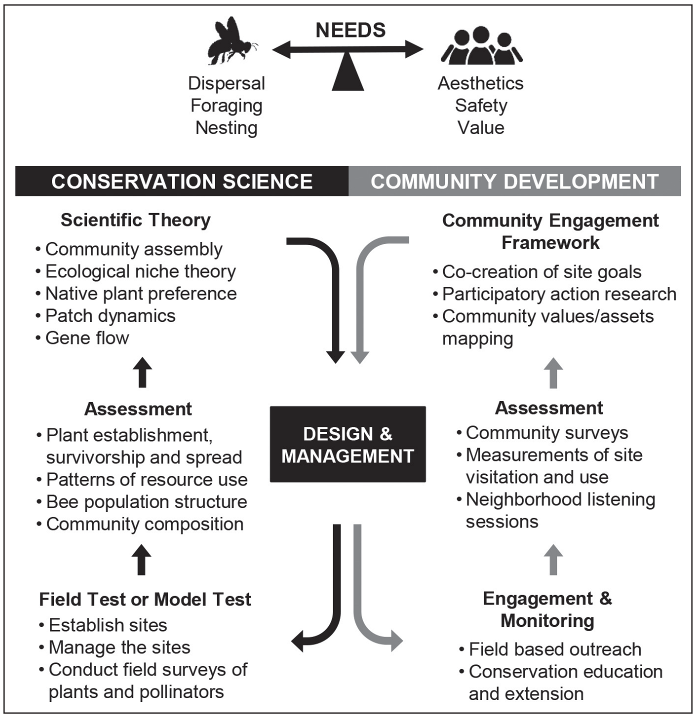

Figure 5. We recommend that future research and conservation projects balance the needs of both people and pollinators through an iterative design process (modified from Nassauer and Opdam 2008). Such a model should be used throughout the conception, implementation, and assessment of urban pollinator habitat.

Finally, new pollinator habitats must be accessible to bees if they are to benefit bee populations, so research must also focus on how urban landscape structure influences bee foraging, fitness, and trophic relationships (Senapathi *et al.* 2017) to address questions such as, "does increasing connectivity between urban parks support greater reproductive success, influence parasitism or predation rates, and/or alter foraging efficiency of target pollinators?". Urban landscape context and site connectivity are known to influence pollinator dispersal, as well as population and metapopulation persistence (Jha and Kremen 2013), but future research will strengthen our understanding of these relationships. As such, researchers should investigate how concentrating urban development within specific areas may minimize adverse impacts on biodiversity and ensure that more continuous habitat is available, allowing pollinators to disperse. In shrinking cities (eg St Louis, Missouri; Cleveland, Ohio) with extensive tracts of vacant land (~1500 ha within each city), opportunities also exist for managing vacant sites as potential large-scale conservation habitats. In these contexts, studies should focus on whether isolated patches function as small-scale "stepping stones" for stopover foraging bouts between larger areas, as some research suggests (Van Rossum and Triest 2012; Braaker *et al.* 2014). Where larger tracts of reclaimed green space are available, corridors could be established to connect these areas at a city-wide scale, and studies could quantify how new corridors affect urban bee populations (Van Rossum and Triest 2012).

Incorporating community perspectives into habitat design

Throughout the process of designing and creating pollinator habitat, it is essential to establish common goals with the community and to collaborate across disciplines (Gobster *et al.* 2007; Hunter and Hunter 2008; Nassauer 2012). Working alongside community residents, city officials, and design professionals during the planning process can help frame the purpose of a conservation site and create shared goals that integrate diverse landscape perceptions and provide a basis for innovative designs (Nassauer 2012). Detailed design decisions – such as reducing mowing; incorporating bare soil patches; framing taller vegetation with a border of mown grass; or adding fences, paths, signage, or other physical borders – should also be guided by active community participation (Nassauer and Raskin 2014). One potential benefit of co-designing with residents is greater cultural valuation of pollinators over time. In some European cities, green spaces that incorporate tall native vegetation are already considered both aesthetically pleasing and appropriate for an urban environment (Garbuzov *et al.* 2015a; Southon *et al.* 2017). In an urban green space design experiment in Bedford and Luton, UK, surveys of experimental designs concluded that taller meadows were preferred over landscaped beds or herbaceous borders. This aesthetic preference was strengthened when individuals exhibited a higher degree of ecocentricity or environmental knowledge (Southon *et al.* 2017). Such tolerance of a "messier meadow" aesthetic may therefore be driven by a cultural switch toward increased environmental knowledge and valuation of local native plants or pollinators (Ignatieva and Stewart 2009; Wilson *et al.* 2017).

When selecting sites in an urban landscape to develop into pollinator habitat, practitioners must also avoid placing an undue burden on poorer communities or contributing to racialized spatial injustices. For example, in the shrinking city of Detroit, Michigan, a proposed green space development program called Detroit Future City has been severely criticized (Clement and Kanai 2015) for including recommendations to reduce municipal services and relocate households in low vacancy zones to accommodate larger green innovation sites. To better collaborate with communities and avoid such discrimination, practitioners should devote greater effort to incorporating community leaders in design decisions and to eliciting feedback from residents. When connecting with a community, designers and conservationists should also be sensitive to a city's unique socioecological context and historical past. Partnering with sociologists can facilitate these critical community connections at the onset of a new conservation program. These professionals have the skills needed to effectively conduct surveys or community hearings, which are essential for project success (Hunter and Hunter 2008).

Figure 6. Enthusiasm can sometimes give way to neglect. Financial constraints, lack of technical support, underestimation of time investment, or absence of long-term management plans can lead to abandonment, as in (a and b) the case of this urban farm's high tunnel. (c) In 2013, a public nonprofit partnership funded many revitalization efforts in Cleveland (re-published from Gardiner *et al.* 2013, printed with permission from Oxford University Press), (d) but by 2018 several of these sites were abandoned. Abandonment can inhibit neighborhood investment in current and future urban greening projects. Thus, we recommend that researchers overestimate the cost and time required for installation and upkeep of urban pollinator habitat.

Despite initial community support, urban conservation ventures can still fail in the absence of long-term economic and political backing (Hostetler *et al.* 2011; Hale and Sadler 2012). Without funding to subsidize regular visits to a site and cover the costs of routine management activities such as trash removal, neighbors may begin to perceive a green space as abandoned. In shrinking cities, this concern is justified, given that many greening initiatives are undertaken but are often discarded when maintenance time or costs become prohibitive (Figure 6). Therefore, sustainable urban conservation also depends on partnering with preexisting local groups who can provide reliable funding and have established neighborhood connections, as well as taking advantage of favorable governmental policies, tax breaks, or endowments that support and incentivize green infrastructure (Hostetler *et al.* 2011). Securing funding that allows continued maintenance can both alleviate neighborhood concerns about aesthetics or safety and help encourage the longevity and sustainability of a pollinator planting.

Finally, because cultural ecosystem services (recreational or experiential) account for much of people's valuation of urban green spaces (Ives *et al.* 2017), we need to find better ways to incorporate recreational spaces, such as walking paths or benches, into the design of conservation habitats and to develop better tools for evaluating cultural services provided by green spaces (Larson *et al.* 2016). Educational experiences can also improve the chances of success; although surveys of adults and adolescents typically report neutral or positive attitudes toward bees, most people are still unaware of native bee diversity (Silva and Minor 2017; Wilson *et al.* 2017). Reported confusion among adolescents about the roles bees play in natural systems (Silva and Minor 2017) is especially problematic, as a lack of knowledge about nature earlier in life can translate to reduced support for conservation projects in the future (Wray-Lake *et al.* 2010). Conducting pollinator education and engaging local residents in conservation initiatives is therefore of great value, and opportunities abound in these settings to provide education on broader conservation themes through the example of pollinators. When conservationists host outreach events, they can also express their own commitment to the community, provide a positive experience, and potentially encourage greater visitation to the green space. Educating community members about bees may also increase their understanding of a conservation site's purpose and may encourage residents to accept green spaces that they did not initially value aesthetically. Gobster *et al.* (2007) noted that "the complexity of human perceptional response…suggests that knowledge and cognitive processes can change perceptions", implying that a positive educational experience in an urban pollinator conservation planting can even improve aesthetic responses to a habitat.

Conclusions

Meeting the needs of pollinators and human communities in urban areas is complex. In our own work, we recognize where our conservation plans and designs failed to anticipate community interactions (Figure 2), and we caution those undertaking future endeavors to take into account these experiences. Moreover, we would like to task urban ecologists and conservationists with more fully assuming the identity of community developers. By designing and changing city landscapes, we are a part of the community development process, and this role requires us to actively work with, and for the betterment of, the communities in which we conduct our research. Urban areas hold enormous potential for pollinator conservation, especially when conservation initiatives prioritize the human communities that live nearby.

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