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5 **The Indian Street dog crisis and multispecies coexistence in**
6 **tropical urban futures**

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22 **Preface**

23 Cities in the Global South struggle with human-animal coexistence conundrums, e.g., in South Asia, old
24 and new collide: people raise livestock informally and feed animals within heterogeneously developed,
25 juxtaposed patches. Digital economies boom amidst threats from waste piles that cause zoonotic diseases
26 and conflicts, as exemplified by the ongoing free-ranging dog crisis in India. Humanity's oldest companion
27 now suffers from misguided compassion and rising conflicts. Indian Courts, attempting to address the
28 problems, have overlooked the root cause—food subsidies. Reactive management must yield to ecological
29 urban planning, acknowledging multispecies communities sharing complex, interconnected lives across
30 space and time.

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35 **Main**

36 Urban conflicts with free-ranging animals are reshaping human-nature relationships in the Global South¹.
37 Two dominant frameworks—Nature-based Solutions (*NbS*) and One Health—have the promise to address
38 these challenges. The *NbS* advocates for protecting and restoring ecosystems to tackle climate change, food
39 security, and disaster risks². One Health emphasises the systemic interconnections between human, animal,
40 and environmental well-being³. But available research discourse on both frameworks overlooks the
41 functional multispecies relationships embedded in South Asian cities, where animals offer essential
42 ecosystem services often invisible to modern urban planning^{4,5}.

43 Way before the rise of modern infrastructure, tropical urban ecology has been co-constructed by
44 humans, domestic animals and opportunistic species^{5,6}. Vultures, black kites, crows, dogs, monkeys, pigs,
45 cattle, etc., have been operating at a dynamic interface shaped within behavioural regimes modulated by
46 human cultural practices and beliefs. Commensals provided critical services—scavenging organic waste,
47 reducing disease vectors, and managing refuse at no cost to communities⁴. This traditional multispecies
48 coexistence was not accidental but emerged from centuries of mutual adaptation, recently termed co-
49 cultures, in human-modified environments⁷.

50 Rapid urbanisation has created an inflexion point for these cross-species ties⁸. For instance, urban
51 expansion offers abundant foraging opportunities through waste and other subsidies, but simultaneously
52 restructures inter and intraspecific interactions and creates novel selection pressures by altering how
53 nonhumans read environmental cues for decision-making^{5,9,10}. On the other hand, for humans, animals that
54 were previously valued for ecological/cultural salience⁵ are increasingly seen as nuisances or health
55 threats¹¹. Consequently, behavioural responses in traditional settings turn maladaptive in modern contexts¹².
56 With up to 65% of people living in urban areas occupying less than 4% of the Earth's terrestrial surface,
57 this tension intensifies^{8,13}.

58 Free-ranging dogs—humanity's oldest nonhuman companion¹⁴—exemplify this crisis. In India,
59 dogs exist in a volatile space between shortsighted kindness (feeding rituals without population
60 management), escalating conflicts (bites and fear of rabies), and ecological oversight (their waste-
61 scavenging roles and negative impacts on wildlife are often overlooked)¹⁵⁻¹⁷. Recent Indian Supreme Court
62 (SC) directives, issued between August 2025 and January 2026, faced fierce backlash despite aiming to
63 protect public health, revealing deep contradictions in how we value animals within and beyond human use
64 landscapes^{4,11,15}. This perspective advocates for incorporating multispecies coexistence concerns into urban
65 planning for tropical landscapes⁶, transitioning from reactive crisis management to anticipatory design that
66 acknowledges complex ecological entanglements and prepares for potential conflicts and diseases^{4,18,19}.

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69 **The tropical urban chaos**

70 A viral video from July 2025²⁰ showed a Delhi woman booking a motorbike taxi for 180 meters, done to
71 avoid stray dogs on her street. The incident drew reactions online, but it reveals a deeper crisis in urban
72 India^{21–23}. This is not merely about fear or convenience. It exposes how FRDs, once integrated into urban
73 ecosystems as waste scavengers, now trigger anxiety, aversion, and conflicts^{4,6,23,24}.

74 FRDs exemplify the growing contradictions about competing priorities in multispecies South Asian
75 cities. It involves people exhibiting cultural tolerance, but they also negotiate aggressive encounters, based
76 on taxa, space or season^{4,22,25}. This paradox—affection mixed with aversion^{20,26}—defines human
77 relationships with multiple urban animals¹. FRDs are erroneously perceived passive and fed. But dog
78 populations respond to gradients in resource availability^{15,17,27,28}. When food is abundant, but space,
79 veterinary care, and waste management are not, dog numbers surge^{17,26,29}. Inter and intraspecies interactions
80 intensify, culminating in territorial instabilities that likely feed into aggression, disease spreads, and
81 conflicts^{30–32}.

82 The chronology of the Municipal Corporation of Delhi's (MCD) trifurcation in 2012, followed by
83 its subsequent unification in 2022³³, serves as an exemplar of broader shifts in urban governance and animal
84 management. These periods have represented a crucial decade of infrastructural transformation, particularly
85 concerning waste management. For instance, the SC directive³⁴ of 2000 mandated the MCD to identify
86 alternatives to the three existing sanitary landfill sites, yet it remains unimplemented. Considering
87 significant variability across areas previously under respective Eastern, Northern, and Southern units of
88 MCD, departmental restructuring and fragmentation have generated jurisdictional ambiguity, accompanied
89 by shifting priorities^{33,34}. Consequently, public health, veterinary services, waste management, and urban
90 planning frequently operate in isolation. Technical expertise in urban ecology is notably limited⁴. While
91 policies are developed based on Western cities³⁵, a deficit in interdisciplinary rigour regarding human-
92 animal dynamics constrains successful replications¹⁵. In addition, monitoring systems, when implemented,
93 typically capture episodic snapshots rather than the longitudinal data essential for adaptive management^{36,37}.

94 Neither the *NbS* nor the One Health frameworks are adequately conceptualised to address the
95 dynamic nature of human relationships with other biota in the Global South^{4,5}. For instance, dogs' functional
96 role in waste disposal, which was potentially the cornerstone for this unique cross-species relationship¹⁴, is
97 progressively becoming obsolete since food production entered a phase of surplus^{16,26}. Wealthy urban
98 centres can account for the full daily dietary demands of FRDs^{15,38}. However, inequitable resource
99 allocation contributes to food wastage within and between variably developed regions, modulated by
100 changing access animals have for food-subsidies^{4,39}. Problems stemming from inefficient supply chains,
101 storage issues, political instability, and economic barriers thus create a highly variable geography of FRDs'
102 dependence on human refuse^{29,32,40}. These are profoundly related to the World Health Organisation's
103 mandate of removing dog-mediated rabies⁴¹ by 2030. Currently, suggestions about handling FRDs as
104 disease vectors (rabies and other zoonoses) through capture-neutering-vaccination and, most crucially,
105 returning (CNVR) them to their original territories remain silent about the demographic engine: waste,
106 intentional feeding, and infrastructure failures in the developing world^{15,42}. The consequences ripple beyond
107 visible street encounters into free-ranging animal/wildlife social systems, affecting public health, municipal
108 budgets, and ecological networks we barely comprehend^{16,17,23,26,32,38}.

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110 **Numbers exhibit a crisis in plain sight**

111 The scale of India’s human-dog coexistence crisis is staggering. Up to 20 million dog bite incidents occur
112 annually³⁶, a figure that has expectedly risen in recent decades. Rabies kills approximately 20,000 people
113 per year in India, accounting for 36% of global rabies deaths. These are indicators of systemic failure in
114 managing multispecies coexistence³⁶.

115 India has the world’s largest FRD population, estimated at 60 million in 2008³⁶. The FRD crisis
116 extends beyond human health: dogs prey on threatened wildlife like kiang *Equus kiang*, Himalayan serow
117 *Capricornis sumatraensis thar*, including the critically endangered Great Indian Bustard⁴³, of which fewer
118 than 150 individuals survive. They transmit canine distemper to wild carnivores, e.g., recently, it reduced
119 the Gir lion population⁴⁴ by 30%. They compete with other scavengers and mesopredators, altering food
120 web dynamics in both urban and peri-urban landscapes. Reportedly, pack hunting behaviour enables FRDs
121 to take fairly large prey, expanding their ecological niche⁵ beyond opportunistic scavenging^{32,45}.
122 Conservation initiatives, despite the presence of zoonotic risks at land-use ecotones spanning from urban
123 centres to protected territories, tend to prioritise the preservation of wild habitats⁴⁶. Consequently, they
124 often overlook the management of subsidised facultative scavenger populations that typically inhabit the
125 periphery of the several small protected areas found throughout South Asia^{4,18,41,46}.

126

127 **An evolving experiment in coexistence**

128 Dogs are the only vertebrate species that followed human migration out of Africa into every climate zone,
129 since the human niche expansion 70,000 years ago⁴⁷. Larson notes^{14,48}, while we do not know exactly when
130 domestication happened, this taxon’s genetic distinctness and stability despite continuous proximity to wild
131 canids is noteworthy⁴⁹. Prior research has designated dog-wolf hybrids an “evolutionary doomed valley”
132 between two adaptive peaks—they are neither good dogs nor good wolves. This resistance to backsliding
133 into wildness proves how thoroughly dogs and humans have shaped one another. In 300 years, humans
134 created over 400 dog breeds, fine-tuning them for companionship, work, and aesthetics¹⁴. We accomplished
135 this feat because dogs’ ancestors adapted their behaviour in ways that matched inter- and intraspecific social
136 changes⁵⁰, eventually cohabiting with people. This mutual shaping, where selection pressures operate not
137 on one species but on what they do together, represents co-evolution at its most intimate⁷.

138 We know dogs intimately—and barely at all. Breed genetics have been dissected to explain
139 labradors, danes and pugs^{14,48,51}. However, approximately 800 million FRDs²¹ inhabiting tropical
140 ecosystems from villages to cities remain poorly understood: *what does their abundance tell us about how*
141 *tropical cities function?* These are not simply strays. They are the world’s most abundant carnivores,
142 occupying an overlapping niche between the wild and domesticated, dependent on human resources but
143 autonomous, ecologically⁴⁵. Such traits simultaneously make them ecological and social keystones, and
144 public health hazards, considering threats posed by daily nuisance from barking, chasing, and the burden
145 of bites that cause rabies. But FRDs also consume organic waste that would otherwise rot in streets,
146 reducing disease vectors and management costs. This dual reality confounds how dogs are perceived in
147 developing societies with deteriorating ecological systems^{16,26,45}.

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149 Canine populations—dogs, jackals, and occasionally wolves and foxes^{32,45}—are woven into daily South
150 Asian life³¹. FRDs rest on pavements, move through markets, and investigate garbage heaps. To some, they
151 are familiar elements of the urban landscape^{4,32,38}. To others, including many dog enthusiasts who encounter
152 unfamiliar FRDs, they represent a daily risk^{26,38,52}. The human-dog dynamic in urbanising tropics is
153 progressively becoming contradictory^{4,38,39}. Others, like the woman in that viral video²⁰, might have to go
154 to absurd lengths to avoid them, based on previous encounter histories. Progressive compaction of urban
155 infrastructure, typical for cities like Delhi²⁵ forces dogs onto roads³⁸ (Fig. 1). Waste and ritual feeding
156 anchor them to human spaces. Dogs respond by becoming territorial, by guarding feeding spots, apparently
157 perceived as street sentinels. FRD vigilance, which traditionally shaped cross-species ties, now faces
158 radically new selection pressures from human/vehicular traffic in streets. FRDs now respond to an
159 increasingly complex array of benefits and threats, which perpetuate conflicts^{16,23,26,38,40,45,52}.

160 Humans have lived alongside dogs and other commensals for millennia, yet free-ranging
161 multispecies coexistence remains unsolved in cities^{14,41} (Fig.1). Unfortunately, the absence of longitudinal
162 research on FRD demographic responses driven by food subsidies has been filled by casual, pet-dog
163 behaviourists. Their misconceptions—suggesting the possibility of absolute control over FRDs—often help
164 people dismiss the street dog crisis³⁸. The risk of commuting in Indian cities signals a shift in mutual street
165 behaviours in response to environmental changes¹⁵. FRDs are transitioning from village scavengers that
166 negotiated relatively higher resource unpredictability. In rural settings, dogs roam(ed) widely⁴⁵, scavenging
167 dispersed waste and occasionally hunting. Such norms of resource acquisition are associated with territorial
168 dynamics that differ from those in current cities^{38,45}. Limited insights about how dogs negotiate intra-
169 specific socialities⁵⁰ in the built environments affect cross-species human-dog ties, obscuring long-standing
170 *NbS* benefits² and, thus, One Health prerogatives³.

171 Nature employs parsimonious strategies within biotic communities to facilitate organisms in
172 attaining comprehensive life-history goals¹². For example, the opportunistic responses of black kites
173 (*Milvus migrans*) in Delhi, which encompass individual-level habitat selection³⁹ and their resultant
174 population-level outcomes⁵³, and behavioural responses²⁵ are concurrently linked to the same urban
175 covariates: access to food-subsidies, built environment and green cover. However, managing multispecies
176 coexistence in a modern urban setup is dysfunctional because humans intervene selectively. We frequently
177 treat symptoms, ignoring ecological causation. Feeding increases commensal population⁵³, including FRDs,
178 against the backdrop of poor implementation of CNVR. The expansion of impervious surfaces and
179 contemporary infrastructure increasingly disregards the traditional coexistence choices that enabled
180 tolerance of nonhuman species⁵⁴. Our comprehension of how built environments predispose animals to
181 conflict with humans is nascent, e.g., black kite breeders that benefit from ritually tossed meat by Muslims
182 are more likely to attack humans when nesting at the level of balconies in Delhi²⁵. This warrants urban
183 planning that anticipates how structural spatio-temporal changes affect demographic and behavioural
184 dynamics. A lack of ecological foresight necessitates quick fixes from policymakers and administrators that
185 currently fluctuate between indulgence and aggressive reactions^{15,31,52}.

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189 **Fig. 1. Urban infrastructure as a behavioural scaffold²⁵: structuring canine degrees of freedom and**
190 **inter-pack dynamics.** This image depicts a busy street intersection in an Indian city, where multiple free-ranging
191 dog packs coexist in proximity to humans, commercial stalls, and traffic corridors. The presence of Packs 1, 2, 3, and
192 4 in distinct spatial zones illustrates how infrastructure shapes the degrees of socio-behavioural interactions among
193 canine groups. While Pack 2 is aligned along a single road segment and exhibits limited, bidirectional interaction,
194 Packs 1, 3 and 4—situated at the crossroad—are positioned at a convergence zone, increasing their degrees of
195 interaction freedom for inter-pack and human encounters. This spatial ecology predisposes the socio-behavioural
196 interface between dogs, other commensals and humans, forming both conduits and barriers⁵⁰. While some humans
197 view these animals as benign or sacred beings worthy of feeding, others perceive them as threats to safety and mobility.
198 This contradiction underpins a multispecies coexistence paradox. Affording food—whether through ritual feeding or
199 waste—induces dogs to respond with heightened alertness and site fidelity, creating “sentinel” effects that are variably
200 interpreted from territorial aggression to protection. This schematic encapsulates urban entanglement by illustrating
201 how infrastructure implicitly structures canine socioecology. Spatial constraints influence mating, aggression, alliance
202 formation, and feeding hierarchies, which remain poorly understood in existing urban animal management
203 frameworks⁵⁰. [Image generated utilising Gemini AI to clearly and simultaneously represent all environmental
204 elements.]

205 **The evolutionary trap: kindness with a catch**

206 The practice of feeding commensal animals is growing in prevalence globally⁵⁴. It stems from compassion,
207 often tied to beliefs about *karma* or *dharma*^{4,25}, which could have implications on cross-species reciprocity
208 that maintain mutual tolerance^{55,56}. Feeding rituals operate on the emotional immediacy of gratification
209 about socio-cultural beliefs^{4,5}. In modern contexts⁴, nonetheless, good intentions that are ecologically
210 incoherent create problems. In cities, e.g., in Delhi, per capita waste production has increased by 300%
211 since the turn of the century. Meanwhile, the capital has overseen similar growth in human and dog
212 populations and the expansion of built-up areas^{29,38,57,58}. Regions in South Asia have long-standing issues
213 with unsegregated, ephemeral garbage accumulations^{4,29}. Densely populated areas with debris-strewn
214 streets, where people feed commensals, increase and modify human-dog interactions. Crowded multi-use
215 streets are escalating public apprehension about FRDs^{32,45}.

216 The consequences spiral and vary, based on local situations: people avoid streets, and some spaces
217 at certain hours; some carry sticks or pelt stones for self-defence, etc.,^{20,38}, which further complicate
218 behavioural repertoire, based on interaction patterns that perpetuate an arms race^{50,55,56}. Unfortunately,
219 committed feeders (some feeding up to 100s) poorly comprehend FRDs' investment criteria in aggression,
220 especially when space, time and feeder predictably converge^{26,32,38}. Multiple studies, including the work on
221 kites in Delhi, have shown that constant human exposure, while foraging in proximity, reduces the fear
222 animals have of people^{54,59}. In such situations, FRDs may bark, chase, or bite when exhibiting offspring
223 defence (e.g., see⁵⁹), or when they are deliberately or inadvertently cornered—behaviours typically
224 displayed by nursing females and/or dominant individuals. Unlike how committed feeders justify their
225 actions to help reduce conflicts, such food subsidies attract dogs to streets, who guard them to claim higher
226 access to food and associated resources (Fig. 1). The behavioural exhibits frequently extend an
227 infrastructure of protection to committed feeders⁶, who may also feel benefited from FRDs' "guarding" of
228 premises. However, given that urban thoroughfares serve as multi-use spaces that fluctuate with time and
229 location, dogs are frequently subjected to persistent and concurrent cycles of feeding and care, as well as
230 regrettable neglect or outright cruelty^{26,38,45,54}.

231 The core issue is not the compassionate acts themselves, but rather executing casual feeding
232 divorced from the One Health vision^{17,22,38,40}. The practice of providing food to FRDs without concurrently
233 implementing CNVR and spatial planning diminishes the ecological benefits of scavenging services⁴². Dogs
234 reproduce rapidly when food is abundant. A fed population without animal-birth control (ABC) measures
235 covering 70% members re-establishes quickly, nullifying CNVR/removal. The Indian situation exemplifies
236 the complexity of a growing and contentious relationship^{23,26,42,45}. While the country is extraordinarily
237 diverse, there is profound homogeneity in how different communities tolerate animals⁴. About 50% of
238 India's population now lives in district headquarters—roughly 800 centres experiencing economic
239 transformation. Simultaneously, 87% of Indians never leave their birth district⁶⁰. Thus, people maintain
240 locally evolved ways of coexisting with dogs while sharing broader cultural attitudes about animals^{4,25,38}.

241 District-centred prosperity⁶⁰ is frequently associated with deliberate feeding³⁸, whose consequences
242 on pack dynamics are unknown. Such acts of kindness constitute an evolutionary trap for coexisting people
243 and FRDs, given the high incidence of pups and adults being fatally struck by vehicles^{26,38}. Evolutionary
244 traps refer to rapid environmental changes, often driven by human activity, causing organisms to prefer
245 resources—such as food, habitats, or mates—that reduce their survival and fitness, even when better
246 alternatives exist⁶¹.

248 Multispecies well-being warrants systemic approaches

249 Feeding free-ranging animals enhances breeding success and survivorship of offspring until
250 fledging/weaning³⁹. It affects spatial behaviour and social structure^{62,63}. The increasing per capita income
251 in tropical urban centres, such as Delhi, which currently holds the highest rank amongst Indian megacities,
252 has led to a surge in the ritualistic feeding of dogs and other animals^{4,38}, whose implications on population⁵³
253 and behavioural dynamics^{25,59} remain undocumented^{4,58}, except for bite statistics³⁶.

254 Furthermore, individuals who meet the dogs' complete daily dietary requirements, typically
255 residing in middle or higher-income areas, generally avoid the detrimental effects of aggressive territorial
256 encounters. This contrasts with blue-collar workers; affluent individuals tend to move predictably within
257 urban environments, owing to the stability of their residential, professional, and recreational zones³⁸.
258 Moreover, wealthier communities frequently outsource feeding/care through informal arrangements. This
259 spatial and social buffering displaces conflict costs, while multistorey urban infrastructure simultaneously
260 restructures and redistributes encounter risks across urban settings (*unpublished data*). Conflict perceptions
261 among urban residents often depend on exposure frequency to unfamiliar dogs. Socioeconomically
262 disadvantaged, particularly those commuting on foot or using bicycles/two-wheelers, face disproportionate
263 vulnerability^{38,64}.

264 Given that feeding congregates dogs at specific points, such as temple premises, market peripheries,
265 and residential communities (Fig. 1), these spatial responses significantly determine the crisis^{25,38,59}. The
266 state authorities and other agencies attempting to limit populations with CNVR⁴² miss the underlying spatial
267 responses, modulated by feeding patterns and waste dispersal³⁷. Misplaced empathy²⁵ that prioritises
268 individual gratification over both animals' long-term well-being and ecological significance simultaneously
269 affects human, animal, and environmental health, a phenomenon I will subsequently elaborate upon^{1,4,5}.
270 State agencies prioritise visible sterilisation drives in wealthier colonies while neglecting the demographic
271 drivers in adjacent resource-poor areas. Such disjunct measures meet failure³⁹, since new dogs move in, or
272 existing dogs breed faster to fill the vacuum. Finally, sterilised dogs can still be a public health concern for
273 years, if feeding/waste is ensured³².

274 Discussing the contrast between tiger conservation⁴⁶ and dog well-being here is instructive. Tiger
275 conservation management rests on scientific foundations that define territorial requirements, prey densities,
276 corridor connectivity, and community engagement protocols. Conservation policies, despite acknowledged
277 shortcomings⁶⁵, reflect this ecological understanding⁴⁶. Despite the empathy feeders exhibit, we lack a
278 comparable framework for FRDs, considering ecological and public health concerns^{3,18,37,42}. We further
279 lack data about the consequences of temporary and permanent removals of individual FRDs on dog social
280 structures⁵⁰.

281 Meanwhile, rapid urban expansion is transforming socio-cultural profiles^{4,5}, which in turn affects
282 tolerance for free-ranging animals²⁵. We do not know how many dogs a neighbourhood can support before
283 territorial aggression escalates, how waste density sustains large FRD populations, or how feeding patterns
284 affect space use and breeding success³⁹. This knowledge gap has consequences, with interventions that
285 remain guesswork; sterilisation programs operate without data on population turnover rates or immigration
286 from surrounding areas^{17,42}. Policy formulation and execution that operate in an empirical vacuum will

287 either underperform or backfire. Each domain—public health, conservation, urban development—operates
288 in isolation⁴, missing the systemic nature of the problem. The ecological and health crises are symptoms of
289 this deeper dysfunction^{4,60}.

290 To start with, we lack systematic research on how dogs navigate their dual social worlds⁵:
291 conspecific relationships and human interactions²². Critical questions that remain empirically unaddressed:
292 *What environmental or social cues trigger territorial defence versus tolerance? How do dogs assess threats*
293 *from humans—is it individual recognition, contextual cues, or learned group behaviour? How does the*
294 *dispersion of food-subsidies shape pack cohesion by affecting micro-scale habitat quality? What factors*
295 *determine site-fidelity and dispersal of dogs, and how do these decisions relate to age, sex and social*
296 *rank*⁵⁰? For instance, vaccination campaigns that treat dogs as randomly distributed individuals miss how
297 disease spreads through social networks and territorial boundaries^{50,62,63}. Urban design that fragments dog
298 territories, e.g., fencing requested by the SC in November 2025, without understanding ranging patterns
299 and social-ranks, can intensify human-dog conflict³⁵.

300

301 **Theoretical bases of multispecies coexistence**

302 Urban spaces create profound behavioural complications for breeding FRDs, as these are not random strays
303 but form packs, employing innate and learned strategies refined over shared living alongside humans^{45,48,66}.
304 FRDs are behaviourally attuned to factor human presence as a signal for food availability from deliberate
305 feeding or accessible garbage (e.g., see³⁹). But there is limited work on ecological variations of these cross-
306 species behavioural associations, e.g., *how does deliberate feeding in variable ecological settings affect*
307 *territorial attachment to people and/or their locations? Does provisioning heighten boldness or aggression*
308 *toward unfamiliar humans/nonhumans that approach feeding zones? How do dogs reconcile pack*
309 *hierarchies and access to resources, since humans*^{50,62,63}, *rather than natural prey in defended territories,*
310 *determine food availability and distribution?* Currently, our folk assumptions⁵ far exceed empirical
311 knowledge about FRD populations and behaviour, with consequences on coexistence.

312 To understand the mechanics of this cross-species dependency, we must look at eco-evolutionary
313 trade-offs. Robert Trivers' parent-offspring conflict theory⁶⁷ offers a useful lens to comprehend the impacts
314 of provisioning dynamics at the human-dog interface. Trivers proposed that parents and offspring have
315 asymmetric interests: offspring benefit from extended parental investment while parents benefit from
316 reallocating resources to future reproduction. In Delhi, female FRDs—frequently malnourished—rear large
317 litters, in areas where human support is highly variable (Fig. 2). Provisioning alters this calculus. When
318 humans supplement food, pup survival initially increases, extending the duration mothers must nurse and
319 defend larger litters. Consequently, this intensifies maternal investment costs while simultaneously
320 introducing a behaviour dilemma⁵⁹: lactating females must navigate conflicts between accepting food from
321 humans and defending pups against perceived threats from those same provisioners, turning the act of
322 feeding into a trigger for conflict²⁵.

323

324 The complications deepen when pups themselves interact with human feeders. Young dogs imprint on
325 provisioners, following them across streets and roadways where feeding occurs (*unpublished data*). This
326 developmental attachment, combined with the prevalence of roadside provisioning, exposes pups to vehicle
327 strikes³⁸. Tragic accidents result not from maternal neglect but from learned associations between humans,
328 pups/adults that gesture food-begging, and specific locations that happen to coincide with traffic
329 corridors^{23,26}. Pups that survive face a subsequent challenge: reconciling social bonds with their mother and
330 pack with dependencies on individual human feeders whose identity is obscured by varying traffic²².

331 We lack data connecting these physiological and social stressors to behavioural outcomes in FRDs.
332 For instance, *how do lactating females balance the aggression necessary for pup defence with the tolerance*
333 *required to access human-provided food? What happens when provisioning ceases abruptly—do dogs*
334 *conditioned to human dependency exhibit heightened aggression or anxiety? How does early imprinting on*
335 *human feeders affect adult territoriality and human-directed behaviour, e.g., begging gestures?* These
336 questions matter because dogs are large carnivores with frequently reported cases of major injuries and
337 mauling to humans, livestock and wildlife^{17,25,32,44,59}. Behavioural dysregulation born of conflicting
338 selection pressures⁵⁹—accept humans for food versus defend against threats—creates dangerous
339 unpredictability that sits at the heart of multispecies coexistence conundrums. A vicious cycle emerges,
340 where suffering begets more suffering. As a result, territorial behaviours that intensify around feeding zones
341 often misfire, generating conflicts with pedestrians, blue-collar workers, other dogs and nonhumans^{38,59}.

342



343

344 **Fig. 2. Maternal investment conflicts in urban environments:** A free-ranging mother dog nursing her
345 litter on an Indian street exemplifies the complex resource allocation dilemmas. The visibly malnourished
346 mother supports multiple offspring while navigating unpredictable anthropogenic food sources and
347 territorial pressures. This scene illustrates the “behavioural bottleneck”⁵⁹ where parental investment
348 strategies evolved for natural environments become maladaptive in human-dominated landscapes. Human
349 feeding interventions often target juvenile animals directly, inadvertently intensifying parent-offspring
350 conflicts by disrupting traditional resource transfer patterns. The mother requires approximately three times
351 more calories than her offspring to sustain lactation⁶⁸, yet well-intentioned feeding practices frequently
352 prioritise the more conspicuous juveniles. This triangulated resource dynamic—between maternal
353 investment, offspring demands, and human intervention—demonstrates how urban environments create
354 novel selection pressures that challenge conventional approaches to animal well-being and population
355 management. Understanding these complex behavioural ecologies becomes essential for developing
356 effective coexistence strategies in rapidly urbanising regions. [*Image generated utilising Gemini AI to*
357 *clearly represent all environmental elements.*]

358

359 **Ecology of coexistence, ethics and legality**

360 India and other developing tropical regions are in the midst of an escalating public-health crisis driven by
361 changing multispecies coexistence^{3,4,18,37}, yet policy responses have become increasingly reactive and
362 scientifically unmoored. To address this issue, recently, the SC issued contradictory mandates for FRDs,
363 reversing orders four times between August 2025 and February 2026. The original directive to relocate ~2.5
364 million dogs from the National Capital Region—an area of 4,500 km²—to (non-existent) shelters within
365 eight weeks was rescinded two days later, following nationwide protests and petitions by individual dog
366 lovers and organisations. With its August 22, 2025, directive, the SC has nationalised the regional mandate
367 prescribed by the Delhi High Court (DHC)³⁵. DHC attempted to resolve the FRD crisis in 2009 by creating
368 designated feeding areas⁶⁹, which contradicts basic ecological principles of territoriality and typically
369 exacerbates conflicts (Fig. 1, 2 and 3). Approaches to coexist with FRDs inhabit two parallel realities:
370 visible acts of kindness masking invisible cycles of suffering.

371 Euphemistically termed “purging”, the latest position of the SC warrants immediate removal of
372 dogs from ~1.5 million schools, hospitals, and public transport zones across the country, while encouraging
373 fencing to prevent re-entry and banning public feeding (except at designated spots)³⁵. This ignores
374 infrastructural challenges, financial constraints, and the behavioural dynamics that could further drive
375 agonistic dog-human encounters⁵⁰. Fencing institutions does not address why dogs congregate near these
376 spaces—often because of accessible waste, deliberate feeding, or food-begging around predictable human
377 activity zones. The order is unlikely to significantly reduce bite frequencies or rabies transmission without
378 addressing underlying attractants¹⁵. The SC’s subsequent orders in November 2025 and ongoing
379 deliberations with various parties in January 2026 have revealed the limitations of reactive policymaking
380 disconnected from ecological realities. The top court is currently attempting to find a middle ground
381 between mass dog removal and animal well-being concerns³⁵.

382 The policy deadlock arises not solely because millions are impacted by FRD conflicts, but
383 concurrently because millions do not like to see starving animals^{15,38}. Thus, propositions to displace FRDs
384 are likely to be ineffective, given that the dogs acquire much of their food at garbage points and feeding
385 stations¹⁵. Extending human-FRD coexistence, if it becomes a socio-legal choice for India, warrants
386 approaches that acknowledge how ritual feeding creates unintended consequences⁴. Actions perceived as
387 charitable—habitually feeding street dogs—have been creating socio-legal stalemate, extended in the form
388 of protests in streets^{20,35}. We create an “illusion of kindness” that normalises dog presence in hazardous
389 environments, exposing them to vehicular trauma, pathogen transmission⁴, and territorial aggression that
390 affects humans, FRDs and other animals alike²⁵.

391 The convergence of casual sentimentality and genuine concern for complete animal well-being is
392 predicated on positive reciprocal behaviours from dogs conditioned to specific human providers^{9,22}. Such
393 misconceptions among laypeople lead to the inaccurate presumption that feeding concurrently guarantees
394 both canine nutrition and public safety. Coexistence foresight requires reconceptualising human-dog
395 relationships through population dynamics, resource dispersion, spatial behaviour, and multispecies
396 ethics^{15,23,26,38}. Currently, municipal authorities and non-governmental organisations across Indian cities
397 operate without baseline ecological assessments³⁵. We do not understand how administrative decisions, like
398 the 2012 MCD trifurcation, created heterogeneous resource landscapes sustaining free-ranging
399 populations^{39,53}. Finally, demographic analyses focus on crude population counts¹⁷ rather than age-structure
400 dynamics, reproductive rates, mortality patterns, and spatial distribution across urban microhabitats^{36,37,52}.

401 The legal institutions³⁵ are attempting to establish coexistence mandates that overlook prevalent
402 compassion⁴, despite the fear instilled by animals attacking people²⁵. This policy volatility prompts
403 retaliations, exposing unaddressed gaps in social-ecological relationships spanning informal economies,
404 waste management systems, community feeding practices, and territorial arrangements^{4,5}. Culling is not a
405 possibility under the Indian culture of non-violence (*Ahimsa*) and legal premises¹⁵. Against such a complex
406 and vast backdrop, the SC is currently holding hearings with interested parties, attempting to find a middle
407 ground between mass removal and animal well-being concerns. The nation is divided.



408
409 **Fig. 3. Standing at the intersection of policy and ecological reality:** where well-intentioned court orders
410 meet the complex science of animal ecology and behaviour. This feeding station board at a university
411 campus represents a common urban challenge—*how do we balance compassion with ecological*
412 *understanding?* While the intention to care for urban commensals is admirable, concentrated feeding can
413 inadvertently create resource competition hotspots, alter territorial dynamics, and increase conflicts.
414 Behavioural research suggests that sustainable coexistence requires moving beyond emotion-driven
415 solutions toward evidence-based strategies that respect both animal well-being and ecological principles.
416 The question is not whether we should care for urban animals, but how it can be done in ways that truly
417 serve multispecies coexistence interests over the long term. [Image of a *Thinkpaws* team member during a
418 field survey].

419

420 **A way forward to multispecies coexistence**

421 FRDs do not conform to a few fixed identities, like hapless individuals awaiting rescue, idealised
422 companions, or pests requiring elimination^{23,26,35,38}. Like other free-ranging animals, these sentient
423 organisms exhibit capacities, specific to their taxa and population³⁹, for interpreting human-use
424 environments²⁵. This way, our socio-cultural practices have been generating adaptive outcomes for
425 nonhumans⁵⁹, fundamentally interwoven with communities amidst urbanising ecosystems⁴. However, such
426 One Health dynamics in urban settings pose a considerable challenge for continued coexistence with
427 commensals³. Traditional beliefs⁵ frequently obscure concurrent trajectories of population and demographic
428 shifts. The latter is especially relevant when the tropical urban is often a conglomerate of variable human
429 agency, e.g., in South Asia^{4,5}. Poor acknowledgement of dynamic human-animal reciprocation causes
430 polarisation and conflicts across the city-wilderness continuum^{5,55,56}. Consequently, antagonism and
431 animosity can erode traditionally manifested acts of compassion, e.g., tolerance and feeding^{4,25}.

432 Human-animal associations are characterised by coexistence trade-offs stemming from mutual
433 decisions, generating inherent tensions^{25,59}. Hence, scientific investigation into the site specificity of
434 encounter histories in variable landscapes is crucial for management. Whether acknowledged or not, these,
435 in turn, influence policies, fears, empathic responses, and biases, limiting anticipatory planning grounded
436 in social-ecological realities. This is not a call to vilify FRDs, but to acknowledge dynamic relationships
437 that warrant consistent steering.

438 Effective interventions necessitate a multi-dimensional approach to waste management, primarily
439 ensuring the unavailability of organic remains for commensals in critical conflict zones¹⁵. Furthermore,
440 research has suggested that animal agency could be judiciously employed for waste disposal, provided this
441 is substantiated by rigorous studies on integrating this *NbS* into modern practices⁵³. Such integration would
442 require spatio-temporal rigour, achieved through the analysis of animal ranging patterns and the systematic
443 screening of disease vectors^{3,18,30,44}. Pairing waste management alongside a simultaneous implementation
444 of strategic feeding initiatives and CNVR programs could prevent strong public resistance and social
445 disorder¹⁵.

446 Public education programs^{40,52} specifically adapted to regional requirements—such as addressing
447 harassment or bites in urban environments^{36,38} versus livestock and wildlife depredation in the Himalayan
448 region³²—could potentially redirect public philanthropic contributions away from indiscriminate roadside
449 feeding. Awareness campaigns are essential⁴⁰, considering the limited public understanding of the etiology,
450 transmission, and prevention of rabies, particularly in remote regions⁵. Furthermore, sustained, longitudinal
451 monitoring of commensal demographics⁵³ is essential to gain a fundamental understanding about how the
452 structure of cities—from infrastructure and traffic to cultural behaviour and waste disposal—affects animal
453 populations¹⁵. Prioritising the vulnerability of children, the elderly, and blue-collar workers to dog-attacks
454 is crucial. These stakeholders may lack adequate representation to voice their concerns^{35,38}. Aforementioned
455 cohesive implementation of strategies necessitates institutional restructuring, requiring functional
456 collaboration of the state departments and resident associations currently operating in isolation around
457 shared objectives. And finally, judicial bodies adjudicating matters with timelines detached from ecological
458 realities would benefit from incorporating scientific expertise, which could assist communities advocating
459 for dogs, including those who remain dissatisfied with poorly implemented sterilisation initiatives.

460 Afterall, coexistence is not a fixed state but a dynamic relationship requiring continuous adjustment as
461 urban conditions change. This means recognising 1) individual feeding decisions have population-level
462 consequences; 2) territorial behaviour responds to spatial resource distribution; 3) disease prevalence and
463 transmission follows human-animal social network structures; and 4) sustainable management and
464 extension of traditional *NbS* requires integrating in modern shared spaces, where human, animal and
465 environmental well-being are quintessentially tied. Traditional patronising attitudes about nature, which
466 overlook the functional ecology of free-ranging species is creating urban habitats that are ecological traps⁶¹.
467 To move beyond an emergency state toward successful multispecies coexistence in tropical urban settings,
468 scientific knowledge must be combined with traditional bio-cultural values and practices⁵.

469

470

471

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492

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499 **Declaration of AI use**

500 This article’s sections were revised for grammatical mistakes and were provided rewording suggestions.
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505

506

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