Folk perceptions for avian scavengers in a tropical megacity: implications for biocultural conservation

Urvi Gupta^{1,2,3}, Qamar Qureshi¹, Nishant Kumar^{1,2,4,5}

¹Wildlife Institute of India, Post Box # 18, Chandrabani, Dehradun, Uttarakhand, PIN-248001, India

²Somerville College, University of Oxford. Woodstock Road, Oxford OX2 6HD, United Kingdom

³School of Geography and the Environment, University of Oxford, South Parks Road, Oxford, OX1 3QY, UK

⁴Edward Grey Institute of Field Ornithology, Department of Zoology, University of Oxford, South Parks Road, Oxford, OX1 3PS, UK

⁵Mansfield College, University of Oxford. Mansfield Road, Oxford OX1 3TF, United Kingdom

Corresponding author email(s):

Urvi Gupta: urvi@wii.gov.in | guptaurvi1@gmail.com

Nishant Kumar: nishant.kumar@zoo.ox.ac.uk

Twitter handle: @gupta_urvi1 | @_nishantk | @delhikites

Mobile: 0091-9899166528. Fax: 0091-135-2640117

Abstract

1. Inductive generalisations based on folk perceptions for animals complement anthropogenic impacts that affect non-human species in myriad ways. Despite the surge in research on urban ecosystems, there is a poor understanding of the importance of human perceptions that affect animal-guilds subsisting on urban food-subsidies.
2. We studied the cultural salience of representative commensal avian species that opportunistically thrive on anthropogenic resources and religious sentiments translating in ritual feeding in Delhi. We investigated people's perceptions of representative avian scavengers, to understand the importance citizens attributed to their ecosystem services. We anticipated homogenising urban impacts over folk perceptions people registered for species-specific-interactions in tropical megacities. For this, we explored the prevalence of people-savenger interactions or experiences represented in local terminology/folk taxonomy and systematics about black kites *Milvus migrans*, house crows *Corvus splendens*, and critically endangered vultures.
3. Folk perceptions varied across various stakeholders and were based on bird morphology and behaviour, and corresponding socio-cultural legends. People have coexisted with opportunistic scavengers, long before the advent of Linnaean systematics, implying a dynamic relationship under the purview of biocultural coevolution. Additionally, cultural values for these commensals, evident in ritual feeding practices, were crucial for the prevalence of inductive characterization, zoomorphism, and anthropomorphism.
4. The social-technological impacts on folk perceptions for animals we associate with rapid urban changes can potentially affect the political ecologies urban human-animal interface. Mediatization and misinformation can mimetically evolve the existing trade-offs, pertinent to the human patronage and the practice of harnessing informal garbage-consumption by companion animals that are the culprit of conflicts and diseases. Frequently reported affective relationships of Indians for animals varied across the stakeholders likely due to urban-sprawl, demographic parameters, refuse management, and religio-cultural folktales.
5. Individually, scientific approaches lack scope concerning the scale of evidence for instinctive animal responses to the diverse, inductive folk practices of native stakeholders. Expansion of the purview of citizen science that factors integration of human socio-cultural estimates within scientific studies is, therefore, vital for human-animal coexistence. We suggest conservation implications of local and indigenous perception pathways about backyard biodiversity and rapidly homogenizing biophilic relationships in megacities.

Keywords: Indigenous, urbanisation, Delhi, Global South, scavengers, conservation, anthropomorphism, intangible biocultural heritage, conflict, biophilia

1. Introduction

Human population growth and urbanization are key threats to biocultural heritage (Turner et al., 2004). Ninety-eight per cent of people predicted to become urban belong to developing countries, potentially transforming their social-ecological landscapes (Anonymous, 2016). Urbanization causes biotic homogenization (Alberti, 2008) and an increase in human-wildlife interactions within cities and towns (Soulsbury & White, 2016). It simultaneously dissociates urban immigrants from their biocultural roots, impacting conservation attitudes (Miller, 2005; Soga & Gaston, 2016). Cities within the Global South are conglomerates of immigrants whose separation from their typically rural environment of origin affects their cultural heritage regarding the non-human world with consequent loss or weakening of indigenous perceptions and expressions, a part of their biocultural heritage (Nazarea, 2006; Pretty et al., 2009). These relationships with backyard biodiversity (Sandifer et al., 2015) that drive the cultural representation of non-human species are of special significance in Asia and Africa, as these will host 75% of the world's urban dwellers by 2050 (Anonymous, 2016). As a force driving the marked, recent expansion of the field of urban ecology, urbanization encompasses multiple disciplines and practical applications that concern conservation and sustainable development (Marzluff et al., 2008). However, few studies have focused on tropical megacities, and on the interplay between urban animals and human socio-economic aspects, which may mediate their resilience and coexistence with humans (Alberti, 2008; Magle et al., 2015).

Urbanization is often portrayed as a physical, abiotic force, generating perennially disturbed systems (Grimm et al., 2017). The absence of social information on how people identify and associate with animals often overlooks the radical differences between the urban ecology of temperate and tropical cities (Nagendra et al., 2018; Kumar et al., 2019a). Such simplification

overlooks the conceptualization of urban ecosystems as complex social-ecological–technological systems (SETS) (Grimm et al., 2017) and the impact of urbanisation on social traditions and practices at multiple scales (Iaccarino, 2003). To date, most studies have characterized human-animal relationships by the behavioural mechanisms that mediate long-term coexistence through mutual adaptation of humans and animals in tropical urban systems (Bhatia et al., 2013; Kumar et al., 2018b, 2019a; Lowry et al., 2013; Newsome et al., 2015). Agglomerated communities of inland immigrants within tropical cities showcase diverse practices that characteristically define local indulgence with animals. For instance, it may involve religious reverence and patronage towards non-human species in response to their ecosystem services (Kumar et al., 2019c). Scientific approaches that concern governance and management of these commensals in cities have not capitalised on aspects of citizen science that informs about local engagement with animals, contextualising traditional or indigenous knowledge (Batt, 2009; Beaudreau et al., 2011; Riley, 2010).

Many commensal animal species exploit anthropogenic food resources (Hulme-Beaman et al., 2016; Kumar et al., 2019c; Oro et al., 2013). Populations of such species have closely coexisted with humans for centuries, frequently entering their local folklore and permeating human social customs and rituals (reviews in Hosey & Melfi, 2014; Soulsbury & White, 2016). In turn, these human perceptions can shape human-wildlife interactions, with consequences for species conservation. For example, Kumar et al. (2019a) showed how socio-religious perception of raptorial black kites affected people’s responses to their attacks on humans during nest defence, leading to conflict mitigation. In this context, an aspect that has received very scarce attention is how the mix of human beliefs and cultural practices that emerge from immigration to cities from disparate regions with different folklore can carve mosaics of varying “habitat suitability” for

different species. Therefore, our primary research question addresses the cultural characterization of urban commensals by local citizens, as part of extensive conversations about urban animals with thousands of casual onlookers during our fieldwork sessions (details below).

Studying various forms of human expressions to commensal species and their importance in human culture is relevant for several reasons. First, culturally-driven tolerance towards animals in regions like South Asia promotes the capacity of animals to withstand human presence and even over-select habitats with proximity to human activities that afford food-subsidies (Bhatia et al., 2013; Saberwal, 2001). Voluntary feeding of animals by humans, an act of biophilia, has well-studied impacts on animal ecology (Lepczyk et al., 2012; Robb et al., 2008) and on people (Cox & Gaston, 2016). Second, the proximity and abundance of common, commensal species make them an integral part of the overall urban landscape, potentially mediating people's connection with nature (Cox & Gaston, 2016; Fuller et al., 2013; Nilon, 2011). Third, studying human socio-cultural perceptions of urban species among citizens could predict how their behavioural and demographic characteristics (e.g. Kumar et al., 2019a, b) may vary in the foreseeable future, with consequential impacts on their long-term management in the urban ecosystem.

To contribute to these overlooked areas, here we focus on the poorly researched 'affective attitude' of citizens to urban animals in Delhi, and South Asia in general. In particular, we focused on common urban scavenging birds that are readily available to observe and interact with for Delhi residents, composed of crows *Corvus splendens*, Black kites *Milvus migrans* and (erstwhile common) vulture species. Our rationale (mentioned below) enabled analysis of complex relationships of biotic and socio-cultural homogenization and their effects on human-animal relationships across multiple stakeholders.

2. Methods

2.1 Ethics statement

Approval for the semi-structured interviews was granted by the Central University Research Ethics Committee (**CUREC**), University of Oxford (reference SOGE 17A-82) and by the Training, Research, and Academic Council (TRAC) of the Wildlife Institute of India, Dehradun (WII). We conducted all interviews by the relevant guidelines and regulations.

2.2 Study area

The study was conducted in Delhi, which has a rich bird diversity and the world's second-largest human population of 29 million inhabitants (United Nations, 2018), within a metropolitan area of 1500 km². The city is a melting pot of cultures, as its population is composed of urban immigrants from most of the Indian subcontinent (Bhagat & Mohanty, 2009). Four aspects of Delhi have significant implications for its waste management that characterize the city's human-animal interface.

First, Delhi is a historic city. It has undergone phases of urbanization, giving differential access to urban green spaces. Second, the system of solid waste disposal in the city creates resources for commensal fauna and informal livelihoods for people that live off the manual collection of garbage to separate it into constituent materials for selling and recycling. Waste, thereby, promotes close interactions with animal scavengers (Kumar et al., 2019c). These urban animals are also featured as symbols of religious veneration that vary across the country (Taneja, 2015). Third, people offer intentional food subsidies to various species as a cultural practice or good-will. Moreover, food processing for people's consumption generates animal remains from state-owned and small-scale, informal meat processing units (Kumar et al. 2019c). Delhi ranks among the top regions of the country for the consumption of animal products, reflecting the high population density and the

city's per capita income, which is three times the national average (MoF, 2018). Therefore, food-subsidies are more frequent in this megacity, as opposed to smaller townships (authors' unpublished data). Fourth, while the volume of general waste and animal remains has increased, waste spaces are progressively more constrained and permissions for new landfill sites have been denied (SCS Engineers and Abt Associates, 2017). Eventually, a lack of suitable new places for garbage disposal generates small-scale, spatially-patterned locations of garbage piles that are associated with rag pickers and animal-scavengers. In turn, this increases the capillary exposure of inhabitants to close contacts with scavenging species, which become scattered throughout the city rather than concentrated at a few large rubbish dumps.

2.3 Research rationale and model species

Since 2013, kite behaviour and demography have been intensively monitored in Delhi, covering the entire gradient of urbanization and observing socio-cultural practices (Kumar et al., 2019b, c). This has generated insights into how waste supplies food for opportunistic animals (Kumar et al., 2019c).

During the fieldwork of the ongoing study on kites, we meet about 25 new onlookers daily (Appendix S1). Often, people tend to voluntarily engage in conversations about nature and share their biocultural perspectives. According to a conservative estimate of this voluntary and random availability of citizens for open conversations, we have surveyed more than 50,000 people since 2013. This enabled the identification of major patterns in their perceptions of backyard biodiversity and charismatic 'wild' species, much in agreement with the cultural geography of the city. We subsequently sub-sampled 279 people and learned that various stakeholders were sympathetic towards aggressive kites and mainly coincided in their affective and empathic attitude for the non-

human world around them (published in Kumar et al., 2019a). Therefore, we hypothesized perceptions to be driven by their socio-cultural backgrounds. These were explored by semi-structured interviews, which give more flexibility than structured interviews or questionnaires, and are more focussed than unstructured conversations that previously allowed us to identify target stakeholders (Newing et al., 2010; also see Appendix S2).

The interviews (n= 71) conducted in 2017, involved studying people's association with representative avian scavengers, namely kites, house crow and vultures. All these species have cultural significance, can exploit anthropogenic food and attain extremely high densities (e.g. Galushin, 1971, Kumar et al., 2019b). Vulture populations, however, have declined by 97% across India by the turn of the century (Markandya et al., 2008).

Interviewees were selected by stratified random sampling, or by snowball sampling of professionals involving association with animals (Newing et al., 2010; Appendix S2). Our multilingual team members helped create the necessary familiarity by initiating conversations in native dialects to build mutual trust to interview the urban immigrants from the nearby states. All interviews for this study were conducted by authors in Hindi or English, as found appropriate.

3. The Salient components of interviews

“No one definition has as yet satisfied all naturalists; yet every naturalist knows vaguely what he means when he speaks of a species” (Darwin, 1859).

Names, stories, art and songs associated with avian scavengers helped people symbolise their ambition and virtue, and develop a sense of place (Appendix S3). Recognition and affective associations were driven by bird’s vocal repertoire and morphology, and peoples’ geographical backgrounds (immigrant or resident), type and duration of the residency (formal residential blocks or informal living establishments) within a heterogeneous city. Males of 35 years and more, and the professionals related to animals had relatively more stories and knowledge about avian scavengers to share than the younger respondents, females and non-professionals (Appendix S3). We classify the drivers of human-avian scavenger association as (i) human factors which included their personal history and residency in a single or multiple cities, education, and professional background, psychological status about urban residency (stressed, cheerful or neutral), along with their religious or cultural motivations (ii) opportunities of direct encounters with urban commensals that further depend on animals’ distribution and abundance, and behaviour in response to the anthropogenic food-subsidies and habituation to human presence (iii) indirect interactions, through stories and media (iv) innate response to biodiversity, further oriented by locally prevalent cultures (Appendix S3).

People used *panchhi* or *pakshi* to depict avian taxa and *chidiya* (translated small birds) for the species whose name they did not know. Those classified as professionals in wildlife conservation (n= 14), who were aware of modern systematics for the target species, also had familiarity with the terms of folk-systematics, which they learnt as youngsters. However, we

195 identified relatively poor knowledge of folk-systematics in the limited sample of young researchers
196 (age <35 years, n= 7), who grew up in urban regions, especially concerning vultures. The
197 morphology and behaviour of the birds comprised of colour, size, the position of eyes in raptors,
198 beak shape, flight and talons formed the basis of ecological and aesthetic charisma, while folklore
199 and mediatisation carved its corporeal charisma (Lorimer, 2007). These drivers of attitudes are
200 closely interrelated with (i) Space and scale of interactions, (ii) temporal activity patterns of
201 animals and people, and (iii) socio-economic condition. For instance, a kite breeding pair mostly
202 attacked only for the two months within the breeding season (November-April) i.e. the time
203 between incubation and fledging of chicks. They nest near human habitations and capitalise on
204 food from waste and ritual feeding by people of the *Islamic* faith.

205 During our interviews, we noticed that amateur bird watchers, experts, and a few elderly
206 people correctly reported changes in the numbers of crows, kites and vultures in the past decades.
207 Untrained respondents confused vulture decline with kite decline. Although folklore described
208 vultures and other carrion-feeding birds as symbols of darkness and death, most respondents
209 expressed grief about the recent declines in the subcontinent's vulture populations. Representatives
210 we interviewed at the three landfills mentioned the dominant presence of vultures before their
211 population crash. Currently, the landfills are largely occupied by the migratory populations of kites
212 *Milvus migrans lineatus* from central Asia and other scavengers. The vernacular nouns or phrases
213 for the focal species of this research, even by the followers of monotheistic faith, stressed familial
214 inter-relationships that are characteristic of the Indian subcontinent. Specifically:

215 **Crows** were the best recognised and described as opportunistic birds across all age groups and
216 stakeholders. They were appreciated for their intelligence based on folklore (especially The Crow
217 and the Pitcher, an *Aesop's fable*), although none of the respondents had witnessed a crow in an

218 ‘intelligent act’. Their plumage represented darkness and mystery to the people. Crows held
219 cultural significance as messengers of *Yam* (God of Death), vehicle of the Saturn God *Shani* and
220 they were also believed to be the dead ancestors’ reincarnated life forms by the Hindu respondents.
221 The latter was the prime motivation behind the ritual food people offered to these birds. Most of
222 the respondents discussed the social legend that associated a crow cawing by the entrance with the
223 potential arrival of guests. Most stories and couplets concerning crows were limited to the middle-
224 aged and elderly (i.e. 35-80 years age group), and urban immigrants (Appendix S2, S3).

225 **Black Kites** were the most misidentified bird in the study, correctly addressed by their vernacular
226 name, *cheel*, only by a few respondents (most of whom were urban immigrants) from non-experts.
227 Only professionals from all stakeholders addressed them as Black Kites. Majority of other
228 respondents misidentified them as eagles, *baaz* (hawk or falcon) or vultures/*giddh*. People above
229 the age of 40, shared memories of kites snatching food from hand. Culturally, they were treated as
230 good omens by the *Islamic* community, which promoted the ritual feeding of kites. Other
231 communities either perceived them as bad omens, were neutral, or treated them as part of the rest
232 of nature that needs to be respected. Despite attacks by kites during the breeding season, people
233 were compassionate that attacks were to protect their young. However, people across all age groups
234 believed that kites will snatch their eyes if they looked at them, although no one had experienced
235 the same.

236 **Vultures:** folk perceptions for these erstwhile supreme obligate scavengers were found associated
237 with the extinction of experience among young and middle-aged people. Their idea of vultures
238 was readily confused for kites. Senior citizens and professionals had more descriptive memories
239 of the species and appreciated them for their ecosystem services as scavengers and their sharp
240 eyesight and flying capabilities. Egyptian vultures *Neophron percnopterus* were confused with

241 kites (Appendix S3). Reasons for vulture decline were attributed to pollution, oestrogen injections
 242 to cattle, or unknown technical intervention by the scientists from the United States of America or
 243 Japan. People readily shared mythological depiction of vultures from the Hindu epic *Ramayana*.

244 **Table 1: Diversity of dominant perceptions people have on three groups based on their**
 245 **presence or nesting habits, diet and behaviour**

Species	Lives in and/or nests	Eats	Behaviour
Crow	Cities, suburbs, villages, jungles, good knowledge of nesting territories	Grains, meat, chapati, rice, roadkill, carrion	Intelligent, Timid, shy, bold, mobs, congregation for a dead crow, attacks on nest intrusion, caws or dance indicate the arrival of guests
Kite	Do not nest in cities or villages, probably Jungles, poor knowledge of nesting habitats	Meat, rat, roadkill	Attacks, snatches eyes, elegant flight, snatched food from hands
Vultures	Rural areas, jungles or mountains, poor knowledge of nesting habitat	Dead animals	Doesn't attack people or animals, congregation over the dead

246

247 **4. Discussion: emergent dimensions**

248 In Delhi, thousands of crows, kites and other scavengers live on waste and the intentional food-
 249 subsidies by millions of devout people who indulge in diverse practices, expressing patronage to
 250 animals. This is probably the largest human-animal interface in the world (Kumar et al., 2019c).

Our study elaborates beliefs and perceptions on common avian scavengers amongst cultural mosaics represented by stakeholder societies within the tropical megacity Delhi. The results contribute to advance the resolution of human-animal interactions, which are interdisciplinary and difficult to achieve via standalone ecological studies or ethnographic surveys. Most of the literature on urban ecology is devoid of discussions on the diversity of naturalistic perceptions of people we gathered during the opportunistic conversations and focused interviews (Serrelli, 2011). The cultural value of avian scavengers, and animals in general, extended beyond their utilitarian value. This was evident by the prolific depiction of common urban birds across multiple stakeholders in the city as shared natural heritage, found practically in every human culture (Posey, 2001).

Relating urban fauna with their individual and community heritage creates a sense of the fruitful relationship between people, nature and the numinous (Tidemann & Gosler, 2012). Over four centuries, the complex interplay of colonization, modernization, urbanization, and technification have caused biological extinctions and severed many people and nature connections. These disconnections are unprecedented today, given the extinction of experience concerning crashes in the populations of vultures and sparrows, along with the progressive reduction of diversity of birds in the backyard (Louv, 2008). People's psychological and behavioural development is conditioned through interaction with biocultural information (Angel et al., 2011) and these links are increasingly threatened by urbanization, creating lost connections to nature that can translate into the erosion of cultural identities. In light of urgent attention to dynamic urban shifts, results from the general discussions and specific interviews with subjects can be broadly discussed along the following four emergent dimensions as the drivers of folk perceptions:

a. The semantics of Folk Taxonomy

Appearance and sound

Avian scavenger species were described very differently by multiple stakeholders within the general public. Calls and colour formed the basis of bird identification across different groups (Appendix S3). Crows had the largest number of names and adnouns in Hindi and Sanskrit (Dave, 2005), consistently evident during the interviews. The etymology of Hindi names for both crow and kite was based on the call of the bird (Appendix S3). Without any hint by us, twenty percent of non-experts mentioned differences between house crow from the thick-billed crow, discussing beak size and shape. While the crow was noticed for its long slender and straight beak, the kite's beak was not mentioned, except by those respondents who were experts or zoo professionals. Nineteen respondents who knew only Hindi, confused kites with vultures' vernacular name, *giddha*, or another generic term, *baaz*, that people use for birds of prey that frequently hunt. Respondents, especially those below 35 years old, were unsure about the appearance of vultures, vaguely described by most as large birds with an enormous wingspan. The majority of respondents mentioned the difference in size, identifying vultures being several times larger than kites and having long-necks. This explains why they discounted the Egyptian vulture that has a markedly different neck and head compared to other vulture species (Naoroji, 2006), and called it *safed cheel*. Respondents admitted to having frequently zoomorphised fellow dark-skinned citizens and people with hoarse voices as a crow. These observations show that Indian society has been colour biased, making zoomorphic perceptions base on colour and sound (Mishra, 2015). Except for some occasional mentions about kites and crows as bad omens, they were not feared for their size. However, with their bald head and neck, combined with large size and association with the dead, vultures were despised by most of the respondents.

296 ***Extension of the human familial structure to bird scavengers***

297 Respondents from the *Muslim* community addressed kites as “*pakshiyon ki Naani*” or ‘the
298 maternal grandmother of all birds’, likely due to the agility and beauty of kite’s flight that generates
299 impressions of sophistication and experience. Kites and other raptors show nesting site fidelity that
300 may have supported the plausible public notion of a long life for these facultative and obligate
301 avian scavengers discussed in Hindu scriptures (see below). Furthermore, they addressed Egyptian
302 vultures as “*safed cheel*” or white kite, and “*cheel ki naani*”, or ‘grandmother of kites’, likely
303 assuming white feathers as a sign of old age; also because of the plumage similarity of juvenile
304 and subadult morphs that resemble kites. These observations are consistent with similar popular
305 legends that discuss other mammalian commensals, e.g. Dhee et al. (2019). Monotheistic or
306 otherwise, culturally, Indian society is collectivistic and promotes social cohesion and
307 interdependence, evident in unique names to depict paternal and maternal relations, unlike the
308 western societies (Chadda & Deb, 2013). The instances of inductive extension of familial
309 relationship amongst common birds can aid urban conservation by promoting the concept of
310 universal brotherhood that includes non-humans, supplicating higher tolerance for animals in the
311 vicinity (Pretty et al 2009; Beaudreau et al., 2011; Medin & Bang, 2014).

312

313 ***Ecosystem services: basis for folk characterization of bird scavengers***

314 Patterns in the ambiguity of names assigned by citizens to various raptors were largely driven by
315 the social perception of ecosystem services by multiple opportunistic species within the human-
316 dominated landscapes. For instance, kites, probably because of similarity in plumage and beak
317 shape, and extinction of experience were called “eagle” or “*baaz*”, to stress one that largely hunts
318 its prey. People who revered multiple animals as vehicles of Hindu gods had wall paintings that

erroneously depicted vulture-vehicle as kites, (vultures are one of the nine animal-vehicles for Saturn god *Shani* (Dave, 2005). It further confirmed that the socially prevalent ambiguity in naming was driven by overlapping urban niches and ecosystem services. After the crash in the vulture populations that were associated with landfills and carcass dumping sites (Naoroji, 2006), large flocks of migratory kites have claimed those foraging grounds (Kumar et al. 2019c). Birds associated with carcasses were collectively perceived as a bad omen by Hindus. People believed that a vulture perching on a house or tree brought devastation and death to the living, substantiating their claims with the frequent death of traditional roosting trees and their explicit sightings as eventual snags covered in excreta. Vultures also gave cultural ecosystem services to the Parsi community by feeding on the corpse (sky burials), on the Tower of Silence (Naoroji, 2006). Age-old aspects of folk taxonomy in indigenous language associate the taxon or species with bird habits and habitat, often contextualising ecosystem services (discussed by Dave 2005, e.g. birds in water bodies being called *jalchar*).

b. Mediatization of perceptions in Social-Ecological–Technological Systems (SETS)

“Vultures can see up to 100 *yojans* (equivalent to 1200 km) like *Jatayu* and *Sampati* who flew high near Sun (vulture brothers from *Ramayana*)”.

While the aforementioned mythological extensions of real-life flight and visual capabilities of vulture species seemed plausible and are widely discussed locally, impacts of mythological animal forms depicted and popularised by media have received poor attention by researchers that study SETS (Fukano et al., 2020). Mythological and anthropomorphised perspectives about several animal species usually precede perceptions formed by actual encounters (Fukano et al., 2020).

341 These perception pathways are unlike the viewpoints based on direct encounters, popular notions
342 and systematic identifications practised in the West. The advent of televised media, especially the
343 mythological series: *Jungle book*, *Ramayana*, *Mahabharata*, have aided in the visualisation of
344 characters previously only imagined (Rajagopal, 2009). Within Indian society, zoomorphising
345 sense of sight in vultures and kites is used as metaphor to praise a person's visual acumen. People
346 also mentioned using vulture as a metaphor greedy and opportunistically exploitative human
347 attitude, or to characterise lustful gaze.

348 Beyond the religious impacts consistent for a long term in the region, the interviews
349 revealed that perception homogeneity was also a product of fictitious opinions circulated through
350 the internet, visual and print media (Barua, 2010; review in Thaler & Shiffman, 2015). For
351 instance, 83% of interviewees based their notions about superior cognition of house crow from
352 *Aesop's Fables*, often depicted as pictorial stories for children. Folk stories have registered bird
353 migrations that likely influenced our respondents in believing the fake news associated with the
354 decline in vultures. In the absence of adequate advocacy to prevent the use of diclofenac, urban
355 poor, who were livestock owners, linked these declines with technological intervention by
356 "scientists, who took the birds to the United States of America, China or Japan", citing local
357 newspapers and social media (e.g. Blokhin & Ilchenko, 2015; Udeze & Uzuegbunam, 2013). A
358 similar belief linked a decline in the number of sparrows with radiation from cellular network
359 towers and pollution. We believe that the popularity of these stories and fables was based on the
360 ease of verbal explanation or with artwork, often contributing to the homogenization of perceptions
361 about urban animals. On the other hand, we also identify the potential of mediatization in further
362 strengthening of patronizing perceptions that may contribute to the preservation of socio-cultural
363 and ecological uniqueness of tropical megacities, just as urban green spaces (Kumar et al., 2018a).

c. Inductive opinions and folk stories abstracting social-ecological experiences

Folk perceptions and inductive opinions that help people identify discontinuities in the environment hold importance in rapidly urbanising systems like Delhi (Atran, 1998; Lopez et al., 1997; Raven et al., 1971). Our interviewees suggested that eco-cultural stories, which get passed down the generations and within the society, were the major practised form of induction and anthropomorphism e.g. *Aesop's fable*, *Panchtantra*, etc. (see Table 1; Anderson, 2001; Medin & Atran, 2004; Bang et al., 2007). We argue that the diversity of such eco-cultural stories, as components of biocultural heritage for each of the focal species, was a good index of their synurbic levels (Hulme-Beaman et al., 2016), depicting variations in anthropophily (Table 1). For instance, crows can withstand human proximity and exhibit higher tolerance for people, consistent with the diversity of their vernacular names and fables. In other words, the function of fiction is abstraction and simulation of social-ecological experiences that mirror the frequencies of significant interaction events (Mar & Oatley, 2006). Even when none of our respondents reported injury to their eyes (or knew of a person whose eyes were injured by kites), these birds were popularly vilified as eye-snatchers. Similarly, crow's superior cognition was well recognised, even when no one admitted to having witnessed the bird replicating the feat of drinking from a partly filled pitcher.

According to Kumar and colleagues (2019c), informal garbage segregators on landfills, one of the stakeholders in this study, routinely work alongside crows and kites and other animals. While the responses of male garbage workers did not differ significantly from the other urban poor stakeholders, counter-intuitively, female waste workers had little to share about more than 10,000 kites that congregate around landfills in winters (Naoroji, 2006). Regarding this, Bang et al. (2007) and Keltner & Haidt (2001) offered a useful approach to integrate the conflicting cultures regarding

social living challenges for the poor. They suggest emotions evolve to solve these problems and culture loosens the link between emotions and the problems so culture finds new ways of using emotions. Our observations suggest the importance of biocultural heritage for urban poor immigrants' wellbeing within informal settlements. Using the existing socio-cultural stories that also represent traditional ecological knowledge, researchers need to find new ways to rejuvenate the emotions of urban poor for the non-human world (Manfredo, 2008).

d. Typology of human-animal interactions in folk perceptions and biocultural expressions

Several studies on biophilia and value of animal-life for humans have remarked the lack of research on native people from the rapidly urbanizing Eastern hemisphere and the Global South (Kellert & Wilson, 1995, Kellert, 1997, Atran et al., 1997,1998, 2004, 2007). Recently, Soga & Gaston (2020) purposely discounted non-sensory or indirect interactions as part of their methodology while reviewing human-nature interactions. They classified human-nature interactions, based on the degree of physical proximity (**immediateness**), the **consciousness** and **intent** with which a subject interacts with nature, the **degree of human mediation** and the **outcome**.

This study, therefore, extends an opportunity to simultaneously address these gaps, taking into consideration that i) more than half of Delhi's population is based in informal settlements (Gupta & Gupta, 2017); ii) these suburbs are often associated with poor solid waste management, livestock and overpopulated environments replete with waste that promotes opportunistic commensals (Kumar et al. 2019c); and iii) the living standards within informal settlements that preclude urban poor's orientation to observe and interact with animals in wilderness. Based on the effects of spatial confinements experienced by our stakeholders within informal settlements, our interviews revealed how localities within Delhi limit the dimensions of human-nature interactions.

409 For instance, **physical proximity to animals** is limited for the people within informal settlements,
410 considering a few species that our respondents regularly observed. Most of these slums and
411 suburbs are also placed far from parklands, precluding the urban poor from the most common
412 pathway of interaction with nature typical of modern western societies (Hinchliffe & Whatmore,
413 2006). Considering the **human-mediated** feeding rituals for backyard species, we noticed high
414 overlaps in the guilds of animals that opportunistically consume garbage and the species with
415 which religiously conscious respondents interacted **through intentional feeding** (Kumar et al.,
416 2019a, b, c). For synurbic species that receive human patronage as well as opportunistic benefits
417 from garbage and ritually-intended feeding in megacities like Delhi, the **direction of outcomes** of
418 dense human-animal urban settlement is the basis for bio-cultural coevolution. The latter involves
419 behavioural co-option by humans as well as animals (Kumar et al., 2018b; 2019a).

420 We felt the need to stress the importance of non-sensory interactions, based on the
421 pervasiveness of socio-cultural opinions for animals in cities like Delhi, due to mediatisation. As
422 opposed to the general cartographic opposition between cities and nature in the western societies
423 that is driven by “dominion” over nature (Hinchliffe & Whatmore, 2006; Pretty et al., 2009),
424 human-animal interactions in South Asian urban systems incorporate unique importance of
425 universal brotherhood and mediatisation for the urban poor (Barua, 2014b; Kumar et al., 2019a,
426 c). Urban food-waste is used as food subsidies, e.g. kites are offered visceral remains of meat
427 processing units, promoting local socio-economy that mediate physical flows and livelihoods not
428 just in offal for opportunistic scavengers but also in waste meat, fruits, and grains to ritually feed
429 cows, dogs, macaques, and other animals (Kumar et al., 2019c). The folk perceptions and socio-
430 cultural stories about common avian scavengers predisposed citizens in Delhi for affective
431 attitudes, often translating to ritual-feeding. The patronage was seemingly driven by the realisation

amongst the locals that humans have destroyed and degraded natural habitats and animals had no option but subsist within a human-use landscape, implying the ‘duty of citizens’ to take care of multiple species. Affection seemed primarily driven by the urban processing of waste by animals, given that people were well aware of the useful ecosystem services (Kumar et al., 2019a). Further, the interviewees discussed anthropomorphism suggested by religion that stress about the inter-relationship between humans and the rest of nature (Pretty et al., 2009).

5. Conclusions: implications for the future of urbanisation in South Asia

Ultimately, species are not “real objective units” (Mayr, 1942) but humanistic constructs of varying accuracy. Similar to how multiple morphological cues are used by taxonomists to classify and name a species, folk perceptions and practices are a result of multiple perspectives that citizens consider based on years of coexistence. Folk perceptions and specific identities for commensals, therefore, highlight the need to incorporate human social-cultural aspects to improve ecological insights and to bridge the gaps between different disciplines concerning urban sustainability. Western, temperate cities have less-pronounced socio-cultural agglomeration and heterogeneity than the tropical region where the majority of the urban poor shall be living. Considering ritually motivated citizens were found across all sets of stakeholders, the importance of understanding folk dynamics and patterns of inductive generalisation are further protracted. Moreover, there is a need to document the intangible heritage, as much folk-culture is held with the urban immigrants displaced from their native lands and the elderly who often lack the contexts in which to pass on their knowledge due to growingly nuclear urban societies (e.g. see Kumar et al 2018a; Ethno-ornithology World Atlas, 2019).

This study addresses the existing challenge of theorizing political ecology for South Asian megacities, potentially implicating the need for policies that incorporate governance of urban space that is shared amidst resident stakeholders, whose waste dumping areas promote variably distributed and abundant animals (Kumar et al., 2019b, c). The amalgamation of social scientific approaches with biophysical ecological perspectives will help upgrade the concept of biological carrying capacity to include drivers of human ecology (Walker, 2005). Owing to rapid development, most of the South Asian fauna either live within, or their habitats are surrounded by human-dominated landscapes. Mosaic of socio-cultural practices, several small and disjunct protected areas, as well as the opportunistic response of wildlife to anthropogenic resources, calls for an upgrade to more relevant social carrying capacity for the human use landscapes (Ghosal & Kjosavik, 2015). Permeation of rituals and cultural factors in the social factors not only promotes tolerance for animals that indulge in conflicts within cities but also at urban-peri urban (Aiyadurai, 2016; Barua, 2014a; Dhee et al., 2019) and village-protected area ecotones (Ghosal & Kjosavik, 2015). If modern systematics allows us to extend and generalize the outcomes of a scientific study, folk identities, perceptions and practices that supplicate coexistence could aid conservation endeavours in times when we need the public will, more than ever before.

Biocultural conservation within the socio-dynamic pool of the urban informal settlements in spatial confinements will need addressing the urban poor's loss of autonomy and cultural expressions to nature. Prevalence of ritualistic animal feeding also provides livelihood to urban poor in Delhi and South Asia (review in Kumar et al., 2019c; Taneja, 2015). Although contemporary approaches factoring urban biodiversity have begun to integrate ecological approaches with human sciences, our results and available literature identify major gaps in transdisciplinary dialogues across experts from psychology, anthropology, education and

traditional biological units. Accommodating the ecosystem concept for tropical megacities would require a nuanced understanding of spatial dimensions of social differentiation that is analogous to patch dynamics in ecology (Pickett et al., 2001). Incorporating folk perceptions in urban studies could address major impediments to the creation of convivial urban spaces by identifying multiple conflicts amongst citizen-groups involving animal-cohabitation and general human-animal conflicts within heterogeneous cities like Delhi. It will integrate scientific approaches that individually lack scope concerning the scale of evidence for instinctive animal responses, and diverse, inductive folk practices of native stakeholders

Acknowledgements

Part of this study formed UG's M.Sc. dissertation at the School of Geography and the Environment (SoGE), the University of Oxford, supervised by Maan Barua. The Black Kite research was supervised by Yadvendradev Jhala, Andrew Gosler, and Fabrizio Sergio. The authors are grateful to the FCO Chevening - HSBC Scholarship, Hansell Travel Grant and Discretionary Grant from Somerville College (Oxford), Dissertation grant of SoGE, the Raptor Research and Conservation Foundation (Mumbai), the Government of India's Ministry of Environment, Forest and Climate Change, and the University of Oxford (Felix Scholarship Trust) for funding. Delhi Police, the Forest Departments of Delhi and Uttar Pradesh, and the municipal corporations and civic bodies of the Government of NCT, Delhi, helped with legal permits. Members of the "Black Kite Project Group," especially Laxmi Narayan, Prince Kumar, Poonam, A Singh, H Malhotra, and G Singh helped in the fieldwork. Authors thank F Sergio and R Godinho for comments on initial drafts. The subjects of this focal study extended enthusiastic participation and support, along with the people of Delhi who voluntarily shared important insights.

499

500 **Author Contributions**

501 UG and NK designed the study. UG, QQ and NK were part of the fieldwork between 2013-2019.
502 UG conducted the focal interview of 71 focal subjects in 2017 and wrote the first draft of the
503 manuscript as her M.Sc. thesis. UG, QQ and NK participated in subsequent domain-expansion,
504 and all the authors contributed in revisions and approved the final version.

505 **Conflicts of Interests**

506 The authors declare no conflict of interest. The funding agencies had no role in the study design
507 and fieldwork.

508 **Data availability statement:** The data is intended to be archived at Oxford University's Research
509 Archive (ORA)

510

511 **References:**

- 512 Aiyadurai, A. (2016). 'Tigers are Our Brothers': Understanding Human-Nature Relations in the
513 Mishmi Hills, Northeast India. *Conservation and Society*, 14(4), 305-316.
514 doi:10.4103/0972-4923.197614
515
516 Alberti, M. (2008). *Advances in urban ecology: integrating humans and ecological processes in*
517 *urban ecosystems*: Springer.
518
519 Anderson, J. L. (2001). Stone-age minds at work on 21st century science: how cognitive
520 psychology can inform conservation biology. *Conservation in Practice*, 2(3), 18-27.
521
522 Angel S, Parent J, Civco DL, Blei A & Potere D (2011) The dimensions of global urban
523 expansion: estimates and projections for all countries, 2000–2050 *Prog. Plann.* 75: 53–
524 107
525
526 Anonymous (2016) Rise of the city. *Science* 352:906–907
527

- Bang, M., Medin, D. L., & Atran, S. (2007). Cultural mosaics and mental models of nature. *Proceedings of the National Academy of Sciences*, 104(35), 13868-13874.
- Atran, S. (1998). Folk biology and the anthropology of science: Cognitive universals and cultural particulars. *Behavioral and brain sciences*, 21(4), 547-569.
- Barua, M. (2009). Ecological Basis of the Bihu Festival of Assam. *Folklore*, 120(2), 213-223. doi:10.1080/00155870902969400
- Barua, M. (2010). Whose Issue? Representations of Human-Elephant Conflict in Indian and International Media. *Science Communication*, 32(1), 55-75. doi:10.1177/1075547009353177
- Barua, M. (2014a). Circulating elephants: unpacking the geographies of a cosmopolitan animal. *Transactions of the Institute of British Geographers*, 39(4), 559-573.
- Barua, M. (2014b). Volatile Ecologies: Towards a Material Politics of Human—Animal Relations. *Environment and Planning A: Economy and Space*, 46(6), 1462-1478. doi:10.1068/a46138
- Batt, S. (2009). Human attitudes towards animals in relation to species similarity to humans: a multivariate approach. *Bioscience horizons*, 2(2), 180-190.
- Beaudreau, A. H., Levin, P. S., & Norman, K. C. (2011). Using folk taxonomies to understand stakeholder perceptions for species conservation. *Conservation Letters*, 4(6), 451-463.
- Bhagat, R. B., & Mohanty, S. (2009). Emerging Pattern Of Urbanization And The Contribution Of Migration In Urban Growth In India. *Asian Population Studies*, 5(1), 5-20. doi:10.1080/17441730902790024
- Bhatia, S., Athreya, V., Grenyer, R., & Macdonald, D. W. (2013). Understanding the role of representations of human–leopard conflict in Mumbai through media-content analysis. *Conservation Biology*, 27(3), 588-594.
- Blokhin, I. N., & Ilchenko, S. N. (2015). Fake as a Format of Modern Journalism: the Information Reliability Problem. *Indian Journal of Science and Technology*, 8(Specialissue10), 84840-84840.
- Carey, M. P., Sanderson, B. L., Barnas, K. A., & Olden, J. D. (2012). Native invaders—challenges for science, management, policy, and society. *Frontiers in Ecology and the Environment*, 10(7), 373-381.
- Chace, J. F., & Walsh, J. J. (2006). Urban effects on native avifauna: a review. *Landscape and Urban Planning*, 74(1), 46-69.
- Chadda, R. K. & Deb, K. S. (2013) Indian family systems, collectivistic society, and psychotherapy. *Indian Journal of Psychiatry*, 55(2), 299-309.

- Cox, D. T., & Gaston, K. J. (2016). Urban bird feeding: connecting people with nature. *PloS one*, 11(7).
- Darwin, C. (1859). *On the origin of species by means of natural selection*. John Murray, London, UK..
- Dave, K. (2005). *Birds in Sanskrit Literature: With 107 Bird Illustrations*: Motilal Banarsidass Publisher.
- Dhee, Athreya, V., Linnell, J. D., Shivakumar, S., & Dhiman, S. P. (2019). The leopard that learnt from the cat and other narratives of carnivore–human coexistence in northern India. *People and Nature*, 1(3), 376-386.
- Ethno-Ornithological World Archive Atlas (2020) Department of Zoology, University of Oxford. Retrieved from <https://ewatlas.net/> on 25-01-2020
- Fukano, Y., Tanaka, Y., & Soga, M. (2020). Zoos and animated animals increase public interest in and support for threatened animals. *Science of The Total Environment*, 704, 135352.
- Fuller, R. A., Irvine, K. N., Davies, Z. G., Armsworth, P. R., & Gaston, K. J. (2013). Interactions between people and birds in urban landscapes.
- Gangoso, L., Agudo, R., Anadón, J. D., de la Riva, M., Suleyman, A. S., Porter, R., & Donázar, J. A. (2013). Reinventing mutualism between humans and wild fauna: insights from vultures as ecosystem services providers. *Conservation Letters*, 6(3), 172-179.
- Ghosal, S., & Kjosavik, D.J. (2015) Living with Leopards: Negotiating Morality and Modernity in Western India, *Society & Natural Resources*, 28:10, 1092-1107, DOI: [10.1080/08941920.2015.1014597](https://doi.org/10.1080/08941920.2015.1014597)
- Grimm, N. B., Pickett, S. T., Hale, R. L., & Cadenasso, M. L. (2017). Does the ecological concept of disturbance have utility in urban social–ecological–technological systems? *Ecosystem Health and Sustainability*, 3(1), e01255.
- Gupta, M., & Gupta, R. (2017). Demand for Rental Housing: Evidence from Slum Settlements in Delhi. *Urbanisation*, 2(1), 9-27. doi:10.1177/2455747117700942
- Hinchliffe, S., & Whatmore, S. (2006). Living cities: towards a politics of conviviality. *Science as culture*, 15(2), 123-138.
- Hosey, G., & Melfi, V. (2014). Human-animal interactions, relationships and bonds: A review and analysis of the literature. *International Journal of Comparative Psychology*.

- Hulme-Beaman, A., Dobney, K., Cucchi, T., & Searle, J. B. (2016). An Ecological and Evolutionary Framework for Commensalism in Anthropogenic Environments. *Trends in Ecology & Evolution*, 31(8), 633-645. doi:<https://doi.org/10.1016/j.tree.2016.05.001>
- Iaccarino, M. (2003). Science and culture. Western science could learn a thing or two from the way science is done in other cultures. *EMBO reports*, 4(3), 220-223. doi:10.1038/sj.embor.embor781
- Inger, R., Cox, D., Per, E., Norton, B., & Gaston, K. (2016). Ecological role of vertebrate scavengers in urban ecosystems in the UK. *Ecol Evol* 6: 7015–7023. In.
- Kellert, S. R. (1997). *The value of life: Biological diversity and human society*: Island Press.
- Kellert, S. R., & Wilson, E. O. (1995). *The biophilia hypothesis*: Island Press.
- Keltner, D., & Haidt, J. (2001). Social functions of emotions.
- Kumar N, Mohan D, Jhala YV, Qureshi Q, Sergio F (2014) Density, laying date, breeding success and diet of black kites *Milvus migrans govinda* in the city of Delhi (India). *Bird Study* 61(1):1–8. <https://doi.org/10.1080/00063657.2013.876972>
- Kumar, N., Gupta, U., Jhala, Y. V., Qureshi, Q., Gosler, A. G., & Sergio, F. (2018a). Habitat selection by an avian top predator in the tropical megacity of Delhi: human activities and socio-religious practices as prey-facilitating tools. *Urban Ecosystems*, 21(2), 339-349. doi:10.1007/s11252-017-0716-8
- Kumar, N., Qureshi, Q., Jhala, Y. V., Gosler, A. G., & Sergio, F. (2018b). Offspring defense by an urban raptor responds to human subsidies and ritual animal-feeding practices. *PloS one*, 13(10), e0204549. doi:10.1371/journal.pone.0204549
- Kumar, N., Jhala, Y. V., Qureshi, Q., Gosler, A. G., & Sergio, F. (2019a). Human-attacks by an urban raptor are tied to human subsidies and religious practices. *Scientific reports*, 9(1), 2545. doi:10.1038/s41598-019-38662-z
- Kumar, N., Gupta, U., Malhotra, H., Jhala Y, V., Qureshi, Q., Gosler A, G., Sergio, F. (2019b). The population density of an urban raptor is inextricably tied to human cultural practices. *Proceedings of the Royal Society B: Biological Sciences*, 286(1900). doi:10.1098/rspb.2018.2932
- Kumar, N., Singh, A., & Harriss-White, B. (2019). Urban waste and the human-animal interface in Delhi. *Economic and Political Weekly*.
- Lepczyk, C. A., Warren, P. S., Machabée, L., Kinzig, A. P., & Mertig, A. G. (2012). Who feeds the birds. *Stud Avian Biol*, 45, 267-284.

- Lopez, A., Atran, S., Coley, J. D., Medin, D. L., & Smith, E. E. (1997). The tree of life: Universal and cultural features of folk biological taxonomies and inductions. *Cognitive psychology*, 32(3), 251-295.
- Lorimer, J. (2007). Nonhuman Charisma. *Environment and Planning D: Society and Space*, 25(5), 911-932. doi:10.1068/d71j
- Louv, R. (2008). *Last child in the woods: Saving our children from nature-deficit disorder*: Algonquin books.
- Lowry, H., Lill, A., & Wong, B. B. (2013). Behavioural responses of wildlife to urban environments. *Biological reviews*, 88(3), 537-549.
- Magle, S. B., Hunt, V. M., Vernon, M., & Crooks, K. R. (2012) Urban Wildlife research: past, present, and future. *Biological Conservation* 155, 23-32
- Manfredo, M. J. (2008). Who cares about wildlife? In *Who Cares About Wildlife?* (pp. 1-27): Springer.
- Mar, R. A., & Oatley, K. (2008). The function of fiction is the abstraction and simulation of social experience. *Perspectives on psychological science*, 3(3), 173-192.
- Margalida, A., & Colomer, M. À. (2012). Modelling the effects of sanitary policies on European vulture conservation. *Scientific reports*, 2, 753.
- Markandya, A., Taylor, T., Longo, A., Murty, M., Murty, S., & Dhavala, K. (2008). Counting the cost of vulture decline—an appraisal of the human health and other benefits of vultures in India. *Ecological economics*, 67(2), 194-204.
- Marzluff, J., Endlicher, W., Alberti, M., Bradley, G., Ryan, C., Simon, U., & ZumBrunnen, C. (Eds.) (2008). *Urban Ecology-An international perspective on the interaction between humans and nature*. In: Springer, New York, USA.
- Mayr, E. (1942). *Systematics and the origin of species*. Columbia University Press, New York.
- McKinney, M. L. (2006). Urbanization as a major cause of biotic homogenization. *Biological Conservation*, 127(3), 247-260.
- Medin, D. L., & Bang, M. (2014). The cultural side of science communication. *Proceedings of the National Academy of Sciences*, 111(Supplement 4), 13621-13626.
- Miller, J. R. (2005). Biodiversity conservation and the extinction of experience. *Trends in Ecology & Evolution*, 20(8), 430-434. doi:10.1016/j.tree.2005.05.013
- Mishra, N. (2015). India and colorism: The finer nuances. *Wash. U. Global Stud. L. Rev.*, 14, 725.

- MoF (2018): Economic Survey 2018–19, Ministry of Finance, Government of India, New Delhi, viewed on 22 July 2019, <https://www.indiabudget.gov.in/economicsurvey/>.
- Moleon, M., Sanchez-Zapata, J. A., Margalida, A., Carrete, M., Owen-Smith, N., & Donazar, J. A. (2014). Humans and scavengers: the evolution of interactions and ecosystem services. *BioScience*, 64(5), 394-403.
- Nabhan, G. P., St Antoine, S., Kellert, S., & Wilson, E. (1993). The loss of floral and faunal story: The extinction of experience. *The biophilia hypothesis*, 229-250.
- Nagendra, H., Bai, X., Brondizio, E. S., & Lwasa, S. (2018). The urban south and the predicament of global sustainability. *Nature Sustainability*, 1(7), 341-349.
- Naoroji, R. (2007). *Birds of prey of the Indian subcontinent*. Om Books International.
- Nazarea, V. D. (2006). Local knowledge and memory in biodiversity conservation. *Annu. Rev. Anthropol.*, 35, 317-335.
- Newing, H., Eagle, C., Puri, R., & Watson, C. (2010). *Conducting research in conservation : Social science methods and practice*. Retrieved from <https://ebookcentral.proquest.com>
- Newsome, T. M., Dellinger, J. A., Pavey, C. R., Ripple, W. J., Shores, C. R., Wirsing, A. J., & Dickman, C. R. (2015). The ecological effects of providing resource subsidies to predators. *Global Ecology and Biogeography*, 24(1), 1-11.
- Nilon, C. H. (2011). Urban biodiversity and the importance of management and conservation. *Landscape and ecological engineering*, 7(1), 45-52.
- Oro, D., Genovart, M., Tavecchia, G., Fowler, M. S., & Martínez-Abraín, A. (2013). Ecological and evolutionary implications of food subsidies from humans. *Ecology letters*, 16(12), 1501-1514.
- Pickett, S. T. A., Cadenasso, M. L., Grove, J. M., Nilon, C. H., Pouyat, R. V., ... W. C., & Costanza, R. (2001). Urban Ecological Systems: Linking Terrestrial Ecological, Physical, and Socioeconomic Components of Metropolitan Areas. *Annual Review of Ecology and Systematics*, 32, 127-157. Retrieved from www.jstor.org/stable/2678637
- Posey D. (2001) In Maffi L, (Ed.) *Biocultural Diversity: Linking Language, Knowledge and the Environment*. Smithsonian Institution Press, Washington DC
- Pretty, J., Adams, B., Berkes, F., De Athayde, S. F., Dudley, N., Hunn, E., . . . Robbins, P. (2009). The intersections of biological diversity and cultural diversity: towards integration. *Conservation and Society*, 7(2), 100-112.

- Rajagopal, A. (2009). *The Indian Public Sphere: Readings in Media History*. New Delhi: Oxford University Press.
- Raven, P. H., Berlin, B., & Breedlove, D. E. (1971). The origins of taxonomy. *Science*, 174(4015), 1210-1213.
- Reddy, K. S., Xie, E., & Tang, Q. (2016). Higher education, high-impact research, and world university rankings: A case of India and comparison with China. *Pacific Science Review B: Humanities and Social Sciences*, 2(1), 1-21.
- Riley, E. P. (2010). The importance of human-macaque folklore for conservation in Lore Lindu National Park, Sulawesi, Indonesia. *Oryx*, 44(2), 235-240.
- Robb, G. N., McDonald, R. A., Chamberlain, D. E., & Bearhop, S. (2008). Food for thought: supplementary feeding as a driver of ecological change in avian populations. *Frontiers in Ecology and the Environment*, 6(9), 476-484.
- Saberwal, V. K. (2001). *People, parks, and wildlife: Towards coexistence* (Vol. 14): Orient Blackswan.
- Sandifer, P. A., Sutton-Grier, A. E., & Ward, B. P. (2015). Exploring connections among nature, biodiversity, ecosystem services, and human health and well-being: Opportunities to enhance health and biodiversity conservation. *Ecosystem services*, 12, 1-15.
- SCS Engineers and Abt Associates (2017): "Ghazipur Landfill Rehabilitation Report," prepared for East Delhi Municipal Corporation, on behalf of US Environmental Protection Agency and Climate and Clean Air Coalition Municipal Solid Waste Initiative, viewed on 25 July 2019, https://ccacoalition.org/sites/default/files/resources/2018_Ghazipur-Landfill-Rehabilitation-Report_SCS-Engineers.pdf.
- Serrelli, E. (2011). *Folkbiology: The Importance of How People Understand Nature*.
- Shochat, E., Lerman, S. B., Anderies, J. M., Warren, P. S., Faeth, S. H., & Nilon, C. H. (2010). Invasion, competition, and biodiversity loss in urban ecosystems. *BioScience*, 60(3), 199-208.
- Soga, M., & Gaston, K. J. (2016). Extinction of experience: the loss of human-nature interactions. *Frontiers in Ecology and the Environment*, 14(2), 94-101.
- Soga, M., & Gaston, K. J. (2020). The ecology of human-nature interactions. *Proceedings of the Royal Society B: Biological Sciences*, 287(1918), 20191882. doi:doi:10.1098/rspb.2019.1882
- Soulsbury, C. D., & White, P. C. (2016). Human-wildlife interactions in urban areas: a review of conflicts, benefits and opportunities. *Wildlife research*, 42(7), 541-553.

- Talyan, V., Dahiya, R. P., & Sreekrishnan, T. R. (2008). State of municipal solid waste management in Delhi, the capital of India. *Waste Management*, 28(7), 1276-1287. doi:<https://doi.org/10.1016/j.wasman.2007.05.017>
- Taneja, A. V. (2015). Sainly animals: the shifting moral and ecological landscapes of North India. *Comparative Studies of South Asia, Africa and the Middle East*, 35(2), 204-221.
- Thaler, A. D., & Shiffman, D. (2015). Fish tales: Combating fake science in popular media. *Ocean & Coastal Management*, 115, 88-91.
- Tidemann, S. & Gosler, A. (Eds.) (2012). *Ethno-Ornithology: birds, indigenous peoples, culture and society*. Earthscan.
- Turner, W. R., Nakamura, T., & Dinetti, M. (2004). Global Urbanization and the Separation of Humans from Nature. *BioScience*, 54(6), 585-590. doi:10.1641/0006-3568(2004)054[0585:Guatso]2.0.Co;2
- United Nations, Department of Economic and Social Affairs, Population Division (2018). World Urbanization Prospects: The 2018 Revision, Online Edition
<https://population.un.org/wup/Publications/Files/WUP2018-Report.pdf>
- Uzuegbunam, C. E., & Udeze, S. E. (2013). Sensationalism in the media: the right to sell or the right to tell. *Journal of Communication and Media Research*, 5(1), 69-78.
- Walker, P. A. (2005) Political ecology: where is the ecology? *Progress in Human Geography*. 29 (1): 73-82.