Conservation Biology

*Essay*

# Motivations for Conserving Urban Biodiversity

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**Abstract:** *In a time of increasing urbanization, the fundamental value of conserving urban biodiversity remains controversial. How much of a fixed budget should be spent on conservation in urban versus nonurban landscapes? The answer should depend on the goals that drive our conservation actions, yet proponents of urban conservation often fail to specify the motivation for protecting urban biodiversity. This is an important shortcoming on several fronts, including a missed opportunity to make a stronger appeal to those who believe conservation biology should focus exclusively on more natural, wilder landscapes. We argue that urban areas do offer an important venue for conservation biology, but that we must become better at choosing and articulating our goals. We explored seven possible motivations for urban biodiversity conservation: preserving local biodiversity, creating stepping stones to nonurban habitat, understanding and facilitating responses to environmental change, conducting environmental education, providing ecosystem services, fulfilling ethical responsibilities, and improving human well-being. To attain all these goals, challenges must be faced that are common to the urban environment, such as localized pollution, disruption of ecosystem structure, and limited availability of land. There are, however, also challenges specific only to particular goals, meaning that different goals will require different approaches and actions. This highlights the importance of specifying the motivations behind urban biodiversity conservation. If the goals are unknown, progress cannot be assessed.*

**Keywords:** cities, ecosystem services, human health, urban biodiversity conservation, urban planning, urbanization

Motivaciones para Conservar la Biodiversidad Urbana

**Resumen:** *En tiempos de urbanización creciente, el valor fundamental de la conservación de la biodiversidad urbana es controversial. ¿Cuánto debe gastarse en la conservación de paisajes urbanos versus no urbanos? La respuesta debe depender de las metas de nuestras acciones de conservación, no obstante que los proponentes de la conservación urbana a menudo fallan en especificar la motivación para proteger la biodiversidad urbana. Este es un defecto importante en varios frentes, incluyendo la oportunidad perdida para atraer a los que creen que la biología de la conservación debe enfocarse exclusivamente en paisajes más naturales y silvestres. Argumentamos que las áreas urbanas sí ofrecen un espacio importante para la biología de la conservación, pero que debemos mejorar en la selección y articulación de nuestras metas. Exploramos siete posibles motivaciones para la conservación de la biodiversidad urbana: preservación de la biodiversidad local, creación de pasos intermedios hacia hábitat no urbanos, comprensión y facilitación de respuestas al cambio ambiental, mejorar la educación ambiental, proporcionar servicios del ecosistema, cumplir con responsabilidades éticas y mejorar el bienestar humano. Para alcanzar estas metas se deben enfrentar retos que son comunes al ambiente urbano, como contaminación localizada, disrupción de la estructura del ecosistema y disponibilidad limitada de terreno. Sin embargo, también hay retos específicos para las metas particulares, lo que significa que metas diferentes requerirán aproximaciones y acciones diferentes. Esto resalta la importancia de especificar los motivos tras la conservación de la biodiversidad urbana. Sí no se conocen las metas, el progreso no puede ser evaluado.*

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**Palabras Clave:** ciudades, conservación de la biodiversidad urbana, planificación urbana, salud humana, servicios del ecosistema, urbanización

## The Conservation Dilemma of Urbanization

Over 50% of the Earth's human population now lives in cities (United Nations 2007). As urban populations expand, so does the urban landscape. For instance, urbanized landscapes—characterized by large numbers of people living at high density—now cover 10.2% of the planet's coastal land area (McGranahan et al. 2005). At a local scale, the proportion of urban landscapes is often even higher. On the island of Singapore, for example, urbanization encompassed more than half the total land area by 1990 (Corlett 1992), which contributed to the local disappearance of perhaps three-quarters of Singapore's native species (Brook et al. 2003). Even in countries less densely populated than Singapore, it is increasingly common for the total size of urban areas to exceed the total size of areas protected for conservation. The continental United States, for example, crossed this threshold in the 1990s (McKinney 2002).

Conservation planners thus face a dilemma: how much of a fixed budget should be spent on conservation in urban versus nonurban landscapes? The answer to this question should depend on the motivations and goals that drive conservation actions because different goals may require very different approaches. We considered seven major motivations for urban biodiversity conservation, ranging from those that benefit nature primarily to those that benefit humans primarily.

Because there has been little comprehensive synthesis of this topic, there is currently no master list of motivations for conserving biodiversity in urban areas. Thus, the seven motivations we explore here are those we see as highly relevant on the basis of the primary and gray literature, our own experience, and our discussions with colleagues. We illustrate these issues with examples from cities around the world. Our aim is to encourage a more explicit conversation about why, and therefore how, urban biodiversity should be conserved.

## Motivations behind Conservation of Urban Biodiversity

It is difficult to define and assign value to biodiversity in an urban context. In undisturbed ecosystems, definitions of biodiversity are scale dependent, but relatively straightforward (Noss 1990; DeLong 1996; but see Holt 2006). In human-dominated systems, however, the definition of biodiversity can be controversial, especially with regard to exotic species, which sometimes dominate urban systems (Angermeier 1994). As we explore in the following sections, the value of exotic species in an urban area depends on the conservation goals that have been delineated.

One possible reason for the widespread presence of exotic species in urban systems is that many native species cannot thrive in the most urbanized areas. Environmental changes in urban areas are dramatic (Pouyat et al. 2007), and only a subset of native species can cope with such environmental shifts (Kark et al. 2007; Williams et al. 2009). Consequently, it may be impossible to protect or reestablish a viable ecosystem that looks and functions like the native system that the urban area replaced. If protection or restoration is not possible, one needs to think about the next-best option (Rosenzweig 2003).

Even if exotic species are excluded from measures of diversity, suburban and peri-urban ecosystems sometimes have higher species richness than the native systems they replaced (McKinney 2008). This may result from an addition of native species that have adapted to the urbanized areas, such as urban exploiters or urban adapters (Blair 1996; Kark et al. 2007), or from an increase in resources and habitat heterogeneity in suburban and peri-urban systems (McKinney 2008). This increased richness in such areas may be valuable if the goal is to maximize human residents' exposure to different species, but may be less valuable if the goal is to maintain functional, sustainable parcels of the native landscape. Thus, the particular reason for biological conservation in an urban area dictates how biodiversity is viewed, defined, measured, and valued. With these difficulties in mind, we considered seven motivations for urban biodiversity conservation (Fig. 1).

### Preserve Important Local Biodiversity in an Urbanizing Environment

Because urban landscapes are increasingly large, they can be an important component of regional or global biodiversity. Many cities were originally established in riparian areas, ecological transition zones, or other locations that are naturally species rich (Kühn et al. 2004), which creates both problems and opportunities for conservation biology. For instance, the Cape Floristic Kingdom in South Africa is being encroached on by the expanding urban front of Cape Town. Conservation efforts are underway in rural and urban areas in the region, including the establishment of the 900-ha Driftsands Nature Reserve, which is surrounded by the poor urban population of Cape Flats (Stanvliet et al. 2004). To achieve meaningful,

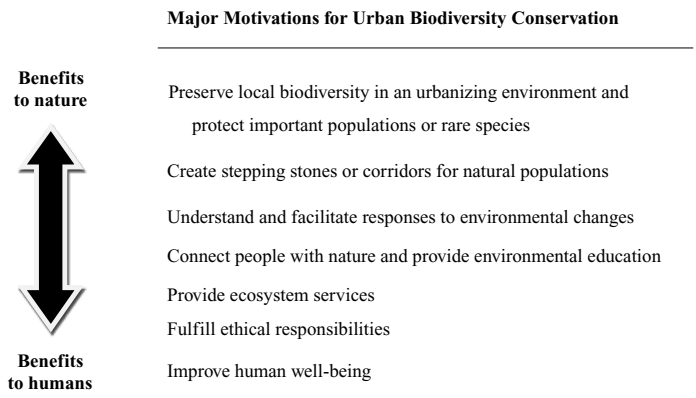


*Figure 1. Reasons why we conserve urban nature. Some reasons, such as ethical and religious motivations, can benefit both humans and nature. Although many conservation biologists will see human welfare as inextricably linked with conservation of nature, members of the general public often better understand explicit arguments that directly connect human welfare and biodiversity conservation.*

long-term success in this and similar settings requires a large block of protected habitat, ecologically responsible development in adjacent areas, and a careful balance of the needs of nature with the needs of impoverished human populations.

These issues are particularly critical when demographically or genetically important populations or threatened or rare species are jeopardized by the expansion of cities. In this case, the reason for conservation action might be very species specific. For example, two rare Australian plant species, *Conospermum undulatum* and *Macarthuria keigheryi*, have large populations at the Perth airport, where ongoing research is identifying threats and appropriate management regimes (Close et al. 2006). Likewise, a prairie remnant in the urban greenway system of Oklahoma City, United States, includes a potentially stable population of the Texas horned lizard (*Phrynosoma cornutum*), a species that is exhibiting range-wide declines (Endriss et al. 2007).

If the goal is to protect such populations in urban settings, there is little choice about the location for investing conservation efforts—sites are dictated by populations' spatial distribution. Managers will have to consider the trade-offs among such tactics as protecting a site from harm by visitors, allowing urban activities at the site and modifying the site—perhaps at the expense of other species—to create suitable conditions for target species.

### Create Stepping Stones or Corridors for Natural Populations

Often, cities do not contain large enough habitat blocks to sustain viable natural populations of most plants and animals, but small blocks can link with surrounding habitat on the city margins. True corridors are difficult to fit into the geographic constraints of an urban landscape, but stepping stones—probably in a chain rather than a complete grid—can be a cost-effective way to enhance biodiversity conservation in cities. In Brisbane, Australia, bandicoots (*Isoodon macrourus*) are present in half of the available habitat patches within the city, and their occupancy is more probable in patches with greater connectivity (FitzGibbon et al. 2007).

The rapid pace of change and high cost of land in urban environments can pose severe challenges to the long-term protection of a network of habitat patches. In particular, the functionality of stepping stones can be broken by the loss of a single green space (Jordan et al. 2003). Maintaining the function of a set of stepping stones requires prolonged commitment of conservationists, planners, and society. Planners should also be cognizant of the potential drawbacks to corridors, including the rapid spread of invasive species (Hobbs 1992), and aim at planning corridors that will address this, if possible.

### Understand and Facilitate Species' Responses to Environmental Change

Natural populations will need to adjust to future urbanization (e.g., by evolutionary adaptation or by phenotypic plasticity). Protecting natural areas within the urban matrix can help smooth this transition and provide a chance to learn more about the unknown responses of populations to an array of management regimes. In other words, if urban biodiversity is worth protecting for any of the other reasons outlined here, then studying and protecting native urban biodiversity now will allow better protection in the future.

In a broader sense, urban ecosystems can serve as models for understanding and mitigating the effects of impending environmental change in nonurban areas. For example, studying bird communities along an urbanization gradient (Blair 1996, Kark et al. 2007) can help predict and potentially mitigate the effects of future urban expansion. In this type of research, the rural-to-urban space axis is used to forecast the changes that will occur along a present-to-future time access as urbanization continues. Cities are already experiencing increases in factors projected to increase in nonurban systems in the coming decades: temperature, $CO_2$, inorganic reactive nitrogen, and ozone (Carreiro & Tripler 2005). Thus, studying natural habitats in urban areas may help conservationists anticipate and mitigate climate-change effects. In addition, conserving urban areas now may provide a refuge

for species or unique genotypes that will be better suited to the future state of currently nonurban environments.

In terms of study design, the choice of habitat fragments may be partially dictated by a desire to control extraneous variables; fragments that meet this need may be suboptimal for other conservation purposes. If the goal is to facilitate long-term population adjustments to urbanization, relatively large populations (and thus large habitat blocks) may be needed. Additionally, the species most likely to persist in urban areas are urban exploiters (Blair 1996; Kark et al. 2007), including a handful of species commonly found in urban areas across the globe (McKinney 2006).

### Connect People with Nature and Provide Environmental Education

Urban areas provide an opportunity to teach environmental processes and conservation to large numbers of people, including those who lack the means or motivation to travel to nonurban areas, where exposure-based wildlife education has been located traditionally. The need for wildlife-centered education is increasing. Children need first-hand experience with biodiversity to become passionate about its protection (Chawla 1999), but are spending less and less time outdoors (Orr 2002). Many conservation organizations realize that outreach and education must be a cornerstone of long-term conservation efforts, but there is still too little emphasis on the urban landscape, where most people live and work (Miller & Hobbs 2002), and on human demographic groups that are not regularly exposed to natural ecosystems.

In Austin, Texas (U.S.A.), people congregate downtown to watch the evening emergence of 1.5 million Mexican free-tailed bats (*Tadarida brasiliensis*). The 100,000 annual human visitors are both an opportunity for, and the product of, environmental education. Bat Conservation International distributes flyers and gives talks about bat natural history and about the financial boon bats provide (Cleveland et al. 2006). Publicity has been so successful that Austin now has a bat statue, bat-watching riverboat tours, an annual bat festival, and a hockey team with a bat mascot. This example demonstrates clearly the potential for the urban public to become informed and excited about nature in its midst—even organisms that are not traditionally flagship species.

When urban areas are protected for the purpose of environmental education, the visitor experience becomes paramount. Important considerations include visitor access, including distance from population centers and availability of parking or, preferably, public transit; compatibility of the site with educational programs; and presence of "observable nature" that is often diurnal, not reclusive, robust to disturbance, and at least mildly charismatic.

Beyond these issues of basic environmental education, urban areas can also provide opportunities for more active involvement, such as citizen science, restoration ecology, and environmental monitoring. For example, the Chicago Wilderness Habitat Project (http://www.habitatproject.org/) incorporates thousands of local volunteers to monitor, manage, fund, and publicize a series of habitat blocks in and around Chicago, Illinois. Volunteers can be matched to tasks that suit their talents and interests, such as removing invasive plants, monitoring frog populations, contacting corporate or government groups to solicit financial or legislative support, and guiding new visitors in nature walks. Chicago Wilderness allows members of the public to take action and thus go beyond environmental awareness, and urban settings provide accessible and visible venues for such ecological volunteerism in areas where large numbers of people live and work.

The need for environmental engagement is especially pronounced among those making decisions in our societies. Increasingly, cities are the places where economic and political powers are concentrated. As such, cities are also the places where public policy is shaped that determines the fate of biodiversity in urban and wilder areas. Apart from the need to educate the general public, there should be efforts to teach decision makers the value and importance of biodiversity. Personal experiences will shape values, and values will shape policy decisions. Thus, policy makers need to have direct positive experiences with biodiversity, and urban areas may be a reliable venue for creating experiences that can lead to a positive feedback loop of experience and policy.

### Provide Ecosystem Services

Because ecosystem services are, by definition, for humans, it makes sense to ensure they are provided in areas where human population density is high. In an urban context, even small green spaces can provide high-impact ecosystem services, if they are well planned. For example, small wetlands can improve urban hydrology by absorbing contaminants or buffering against flooding (Pankratz et al. 2007), and vegetated rooftops can reduce the heating and cooling costs of buildings and slow runoff during rainstorms (DeNardo et al. 2005). These are important benefits given the heat-island effect and the extent of impervious surface in urban areas. Green rooftops can have the added benefit of enhancing local biodiversity, not only for the initially installed plants but also for beetles, spiders, birds, and additional plants that subsequently colonize the site (Brenneisen 2006). Some of the insects and birds might be especially important as pollinators, given the growing interest in small-scale urban agriculture (Mendes et al. 2008).

Another important ecosystem service is the scope for improving some aspects of air quality in urban areas. In

the United States, urban trees annually remove 711,000 tons of air pollutants, providing an economic value of U.S. $3.8 billion (Nowak et al. 2006). Although the overall percent reduction in pollution is small for most pollutants (Nowak et al. 2006), urban trees can be a cost-effective component of pollution-reduction strategies in urban areas (e.g., Santiago, Chile; Escobedo et al. 2008).

Larger effects of urban vegetation are evident in carbon cycles. In the struggle to come to grips with global warming, the carbon budgets of cities will become much more important (Daniels 2009). Increased amounts of urban vegetation can sequester substantial amounts of carbon (Pickett et al. 2008). Especially interesting is the possibility that urban trees can have a stronger effect on carbon budgets than trees outside cities. One shade tree in Los Angeles, California, can provide an overall carbon benefit equivalent to that of three to five forest trees, through its ability to sequester carbon and moderate the heating and cooling budget of a building (Akbari 2002).

One unusual aspect of an ecosystem-services motivation to conserve urban biodiversity is that exotic species may be equivalent to, or sometimes even better than native species in providing some services (Pickett et al. 2008). If trees and shrubs need to be purchased for greening of a developed urban space, the least expensive and most biologically effective option might actually be commercially available cultivars that are not native to the region (e.g., Chilean mesquite [*Prosopis chilensis*] planted in cities in the southwest United States with encouragement from the U.S. Department of Agriculture Forest Service; McPherson et al. 2004). Non-native vegetation could be a reasonable solution for providing ecosystem services and perhaps also for providing human health benefits, but not necessarily if other motivations for biodiversity conservation are also important. The lower cost of installing non-native vegetation can create a potential conflict between the different motivations for promoting vegetative cover in urban areas. Some motivations will value native species and high biodiversity, whereas others will place a higher value on functionality and cost-effectiveness. Thus, it is important to define in advance whether or not non-native species are included among the goals for urban biodiversity conservation.

### Fulfill Ethical Responsibilities

One of the most straightforward reasons for conserving biodiversity in any setting is to fulfill an ethical obligation. In many philosophical, religious, and secular traditions, there is a responsibility to be good stewards of the planet (Berry 2006). Pope John Paul II (1996) has gone so far as to describe the environmental crisis as a moral crisis. Biodiversity conservation in urban areas could facilitate the fulfillment of these moral obligations because opportunities for conservation are located in or near residential neighborhoods. This geographic proximity allows people to more easily experience the reinforcement of having lived by their ethical or religious mandates. For individuals without an existing sense of environmental responsibility, exposure to urban biodiversity (particularly via educational programs) may help instill a conservation ethic.

### Improve Human Well-Being

Physically, human health can be improved by urban ecosystem services such as reduction in air pollution (Samet et al. 2000). Furthermore, exposure to natural environments can promote emotional well-being through mechanisms such as making problems feel more manageable (Kuo 2001). Interestingly, the distinction between physical and psychological effects may be artificial, as evidenced by the faster recovery from surgery of patients whose windows look out over green spaces (Ulrich 1984).

Results of recent work in Sheffield, England, showed something equally remarkable. The psychological benefits of exposure to urban green space increases with greater biodiversity, as measured by species richness of plants, birds, and butterflies (Fuller et al. 2007). Although there may be human health benefits from exposure to any urban green spaces (including those populated by alien species), the ability of the public to perceive—and benefit from—species richness suggests that the protection or creation of biologically diverse urban environments is important. When planning urban green space for human health benefits, the issue of access becomes important. As with green spaces for environmental education, there is a need to consider how people will travel to the site. Walking access is ideal, although the provision of green spaces within walking distance would require many small green spaces throughout the city instead of a smaller number of large spaces.

Beyond the immediate benefits to human health, broader conservation goals can be served by creating or encouraging high-quality interactions between people and the natural world. Improving human well-being might be seen as a by-product of successful conservation in urban areas, but this effect can, in turn, catalyze people to be more supportive of other efforts at biodiversity conservation.

## Urban Versus Rural Conservation

Historically, conservation biology has been rooted in wild or rural landscapes, with proponents ranging from early champions, such as Muir (1901) and Leopold (1949), to more recent–and more radical–enthusiasts such as supporters of the Rewilding Institute (http://www.rewilding.org/) in the United States (Foreman 2004). Within this broad span of time and ideas,

two influential frameworks for conservation biology bear special mention. First is Soulé's (1985) modern foundation of conservation biology, which is articulated in his four value-based postulates: diversity of organisms is good (and untimely extinction is bad); ecological complexity is good; evolution is good; and biotic diversity has intrinsic value. In the context of urban biodiversity conservation, we think these postulates might apply fairly well. One area of possible discord is the importance of diversity and complexity. These components of biodiversity are valued under some, but not all, of the motivations for urban conservation. In particular, ecosystem services (such as carbon sequestration or buffering of storm runoff) and some human-health benefits might be achieved effectively with a small set of (not necessarily native) species. This is not to say that additional diversity or complexity are not good, but some may claim that it might be possible to do the job with a simple community of organisms. Otherwise, the ideals in Soulé's postulates seem relevant to urban settings, but they may be difficult to uphold fully.

The second important framework is Michael Rosenzweig's reconciliation ecology (Rosenzweig 2003), which centers on "inventing, establishing and maintaining new habitats to conserve species diversity in places where people live, work or play." This approach is explicitly tailored to areas that are no longer wild and emphasizes finding ways for civilization and wildlife to coexist. Rosenzweig argues that the more traditional approach to biodiversity conservation is likely to meet limited success in urban areas. Wilderness-based conservation is rooted in an incompatibility between biodiversity and a heavy human presence. In contrast, reconciliation ecology sees the merging of these two ideas as indispensible in the acceptance that human-occupied landscapes can be ecologically valuable without being wild or pristine. In urban areas, this type of compromise is largely necessary.

Given the above, the biggest difference between conservation biology in urban areas and in traditional, wilder settings may be in the loftiness of the ecological goals. In urban areas, a balance between ideals and pragmatism will need to be struck more frequently. Wilder areas may offer a venue for a more preservationist approach, but in urban and peri-urban areas, where people live and work (Miller & Hobbs 2002), conservation planners must take a more open-minded approach. In both environments, however, conservation goals must be stated clearly before action is taken. The traditional conservation objective of maintaining or even increasing native species diversity is unrealistic in many urban landscapes. Instead, it will have to be decided what biodiversity is wanted, which species assemblages or which ecosystem functions are desired, and for what purposes they are desired. At one extreme, this may lead to very "engineered" urban ecosystems, whereas at the other extreme, it may lead to a passive acceptance of whatever ecosystem emerges at equilibrium. In either case, the resulting ecosystem may be novel in many respects (Hobbs et al. 2006). In addition, biodiversity conservation in urban areas entails some unique logistical hurdles that will require creativity in setting conservation goals and in the methods used to attain them.

## Challenges and Conclusions

Despite (or due to) the strong wilderness tradition of conservation biology, the past decade has seen a dramatic boost in the interest in urban biodiversity and its conservation, from both scientific and applied perspectives. For example, we recently marked the 10th anniversaries of the journal *Urban Ecosystems* and of two federally funded urban ecology research sites (long-term ecological research [LTER] sites in Baltimore and Phoenix, U.S.A.). These efforts to understand urban ecosystems are beginning to bear scientific fruit (e.g., Shochat et al. 2006; Pickett et al. 2008), yet the fundamental value of conserving urban biodiversity has remained controversial. At the heart of the issue is the need to be better about clearly specifying our intentions. Furthermore, having an explicit purpose is necessary for tailoring our approach to urban conservation and for assessing whether such actions are effective (Parrish et al. 2003). If the goals are not specified, success cannot be marked.

The existence of multiple motivations for protecting urban biodiversity raises an additional point: different groups of people have different cultures and values and, hence, different legitimate motivations to conserve urban biodiversity (see example in Fig. 2). Some cities may focus primarily on ecosystem services or human health, whereas cities in countries with a strong scientific tradition and resources may be the only ones to prioritize the research opportunities in urban ecosystems. Within any country, cultural traditions, financial resources, religious beliefs, and local environmental issues all will influence the goals of urban biodiversity conservation. Thus, to make successful choices among priorities, many local stakeholders will need to be involved. The Chicago Wilderness consortium provides an excellent example of a broad and integrative approach to urban conservation with multiple stakeholders (Chicago Wilderness 2007).

Beyond agreeing on a purpose, stakeholders will need to address logistical problems that are particular to their urban environment. First, urban areas often have extreme constraints on available space. Land is expensive and there are many owners who have multiple interests, some of which contradict one or more of the motivations for urban biodiversity conservation. Available land may require remediation before use for conservation, and land use in areas bordering a protected parcel may not

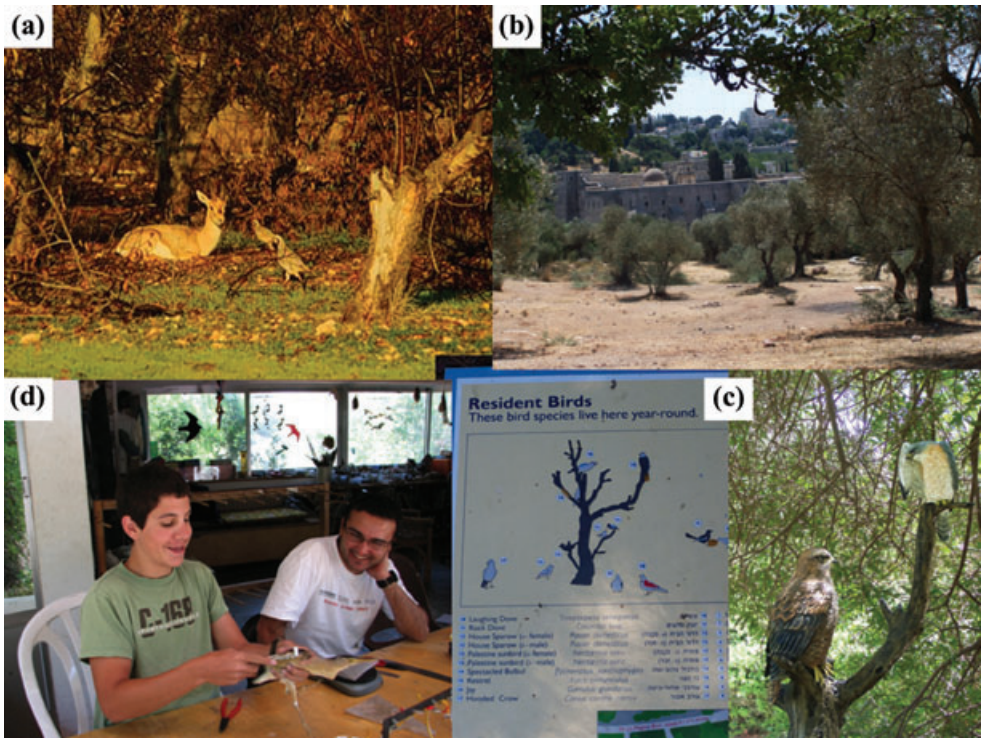


*Figure 2. Photos from four locations in Jerusalem that exemplify some of the motivations for urban biodiversity conservation. (a) The Gazelle Valley maintains a very small, isolated population of gazelles (Gazella gazella) that is enclosed between several major roads. Despite limited financial resources, local residents have worked with some success to maintain the valley as an open space for recreation, preservation of historical sites, and biodiversity conservation. (b) Valley of the Cross Open Area has walking and biking trails, youth activity centers, an old olive grove, and the Monastery of the Cross, which dates back to the 11th century. (c) Givat Ram Campus of The Hebrew University of Jerusalem houses urban green spaces for students, faculty, and biodiversity. The campus includes the Nature Park & Galleries open museum, where children and adults visit university collections and outdoor exhibitions around campus such as the outdoor bird models shown in the photograph. (d) The Jerusalem Bird Observatory (JBO; http://www.jbo.org.il) conducts programs on a 0.5-ha plot located between the Knesset (Israel parliament) and the Supreme Court. The JBO trains volunteers in ringing, provides educational activities, creates Israeli and Palestinian partnerships around educational themes, and provides habitat for resident and migrant birds. In the picture, Samech Darawshi and Aviv Bloch are ringing a heron. (Photos by S.K. except for bottom left photo, which is by R. Schueler.)*

take biodiversity goals into consideration. Second, the urban environment may differ from wilder areas in its ecological processes and in the challenges that plants and animals face when trying to survive and reproduce (Shochat et al. 2006). Noise and light pollution can cause animals to shift activity patterns, urban pollutants can cause physiological stress, and the loss of top predators can cause mesopredator release. Third, urban areas cannot accommodate all the management tools used in traditional rural settings. Broad distribution of poison baits has reduced invasive mammal populations in New Zealand wilderness (Parkes & Murphy 2003), but these baits cannot be used in urban areas because of safety concerns for children and pets. Finally, urban areas are often centers of human diversity, and planners must be mindful of how the human dimension is incorporated into conservation efforts. Urban people have many different human needs, beliefs, and motivations that exist at different socioeconomic levels, and have different cultural backgrounds.

The problems of urban conservation are not insurmountable, but success requires a careful start. The first step is to answer the fundamental questions of why urban biodiversity should be conserved and what species assemblages or ecosystem functions are desirable and achievable in an urban setting. Without such an explicit starting point, progress will not be effective and limited conservation resources may be wasted.

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