Recent Distribution of Coyotes Across an Urban Landscape in Southeastern Michigan

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Abstract

Human–wildlife interactions in urban areas are widely reported by ecologists to be the result of human encroachment on wildlife habitat. Highly mobile species, however, have been documented by both wildlife biologists and casual observers to occupy areas heavily populated by humans. Range expansion and population growth of coyotes (*Canis latrans*) has led to their increased presence in metropolitan Detroit, Michigan, where poor economic conditions over the last several decades have resulted in the reversion of numerous recreational areas and abandoned parcels to more wooded or vegetated conditions that have provided potential wildlife habitat. We performed an extensive survey for coyote evidence (i.e., carcasses, den sites, scats, sightings, or tracks) across metropolitan Detroit to examine distribution across both the general region and specific land cover types. We found 58% of all coyote evidence on unpaved trails, paths, and unimproved roads within edge habitats (e.g., grassland adjacent to urban non-vegetative land cover), with den sites and tracks the only types of evidence found strictly in interior habitats. Land cover around evidence points included more wooded land cover than expected in suburban areas, suggesting the importance of tree cover for coyote occupancy, and more open space and wooded land cover than expected in urban areas, highlighting the coyotes' avoidance of heavily populated areas. We speculate that habitat characterized by tree cover has likely never been limiting within metropolitan Detroit, and that reoccupation of southeastern Michigan by coyotes is more likely a consequence of expanding coyote populations outside of suburban and urban areas rather than newly available habitat resulting from land cover change.

Keywords: Urban coyote distribution; Detroit; habitat fragmentation; urban ecology; urban wildlife habitat; urban land cover

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Introduction

Urbanization is known to fragment or destroy wildlife habitat and alter ecological processes that occur within it (McKinney 2002), and much of the ecological literature has focused on human encroachment and alteration of wildlife habitat. However, species classically adapted to edge habitat (e.g., white-tailed deer [*Odocoileus virginiana*]) and those that utilize human-associated food (e.g., raccoons [*Procyon lotor*]) may benefit from inhabiting urban areas (Adams 2005). As such, understanding the distribution and habitat use by wildlife establishing or reestablishing in areas already populated by humans (Adams 2005) warrants additional investigation.

Coyotes (*Canis latrans*) have readily adapted to urban landscapes and have become a top carnivore in many major metropolitan areas in the last decade (Crooks and Soulé 1999; Gompper 2002; Gehrt 2004). Most studies of coyotes in urban areas have found that coyotes typically avoid human activity by being nocturnal in human-dominated areas (e.g., Atkinson and Shackleton 1991; McClennen et al. 2001; Atwood et al. 2004); however, other studies have shown that they are often active during the day in more rural or wilderness areas (Major and Sherburne 1987; Gese et al. 1989; Kitchen et al. 2000). Studies of distribution and habitat use of coyotes in urban landscapes have provided mixed results, but coyotes are generally associated with green space (undeveloped land partly or completely covered with natural or naturalized trees, shrubs, grass, or other vegetation) within the urban matrix specifically for food, den sites, and diurnal resting cover (Quinn 1997; Riley et al. 2003; Gehrt et al. 2009). Notably, some researchers have found coyote use of green space within urbanized landscapes to be less than expected based on its availability (Grinder and Krausman 2001), or that habitat is occupied regardless of the presence of humans (Gibeau 1998). Coyotes will readily move through residential and commercial areas, but they do so quickly, covertly, and usually at night to avoid humans (Grinder and Krausman 2001; Way et al. 2004; Gehrt et al. 2009). Most studies of coyotes in urban areas have been conducted in southwestern North America (e.g., Grinder and Krausman 2001; Riley et al. 2003; Grubbs and Krausman 2009) where coyotes were probably never completely extirpated from many metropolitan areas (Gehrt and Riley 2010). Coyote presence in Midwestern and eastern cities is more recent and less studied (see Atwood et al. 2004; Way et al. 2004; Gehrt et al. 2009), and likely poses a very different set of ecological and societal issues (Gompper 2002).

In Michigan, coyotes historically inhabited the prairies and oak savannas of the southern Lower Peninsula (Dice 1927; Baker 1983) because of the abundant prey species these habitats supported. Coyote populations within the geographic range of wolves (*Canis lupus*) were limited by interference competition and direct killing of coyotes by wolves (Thurber and Peterson 1991; Peterson 1996; Berger and Gese 2007), although temporal resource partitioning may have allowed some coyotes to coexist with wolves (Berger and Gese 2007). Humans essentially eliminated coyotes from southeastern Michigan as the region developed into a major metropolis in the late 19th century. Coyotes from the Great Plains expanded into Michigan to reoccupy their historic range, as well as areas previously unoccupied, by the early 20th century. Human-associated disturbances facilitated coyote range expansion across Michigan by promoting the availability of communities of prey species across the landscape (Patterson and Brown 1991). In addition, state-sponsored predator control programs that emphasized wolf removal allowed coyotes to utilize areas where they were previously outcompeted (Ballard et al. 2003). Range expansion and population growth of coyotes in Michigan since 1980 (Frawley 2008) has led to their increased presence in urban environments, including the counties surrounding the metropolitan Detroit area in southeastern Michigan. The recurrence and range expansion of coyotes in Michigan and their appearance in northeastern North America in general has become a major wildlife management challenge, with extremely negative public perceptions of coyotes predominating in urban areas (Gompper 2002; Gehrt 2004). For example, homeowners in the greater Chicago metropolitan area rated coyotes highest among nuisance wildlife species perceived to pose the greatest threats to human health and safety (Miller et al. 2001).

Coyotes can significantly impact the abundance and community structure of flora and fauna through direct and indirect top-down effects. Coyote exclusion or predation of mesocarnivores (Sovada et al. 1995; Rogers and Caro 1998) and predation on small rodents (Henke and Bryant 1999), feral domestic cats (Crooks and Soulé 1999), and overabundant urban wildlife (e.g., white-tailed deer fawns [Gehrt and Riley 2010]) can have both ecological and economic benefits despite a largely negative public perception of coyotes. Understanding coyote distribution and habitat use in urban areas is therefore important for providing the most basic data describing how coyotes behave in close proximity to humans (Way et al. 2004). We examined the distribution of coyote evidence in metropolitan Detroit to 1) identify habitats used by coyotes in a human-modified landscape and 2) examine how coyotes distribute themselves with respect to the arrangement of land cover. We predicted that coyote evidence would more likely be found in areas with a greater proportion of green space and less urban non-vegetative land cover regardless of the degree of human development.

Study Area

The greater metropolitan Detroit area of southeastern Michigan encompasses portions of Livingston, Macomb, Oakland, Washtenaw, and Wayne counties, an area of approximately 8,600 km^2 (Figure 1), with a human population of approximately 4.5 million (SEMCOG 2010). In its urban core (the area where anthropogenic development and activity is greatest, impervious surfaces predominate, and green space is lacking [Gehrt 2010]), human population density of metropolitan Detroit is nearly five times greater than in the surrounding suburbs (Table 1). Land use in the urban core is primarily residential, commercial, industrial, and transportation-oriented, with parks, recreation areas, and other green space representing only a small proportion of the landscape. In the suburbs, land use is predominately residential and agricultural (Table 1).

Within the urban core existing areas of natural and naturalized vegetation are extremely fragmented; most are highly altered river floodplains dominated by grassy areas and eastern cottonwood (*Populus deltoides*), or abandoned lots and old farmland dominated by nonnative grasses and forbs. Forest remnants are more common in suburban areas, and are often second-growth woodlots dominated by oak (*Quercus* spp.), elm (*Ulmus* spp.), or other tree species that have become established with the reversion of former agricultural lands to more natural conditions. The urban core in the region has lost about 270,000 people to net out-migration since 2000, while 80% of suburban communities situated along the urban boundary have grown in population (SEMCOG 2010).

Methods

Field survey

We performed an extensive survey of urban and suburban areas in metropolitan Detroit for coyote evidence (i.e., carcasses, den sites, scats, sightings, or tracks). We classified exurban areas, defined as the semirural region beyond the suburbs and characterized by low-density, large-lot (>0.02 km^2 per unit) development (Daniels 1999) as ''suburban'' for this analysis. We

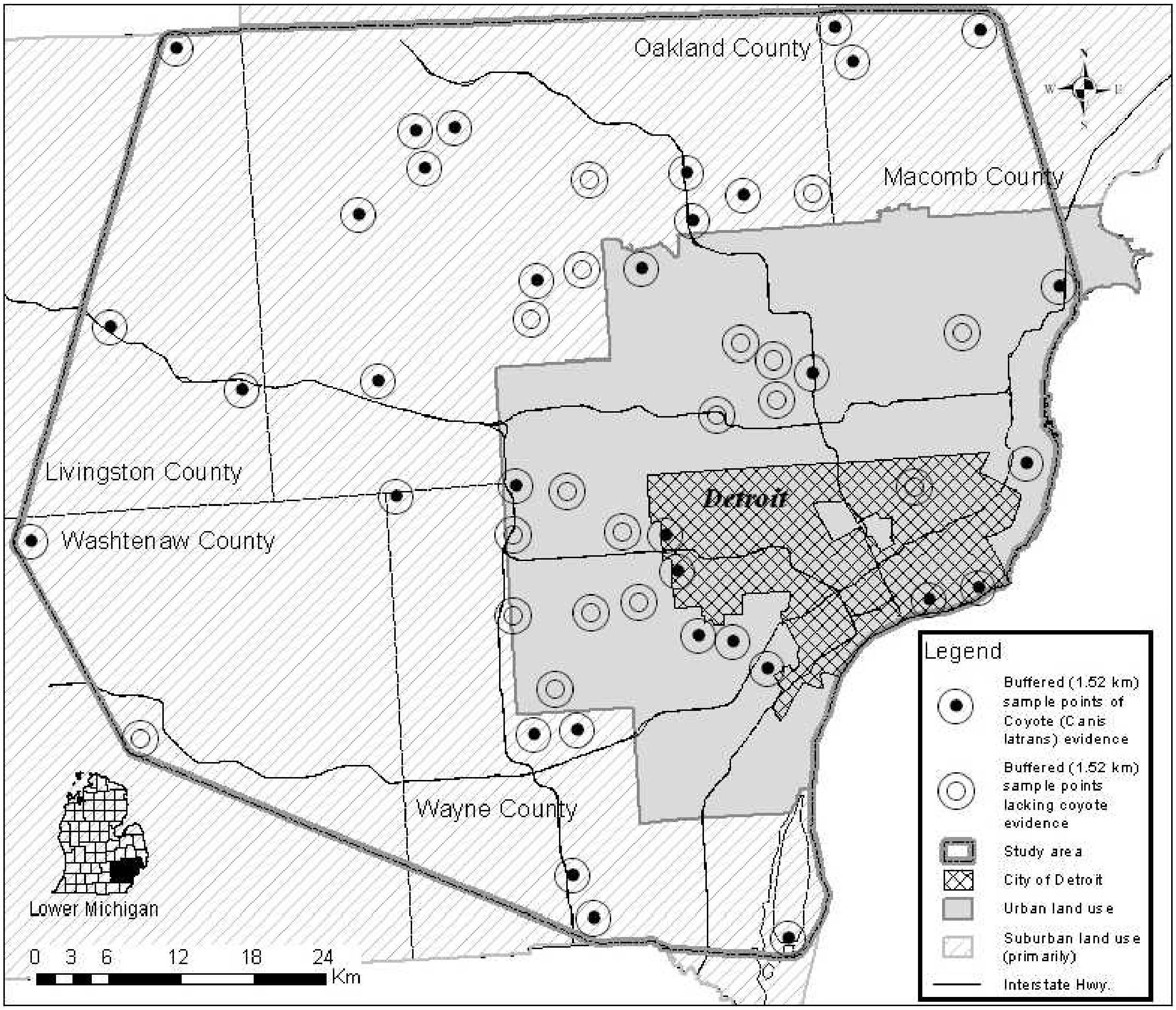

Figure 1. Sample points of coyote (*Canis latrans*) evidence at 34 locations (urban: $n = 12$; suburban: $n = 22$) and sample points lacking coyote evidence at 18 locations (urban: $n = 13$; suburban: $n = 5$) sampled May–September 2009 and June–December 2010 in the Detroit, Michigan, metropolitan area. Rings around each sample point signify 1.52-km–radius buffers encircling each location.

defined urban areas as having housing density >500 units/km^2 and human population density >1,000 people/km^2. We divided the five-county area of southeastern Michigan into 64.0-km^2 square plots ($n = 163$), which approximates the annual home range size of transient urban coyotes (Gehrt and Riley 2010), and randomly selected 25% of these plots ($n = 41$) for surveying. We visited 37 plots during May–September 2009 and 4 plots during June–December 2010. Because coyotes are generally associated with patches of natural vegetation in developed areas (Quinn 1997; Riley et al. 2003; Gehrt and Riley 2010) our survey efforts focused upon state, metro, county, city, and local parks; golf courses; abandoned industrial and residential sites; and undeveloped lots in each plot. We used unpaved trails (i.e., hiking, biking, horse), unimproved roads, margins of roadways, paved trails, railroad beds, and utility rights-of-way as primary survey transects with start points randomized along these features, based on documented coyote propensity to travel and defecate along these features (Macdonald 1980). Field reconnaissance was based on communication with local organizations in the area (e.g., police stations, animal control centers, nature centers, and local and regional newspapers) for evidence and published articles on coyote sightings, control

Table 1. Comparison of urban and suburban land use in the Detroit, Michigan, metropolitan area between 2009 and 2010. Data and land use classes are summarized from SEMCOG (2010).

Characteristic	Urban	Suburban
Area (km^2)	1,815	6,662
Human population density (people/km^2)	1,500	280
% Residential	47	48
% Commercial, industrial, orgovernmental	24	11
% Transportation, communication, or utility	24	7
% Parks, recreation, or open space	5	9
% Agricultural	0	22

efforts, and attacks on pets in the last decade. We attempted to survey all patches of natural and naturalized vegetation (both grassland and woodland) within each plot. Universe Transverse Mercator (UTM) coordinates were recorded with a hand-held GPS unit whenever coyote evidence was encountered. We also recorded UTM coordinates at the approximate centroid of areas searched where no evidence of coyotes was found.

Coyote scat was differentiated from that of other canids and raccoons by size, shape, content, and nearby sign (e.g., coyote tracks) if present (Murie 1935). Canid scat <19 mm in diameter is difficult to distinguish between coyote, red fox (*Vulpes vulpes*; Green and Flinders 1981), or gray fox (*Urocyon cinereoargenteus*; Danner and Dodd 1982) and was excluded from our analysis. Contrasting dietary characteristics in this region make scat of raccoon, medium-sized domestic dog (*Canis familiaris*), and coyote distinguishable. Coyote scat tends to be ropelike with tapered ends and often contains large amounts of fur, bones, and teeth (Rezendes 1999). Comparatively, domestic dog scat often occurs as amorphous piles or blunt-ended tubes, is foul-smelling, and rarely contains wild prey. Similar to coyote scat, raccoon scat often contains the remains of insects, grains, or fruit seeds due to its omnivorous diet, but rarely does it contain mammal hair. Because coyotes also consume fruit and other plant material, scat that contained only fruit was not collected unless other strong coyote evidence was nearby. For each coyote scat we recorded the maximum diameter, verifying evidence (size, shape, content, and nearby tracks), primary content, and the habitat type in which it was found.

Coyote tracks were separated from other canid tracks by size, shape, trail pattern, and other diagnostic characteristics. Paw impressions measured with a tape measure to the nearest 0.1 cm that fell within 5.7–8.3 cm long × 3.8–6.4 cm wid (front) and 5.4–7.6 cm long × 2.9–5.1 cm wide (rear) with trail width (straddle) >10.2 cm and stride >27.9 cm (Elbroch 2003) were used to differentiate coyote from fox and small domestic dog. Compared to domestic dogs, individual coyote tracks tend to be much neater and register at an angle rather than flat (i.e., the palm pad is on a much higher plane than the digit pads); coyote claws are sharp and pointed rather than thick and blunt; and in coyotes the leading claws (toes three and four) often register close together and point toward each other (Elbroch 2003). Trails of coyotes are also much cleaner, straighter, and narrower, and their tracks direct-register (i.e., the rear foot is placed exactly where the front foot had been) much more often than most domestic dogs (Rezendes 1999). Entrance holes >33.0 cm in diameter with conspicuous throw mounds of dirt and evidence of prey and scat nearby were considered to be coyote dens (Elbroch 2003).

Evaluation of land cover

Coyote occupancy of different land covers was calculated using a raster geographic information system (GIS) land cover types distribution layer of southeastern Michigan (SE Michigan Land Cover 2002; Center for Geographic Information, Michigan Department of Information Technology, Lansing, Michigan) consisting of three categories: urban non-vegetative; open space with grass and scattered trees (hereafter "grassland"), and wooded areas. These categories were selected to encompass a gradient of habitat cover across urban and suburban areas. Locations were buffered within the GIS with a 1.52-km–radius circle, derived from the grand mean of estimates of annual home range size (7.3 km^2) of urban coyotes across seven studies reviewed by Gehrt (2007). To ensure that locations could be considered independent, locations whose buffers partially overlapped were removed from the analysis. When the choice between which buffers to keep was ambiguous, we retained buffers that encompassed the greatest number of evidence locations, were farthest apart if there were an equal number of locations within the buffers, and preserved the greatest total number of sample points. The study area boundary was defined by creating a minimum convex polygon using all locations and buffering the polygon with a 1.52-km buffer.

We summarized land cover types contained within buffered locations of coyote evidence across the entire study area and by development class (suburban and urban) to determine habitat occupancy in the region. We used a χ^2 goodness-of-fit test to compare the observed proportion of land cover categories within buffered locations of coyote evidence to their expected proportion calculated from the proportion of land cover across the greater study area. We performed χ^2 analyses by development class and for the pooled data set to determine whether coyotes were selective in their use of land cover categories or whether they were located across the categories at random. We used percent deviation as a measure of the degree to which the observed proportion of each land cover category differed from the proportion expected for a random distribution. A positive percent deviation indicates that the observed frequency is greater than expected, while a negative percent deviation indicates that the observed frequency is smaller than expected.

Results

We recorded evidence of coyotes on 24 of 30 (80%) suburban and 7 of 11 (64%) urban plots. Evidence included three road-kills, two den sites, eight groups of tracks, four sightings, and 285 scats. Coyote evidence was ubiquitous, but appeared more widespread across suburban plots than in the urban core, where it was more locally distributed. Coyote evidence in the urban core averaged 28 locations per plot compared to <5 locations per plot in suburban plots, although it remains unclear whether these locations represent the same individuals or multiple coyotes. Using our criteria for considering locations to be independent, we identified 34 locations (12 urban, 22 suburban) where coyote evidence was present (Figure 1; Table S1).

Across the study area, we found coyote evidence primarily on unpaved trails and unimproved roads within wooded areas or open grasslands, often within 15 m of

Table 2. Land cover and adjacent land cover within 15 m of independent 1.52-km buffered locations of coyote (*Canis latrans*) evidence in the Detroit, Michigan, metropolitan area, May–September 2009 and June–December 2010. Records lacking adjacent land cover are those located in nonedge habitat.

Coyote evidence				
Type	*n*	Land cover[a]	Adjacent land cover[a]	%[b]
Road-kill	3	Urban non-vegetative	Grassland	100
Scat	2	Grassland	—	7
Scat	3	Grassland	Wooded	11
Scat	1	Grassland	Urban non-vegetative	4
Scat	5	Wooded	—	18
Scat	6	Wooded	Grassland	21
Scat	2	Wooded	Urban non-vegetative	7
Scat	4	Urban non-vegetative	—	14
Scat	5	Urban non-vegetative	Grassland	18
Tracks	1	Grassland	—	50
Tracks	1	Wooded	—	50
Visual	1	Grassland	—	100

[a] Urban non-vegetative includes both urban non-vegetative and urban–bare soil land cover categories.
[b] Percentage of the land cover to adjacent land cover combination within a given evidence type.

other land cover (i.e., edge habitat). We found 58% of independent locations of coyote evidence in edge habitat (Table 2). Den sites and tracks were the only types of evidence that we found strictly in nonedge habitats. All road-killed coyotes were found on interstate or state highways bordered by grasslands interspersed with shrubs, small diameter trees, or both. We observed extremely heavy concentrations of scat along a 4.5-km length of a heavily industrialized, channelized portion of the Rouge River within the urban core in Wayne County. Habitat directly adjacent to the edge created by the concrete channel consisted mostly of grassland (~32.0 m wide) or small irregularly shaped wooded patches. Scats found in non-edge habitat were more often located in woodland patches (43%) compared to grassland or urban non-vegetative (each 29%) patches. Observations of live coyotes (four) in this study occurred exclusively in open areas (grassland or agriculture).

Land cover within the buffer around coyote evidence was occupied differently than expected across the entire study area ($\chi^2 = 3{,}121.2$, $P < 0.0001$; Table 3; Figure 2a). Compared to the greater study area, buffer areas around coyote evidence included higher than expected wooded and grassland land cover, but less urban non-vegetative cover (Table 3). Specific to suburban areas, buffered areas included more wooded and less urban non-vegetative land cover than expected ($\chi^2 = 2190.0$, $P < 0.0001$; Table 3; Figure 2b). In urban areas, buffered areas included more wooded areas than the greater study area, as well as more grassland than expected, but less urban non-vegetative land cover ($\chi^2 = 2342.4$, $P < 0.0001$; Table 3; Figure 2c). Land cover surrounding areas where no evidence of coyotes was found differed from the expected amounts of land cover types across the study area ($\chi^2 = 16{,}012.4$, $P < 0.0001$) as well as in suburban ($\chi^2 = 2{,}248.9$, $P < 0.0001$) and urban areas ($\chi^2 = 323.2$; $P < 0.0001$).

Discussion

Coyotes are common in both urban and suburban areas in southeastern Michigan. Coyote evidence was found in nearly all environmental settings examined in this study, including urban areas within and near the city limits of Detroit, suburban areas within neighborhoods, on the grounds of major corporations (including Ford Motor Company's world headquarters in central Wayne County), in parks and green space within the urban–suburban matrix, and in rural or exurban areas in outlying counties (Figure 1). Notably, coyote presence was not always predictable, as many locations within the types of habitat described above contained no coyote evidence. Coyote evidence was repeatedly found in clusters, to the extent that locations in close proximity were considered to be nonindependent for the purposes of statistical analysis of habitat occupancy. Genetic analysis of DNA isolated from coyote scat would clarify whether these clustered locations of coyote evidence represent transient or nomadic, solitary individuals, or whether we have documented resident, territorial family

Table 3. Percent deviation and calculated χ^2 value for observed and expected (based on availability) proportion of land cover surrounding locations of coyote (*Canis latrans*) evidence in the Detroit, Michigan, metropolitan area, May–September 2009 and June–December 2010. A positive percent deviation signifies a higher proportion of the landscape in that category than expected at random. $P < 0.0001$ for all χ^2 values.

Land cover category	Study area	Suburban	Urban
Grassland	+3.9	−0.8	+42.2
Wooded	+18.1	+16.3	+31.7
Urban non-vegetative	−12.9	−17.0	−10.8
χ^2	3,121.2	2,190.0	2,342.4

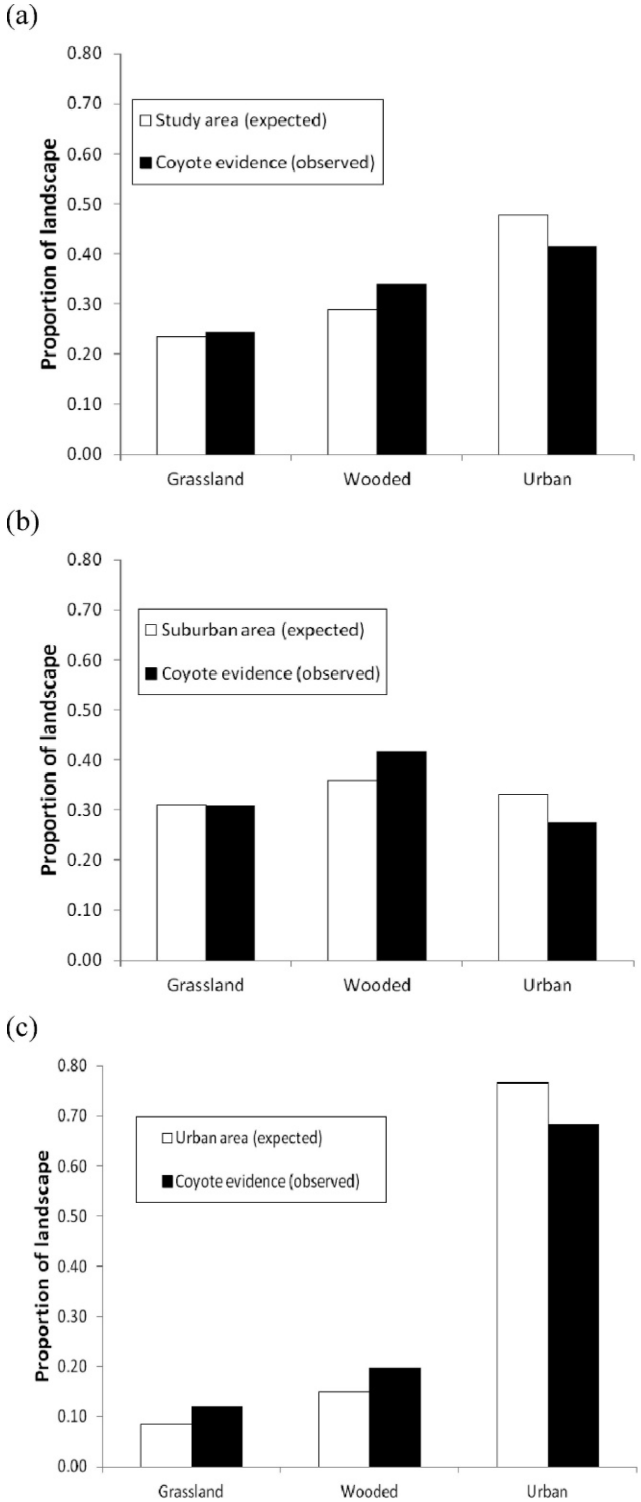

Figure 2. Observed proportion of land cover types contained within buffers (1.52-km radius) of independent locations of coyote (*Canis latrans*) evidence compared to their expected proportion for (**a**) the greater study area, (**b**) suburban and (**c**) urban portions of the study area in the Detroit Michigan, metropolitan area, May–September 2009 and June–December 2010.

groups or resident populations, and such analysis should be employed in future research. Analysis of shed DNA extracted from coyote scats could also be used to unambiguously differentiate coyote scat from other sympatric carnivores (Foran et al. 1997), obtain short-term coyote population estimates (Kohn et al. 1999), and monitor long-term population dynamics of coyotes (Prugh et al. 2005) in southeastern Michigan.

The observed proportion of urban non-vegetative land cover surrounding coyote evidence was less than expected across the pooled study area as well as in urban and suburban areas individually (Table 3), consistent with other studies that show coyotes avoid more developed areas regardless of whether they are found in urban or suburban environments (e.g., Quinn 1997; Tigas et al. 2002; Gehrt et al. 2009). Landscape composition surrounding locations of coyote evidence across the study area suggests that availability and access to habitat with cover—particularly areas with trees—appears to be more important to coyotes than the presence of open space or undeveloped areas. Although coyote evidence in the field was rarely located within interior wooded areas, cover habitat provided by wooded areas is likely important for den and rendezvous sites especially in human-dominated landscapes where coyotes can avoid and remain hidden from humans except when traveling (Grinder and Krausman 2001; Way et al. 2004; Gehrt et al. 2009).

Wooded land cover was also a major component of buffer areas in both urban and suburban settings (Figures 2b and 2c). Coyote occupancy was less common in urban and open areas compared to wooded land cover and undeveloped woodlots, presumably because of the tree cover they provide, but also probably because of abundant prey available near the edges of wooded areas. The propensity for coyotes to remain near wooded areas may be one explanation for the ability of urban coyotes to avoid humans despite their prevalence in heavily populated areas (Riley et al. 2003; George and Crooks 2006; Gehrt et al. 2009).

Land cover surrounding locations where no coyote evidence was found consisted of a greater proportion of urban non-vegetative and lesser proportions of wooded areas and grasslands than expected across both the pooled study area and in suburban areas. This outcome appears to support the importance of cover habitat for coyotes and their avoidance of urban areas. The outcome was more ambiguous in urban areas where the observed proportion of wooded land cover surrounding nonevidence points was greater than expected, with grassland and urban non-vegetative land cover occurring less than expected. Our field sampling may have been biased against finding coyote evidence in heavily urban non-vegetative land cover because of our focus on green space within the urban matrix, and studies tracking the movement of individual coyotes in urban environments are clearly necessary to discern where urban coyotes allocate their time.

Habitat patches in urban areas were generally smaller, more isolated and fragmented, and consisted of more nonnative plant species than those in suburban areas.

Competition for limited high-quality habitat, particularly in urban areas, may force subordinate coyotes into more marginal habitats with a greater proportion of urban land cover and less wooded areas and grasslands. Coyotes have naturally recolonized the most urbanized and human-modified landscapes in the Detroit metropolitan area, probably in part due to the recent economic decline in southeastern Michigan, which has resulted in the reversion of many sites into naturalized areas that are often utilized by wildlife. Like many urban areas, however, metro Detroit has long been interspersed with numerous parks, golf courses, highway interchanges, and other human-created green spaces that provide habitat for coyotes. Based on this historical land coverage alone, we speculate that coyotes were probably never limited by habitat in southeastern Michigan. The fact that coyote abundance in the region was increasing even during the height of land development in the late 1990s supports the assertion that habitat was not likely limiting. Although human-associated foods are available in urban areas, coyote diets are typically dominated by food items associated with natural areas (Morey et al. 2007; W.B. Dodge, Wayne State University, unpublished data) and human-associated foods are therefore not likely to be a primary driver of the distribution of coyotes in metro Detroit. Rather, we speculate that reoccupation of southeastern Michigan by coyotes likely occurred as a consequence of an expanding coyote population and increased competition for limited space in outlying rural and exurban areas. An accurate estimation of the coyote population is necessary to determine if current population levels in southeastern Michigan have stabilized or if coyotes will continue to expand into suburbs and cities of the area to fill unoccupied habitat.

Increased coyote abundance in southeastern Michigan may have implications from both an ecological and economic perspective. Notably, coyote presence in the Detroit area and elsewhere in midwestern and eastern United States metropolitan areas represents the range expansion of a native species rather than invasion of an exotic species (Gompper 2002), and thus is an important conservation issue. From a utilitarian perspective, coyotes have the potential to play a keystone role in limiting the population growth of nuisance urban wildlife. For example, coyote predation in Chicago has been considered as an important bio-control agent limiting the population growth rate of Canada geese (*Branta canadensis* L.; Brown 2007), reducing the growth rate of high-density urban white-tailed deer populations through predation of fawns (Gehrt and Riley 2010), and limiting the abundance of small rodents (e.g., voles [*Microtus* spp.] and mice [*Peromyscus* spp.]), which most often make up the bulk of coyote diets in urban and suburban areas (Morey et al. 2007). In rural Texas, experimental removal of coyotes to protect sheep resulted in a dramatic increase in rodent abundance and decrease in rodent diversity (Henke and Bryant 1999); coyotes may serve a similar ecological role in urban and suburban areas.

Despite the potential positive aspects of urban-dwelling coyotes, the focus of coyote management in urban areas will inevitably be on human–coyote conflicts (Gompper 2002; Way et al. 2004; Gehrt and Riley 2010), as it has been historically. The challenge for wildlife managers in urban landscapes is balancing the needs of coyotes and their coexistence with humans with preventing and mitigating conflicts with humans, typically through removal of coyotes. Coyote reduction has already been a focal point for several communities in metropolitan Detroit as a response to predation on small pets (J. Cravens, City Manager, Bloomfield Hills, Michigan, personal communication) and game species. Coyote populations compensate for reductions in numbers by increases in rates of immigration, reproduction, and survival of the remaining individuals, resulting in maintenance of coyote populations in a perpetual state of colonization (Crabtree and Sheldon 1999; Knowlton et al. 1999). Efforts to reduce coyote numbers are unlikely to be effective unless >70% of the individuals in a population are continually removed on an annual basis (Connolly and Longhurst 1975; Connolly 1995) across a large geographic region (Gompper 2002). We suggest that coyotes have minimal negative impact on humans and that indiscriminant lethal control is likely to be counterproductive, given the benefits of coyote presence in urban areas (especially the reduction of undesirable prey species). Moreover, we believe the goal of coyote management in urban areas such as metropolitan Detroit should be human–coyote coexistence, as the ecosystem services provided by coyotes may increase human well-being and overall environmental quality.

Supplemental Material

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Table S1. Specific locations, collection dates, and land use at 34 sites containing coyote (*Canis latrans*) evidence and 18 sites absent of coyote evidence in the Detroit, Michigan, metropolitan area sampled between May 2009 and December 2010. Sites are considered to be independent and exclude those with overlapping 1.52-km–radius buffers (see text for explanation).

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