# ANIMAL GEOGRAPHY AND WILDLIFE INTERPRETATION OF URBAN BATS

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by

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San Francisco, California

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CERTIFICATION OF APPROVAL

I certify that I have read Animal Geography and the Wildlife Interpretation of Urban Bats by Jill Flaningam Miller, and that in my opinion this work meets the criteria for approving a thesis submitted in partial fulfillment of the requirement for the degree Master of Arts in Geography: Resource Management and Environmental Planning at San Francisco State University.

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# ANIMAL GEOGRAPHY AND WILDLIFE INTERPRETATION OF URBAN BATS

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2016

Despite the imaginary geography of urban space that locates wildlife bodies far beyond city limits, wild animals do persist in urban backyards, buildings and parks. Spontaneous encounters with urban wildlife rupture the imagined boundaries between urban and wild, potentially either remaking cities into more humane and more-than-human spaces or leading to energized calls for the expulsion of wild animals from urban areas where they are largely considered out of place. Animal geographers have articulated theories necessary to shift beyond anthropocentric attitudes supporting the expulsion of wildlife from cities, but praxis "in the field" – that field being society at large – is essential if the concepts promoted by geographers are to have impact in the public sphere. Environmental interpreters are well-suited for this task as their objective is to introduce new ways of perceiving the world through thematic presentations and field-based experiences. To demonstrate the compatibility between the fields of animal geography and environmental interpretation, this paper outlines the development of a model urban wildlife interpretation program on the subject of bats living in Oakland's Sausal Creek watershed. Bats are a particularly charismatic subject because of their enduring cultural construction as transgressive creatures. In the appendices are ready-to-use program materials for an interpretative slide show and bat walk.

I certify that the abstract is a correct representation of the content of this thesis.

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Chair, Thesis Committee Date

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TABLE OF CONTENTS

LIST OF TABLES

Table Page

LIST OF FIGURES

Figures Page

LIST OF APPENDICES

Appendix Page

## Introduction

Cities are animal-human spaces. Despite their perceived invisibility in urban areas, wild animals persist and sometimes thrive in our backyards, buildings and parks. Spontaneous encounters with urban wildlife rupture the imagined boundaries between urban and wild, potentially remaking cities into more humane and more-than-human spaces. Without a shift of dominant perspectives and values, however, wildlife encounters may also lead to an energized call for the expulsion of wild animals from urban areas where they are largely considered out of place. A post-humanist reimagining of urban space must be made available to the general public so that the presence of wildlife is interpreted as positive. Embodied and mediated encounters with urban wildlife present opportunities to move past ingrained anthropocentric ideologies for the purpose of contemplating non-human perspectives in what may be considered the most human of spaces. Through observation and interaction with wildlife, space that was formerly perceived as ordinary is transformed into a more alive, diverse and ultimately interesting place to be. This, in turn, may inspire advocacy and a collective willingness to consider wild animals' needs when making urban land-use decisions.

Theorists and practitioners are both needed in the endeavor to revitalize our cities. Animal geographers and scholars in fields including anthropology and philosophy have provided the theoretical architecture necessary to support a widespread shift beyond anthropocentric attitudes, design and policy. Praxis "in the field" – that field being society at large – is essential if the concepts articulated by theorists are to have impact in the public sphere. Environmental interpreters are well-suited for this task as their objective is to engage lay audiences in appreciation of place through situated activities that heighten intellectual and sensory perceptions. By designing thematic presentations and field-based experiences that introduce new ways of perceiving the world, interpreters become agents of popular diffusion for ideas forwarded by academics and researchers. As environmental interpreters help bring people into greater intimacy with wildlife, they

promote a less anthropocentric notion of community in which our most colorful and fascinating neighbors are the non-human ones.

This paper explores the practical application of animal geography through an environmental interpretation program on bats in Oakland, California. Part I provides the theoretical foundations for this project: a review of literature followed by presentation of "conceptual nodes" of intersecting concepts from animal geography and environmental interpretation to illustrate compatibility between the two fields. Part II outlines the development of a model urban wildlife interpretation program on the subject of bats living in Oakland's Sausal Creek watershed. In the appendices are ready-to-use program materials for an interpretative slide show and bat walk.

# PART I: THEORETICAL FOUNDATIONS

## Literature Review: Animal Geography

### *Hyperseparation from the Animal Other*

The Western idealization of nature as a bounded entity existing separate from human culture is informed by a dualistic ontology employed since the age of classical Greece to legitimize social-political hierarchies (Haraway 1985; Plumwood 1993; Baker 2001: Whatmore 2002). Operationalization of the nature/culture binary into the unambiguous, fundamentally opposed categories of animal/human have long enabled human domination over both animals and humans considered to be animal-like (Philo 1998; Wolch 1998; Brownlow 2000; Griffiths, Poulter and Sibley 2000; Castree 2001; Castree and Nash 2006).

Extreme polarization of binary entities results is what Plumwood terms "hyperseparation" (1993). In hyperseparation, the boundary between binary opposites is made conceptually immutable through a total denial of similarity, allowing humans to act without ethical consideration of the animal other's experience, agency or inherent worth. This process facilitates a complete denial of dependency on an Other, occluding all recognition of interrelationship or kinship with animals (Plumwood 1993, Wolch 1998). The fiction of individual human autonomy, legitimized by a social doctrine of binary opposites, establishes a purely instrumentalist role for animals who provide labor, food, companionship for human subjects (Philo 1998).

The Enlightenment period writings of Descartes are widely cited when locating the philosophical roots of contemporary Western attitudes towards nature and animals (see Fitzsimmons 1989; Plumwood 1993; Watson and Huntington 2008). According to Descartes, all nonhuman animals are *automata* – self-moving machines – that are unequivocally incapable of abstract thought, the defining keynote of humanness (1993). Animals are capable of corporeal sensations, but unlike humans they do not possess an

immortal "thinking soul" (Descartes 1993, 4). Knowledge originating from emotions and physical sensing are denigrated through association with animals while cognition is thought to occur solely in the enlightened human's "disembodied mind," (Plumwood 1993, 111; Descartes 1993). Lived experience or embodied knowledge such as that held by non-experts is not considered valid. Scientific knowledge of animals is predicated on the Cartesian assumption of nature/human separation and is acquired through observation by supposedly dispassionate and disembodied experts.

Furthermore, Descartes argued that because animals do not possess the capacity for disembodied rational thought, their experiences do not warrant ethical consideration, thus absolving humans from "the suspicion of crime when they eat or kill animals" (Descartes 1993, 4). If animals are considered to be objects without agency or meaningful lifeworlds, then it is not incumbent upon humans to make moral choices about our influence upon them; business as usual may continue (Herzog and Galvin 1997; Emel and Wolch 1998; Wolch 1998; Wolch 2002, Acampora 2006). As noted by ethologist and bat researcher Donald Griffin, acknowledging the possibility of animal consciousness "threatens the deep-seated philosophical convictions of human superiority" (Griffin 1999, 250) and provides justification for willful exploitation or exclusion from moral consideration.

***Imagination and Invisible Urban Wildlife***

Managing the places occupied by wildlife is critical to sustaining theoretical and material boundaries between humans and animals (Griffiths, Poulter and Sibley 2000; Jerolmack 2008; Power 2009). By placing things into socio-spatial categories – *putting them in their place* – humans establish an ordering of their world that reflects cultural values and ontology (Brownlow 2000; Griffiths, Poulter and Sibley 2000; Philo and Wilbert 2000; Thomson 2007). This process is highly discursive, occurring largely through the conceptual linking of a subjugated Other to distant or exotic locations in the construction of "imaginative geographies" (Philo and Wilbert 2000:10) that enable

control of spaces and bodies (Gregory 2009). In the case of urban spaces, imaginative geography locates wildlife bodies in wilderness areas far beyond city limits, thereby affirming the city as a distinctly human landscape (Philo and Wilbert 2000; Wolch 2002; Hinchliff et al. 2003; Thomson 2007; Jerolmack 2008). Wolch (1998) notes that urban theory promotes this anthropocentricism through its language: "In mainstream theory, urbanization transforms 'empty' land through a process called 'development' to produce 'improved land'" (119).

Routine and varied embodied interactions between humans and wildlife in urban areas have been diminished or outright eliminated due to urbanization's deleterious effects on individual animals and species richness as a whole (Gullo, Lassiter and Wolch 1998; Griffiths, Poulter and Sibley 2000; Wolch 2002; Miller 2005; McKinney 2006; Muller and Werner 2010). Although wild animals do persist in the city, and some even thrive in human-dominated landscapes (Thomson 2007; Muller and Werner 2010), urban wildlife are often relegated to marginal spaces and temporal cycles including vacant lots, attic eaves, and dusk where they are not readily perceived (Griffiths, Poulter and Sibley 2000; Power 2009). Their invisibility is further compounded by "systematic not noticing" (Plumwood 1993, 69) resulting from a devaluing of those non-humans living closest to us (Wolch and Emel 1998; Brownlow 2000; Baker 2001; Wolch, Emel and Wilbert 2003).

Due to the material and perceived absence of wild animals in cities, wildlife living in exotic locations have become the primary animal objects of fascination for an increasingly urbanized populous and are the lead attraction in nature documentaries or "cyberzoos" (Wolch, Emel and Wilbert 2003, 195; Wolch 1998). The visual consumption of highly curated digital images objectifies animals and limits the possibility for local, embodied interactions with wild animal subjects (Wolch et al. 2003; Davies 2000). Undomesticated animals who live in our backyards or roost in the eaves receive scant comparable notice as the "unwritten priorities of the culture enable even that which is in full view to be rendered effectively invisible – or if still visible to be drained, by common

consent, of any significance" (Baker 2001, 8; Wolch 1998; Wolch and Emel 1998; Brownlow 2000; Hinchliffe et al. 2003).

### *Animal Geography: Embracing the Animal Other*

Energized by environmental and animal rights campaigns and informed by feminist and critical social theory of the latter 20th century, scholars of the past 20 years have developed an interdisciplinary post-humanist study of animal-human relations. Through their contributions to this endeavor, geographers have vigorously reanimated the formerly languishing field of animal geography (Emel and Wolch 1998; Wolch, Emel and Wilbert 2003). An earlier school of mid-20th century Sauerian-influenced animal geography primarily examined the function of livestock-human relations in creating what Sauer termed the "cultural landscape" (Wolch and Emel 1998; Wolch, Emel and Wilbert 2003, 186; Philo 1998). The material and symbolic role of domestic animals in shaping culture was recognized, but animals were still treated as a backdrop against which human society asserted itself rather than as subjects themselves (Wolch, Emel and Wilbert 2003). Beginning in the 1990s, geographers began producing scholarship interrogating society's (and academia's) deeply constitutive alienation from and domination over animal subjects (Philo and Wilbert 2000; Wolch, Emel and Wilbert 2003). Since the initial call to "bring animals back in" (Wolch 1998) to the realm of scholarly and moral consideration in 1995 with a thematic issue of *Society and Space* (Wolch, Emel and Wilbert 2003), some core themes have emerged within the field. Following is a review of five of those themes that relate to this particular study of urban wildlife interpretation as animal geography praxis.

### *Core Concept: Animal Representations, Value and Place-Making*

One objective of contemporary animal geography is to understand how cultural representations of animals influence their placement (Philo and Wilbert 2000). The symbolic presence of animals is considered in the examination of place-making and

identity construction because "representational, symbolic and rhetorical uses of animals must be understood to carry as much conceptual weight as any idea we may have about the 'real' animal, and must be taken as seriously" (Baker 2001, 10; Holloway 2003). The cultural construction of wild animals largely problematizes wildlife found in urban areas, necessitating removal of the animals so that boundaries between human/animal, home/outdoors and city/wilderness are maintained (Griffiths, Poulter and Sibley 2000; Jerolmack 2008; Yeo and Neo 2010).

Perceived absence and limited embodied contact with wildlife in cities makes animals especially vulnerable to expulsion based on the negative socio-political "mediated characterization" of them (Gullo, Lassiter and Wolch 1998, 141; Brownlow 2000; Woods 2000). In lieu of ideas gained from corporeal encounters with wild animals, representations of wildlife stand in. As the consummate Other, animals have great "symbolic availability" (Baker 2001, 5) and are ready embodiments of a culture's fears and desires (Brownlow 2000). Discursive frames such as "pest," or "vector" that cast species as proxies for disease and filth serve as a moralizing "distancing mechanism" to justify an animal's removal from human spaces (Jerolmack 2008, 86; Power 2009). Characterization as a "predator" also facilitates eradication from urbanized areas, as in the case of cougars (*Puma concolor*) living in California's Orange County (Gullo, Lassiter and Wolch 1998).

Even if a wild animal is not perceived as a threat, it is often seen as out of place in urban areas (Hinchliffe and Whatmore 2006; Yeo and Neo 2010). Some Sydney residents whose homes had been visited by brushtail possums (*Trichosurus vulpecula*) didn't feel antipathy towards the animals, but did feel that the possums properly belonged in the bush (Power 2009). A large population of grey-headed flying foxes (*Pteropus poliocephalus*) who[1] took up residence in Melbourne's Royal Botanic Gardens were

[1] [1] The majority of reference works including dictionaries, grammar guides and publication manuals mandate the use of the relative pronoun "who" to humans and non-human animal individuals exhibiting human-like characteristics (Gilquin and Jacobs 2006; Gupta 2006). Use of the pronoun who "reflects . . .

viewed sympathetically by some locals as habitat loss refugees, while others saw them as invading opportunists who deserved to be removed (Thomson 2007). No matter the attitude, when species are represented as outsiders in the city, they are vulnerable to expulsion (Thomson 2007).

Representations of animals change over time and space (Wolch 2002). As humans acknowledge their role in widespread environmental destruction, wild animals are increasingly seen as representative of an assailed yet resilient natural world. In the United Kingdom, river otters who were historically viewed as thieving vermin were hunted for sport up to the middle of the 20th century (Matless, Merchant and Watkins 2005). Yet, in 2009-2010, Syse (2013) found that inhabitants of the Scottish village Mid-Argyll were highly unified in their pride over the resident otters whose liminal, water/land nature heighten their symbolic availability. In Mid-Argyll, people's interest in otters was a representative of their care for the greater natural world.

Viewing urban wildlife as the embodiment of nature during an era of anthropogenic eco-crisis may, paradoxically, contribute to urbanites' feeling of belonging in a city environment. In her study of Sydney residents whose homes were occupied by native brushtail possums, Power (2009) found that many people interviewed felt comforted by the intimate presence of native wildlife in their home. Participants viewed the possums as representative of a wild and healthy nature that was being lost to human development; the possums' presence signaled the welcome integration of "natural" Australia into the city. In this case, the construction of the brushtail possums as native, original inhabitants of the land was critical in residents' willingness to cohabit with them (Power 2009).

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an attitude to the way the world is structured" (Gupta 2006, 109); limiting the usage of who to humans and certain animals affirms a human-dominated moral world. In the spirit of Jane Goodall who insisted on using who "in an effort to rescue chimpanzees from 'thing-ness' and restore them to being-ness'" (in Gilquin and Jacobs 2006, 80), this study uses the pronoun who for animal subjects in recognition of their complex intellectual, social and emotional lives (Blecha and Davis 2014).

Non-human charisma – defined as "the distinguishing properties of a non-human entity or process that determines its perception by humans and its subsequent evaluation" (Lorimer 2007, 915) – is a form of representation that contributes to the perceived worth of an animal. Lorimer (2006a, 2006b, 2007) has outlined different types of charisma for the purpose of better understanding humans' affinities for and valuation of various non-human animals (Table 1). Animals with time-space rhythms similar to humans have what Lorimer terms "ecological charisma" (2007, 916) derived from their ability to be readily observed. Detectability contributing to this element of charisma is based upon an animal's corporeal (Can it be seen without equipment?) and geographic (Is it most active in the day? Does it roost near the ground?) characteristics (2006a). The usefulness of an animal species to humans affects its "socio-economic charisma" (2006b); economically important animals are generally valued, while those categorized as pests are reviled (Lorimer 2006; Kunz et al. 2011).

**Table 1**: Charisma typology

| Charisma Type | Determinants |
|---|---|
| Ecological | Detectibility: Is the animal easily observed? |
| Socio-Economic | Usefulness: Does the animal have economic value to humans? |
| Aesthetic: *cuddly* | Gut response: Does the animal's anthropomorphic nature trigger strong positive emotions in humans? |
| Aesthetic: *transgressive* | Gut response: Does the animal's alien, wild nature trigger negative or ambivalent emotions in humans? |

Another influence upon the perception and evaluation of animals is based upon what Lorimer calls "aesthetic charisma": "the distinguishing properties of an organism's behaviour and appearance that trigger particular emotions in . . . humans" (2007, 918). Wildlife conservation organizations often use animals with "cuddly" (Lorimer 2007, 919) aesthetic charisma such as panda bears to capitalize upon the attachments of donors who respond emotionally to animals with human-like faces or traits. Animals perceived as monstrous-looking, parasitic or swarming have "transgressive" aesthetic charisma (Lorimer 2006b, 3) that elicits negative reactions or phobias and makes them unsuitable

candidates for conservation campaigns based on emotionally-laden representations of animals. Thus the placing of animals within the bounds of humanist ethics determining which species are worthy of conservation resources is greatly based upon their perceived similarity to humans (Lorimer 2007).

***Core Concept: Embodied Encounters with Animal Subjects***

Representations of animals – however meaningful in the creation of space and identity – are still "social fabrications" (Gullo, Lassiter and Wolch 1998, 140), not animals themselves. Actual, embodied encounters with wildlife are necessary for the transformation of human-animal relationships and spaces (Michel 1998; Acampora 2006; Johnston 2008; Keul 2013). In his study of Atchafalaya River Basin alligator tours, Keul found that "encounters with animals – even animals as 'wild' as alligators – are able to inform people's sense of what it means to coexist and share space with animal bodies" (2013, 931). Knowledge gained *in situ*, from senses and emotions as well as cognition, allows people to experience familiar space or animals known only through representations in a novel way (Johnston 2008; Kuel 2013). Furthermore, if a person truly wants to understand the lifeworlds of wild animals, "one must enter environments not wholly of human making" (Acampora 2006, 12).

Physical encounters foreground sensory experience in the construction of what Ingold (2005) terms "aesthetic knowledge" as different from scientific knowledge (in Johnston 2008, 642). Scientific knowledge of animals is predicated on the Cartesian assumption of nature/human separation and practice of supposedly dispassionate, disembodied observation by experts. Aesthetic knowledge, however, assumes individuals to be enmeshed in situated relationships with other beings; knowledge is derived from physical "being-in-the world" with others (Ingold 2005 in Johnston 2008, 643). Comparison of one's sensory experience in an environment to that of an animal allows for recognition of the embodied likeness shared with other creatures, even those as radically different as alligators (Keul 2013), water voles (Hinchliffe et al. 2003) or bats

(Wolch 1998; Acampora 2006). Being with animals in space – under the hot sun for example – may precipitate the realization that animals have bodily vulnerabilities, as do humans, and are not just ecological objects or economic inputs. As in the case of gator tour participants, this epiphany may elicit a feeling of kinship and desire to help the animals meet their needs (Keul 2013). The kinship with animals "whom I understand as variants of my own embodiment" (Merleau-Ponty in Acampora 2006, 14) promotes inclusion of non-human animals into the moral sphere (Acampora 2006).

The dissimilarities between animal species and humans may also serve to enlarge a sense of kinship when differences become points of interest and admiration, not a means to classify animals as an aberration or Other that must be removed (Acampora 2006; Lorimer 2007). Framing an animal as a "related other" rather than a "deviant similar" engenders "neighborliness" (Acampora 2006, 18) which places non-human animals within the bounds of morality and subjecthood (Acampora 2006, Johnston 2008). Animals with transgressive charisma due to distinct alterity, or otherness, have the power to draw the admiration of researchers who celebrate non-human difference (Lorimer 2007) as well as lay people who seek communion with exotic, wild animals (Keul 2013). Whether the animal is viewed as being human-like or a related other, the experience of sharing space with the non-human animal can be an "ecstatic" (Lorimer 2007, 911), emotionally charged one.

For animal geographers (see Wolch 1998, Philo and Wilbert 2000, Wolch 2002, Johnston 2008), animals' alterity is essential to their subjectivity. Like humans, animals have their own worldviews that "are likely to be markedly different from ours but may be no less real" (Noske 1989 in Wolch 1998, 121). They, too, "possess their own stories" (Philo 1998, 54) and socially construct their own worlds (Lynn 1998; Wolch 1998; Philo and Wilbert 2000; Wolch, Emel and Wilbert 2003). Humans should not try to assume total understanding of animals' realities, but acknowledge that they are as valid as our own and need to be taken seriously (Philo and Wilbert 2000; Johnston 2008). Philosopher

Thomas Nagel (1974) posed his famous query, “What is it like to be a bat?” to support the assertion that a human can never truly know the life experience of a creature whose faculties are so different. Yi-Fu Tuan agrees that “a person cannot enter imaginatively into the life of his dog; canine sense organs diverge too far from our own for us to leap into the dog’s world of smells, sounds and sights” (in Acampora 2006, 26). This does not, however, mean that the bat experience is more impoverished than the human one; Nagel writes, “The fact that we cannot expect ever to accommodate in our language a detailed description of bat phenomenology should not lead us to dismiss as meaningless the claim that bats . . . have experiences fully comparable in richness of detail to our own” (1974, 440).

***Core Concept: Animal Agency and the Borderlands***

A third core concept of animal geography is that animals have agency, meaning that they act with intention and observable effect (Sharp 2009). One way in which animals exercise agency is through transgression of human-designated boundaries constructed to keep them in their discursive and physical place (Philo 1998; Philo and Wilbert 2000). Although the action may not be performed in conscious rebellion (as implied by the term “transgression”), some scholars argue that crossing human-animal borders is nonetheless a transgressive act undertaken by self-determined animal subjects who act to meet their own distinct, beastly needs (Michel 1998; Philo 1998; Philo and Wilbert 2000; Johnston 2008; Yeo and Neo 2010).

The occupation of cities by wildlife demonstrates the agency of animals who do not adhere to spatial categories established by humans. Wildlife will readily occupy an environment that meets their needs and do not distinguish between “natural” and urban landscapes as humans do (Sheppard and Lynn 2004; Thomson 2007). Contrary to the characterization of wild animals as being passively victimized by human-driven habitat loss, some wildlife species actively exploit opportunities provided by the built environment, as in the case of possums who may prefer dens in houses rather than so-

called natural cavities (Power 2009) or peregrine falcons who are found in highest global concentration in New York City and Berlin (Hinchliffe and Whatmore 2006; Luniak 2004). Like humans, some wild animal species are able to adapt to city life (Muller and Werner 2010). In some cases, urban populations of a species will develop distinctive morphological and behavior characteristics that allow them to thrive in the city. The observed increase in "microevolutionary" adaptions in urban-based populations in recent decades has given rise to the concept of *synurban* species (Luniak 2004).

In urban areas, wildlife transgressions are frequently the source of conflict between animals and humans because boundary destabilization causes anxiety (Gullo, Lassiter and Wolch 1998; Jerolmack 2009; Power 2009; Yeo and Neo 2010). These conflicts are opportunities for exchange which have the potential to precipitate the formation of new identities and "ways of engaging with the world" (Kaika in Power 2009, 31; Michel 1998). In a conflict situation, emotions are heightened and distinctions blur, making people more receptive to change in perception and bodily experience. (Power 2009; Keul 2013).

Geographers have applied the conceptual framework of the *borderlands* as a tool for understanding transgressive spaces, experiences and identities as opportunities for renegotiation of boundaries and human-animal relationships. Borderlands describe the ambiguous space between discrete entities in which distinctions blur and separation is transcended; borderlands exist between binaries such as those demarcating space (e.g. city/wilderness), identity (e.g. human/animal) and knowing (e.g. disembodied rationalization/emotions and corporal sensing) (Michel 1998).

Borderlands spaces in urban areas include the marginal zones into which wild animals have been forced. They are the places where humans and animals share space: outskirts, the urban-wildland interface, derelict lots and interstitial spaces (Griffiths, Poulter and Sibley 2000; Power 2009). In our homes, borderlands are the spaces that are not readily visible: behind the walls and high in the attic (Power 2009). Borderlands time

includes dawn and dusk, a moment described as “between dog and wolf” in which the familiar becomes blurred and people “half hope, half fear that a dog will become a wolf” (Jean Genet in Griffiths, Poulter and Sibley 2000, 62). Entering a borderlands space and time –“environments not wholly of human making” – is critical to developing awareness of other animal worlds and subjectivities (Acampora 2006, 12).

Borderlands states occur when human individuals shift focus from being purely intellectual to emotional and sensory awareness. Participants on gator tours in the Atchafalaya River Basin are drawn to this experience because they want to confront their fears by sharing space with a fearsome predator (Keul 2013). The emotionally-charged, embodied encounter often yields new insights into characteristics they share with alligators and the sense of total alienation/separation is transcended (Keul 2013). Borderland states are also created by confrontation with unsettling sensory stimulation such as the strong smells or unfamiliar sounds created by wild animals in close proximity to humans (Power 2009).

Borderland animals are those who transgress boundaries. Wild animals residing in the city are inherently borderlands creatures (Power 2009). They are unsettling because they are out of place, but desirable because they represent humanity’s wish to connect with nature even in the urban environment (Griffiths, Poulter and Sibley 2000; Power 2009). Borderlands animals are liminal species who inspire ambivalence because they defy easy categorization or are not easily seen such as those with crepuscular or nocturnal habits (Syse 2014). Examples of elusive, borderlands animals include feral cats who are seen as both domestic and wild (Griffiths, Poulter and Sibley 2000) and bats because they appear to be mice who fly (Adams 2003; Syse 2014). Borderlands animals are symbolically potent (Syse 2014), frequently appearing in human ritual and mythology because “liminality can cure, and liminality can initiate a transformation” (Syse 2014, 24). Animals with charisma or an ability to elicit emotional responses from humans may act as “boundary objects” (Lorimer 2007, 925) that bridge the divide between scientific

researchers and lay people working together on conservation projects. Boundary object animals allow for "the acceptable entry of emotional and vernacular understandings of nature into 'objective' conservation biology" (Lorimer 2007, 926).

***Core Concept: A Borderlands Politics and Ethic of Care***

At the heart of animal geography scholarship is the normative task of enlarging the circle of humanist morality to include non-human animals in "response to our political and ethical responsibilities to the species who share our planet" (Johnston 2008, 633; Wolch and Emel 1998; Lynn 1998; Philo and Wilbert 2000; Wolch, Emel and Wilbert 2003; Sheppard and Lynn 2004). In her analysis of golden eagle (*Aquila chrysaetos*) advocacy in San Diego County, Suzanne Michel uses a "borderland perspective of wildlife politics" based upon an ethic of care (1998). She argues that the act of caring for nonhumans through wildlife rehabilitation and environmental education is a borderlands political act of resistance against the placement of nonhumans outside the realm of moral and political consideration. Wildlife care practices are borderlands acts because "they foster non-dualistic thinking, which allows for local communities and individuals to become experientially and emotionally connected with the plight of disappearing wildlife" (Michel 1998, 163). Borderlands politics, then, is found when kinship with animals encouraged by care practices engenders active resistance to destruction of wildlife.

It is not enough to recognize animal subjectivity, as this alone will not end the socio-cognitive processes that promote the injury and expulsion of animals (Michel 1998; Wolch 1998). People must engage politically to create many forms of "shared space" with animals, including wildlife (Wolch and Emel 1998, xii; Philo and Wilbert 2000). Geographers have also advocated for making imaginative and material space for animals to freely create and occupy their own sovereign, "beastly places" (Philo and Wilbert, 2000; Whatmore 2002; Johnston 2008).

An important site for shared animal-human space is in cities, as outlined by Jennifer Wolch in her call for a renaturalized, post-humanist urban theory and planning she terms *zoopolis* (1998). In the *zoopolis*, as in Hinchliffe and Whatmore's concept of *living cities* (2006) and Sheppard and Lynn's *cosmopolis* (2004), "urban theory takes nonhumans seriously" (Wolch 1998, 120) by considering the perspectives and needs of nonhuman as well as human subjects. Subsequent urban design of the zoopolis deliberately enhances human and nonhuman needs and interrelationships through a process of decision-making based upon a "re-definition of expertise so that it includes lay engagements with place, gardeners as well as horticulturists, amateur enthusiasts as well as professional ecologists" (Hinchliffe and Whatmore 2006, 131). While Wolch agrees with Nagel that it is impossible for a human to ever know what a bat's life is like, she argues that bats and humans alike depend on complex interspecies social networks. Recognition of this fact is reason for people to "come to know, however partially, the animals with whom they coexist, thereby sustaining webs of connection and an ethic of respect and mutuality, caring and friendship" (Wolch 2002, 734).

Critical to Wolch's concept of zoopolis is political activism in which an "interspecific ethic of caring replaces dominionism" (1998, 125). When this occurs, the city may be transformed into more vibrant and equitable human-animal space because animals will not be expelled or placed in zoos, "but instead are valued neighbors and partners in survival" (Wolch 1998, 125) with whom humans may form alliances to fight environmental degradation that affects animals and nonhumans alike. In Seattle, the site of critical urban salmon habitat, the city's policy-makers and residents have united in the belief that the needs of humans and fish are intertwined – in other words, "What's good for salmon is good for people" (Verhovken 1999 in Wolch 2002, 729).

Michel (1998) cites environmental education as a "subtle form of political activism" and "probably the most successful borderland political activity" because its objective is not merely entertainment, but to mold the public's perceptions of wildlife and

inspire people to support conservation. Inherent to environmental education is "the belief that animals have equal rights to coexist with humans" (Michel 1998, 180). Furthermore, environmental education empowers individuals who are otherwise not located within traditional spheres of political and/or scientific power to take action in resisting destruction of their local natural environments and wildlife through organizing watershed festivals or participating in petitions or letter-writing campaigns (Michel 1998).

***Core Concept: Human-animal entanglements that make life more interesting***

The harassment, injury and displacement of urban wildlife are undoubtedly harmful to animals, but also to people; in banishing wild animals from our neighborhoods, opportunities are severed for human/non-human "entanglements that make life more interesting" (Hinchliffe and Whatmore 2006, 129). When urbanites' primary exposure to wildlife is through digital media in what Davies (2000) terms "electronic zoos," wildlife may be made fully visible, but it is also "fully controllable" and unambiguous (258). Viewing wildlife through a nature documentary is an experientially impoverished exercise that precludes the chance of learning about oneself through an unmediated interaction with a wild animal (Davies 2000). In cities, humans are ostensibly protected from nature's dangers, but they are also deprived of what Wolch calls the "dignity of risk" (1998, 123). While the presence of wildlife in the city may indicate a loss of control, it signals the restoration of wonder and excitement that comes from spontaneous encounters with wild nature (Wolch 1998, Griffiths, Poulter and Sibley 2000).

## Urban Wildlife Interpretation: Animal Geography Praxis

As shown in the studies of golden eagle education (Michel 1998) and of alligator tours (Keul 2013), public outreach through wildlife interpretation is a means through which the normative objectives of animal geography may be met. Just as wildlife restoration is a material, on-the-ground practice of "bringing the animals back in"

(Brownlow 2000), urban wildlife interpretation brings local wildlife species back into our imaginative and moral spaces. The reestablishment of embodied, localized relationships between urbanites and wild animals promotes inclusive borderlands thinking, values and advocacy. Wildlife interpretation – specifically bat interpretation – informed by animal geography concepts has the potential to achieve a post-humanist reordering of knowledge, identity, landscape and policy. Furthermore, the field's "real-world" applications are capable of animating the otherwise abstract theories advanced by geographers.

***What is urban environmental interpretation?***

Environmental interpretation "involves translating the technical language of a natural science or related field into terms and ideas that people who aren't scientists can readily understand" (Ham 1992). The concept of interpretation as a translation of nature is attributed to John Muir who wrote, "I'll interpret the rocks, learn the language of flood, storm and the avalanche. I'll acquaint myself with the glaciers and wild gardens and get as near the heart of the world as I can" (Bacher et al. 2007, 2). As illustrated by this quote, environmental interpretation is guided by a relational orientation towards others – animate and otherwise. The interpreter is conversant with nature because she is an intimate with nature; her task, then, is to guide others into a more fluent and meaningful relationship with their environment.

The practice of interpretation is necessarily rooted in place as revealed by this description provided by the National Association for Interpretation (n.d.): "Interpreters connect visitors to important natural, cultural, and historical resources at parks, nature centers, historical sites, aquariums, zoos, and anywhere that people come to learn about places." Furthermore, an objective of interpretation is to make a person "feel at home in the environment" (Bacher et al. 2007, 4) through facilitating participants' highly personal connections with a natural resource (Tilden 1977). In the case of environmental

interpretive programs located in cities, the goal is to cultivate meaningful connections between urban residents and local nature.

## Conceptual Nodes: Principals of Animal Geography and Environmental Interpretation

The principles of interpretation as a discipline were formally developed by National Park Service educator Freeman Tilden with the 1957 printing of his seminal text *Interpreting Our Heritage* (Ham 1992; Bacher et al. 2007). Along with Tilden's foundational tenets are guiding principles established by renowned environmental interpreter Sam H. Ham, organizations including National Association for Interpretation and the North American Association for Environmental Interpretation and interpretive training and planning programs developed by public agencies such as the National Park Service (NPS) and California State Parks.

Many of the core philosophical tenets of environmental interpretation mirror those of animal geography in a series of what I have termed "conceptual nodes." Each conceptual node represents a cluster of related, intersecting ideas from the two disciplines as outlined in Table 2 on pages 20 - 21. Following Table 2 is a more detailed analysis of the principles of environmental interpretation as they correspond to animal geography concepts introduced in this paper's previous section.

**Table 2: Conceptual Nodes between Animal Geography and Environmental Interpretation**

| | |
|---|---|
| **Cultivating meaningful connections between humans and wildlife** | **Animal Geography** |
| | • Overcoming human/animal hyperseparation; humans are in relationship with the natural environment and wild animals<br>• Animals are subjects with agency<br>• Urban wildlife are valued neighbors who actively shape the city landscape and make us feel "at home"<br>• Wildlife presence enlarges our world, makes life exciting<br>• Positive representation of urban wildlife species as<br>- related other: similar, yet different than humans<br>- charismatic<br>- embodiment of wild nature in the city<br>- city residents, not aliens<br>- borderlands subjects |
| | **Environmental Interpretation** |
| | • Programming must be relevant to audience<br>• Themes reveal personal connections meanings and relationships<br>• Promotion of curiosity, wonder, new perspectives, enrichment<br>• Participant is changed through personal revelations inspired by the interpretation experience<br>• Making people feel at home in a natural environment |
| **Embodied encounters** | **Animal Geography** |
| | • Urban wildlife are foregrounded, made visible<br>• Aesthetic knowledge production transcends mind/body split, promotes kinship and awareness of shared bodily experiences<br>• Borderlands experiences facilitate nondualistic ways of knowing<br>• Restoration of wonder and risk makes life more interesting |
| | **Environmental Interpretation** |
| | • Environmental interpretation where people live: the city<br>• Multi-sensory, non-traditional learning setting and methods<br>• Novel experiences heighten learning<br>• "First-hand" experience based on sensory engagement with/in place |

| | | |
|---|---|---|
| **Ethic of care and wildlife advocacy** | **Animal Geography** | • Post-humanist values, ethics, morality<br>• Interspecific practice of care<br>• Environmental education<br>• Political advocacy to make space for wildlife needs in cities |
| | **Environmental Interpretation** | • Advocacy for urban parks, wildlife conservation<br>• Connectedness to and care for local sites and wildlife<br>• Environmental education |

***Conceptual Node: Cultivating meaningful connections between humans and wildlife***

The purpose of environmental interpretation is to inspire as well as educate (Ham 1992; Stern et al. 2013; Tilden 1977). Using a "communication process that forges emotional and intellectual connections between the interests of the audience and meanings inherent in the resource" (Definitions Project 2006), interpreters present factual information to "reveal meanings and relationships" (Tilden 1977, 8) that foster appreciation, pro-environmental values and, ultimately, a commitment to resource stewardship (Ham 1992; Ham 2009; NAI 2009).

Truly effective interpretation resonates with people in meaningful and lasting ways through what Tilden famously termed "provocation" (Tilden 1977, 32). A person inspired by interpretive provocation is moved through emotion and/or epiphany to consider deeper meanings embodied by the subject (Bacher et al. 2007). For an already knowledgeable audience, interpretation offers an opportunity to view a site or resource with new eyes (Bacher et al. 2007).

In order for interpretive programming to be provocative, it must be first be personally relevant (Tilden 1977; Ham 1992; Ward and Wilkinson 2012). Relevant content is able to "connect to what people care most about (themselves and their own

experience in life)" (Ham 2009). Information is highly relevant when it touches upon highly personal concerns: "our families, our health, our well-being, our quality of life, our deepest values, principles, beliefs and convictions" (Ham 1992, 13). Connecting tangible entities such as an animal or habitat site to the intangible concepts they represent is integral to making interpretation relevant and meaningful (Bacher et al. 2007; Ward and Wilkinson 2012). For example, the linking of bird song to the concepts of competition and health is a way to contextualize the material world.

Interpretation is pointedly not just the presentation of information, but an immersive experience that engages people's emotions, senses and intellect for the purpose of allowing individuals to make their own discoveries and create their own personal meaning (Tilden 1977; Ward and Wilkinson 2012). Meaning is achieved when "interpretation relates what is being interpreted to the hearts and minds of the audience and answers the question 'Why should I care?'" (Bacher et al. 2007). Organizing a program around a compelling theme ensures that interpretation is meaningful and capable of having a lasting impact (Ham 1992; NAI 2009; Tilden 1977). A theme is a central message about a topic that a communicator conveys to an audience (Definitions Project 2007). While a topic is just the subject matter of a presentation, a theme gives participants a reason to *care* about that topic because it points to "the larger truth that lies behind any statement of fact" (Tilden 1977, 8; Ham 1992).

Discovering truths and developing relationships with the natural world through interpretation is a joyful act (Tilden 1977; NAI 2009). Successful interpretation should be a pleasurable experience for all participants (Ham 1992). Tilden writes that interpreters are the "middlemen of happiness" (1977, 12) because the experience of connecting with nature helps people to connect with their own capacity for joy.

***Conceptual Node: Embodied encounters***

Tilden (1977) asserts that education through interpretation is arguably superior to that of classroom schooling because it provides the opportunity for a person to meet "the

Thing Itself" (3). Rather than familiarity gained through mediation as in the case of a nature documentary or a textbook description, environmental interpretation that occurs *in situ* facilitates a "firsthand experience" (Tilden 1977, 33) with a place or object. As stated in the National Park Service's interpretation curriculum, "The most powerful experiences come from direct interaction with the resource itself" (Bacher et al. 2007, 8). A participant's sensory perception of a subject thus represents the entry point of personal interest and connection upon which an interpretive program is built (Tilden 1977). Although an interpreter presents a provocative theme in order to connect intangible meanings to physical objects, implicit within the pedagogy of environmental interpretation is the belief that "non-experts" directly form their own knowledge through meaningful, aesthetic engagement with a subject (Tilden 1977; Ham 1992; Bacher et al. 2007).

While interpretation principles do assume a participant's intrinsic ability to draw meaning from aesthetic encounters, it is not taken for granted that a lay person is adept at perceiving complexity and nuance within an environment (Bacher et al. 2007). If a goal of interpretation is to "help the visitor develop perception" (Wallin 1965 in Bacher et al. 2007), then this practice is well-suited to urban environments where local audiences have, in great part, lost the ability to perceive urban wildlife (Plumwood 1993, 69). Designing interpretive experiences that emphasize the use of multiple senses – not just vision - to observe local wildlife helps people to better connect intellectually, emotionally and physically to the animals (Bacher et al. 2007; NAI 2009; Ward and Wilkinson 2012). This, in turn, will make the subject more personally relevant and valuable to an individual (Bacher et al. 2007).

***Conceptual Node: Ethic of care and wildlife advocacy***

The primary goal of environmental interpretation is to encourage people to care enough about a site or natural resource to actively participate in conserving it (Bacher et al. 2007; Ward and Wilkinson 2012). The centrality of this objective is demonstrated by

the popularity of following quote originally presented by Tilden (1977, 38) that interpreter and scholar Sam Ham (2009) claims may be the most cited quote in all interpretation literature: “Through interpretation, understanding; through understanding, appreciation; through appreciation, protection.”

Urban environmental interpretation is critical to the objective of wildlife conservation both globally and locally. With the majority of the earth’s population now living in cities and projected to continue increasing (UN 2014), “the battle for life on earth will be won or lost in urban areas” (CBD 2007 in Muller and Werner 2010, 6). In the United States, this struggle is especially acute, with over 80% of the population residing in urban areas and land use conversion resulting from urbanization being a major factor in the decline of wildlife species populations (McKinney 2006). In California, the most urbanized state in the country, nearly 95% of residents are city dwellers (U.S. Census 2012). Fundamental to achieving environmental advocacy is the promotion of urban residents’ positive attitudes towards the natural world through *direct* experience with nature and wildlife (Hungerford and Volk 1990; Adams 2005; Miller 2005; Dunn et al. 2006).

Research has shown that information alone is usually not effective in influencing people’s behaviors; a perception of connectedness to a natural resource, however, is more likely to do so (Hungerford and Volk 1990; Schultz 2011). Miller (2005) posits that building meaningful connections between people and wildlife is a more effective conservation approach than messaging based upon altruism or guilt. Lorimer proposes the same notion, expressed in animal geography vernacular when he argues for an approach to conservation “as a mode of companionship in search of convivial relations” (2010, 501).

Meaningful connection forged through experiential education including urban wildlife interpretation is a powerful strategy for cultivating pro-wildlife values and behaviors. Participants have the opportunity to derive highly personal meaning from first-hand experiences with local wildlife as opposed to “conservation that happens

somewhere else" – ostensibly in a more "wild" location far from the city (Miller and Hobbs 2002, 334).

# PART II: MODEL URBAN WILDLIFE INTERPRETATION PROGRAM

## Bats: Borderlands Wildlife Interpretation Subject

### *A Charismatic Urban Species*

Bats are ideal subjects for urban wildlife interpretation programs because they are subjects of fascination who live in city habitats but are not readily perceived. They are found on all continents except Antarctica and are known to live in urbanized areas where they occupy borderlands spaces including old buildings, attics and bridges (Altringham 2011). Urban bat colonies have proven to be successful recreation and tourism sites, as illustrated by the popularity of programs such as the routinely sold-out summer bat watching series at the Yolo Bypass Wildlife Area outside Davis, California (Costabile 2012). The most spectacular urban bat watching and conservation initiative is located in the city center of Austin, Texas at the Congress Avenue Bridge where 1.5 million Mexican free-tailed bats (*Tadarida brasiliensis*) form the world's largest urban bat colony every year (BCI 2007). When bats first began inhabiting the renovated bridge in the early 1980s, some Austin residents petitioned to have the bats removed. Conservationists led by bat biologist and Bat Conservation International (BCI) founder Merlin Tuttle were successful in convincing people that the bats did not pose a threat (BCI 2007). Today, the bats of Congress Avenue Bridge enjoy high socio-economic charisma (see Table 1 on page 9): the site is estimated to bring in 140,000 visitors and an $8 million annual economic boost to the city of Austin (Pennisi, Holland and Stein 2004).

Urban-dwelling bats share spaces with humans, yet remain mysterious creatures with low detectability or ecological charisma. Their presence in a variety of urban habitats, including the city core, means that people may observe these enigmatic wild animals without leaving the city bounds (Ghert and Chelsvig 2003). The phenomenon of biotic homogenization – the loss of biodiversity – accompanying urbanization along with "systemic not-noticing" (Plumwood 1993, 69) of wildlife limits city residents'

perceptions of biodiversity (Miller 2005; McKinney 2006; Muller and Werner 2010), but an awareness of urban bats facilitated by interpretive programing broadens people's otherwise impoverished exposure to local wildlife.

The aesthetic charisma of an animal species – its power to elicit strong emotional responses in humans – impacts its viability as an engaging interpretation subject. Some animals have high "symbolic availability" (Baker 2001, 5) because their ambiguous and borderlands nature inspires fascination, as in the case of many nocturnal and crepuscular species (Syse 2014). The contradictory qualities possessed by bats – mammalian flight, "seeing" in the night, hanging upside down – and occupation of borderlands geography and temporal zones including night and dusk convey transgressive charisma (Lorimer 2006b). Transgressive, liminal animals become repositories of people's deep fears and desires, similar to supernatural figures of fantasy and Gothic horror (Griffiths, Poulter and Sibley 2000). Bats' power to trigger disgust and fear is illustrated by their popular association with witches, the devil and underworld deities in historical Western, American Southwest and Meso-American cultures (Sax 2001; Read and Gonzales 2002). Studies of Americans' attitudes towards animals have found that bats ranked as one of the public's most disliked animals along with rats and roaches (Herzog and Galvin 1997; Kellert 1980 in Pennisi, Holland and Stein 2004). However, species with transgressive charisma are embraced by some individuals who have turned against the popular fixation with animals possessing cuddly aesthetic charisma (Lorimer 2006b; 2007). An animal's bizarre morphology, autonomous behavior and undomesticated image instead become the source of excitement and awe.

Bats have high socio-economic charisma, even if it is not as apparent as that of animal species domesticated for human use. Bats provide a variety of critical ecosystem services – non-anthropogenic environmental processes and products which support human life (Kunz et al. 2011). Bats pollinate over 300 species of fruit, including commercially important varieties such as banana, mango, guava (USDA n.d; Jemison 2015). Frugivorous species help to revegetate cleared tracts of rainforest through seed

dispersal (Muscarella and Fleming 2007). Over 2/3rds of the 1300+ species of bats are primarily insectivores and eat pests that damage some of our most important commercial crops including corn, cotton, tomatoes, beans and orchard fruit (Long et al. 1998; Kunz et al. 2011). The value of the global pest control ranges between $54 billion and $1 trillion, an estimate that includes reductions in both crop losses due to pests and direct/indirect costs of pesticide use (Kunz et al. 2011). Economic valuation of ecosystem services provided by bats is a new endeavor amongst economists, but Kunz et al. (2011) argue that assigning monetary values to bat activities is "one way of positively influencing the public's perceptions of these beneficial mammals" (27).

### *A Modern Monster*

Mythology in the contemporary era is promulgated chiefly through the wide and pervasive reach of modern media. The association of bats with the "undead" has been reproduced and solidified in the modern imagination through iconic horror films such as *Dracula* (1931) and *Devil Bats* (1940) starring Bela Lugosi. The power of bats to frighten and disgust is enduring; *Nightwing* (1979) reminded viewers that "The day belongs to man. The night is theirs." As asserted by the words and images of the film's poster, bats are bloodthirsty and "savage" (Figure 1).

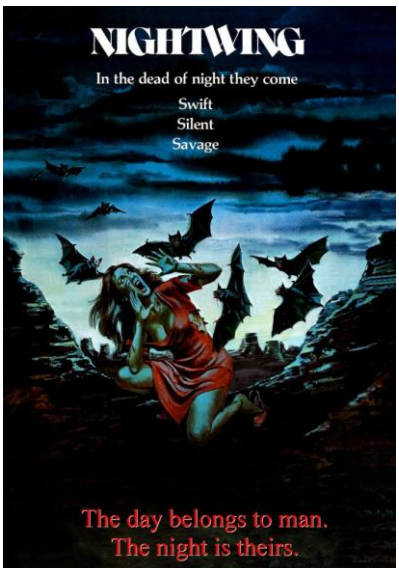


**Figure 1**: *Nightwing* movie poster (Wikipedia 2016b)

Fearsome contemporary portrayals of bats are not limited to fiction, but are found in news media (Kunz et al. 2011). When bats transgress human/animal spatial boundaries, they may be perceived as aggressive or dangerous, as in the case of a Mexican free-tailed bat colony living in the attic of a Vallejo, CA elementary school for years before being detected. A KPIX 5 televised news story reporting on the

discovery began with the line, “A Vallejo elementary school invaded by a colony of bats . . .” and went on to describe staff’s fears over disease transmission (CBS 2014). The use of the emotionally charged word “invaded” indicates the perceived threat represented by the bats’ presence in the building. Despite their apparent preference for this urban roosting site, as evidenced by their years-long occupation of it, the bats are considered trespassers.

A highly provocative headline from a 2011 UK Daily Mail story read, “California’s Flying Horror: Surge in Killer Bats Stalking Residents and Animals” (Mail Online 2011, Figure 2). A spike in downed bats found with rabies in Los Angeles and Ventura counties was easy fodder for attention-grabbing headlines and copy. A nationally-televised ABC news story from 2011 used similarly alarmist language to describe vampire bats, the species implicated in a rabies-related death of a man in Louisiana (Vampire Bat 2011). Once again, the language used to report the story (e.g. “swarm” and “bloodsuckers”) promotes the representation of bats as a menacing AND uncontrollable threat to personal safety and national security. News anchor Diane Sawyer states, “. . . the fear is that the warming climate will drive a new swarm of the bats north into this country.” Reporter David Wright continues, “They are creatures straight out of a horror movie – nocturnal bloodsuckers with razor-sharp fangs.”


California's flying horror: Surge in KILLER bats stalking residents and animals

By DAILY MAIL REPORTER
UPDATED: 15:24 EST, 22 July 2011

Share

2 View comments

An dramatic rise in rabid winged mammals has California going batty.

It may seem like something out of a vampire film, but officials in two counties are warning for residents to beware of the bat.

Just one bite from an infected bat can kill a person or an animal, and the creatures can somehow live with the disease for longer.

Watch where you step: Experts say that bats infected with rabies can lose their ability to fly and be lurking on the ground

**Figure 2:** Daily Mail news article (Mail Online 2011)

Despite its use of hyperbolic and irresponsible language, the Daily Mail did accurately report that rabid bats are found every year in California. Rabies is an infectious mammalian disease that is transmitted through bite and usually results in death

(CDC 2013). Among wild animals found to have rabies, bats are the most common. Among reported animal rabies cases in the state from 2007-2012, 83% were bats (DCDC 2011; DCDC 2014). The San Francisco Bay Area is among the state's regions with the highest number of rabid bats detected (DCDC 2011; DCDC 2014). Despite the regular detection of the virus in bats, rabies in humans remains rare in California. Between 2001-2012, only eight cases of rabies were reported in humans (DCDC 2011; DCDC 2014).

The outsized fear of contracting rabies influences the representation of bats in rabies literature, where bats are portrayed as terrifying and powerful vectors. Photographs of bats in this context are usually out of scale in largeness and feature individuals showing their teeth (Figure 3). A USGS National Wildlife Health Center publication about bat rabies (Constantine 2009) features an introductory page with a large picture of a bat surrounded by fearsome quotes from Bram Stroker's *Dracula* ("What shall I do? What can I do? How can I escape from this dreadful thing of night and gloom and fear?"), and a 10th century Persian physician ("He who shall eat the tongue or the heart of the bat shall flee from water and die").


**Figure 3**: Rabies brochure (Sonoma County Department of Health Services 2011)

The location occupied by a bat is influential in determining whether or not it is considered a friend or foe. Bats are considered pests when they roost in structures meant for human occupation such as homes or schools, even if their ecological value is recognized (Glassey and Karlick 2014). On a University of California Integrated Pest Management (IPM) web page resource about bats, a reason given for their status as pests

in addition to droppings accumulation and rabies transmission risk is that "some people are uncomfortable with close proximity" (Glassey and Karlick 2014).

Wildlife interpretation is an appropriate, if not essential, vehicle for combating ignorance responsible for risky contact with potentially rabid bats. There is no doubt that rabies is a deadly disease that should be feared, but persecution of animals is not an effective risk mitigation strategy (Streikler et al. 2012). Education is an indispensable tool to keeping humans and animals safe (NASBR 2004; Chomel, Belotto and Meslin 2007; Friend 2007). USGS Biologist Milt Friend (2007) notes that, in his experience, "private sector presentations by those interested in bat conservation often understate disease considerations . . . in efforts to overcome negative perspectives of bats advanced by others" (vi). He is especially concerned about the exposure of children, who have "uninhibited curiosity" (2007, vi), about bats they may find, perhaps captured by the family cat. The disease's appearance in bats does not meet the conventional perception of rabies, making education all the more critical in protecting people and bats. Rabies expression in bats is "dumb," not furious, so a rabid bat will often lie quietly on the ground, appearing non-threatening (Mickleburgh, Hutson and Racey 2002). It is imperative that interpreters ensure people are made aware of the discrepancy between the aggressive text and images promoted in rabies literature and the reality of lethargic rabid bats.

### *Making Bats Visible*

Despite their enduring portrayal as menacing monsters and disease vectors, bats have been gaining some positive – even cuddly – charisma. This is, in large part, due to the educational efforts of conservation organizations such as Bat Conservation International (BCI) based in Austin, Texas (Fenton 1997; Pennisi, Holland and Stein 2004). In addition to protecting critical habitat and supporting field research, one of the core strategies used by BCI to achieve its mission of wildlife and ecosystem conservation

is education carried out through a variety of means including interpretive programs at bat observation sites (BCI 2007).

Technological advances within recent decades have done much to overcome the low ecological charisma and negative aesthetic charisma associated with bats (Fenton 1997; Lorimer 2006). The extreme disparity between human and bat sensory mechanisms highlighted by Nagel's query (1974) – *What is it like to be a bat?* – has been lessened as newly developed photographic and biological monitoring techniques make the life worlds of bats more accessible to experts and lay people alike (Fenton 2004).

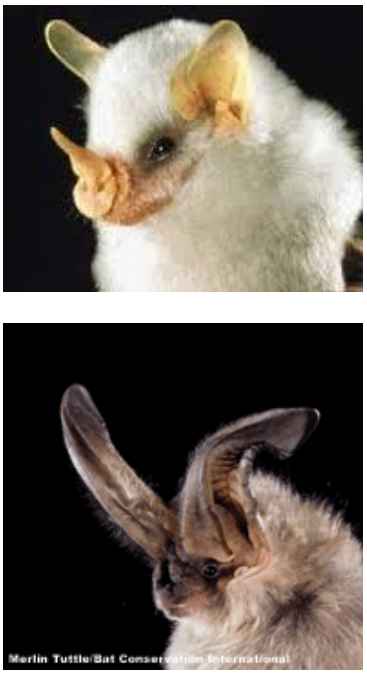


**Figure 4:** bat faces (BCI 2016a)

High-quality photographs of bats are invaluable in gaining the public's interest and sympathy for animals whose fine physical features are otherwise nearly impossible to see. For example, a comparison of bat faces (Figure 4) is an engrossing aesthetic experience as well as a compelling study in the principles of natural selection and adaptive radiation (Altringham 2011). The pioneering photography of biologist and Bat Conservation International (BCI) founder Merlin Tuttle are especially valuable for their high-resolution and close-up images of relaxed bat subjects engaged in natural behaviors (Fenton 1997). Tuttle was inspired to take up photography of bats because he was "appalled at the vicious-looking pictures of bats" and aspired to "show bats as they really are" (Ackerman 1991, 45). As illustrated by Figure 5, Tuttle has perfected the art of bat portraiture as well as subjects in flight.

**Figure 5**: Merlin Tuttle photography (BCI 2016a)

The seemingly magical ability of bats to "see" in the dark was not understood to be a function of bats' use of ultrasonic calls and echoes until the late 1930s when technology (in the form of a microphone and modified AM radio receiver) facilitated biologist Donald R. Griffin's discovery of what he termed "echolocation" (Elliot 1998; Fenton 2004; Griffin 2004). Since that groundbreaking discovery, the development of bat detectors – instruments that convert ultrasonic bat calls into sounds audible to humans – has enabled researchers to gain previously unattainable insight into the lives of bats (Fenton 2004). Despite being highly sophisticated, this increasingly affordable technology is a valuable tool for environmental interpreters because it helps "make bats more visible" to scientists and lay people alike (Elliot 1998, 42; Fenton 1997).

The use of sound analysis software in bat interpretation makes visible the diversity of bat echolocation calls through spectrograms (Figure 6) of different species and types of calls (Walsh and Morton 2009). When used together, bat detector recordings and spectrograms engage a person's senses to provide an enhanced aesthetic experience.

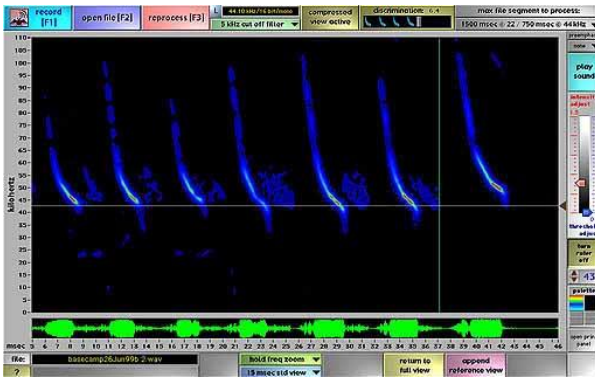


**Figure 6**: Bat call spectrogram (Sonobat n.d.)

***Related Difference***

Technological advances enabling research into the seemingly alien world of bats have revealed similarities between bat and human cultures. Like humans, many bat species are highly gregarious and form communities in which members demonstrate altruistic, care-giving behavior that is not limited to kin groups (Kunz et al. 1994; Wilkinson et al. 2016). Relationships between non-kin individuals formed within shared roosts may last for years and even decades (Wilkinson et al. 2016). Bats use sophisticated communication systems – what might be thought of as language – to share information and form relationships. They are able to recognize each other's "voices" that are unique to individuals (Yovel et al. 2009). Male courtship songs are especially complex and individuated (Behr and von Helversen 2004). Indeed, the unique vocal repertoires of male sac-winged bats (*Saccopteryx bilineata*) could arguably be thought of as an example of creative expression.

Female bats, most of whom give birth to a single pup per year, are recognized as being active mothers and care-givers. Communal nursing has been observed within large colonies of Mexican free-tailed bats, although it has been hypothesized that this is likely due to the difficulty of locating pups within maternity colony populations that can number into the millions and contain pup density of 4000 individuals per meter$^2$ (McCracken 1993a). When returning to the roost from foraging, mothers use a combination of call, odor and sight recognition to find their babies (McCracken 1993a; Knornschild, Feifel and Kalko 2003). Female bats have exhibited altruistic parturition behavior, for example female Rodrigues fruit bats assist birthing mothers by grooming the mother and emerging pup (Figure 7), holding the mother with wings and tutoring the mother in the correct birthing position (Kunz et al. 1994). Greater spear-nose bats form stable roosting groups in which females take turns being "babysitters" during foraging periods (Wilkinson et al. 2016).

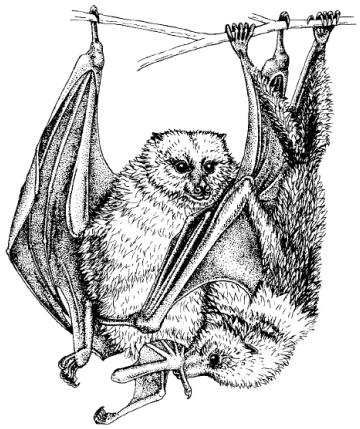

**Figure 7:** Altruistic birthing behavior (Kunz et al. 1994)

Bats demonstrate non-kin altruism when feeding. Greater spear-nosed bats help one another to locate prey by using calls that are only understood by members of their roosting groups (Wilkinson et al. 2016). Individuals belonging to the most misunderstood and feared bat species, the vampire bat, regularly regurgitate blood for others who did not find enough food in an evening, prioritizing those who are closest to starvation (Wilkinson 1984). While bat acts of care-giving or creative expression are distinct from those demonstrated by humans, an exploration of comparable experiences or "related difference" (Acampora 2006, 49-50) is an engaging and enriching subject for advancement of animal geography themes through wildlife interpretation.

### *The City Bat, the Global Bat*

Perhaps most important to an urban bat interpretive program built upon animal geography themes is the fact that bats are actually urban dwellers. Their presence in cities transforms our otherwise familiar neighborhoods into a borderlands blending domesticity with wild nature. Studies of urban bat populations are limited and do not present a general consensus on the influence of urbanization on bats (Ghert and Chelsvig 2003). Consistent with studies of urbanization effects on wildlife, many bat species are negatively affected by natural habitat loss (Ghert and Chelsvig 2003; McKinney 2006). Members of some bat species, however, appear to thrive in human-shaped environments by adapting to the opportunities provided within these urban habitats. Bats with broad food preferences, for example, are able to live in cities, as are those able to shelter in human-made structures including buildings and bridges (Luniak 2004). A study of big

brown bat (*Eptesicus fuscus*) maternity colonies located in buildings revealed that these roosts provided thermoregulation benefits and increased protection from predation compared to natural roosts such as those in rock crevices (Lausen and Barclay 2006). Some species have become so well-adapted to artificial roosts that they rarely use natural ones (Altringham 1996). Artificial lights such as streetlamps and stadium lighting provide excellent foraging sites for tolerant species (Gaisler et al. 1998; Jung and Kalko 2010). Populations of species including big brown bats (*Eptesicus fuscus*) and myotis (*Myotis spp.*) are considered "synurban" because they display ecological and behavioral adaptations that are distinct from rural populations (Luniak 2004; Coleman and Barclay 2011). In this sense, bats may be considered capable of developing urban sensibilities and culture, similar to humans who adjust to the rhythms of city life by altering their lifestyle to match local opportunities and constraints. Like humans, bats are a widespread and successful taxon in an increasingly urbanized world because they are able to achieve microevolutionary adaptations. However, bats do have their own beastly, yet charismatic ways. The value of an interpretive program is in illuminating the decidedly un-human nature of these ways for the purpose of promoting connection to and appreciation for neighboring bat lifeworlds as equal in richness and meaning as our own (Nagel 1974).

Bats have needs for beastly spaces, even if those are embedded within human-built structures. It should be noted that some opportunistic species are able to adapt to highly urbanized environments, but many species need critical tracts of wildlands habitat within, interfacing and far from urban zones (Evelyn, Stiles and Young 2004; Avila-Flores and Fenton 2005). Urban adaptation and synurbanization are not necessarily an indication of fitness as measured by enhanced body condition or reproductive rates; a study of little brown bats (*Myotis lucifugus*) living in highly urbanized zones revealed decreased fitness as compared to suburban and rural conspecifics (Coleman and Barclay 2011).

Relentless global conversion of undomesticated landscapes has resulted in the drastic decline of bat species unable to adapt to the built environment or cultivated land

(Avila-Flores and Fenton 2005). In the U.S., 56% of bat species were either listed or in consideration of being listed under the federal Endangered Species Act by 2004 (Evelyn, Stiles and Young 2004). This figure does not take into account the devastating population declines due to the catastrophic 2006 arrival of the lethal fungal disease White-Nose Syndrome (WNS) in North America from Europe. Gregarious bats forming large colonies are especially vulnerable to the virulent communicable disease. Endangered species such as the Indiana myotis (*Myotis sodalis*) and gray bat (*Myotis grisescens*) who were already experiencing population decline from habitat loss are now at risk of regional extinction because of WNS mortality (USFW 2016). The little brown bat, a widespread species, is experiencing population collapse in the U.S. Northeast and is predicted to become regionally extinct by 2026 (Frick et al. 2010).

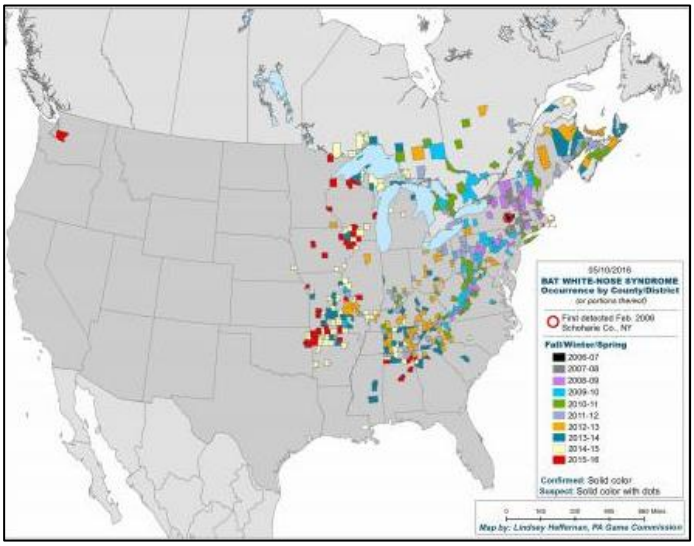


**Figure 8**: WNS occurrences, May 2016 (WNS.org 2016)

Until recently, WNS had been moving westward from state to state. Since being first detected in New York state, WNS had made it as far west as Minnesota by the fall of 2015. Then, in April 2016, WNS was detected in Washington state, marking a drastic and unpredicted leap into the western U.S. (Figure 8; WNS.org 2016)). With no effective treatment, the disease threatens further national declines in already beleaguered bat populations.

Although a sensitivity to the presence of neighborhood bats expands, diversifies and enriches human perceptions of urban space, it does not ensure that the bats themselves have access to the "space" or habitat they need to live equally as well. If bats

are able to live in cities it is because they are capable of adapting; urban environments are "habitats constructed almost exclusively to meet the relatively narrow demands of just one species, *Homo sapiens* (McKinney 2006, 248; Wolch 1998, 2002). Although suburban environments have been shown to have high levels of biodiversity, they contain fewer indigenous species than surrounding natural landscapes, making for a loss of "regional biotic uniqueness" (McKinney 2006, 256). Furthermore, urbanization has resulted in global biotic homogenization as the populations of specialist and endemic species unable to tolerate urban environments decline or disappear as cities expand (Fahrig 2003; McKinney 2006).

Interpretation of local, native wildlife species in urban areas is an important way to encourage advocacy at multiple scales. An essential goal of both animal geography scholarship and environmental interpretation is the promotion of political advocacy on behalf of habitat and wildlife conservation. Urban bat interpretation is capable of encouraging community members to advocate for the enhancement of habitat needed by local species dependent on significant, contiguous wildland tracts. Education through interpretive programming of the few local, urban-adapted species may also provide an interest in conservation of global species. As argued by Dunn et al. (2011), if people are more likely to advocate for conservation when they have had direct, personal experience with nature, then it is important to cultivate relationships between city dwellers and ubiquitous or even "pest" wildlife species including raccoons and crows. Therein lies what they term the "pigeon paradox" (1814): the survival of many species unable to live in close proximity to humans and urban environments is dependent upon people living in cities having contact with common urban wildlife species.

## Urban Interpretation Site in Oakland, CA

### *Sausal Creek Watershed*

The San Francisco-Oakland area is the second most densely populated urbanized area in the United States (U.S. Census 2012). The city of Oakland has a population of over 400,000 people and a population density of 5304 people/mile² (U.S. Census n.d.). Despite the high level of urbanization in the region, the varied geography and open space found in the California central coast supports 17 species of bats, some of whom tolerate living in close proximity to human structures and populations (Krauel 2009). Some bat species such as Yuma myotis (*Myotis yumanensis*) and the Mexican free-tailed bat (*Tadarida brasiliensis* ) are year-round residents, while migratory species including the hoary bat (*Lasiurus cinereus*), red bat (*Lasiurus blossevillii*) and some Mexican free-tailed populations overwinter in the Bay Area (Johnston 2007; Krauel 2009). I have sighted bats in various locations around Oakland including the downtown urban core, Oakland Coliseum sports stadium and Fruitvale BART station adjacent to the I-880 freeway.

A few bat interpretation opportunities in Oakland have been offered in recent years. The East Bay Regional Park District provides some seasonal bat observation and campfire programs at Anthony Chabot Park in Oakland (Jessica Sheppard, EPRPD Resource Analyst, 18 November 2014, email). In October 2015, the City of Oakland's Rotary Nature Center hosted a bat interpretation program presented by NorCal Bats (Rotary 2015). Given the high level of interest in these charismatic animals, urban bat interpretation in Oakland is not a saturated field.

Oakland's Sausal Creek watershed is an ideal, untapped site for bat interpretation; the geography of this urban watershed provides adequate natural and social resources to support varied environmental interpretation experiences (Figure 9). The watershed is already the site of wildlife education and monitoring programs organized by Friends of

Sausal Creek (FOSC), a local watershed education and advocacy organization created by community members in 1996 (Owens-Viani 1998). FOSC has an established an extensive outreach infrastructure consisting of regular interpretation and restoration activities, a 2,400 member email list and trailhead fliers (Kimra McAfee, FOSC Executive Director, 28 April 2016, email). Effective publicity of interpretive programs is obviously critical to their success; without an audience, an interpreter has no purpose.

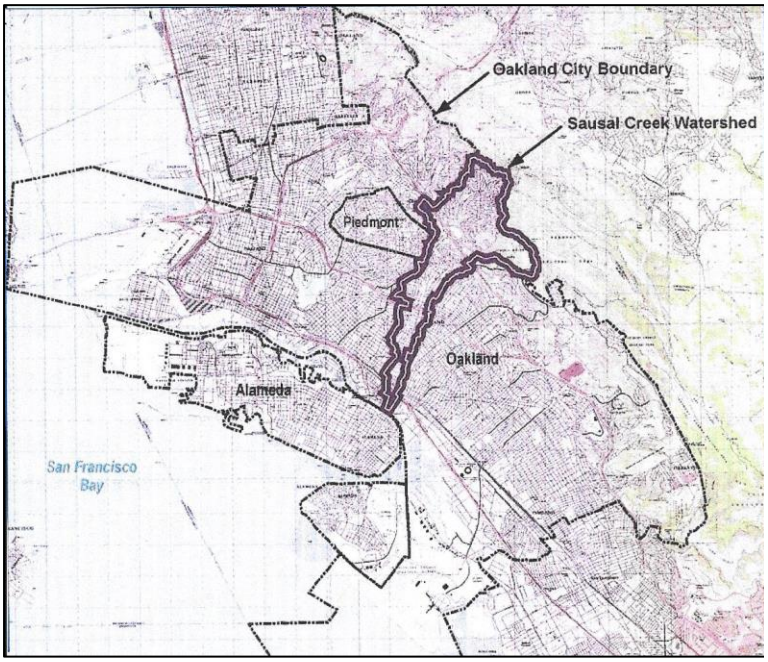


**Figure 9**: Sausal Creek watershed (Marcus 2010)

Sausal Creek is one of several perennial creeks that originate in the Berkeley Hills and run through Oakland to meet the San Francisco Bay. As the creek travels from its headwaters around 1300 ft. elevation to the Oakland estuary, it passes through varied vegetation communities and urban landscapes. In the upper watershed, the creek often flows above ground through parklands and wooded residential zones; in the lower watershed it primarily runs through culverts and engineered channels as it moves through the heavily urbanized neighborhoods of the Fruitvale District (Owens-Viani 1998).

A number of Sausal Creek's upper watershed tributaries flow through Joaquin Miller Park, a 500-acre open space characterized by a mosaic of typical central coastal range vegetation communities: redwood forest, coast live oak woodlands, riparian wetlands, chaparral and grasslands (OPR 2016). The redwood forest of Joaquin Miller

Park is composed of second and third-growth trees that have been maturing since the area was last logged about 100 years ago (OPR 2016; Owens-Viani 1998).

Woodlands are important to the viability of many bat species because they offer favorable foraging and roosting habitat as well as cover from predators (Gaisler et al. 1998; Evelyn *et al*. 2004; Avila-Flores and Fenton 2005). Even in highly urbanized areas, forested patches provide bat habitat. The presence of more mature and large trees is especially favorable, as found in a study of second and third growth redwood groves in the San Jose area which provide critical roosting sites for at least one species, Yuma myotis (Evelyn et al. 2004). In their study of bat activity in undeveloped patches of the Chicago area, Ghert and Chelsvig (2003) found a consistent, positive correlation between woodlands and bat activity. Abundant edge habitat found in patchy landscapes is also important to foraging success for bats, as these areas are sites of increased insect abundance and are easier for flight navigation (Walsh and Harris 1996; Everette et al. 2001; Ghert and Chelsvig 2003; Krauel 2009).

In addition to the woodlands found there, the Sausal Creek watershed constitutes suitable bat habitat because it contains open flowing surface waters. Many insectivorous bat species depend on access to water for successful foraging as well as drinking water (Walsh and Harris 1996; Gaisler et al. 1998; Everette et.al 2001; Ghert and Chelsvig 2003). The waters of the upper watershed creek support a moderate diversity of insects that depend on the creek for some or all life stages (Marcus 2010). These insects constitute a crucial trophic foundation for watershed wildlife including insectivorous bats.

### *The Bats of Bridgeview Trail*

The southwest portion of Bridgeview Trail is located in Dimond Canyon Park, a 95-acre vegetated riparian corridor in the lower part of the upper Sausal Creek watershed. This part of the trail is about 150 feet above Sausal Creek and begins at the terminus of

Bridgeview Drive in Oakland's residential Oakmore neighborhood. Most homes in Oakmore were built in the 1920s when the neighborhood was established as a San Francisco commuter suburb for urban dwellers wanting to live in a natural setting (Lavenson 2015). Today, this little district maintains a relatively low-intensity urbanized landscape containing just 20-29% impervious surfaces (Peterson 2013). The trail itself leads past native coast live oaks, California bay laurel, Pacific madrone, Monterey pine and Monetery cypress trees and shrubs including coyote brush, coffeeberry and toyon (Figure 10). The other end of the mile-long Bridgeview trail winds through a redwood grove bordering Joaquin Miller Park. When combined with the adjacent tract that encompasses much of the upper Sausal Creek watershed, the population density is 2672 / mile$^2$, about half of the Oakland average of 5304 / mile$^2$ (USBoundary). Numerous studies have found that urban bats are most abundant in areas that have lower density than the urban core, like Oakmore, and could be described as suburban (Gaisler et al. 1998; Avila-Flores and Fenton 2005).

From June-September of 2015, I consistently observed bats on the southwest portion of the Bridgeview Trail. They emerged approximately 30 minutes past sunset and could be seen without audio or visual aids for about 20 minutes before it became too dark. Some of the bats appeared to be foraging at the edges of the Monterey pines and cypress trees, making fast and jagged passes back and forth in their distinctive foraging style. Most of the bats were traveling in an east-west direction, indicating that they were most likely emerging from day roosts located in adjacent Joaquin Miller Park.

It is difficult to accurately identify bats without acoustic equipment. For this reason, I asked local bat biologist Gabriel Reyes who works with Bay Area ecological consulting firm H.T. Harvey and Associates to help me identify the species of bats that could be observed on a twilight bat walk. Using a Pettersson D240x bat detector and Sonobat call analysis software, he determined that the bats were likely California myotis (*Myotis californicus*), but could also be Yuma myotis as these two species have a very similar call pattern.

For an interpretation program designed to introduce Oakland residents to their chiroptera neighbors, the site should be accessible to a wide audience. The section of the trail suitable for bat viewing is roughly a quarter mile long from the trailhead where there is street parking and is under a quarter mile distance from a bus stop. The trail is flat and wide enough to accommodate people of all ages and walking abilities, including those in wheelchairs.

### Mediated Representation: Interpretive Slide Show Program Overview

The interpretive slide show presented here is, inescapably, a representation of bats. Viewing it may be intellectually and emotionally engaging, but it is not a stand-in for an embodied encounter with bats themselves. In the absence of personal and corporeal experiences with bats, representations of bats become the sole source of meaning about the animals (Gullo, Lassiter and Wolch 1998, 141; Brownlow 2000; Woods 2000). As discussed in Part I, wildlife images and scientific information are powerful tools in categorizing species as pests or predators to be eradicated from city spaces (Gullo, Lassiter and Wolch 1998; Jerolmack 2008; Power 2009). If wildlife species are to survive and zoopolis is to be realized, it is critical for humans to have unmediated physical interactions with wild animals (Michel 1998; Wolch 1998; Acampora 2006; Johnston 2008; Keul 2013). However, it is not necessary – or even practical - to reject all wildlife representations. Characterizations such as those presented by an environmental educator or wildlife interpreter may offer a “benevolent manipulation” (Baker 2001, xxxvi) of discourse and perceptions.

An interpretive program featuring a slide show such as the one developed here are important to shifting popular perceptions of urban wildlife species. Presentation of themes emphasizing animal subjectivity, charisma and related otherness builds a cognitive framework for understanding embodied encounters, when they do occur, as positive interactions with valued animal subjects. Without the context provided by such representations of urban wildlife, people may instead draw upon dominant narratives of

wild animals as dirty, dangerous or misplaced in urban spaces. In his study of Atchafalaya alligator swamp tours, Keul (2013) found that the "adept representation" constructed by the tour guides "structures the outlook of tourists" (937) so that they are able to behold the alligators as charismatic and endearing subjects. The tour guides are successful in establishing an aesthetic of the "marvelous" instead of "monstrous" (Acampora 2009, 49-50). With this slide show on bats, I strive to similarly cultivate the "admiration of strange beauty" (Acampora 2009, 50). As noted by Lorimer, nonhuman charisma is culturally-specific and "can also be constructed and enhanced with careful marketing" 2006, 1). I propose that the presentation of high-quality visual media of bats' diverse and strangely beautiful morphologies is invaluable in promoting their positive aesthetic charisma.

In order to be effective, environmental interpretation must be organized around a central theme and subthemes that aid in developing the central idea (Ham 1992; Bacher et al. 2007; Ward and Wilkinson 2012). This slide show interpretive program is based upon intersecting themes from animal geography and interpretation literature. The central theme, "Bats make great neighbors," is supported by a number of subthemes that are all derived from the animal geography/environmental interpretation conceptual nodes presented in Part I. The slides are grouped by theme as identified in the slide show notes chart below which includes presentation points for each slide and references for data cited. The slide show itself is in the appendix of this paper.

The intended audience for this interpretive presentation includes adult residents of the Sausal Creek watershed in Oakland, California but it may also be meaningful to people living elsewhere. With some modification, the slide show may be made relevant to any number of neighborhoods, watersheds or cities throughout the San Francisco Bay Area.

**Embodied Encounters: Interpretive Bat Walk Program Overview**

Wildlife interpretation that occurs *in situ* – that is, within zoocentric spaces occupied by wild animal subjects – facilitates a borderlands experience because it invites human participants to experience familiar landscapes from an unfamiliar, animal vantage point. To transgress a reflexive human orientation for a more beastly one, a person "must enter environments not wholly of human making" (Acampora 2006,12). When bats are the subjects, interpretation occurs in the twilight or at night, forcing people to observe their surroundings using hearing and touch instead of sight. This may be an unfamiliar exercise for urban dwellers most accustomed to landscapes bathed in ubiquitous artificial light. Attempting a borderlands sensibility through confrontation with the unknown nurtures an attitude of respect and curiosity for wildlife and our own lives. Wolch writes, "In our apparent mastery of urban nature, we are seemingly protected from all nature's dangers but chance losing any sense of wonder and awe for the nonhuman world. The loss of both the humility and dignity of risk results in a widespread belief in the banality of day-to-day survival" (Wolch 1998, 123-4). Urban wildlife interpretation located in zoocentric spaces thus has the potential to "revitalize our own cultural home by transgressing and reshaping its boundaries" (Acampora 2006, 19).

Nagel (1974) argued that people will never be able to understand "what is it like to be a bat" because the bat way of sensing and knowing the world – through hearing, and flight in darkness – is so alien to humans. While it may be impossible to truly know a bat's perspective, the experience of observing and possibly interacting with bats in their own habitat may nurture awareness of the ways in which we are actually similar to these otherworldy animals. Encountering an animal body promotes knowledge of that animal's need to stay warm, quench thirst or find a safe place to raise a baby. From his study of alligator tours in Lousiana, Keul concluded that, "For some people, encountering an other body yielded more than just a feeling of respect for similar experience in the world. They

experienced an understanding that like their own, animal bodies have needs and that people can help them meet those needs" (2013, 949).

An *in situ* bat interpretive program may take many forms and will be shaped, primarily, by the habits of the bats themselves at a specific site. Large roosting sites including Austin's Congress Avenue Bridge and the Yolo Bypass causeway in Davis, California provide an opportunity for people to observe the dramatic twilight emergence of hundreds of thousands to even millions of bats. However, watching even a few bats foraging in one's neighborhood is a potentially exhilarating experience (Walsh and Morton 2009).

The site for this particular study in bat interpretation, Oakland's Sausal Creek Watershed, is well-suited for an interpretive bat detection walk in which participants observe bats as they forage. Experiencing the neighborhood park during the darkening twilight period – the time "between wolf and dog" – provides a unique borderlands opportunity for bat walk participants to think and physically sense less like humans and more like bats. The bat walk outline presented in Appendix C includes activities that emphasize novel, multi-sensory observation skills of a familiar landscape. In other words, participants are encouraged not only to look for bats, but to think (and sense their environment) like a bat.

Specialized equipment is helpful, although not necessary, in this endeavor. The most simple and inexpensive piece of equipment is a flashlight with a red filter that the interpreter can use to put a spotlight on bats that may be otherwise difficult to see in the evening sky. A red-filtered light is less disturbing to bats who may evade high-powered lights. More costly equipment includes bat detectors that transform ultrasonic bat calls into sounds audible to humans and sound-analysis software that display bat calls into visible spectrograms. Viewing the shape and frequency of bat calls helps participants to understand bats' use of echolocation to forage. Again, this equipment which costs upwards of $400 is not necessary for a meaningful interpretive program.

## Conclusion

A wild animal living in the city may be perceived as a threat, a pest or a stranger. That same animal may also be considered a neighbor if welcomed into the circle of human morality and care. This circle is not strictly bounded; its perimeter is porous, ever-shifting and – most importantly – it is growing. Even the urban landscape, often perceived as space removed from nature, is a borderlands created by humans and wild animals alike.

The contours of the urban borderlands are unsettled, but not undecipherable. Scholars working in the field of animal geography have contributed greatly to a collective understanding of animal-human spaces in the city by offering post-humanistic conceptual frameworks necessary for the transformation of our shared home. Central to this transformation is a dismantling of the imaginative geography placing wild animals far away from human bodies and settlements. However, the insistence to grant animals their due respect as social, complicated beings through literally allowing for beastly spaces and bodies in cities runs counter to a deep-seated societal denial of human desire for deferential relationship with wild animal subjects.

Urban environmental interpretation is a critical vehicle for presenting ideas developed by animal geographers. Interpretive programs encourage audience members to consider novel perspectives and ways of being in the world. In the case of urban bat interpretation, the programming cultivates meaningful, personal connections between local residents and the bats they encounter in their own neighborhood. The interpretation of bats such as that found in a slide show presentation or within the narrative accompanying an evening bat walk combined with the sensual, embodied experience of being in the company of bats as they forage is animal geography in action. Admittedly, these types of singular interpretive experiences will not precipitate the radical change in urban planning and policy necessary to ensure that wildlife has access to the resources they need to live well. In order for that to happen, people will need to engage in direct

and sustained political action. Interpretive wildlife programs have the capacity to inspire and educate, but they are not forums for political organizing. Still, the interests of urban wildlife can only be realized if local human residents are themselves interested enough in wildlife to consider the needs of their non-human neighbors. Interpretive programming thus nurtures an ethic of care that has the potential to inspire a revolution in thinking and action that is needed for the survival of ourselves and our animal kin. As poet James Bertolino (1995, 50) writes,

To survive,
our minds must taste redwood,
and agate, octopi,
bat, and in the bat's mouth,
insect. It's hard
to think like a planet.
We've got to try

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## APPENDIX 2: INTERPRETIVE BAT WALK

I. Introduction

A. Welcome: interpreter introduction, program title

B. Program Overview

1. Program Objectives:

a. To develop bat watching skills (see "b." below)

b. Learning how to "think" like a bat by using our senses

c. To see some of our neighborhood bats

2. Program Theme: *If you learn how to think like a bat, you will find that the city is alive with wild nature.*

3. Order and timeframe of primary program activities

C. Safety and bat watching etiquette (*see* Walsh and Morton 2009)

1. Do not disturb bats as they fly and forage

a. Keep voices low

b. Do not shine bright lights on bats

c. Keep distance, as much as possible

d. Do not throw objects at or around bats

2. Do not touch any bats, even grounded ones

a. Bats are wild animals and are scared of you

b. Bats are the primary wildlife carriers of rabies in California

c. Rabies in bats is paralytic; a rabid bat may not "look" diseased

d. No need to fear bats if you do not touch or harass them

II. Think like a bat activity #1: If you were a bat, why would you hang around this particular spot? First consider what you need to live well: food and shelter. Look around and tell me what looks good to your bat self.

A. Water: drinking and insect prey (our local bats are insectivores)

B. Trees / Edge: foraging and roosting habitat (edge effect)

C. Adjacent Forest: roosting habitat (mature forests have good roost sites)

D. Adjacent artificial roosts and foraging sites: roosts – older buildings, bridges, culverts, bat boxes; foraging sites - streetlights, swimming pools

III. Think like a bat activity #2: If you were a bat, where else in Oakland would you like?

A. Parks with woodlands: Joaquin Miller and Knowland Parks, Redwood Regional Park, Anthony Chabot Regional Park

B. Water bodies: creeks, lakes, reservoirs, marshes

C. Artificial lights: Oakland Coliseum

D. Older buildings: e.g. a colony of bats lives in stables at Piedmont Stables

E. *If you learn how to think like a bat, you will find that the city is alive with wild nature.*

IV. Think like a bat activity #3: How can we be good neighbors to bats in our city?

A. Enhance our city's water bodies

1. Support organizations like Friends of Sausal Creek that work to keep water clean and flowing

2. Eliminate use of toxic products like herbicides, insecticides, etc. that poison water and bat prey

B. Protect our urban redwood and oak forests

C. Protect and retrofit older buildings

1. Allow older and historic buildings to remain; if bats are present, retrofit to prevent contact with humans if desired.

2. talk with a specialist if you find bats roosting on your property: there are ways to create barriers if they are in your attic space or they can be humanely evicted if it is after birthing season.

3. Install a bat house!

4. Rabies education

1. Spread the word about the appearance of rabid bats (lethargic)

2. Keep cats indoors, as they may bring home sick bats

3. Never touch a bat!

V. Think like a bat activity #4: We've all been thinking like bat species who are adaptable to urban environments because we are generalists: we aren't super picky when it comes to roosts and we tolerate living close to humans and human activity. We are thinking like big brown bats who mostly roost in buildings and Mexican free-tailed bats who form huge colonies under bridges or Yuma myotis who live close to urban creeks. What if you were a very specialized bat species like the red bat who prefers old growth trees or Townsends' big-eared bat who needs peace and quiet for roosting?

A. You would avoid cities!

B. California is home to 23 bat species, but you will only encounter a few here in Oakland.

C. *Our city is alive with wild nature*, but we still need to protect remote wilderness areas that are good habitat for bats who don't like the city life.

VI. Think like a bat activity #5: If you really want to think like a bat, you to have to use your senses to get in touch (and sight and sound) with your surroundings. Let's practice using our bat senses.

A. *Touch*: how would you describe the:

1. Temperature?

2. Wind level?

3. Humidity or precipitation?

a. Warm temp, low wind, no precipitation = more insects

b. Wind and humidity decrease echolocation effectiveness.

c. If it is too cool and/or windy, bats don't even bother foraging, but will go into torpor to save energy while they wait for a better foraging opportunity

B. *Sight*: how would you describe the level of natural light right now?

1. What is the advantage to being crepuscular and nocturnal?

a. Fewer predators and competitors

b. Insect activity is highest in early evening, so many bat species emerge at a time that is a compromise: early enough to catch some prey, but late enough to avoid most diurnal predators.

c. Bat predators include

i. mammals (raccoons, opossums, domesticated cats)

ii. diurnal raptors (peregrine falcon, red-tail hawk)

iii. diurnal birds (corvids: scrub jay, crows)

iv. nocturnal raptors (great-horned owl, barn owl, burrowing owl)

v. other opportunistic feeders (spiders, snakes, frogs)

C. *Sound*: How do bats see in the dark?

1. Listening – just like humans.

a. Close your eyes and listen to the sounds around us for the next minute. See if you can identify the source and direction of the sound. What did you hear and where did it come from? Our hearing is not as good as bats, but we both hear in stereo (function of two ears), allowing us to identify the direction of the sound.

b. Some bats, like the pallid bat that is found in the greater Bay Area and throughout California, have such good hearing that they can hear the footsteps of ground-dwelling insect prey like crickets and scorpions.

2. Echolocation

a. Echolocation is the ability to observe an environment using sound. Bats emit powerful, high frequency sounds that bounce off nearby objects, returning an echo the bat uses to determine information such as the size and shape of the object, its direction in relation to the bat, if it is moving towards or away from the bat and how fast it is moving.

b. The pulse-echo delay is how bats tell how close the object is.

c. High frequency sound waves are used because they have shorter wavelengths and are thus better at detecting smaller prey like little insects.

d. Human hearing range is between 40 Hz – 20 kHz, while bat echolocation calls fall between 20 kHz – 120 kHz. We can hear some echolocation calls like those from the Western mastiff bat, a large bat that does occur in the Bay Area and we can also hear social calls or sounds that are not the kind used for echolocating.

e. High frequency sound waves do not travel very far, so they are emitted frequently and primarily for foraging, not navigation over distance.

f. We use bat detectors that transform ultrasonic bat calls into sounds that are audible to us.

g. Optional activity: listen to pre-recorded bat calls; discuss the differences between the three phases of foraging calls: search, approach, terminal

h. Optional activity: compare spectrograms of a few different bats to illustrate the differences in frequency and shape

VII. Think like a bat activity #6: Prepare to bat watch

A. Using our bat sensing skills, do we think that bats will emerge this evening?

B. Review: where should we look?

1. Up! Some species are high-fliers, but the ones I have detected in this area, the California myotis and Yuma myotis fly at about under 15 ft. from the ground.

2. In a part of the sky that is backlit by the setting sun

3. At the tree canopy edges

C. Review: When should we look?

1. When it is almost too dark for us to see (still some insects, but not diurnal predators)

2. About a half hour after sunset

3. May - September

D. How do we know it is a bat and not a bird?

1. Emergence time at dusk, near-dark

2. Flight pattern is erratic: constant flapping, not gliding

VIII. Activity: Watch for bats!

A. Optional : use a bat detector and call analysis software projected on an ipad.

B. Optional: use a flashlight with a red filter