



Urban conservation: The northeastern coyote as a flagship species



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HIGHLIGHTS

- Cites are dynamic and characterized by change, a challenge for urban conservation.
- Flagship species can be used to communicate the challenges of urban conservation.
- The NE coyote is symbolic of resilience, novelty, and the human-nature divide.

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ABSTRACT

Flagship species have played an important role in defining and promoting various conservation causes. Over the past several years, the importance of and need for conservation in urban environments has grown as our cities and their footprints have dramatically expanded. Yet, cities face constant change and the mark of humans is the landscape's most prominent feature. This brings new challenges for practicing conservation in cities and in communicating its goals. In this essay, we demonstrate how a flagship species could be used to articulate the themes of urban conservation using the northeastern coyote or coywolf (*Canis latrans* var. or *C. latrans* × *lycaon*) as an example. We demonstrate how the natural history of the northeastern coyote can serve as an entry point to conceptualizing and communicating key concepts including ecosystem novelty (e.g., the northeastern coyote as an unintentional, but anthropogenic hybrid of canid lineages), resilience thinking (e.g., the northeastern coyote as apex predator following a period of defaunation and continued predator control), and the breakdown of the human-nature divide (e.g., the northeastern coyote as possessing elements of wilderness despite being a product of anthropogenic change). These are ideas that have come to define, and challenge, the field of urban conservation.

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1. Introduction

At first glance, the northeastern coyote, or coywolf (*Canis latrans* var. or *C. latrans* × *lycaon*; see Way, 2013; hereafter, northeastern coyote) would appear to be a poor fit as a flagship. The flagship species concept is based on the idea that it is easier to generate interest in a charismatic organism than it is to communicate the complicated ecology of an ecosystem (Caro & O'Doherty, 1999). Flagship species have been used as surrogates for biodiversity, threatened habitats, and entire regions. They are poster-children that foster political and financial support for conservation efforts (Clucas, McHugh, & Caro, 2008; Simberloff, 2008). Yet coyotes, in general, can be feared or hated in many communities (Kellert, 1985) and may not promote sympathy. Coyotes are not threatened

(IUCN Red List, 2013) and thus do not demand political or financial support; they are generalists (Gompper, 2002) and therefore are not surrogates for specific biodiversity or threatened habitat. More damaging, the northeastern coyote has become the dominant apex predator across its range by colonizing a region characterized by a history of defaunation, deforestation, urbanization, and sprawl.

However, the choice of a flagship should also resonate with or be symbolic of the cultural and natural history of a region (Bowen-Jones & Entwistle, 2002). Unlike indicator or umbrella species, flagship species are not valued solely by measures of ecological integrity, but by their ability to convey a message (Simberloff, 2008). "The criteria for selection of flagship species are not universal, but related to the human audience that the flagship is intended to target" (Nekaris, Arnell, & Svensson, 2015). Here, we propose that the northeastern coyote can serve as a flagship by defining the cause, capturing public attention, and increasing awareness for the field of urban conservation in the northeastern U.S. and Canada.

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Urban conservation, as a discipline, is emerging in response to a global demographic shift toward cities and an expansion in what conservation scientists and practitioners consider to be legitimate targets of conservation efforts. Approximately 50% of the world's population now lives in urban areas and this is expected to reach nearly 70% by 2050 (UN-DESA, 2014). An increasingly urban population and a rapidly expanding urban ecological footprint raise new challenges for a field traditionally focused on native biodiversity preservation and habitat protection in areas with the least anthropogenic impact (Kareiva, Watts, McDonald, & Boucher, 2008; Parker, 2015; Rosenzweig, 2003). Cities – as the antithesis of these landscapes – have historically been ignored as areas of rigorous ecological study and conservation action (Grimm et al., 2008; McDonnell, 2011).

Urban conservation builds on the philosophical premise found in urban ecology that there is no divide between humans and nature and contextualizes the city as a coupled socio-ecological system (Pickett, Cadenasso, & Grove, 2004). These landscapes must be managed with both human and non-human communities in mind, and in furtherance of a range of goals, including providing resilient ecosystem services and protecting biodiversity (Hobbs et al., 2014; Sayer et al., 2013). The object of urban conservation efforts is not restricted to remnant greenspaces. Rather, the focus is on the totality of the urban environment, inclusive of native and non-native biodiversity and the human communities of the built environment. These ideas may be viewed as destabilizing, distracting, or unorthodox by some conservationists (see Davison & Ridder, 2006), and are also probably unfamiliar to the majority of urbanites (Calvin, 2013; Miller & Hobbs, 2001).

Way (2009) was an early proponent of raising the coyote to flagship status, highlighting the role that a charismatic, albeit common predator, could play in promoting interest in the local environment among youth. We build upon this idea and argue that the natural history of the northeastern coyote can be used as a parable to frame and communicate complex issues that have come to define (and challenge) the field of urban conservation, specifically, ecosystem novelty, resilience thinking, and the human-nature divide. We here provide a brief review of these expansive themes to help contextualize the symbolic role that the northeastern coyote can play as an urban flagship.

2. Urban conservation: accepting novelty and thinking resiliency

Urban development is generally characterized by wetland destruction, land clearing, and habitat alteration that indisputably compromise native biodiversity (Alberti & Marzluff, 2004; Aronson et al., 2014). Yet, patterns of urban biodiversity are neither uniform nor linear (McDonnell & Hahs, 2008) and vary with the degree of disturbance (e.g., urban core vs. exurban development; McKinney, 2008) and across geographic locations (Aronson et al., 2014). Depending on their age and history of development, cities may encompass a range of habitat types such as post-industrial wilderness, pre-urbanization habitat, or manicured parkland (Kowarik, 2011), to name a few. The heterogeneity of urban habitats is only reinforced by interaction with the cultural and socio-economic diversity of its citizenry (Pickett et al., 2001). Accordingly, urban biodiversity encompasses native and exotic species that reflect past and present patterns of human settlement, immigration, and trade (Hobbs et al., 2006), all of which have passed through the harsh filters of urban biogeochemistry (e.g., increased temperatures, impervious pavement, altered hydrology), extreme fragmentation, and pollution (e.g., chemical, light, noise; Croci, Butet, & Clergeau, 2008; Ehrenfeld, 2000).

Due to an influx of exotic species, habitat modification, and altered biogeochemical cycles, cities often comprise novel ecosystems defined by species assemblages that have no contemporary or historical analog (Perring, Standish, & Hobbs, 2013). Furthermore, cities, as a whole, may be viewed as novel landscapes stemming from their heterogeneous, ever-shifting landscapes. These systems are a direct result of human activity and cannot be restored to some historic set point (Hobbs, Higgs, & Harris, 2009). Because the primary focus of conservation has historically been to mitigate anthropogenic change or to restore habitats where disturbance has already occurred, novel ecosystems might be viewed as outside of traditional conservation goals (Hobbs et al., 2009).

Novelty is essentially inevitable in cities due to their greatly altered abiotic conditions (Ehrenfeld, 2000). Attempting to reverse the tremendous changes that humans have imposed upon the urban landscape is Sisyphean. More importantly, imparting classic views of static equilibria of species assemblages upon cities is unrealistic, considering that all other aspects of cities continue to change (Hobbs et al., 2009; Kowarik, 2011). Cities are defined by, and celebrated for, their innovation (Ernstson et al., 2010) and dynamism (Cadenasso & Pickett, 2008). Vibrant, functional cities constantly reinvent themselves (Colding, 2007), as marked by ongoing turnover in industry, land use, and demographics. Traditional restoration focused on restoring the “historical trajectory of an ecosystem before anthropogenic influences derailed it” (Simberloff, 2015) will fall short in cities where there is no interest in removing the human presence and where removing anthropogenic influences is impossible. Urban conservation, therefore, must reckon with ecosystem novelty if it is to remain relevant and useful.

This does not translate into a devaluation of native biodiversity. Conserving communities dominated by native biodiversity will remain a priority where functionally intact tracts of remnant habitat persist. Nor does recognizing cities as consisting of novel ecosystems lower the bar for conservation, rather, it provides a practical path forward (Perring et al., 2013). Novel species assemblages may actually represent “adaptation to severe habitat transformation” (Kowarik, 2011) and can have positive impacts in already degraded environments (Schlaepfer, Sax, & Olden, 2011). Exotic species' ability to spread rapidly across a range of conditions suggests that these species may be important community components that can help provide ecosystem services during a period of immense global change and uncertainty (e.g., urbanization, climate change; Dukes & Mooney, 1999; Schlaepfer et al., 2011).

Following disasters such as hurricanes Katrina and Sandy, city managers are increasingly recognizing how repeated patterns of habitat degradation and a shortage of green capital have left infrastructure, human communities, and economic and ecological systems vulnerable to climate change and its attendant increase in extreme weather events (Ernstson et al., 2010). Accordingly, professionals from a wide spectrum of disciplines including, policy makers, planners, and conservation scientists have coalesced around the common theme of resiliency, or the idea that a system may reorganize and change following a perturbation, but it will retain functional elements and processes (Colding, 2007). This resiliency is an emergent property of a system with complexity and functional redundancies (Dalerum, Cameron, Kunkel, & Somers, 2010).

Developing resilient ecosystem services is a priority for city managers. Vital ecosystem services for urbanites will include flood control, air filtering, microclimate regulation, rainwater drainage, and sewage treatment, among others (Bolund & Hunhammar, 1999). Managing for these services may not, however, always be commensurate with traditional conservation targets, such as maximizing native biodiversity (Dearborn & Kark, 2010), and raises the question as to the role and or contribution of exotic species and

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