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HUMAN–WILDLIFE CONFLICT IN THE TERAI OF UTTAR PRADESH (INDIA) IN CONTEXT TO GLOBAL PATTERNS, DRIVERS AND MITIGATION PRACTICES: A COMPREHENSIVE REVIEW

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ABSTRACT
Human–wildlife conflict has become one of the defining conservation and rural development problems of the present century, and India carries a disproportionate share of it. This review examines the problem in the Terai belt of Uttar Pradesh, a densely settled agricultural plain adjoining some of the most productive tiger and elephant habitat in South Asia, and places the regional picture within a global comparative frame. Evidence was drawn from peer-reviewed literature, government returns tabled in Parliament and the State legislature, protected-area records, and verified contemporaneous reporting for episodes that have not yet entered the scientific literature. Uttar Pradesh recorded 111 human deaths from tiger attacks between 2014 and 2024, the second highest of any Indian State, and the Dudhwa–Pilibhit landscape is now widely regarded as the country's second most severe focus of human–tiger conflict (SDG 15-Life on Land). Approximately 44.9% of tiger attacks in this landscape occur inside forest or along the forest fringe and a further 43.2% in crop fields, overwhelmingly sugarcane, which occupies about a third of the sown area in Pilibhit district and acts as seasonal habitat for tigers in this human-dominated landscape for much of the year. Between March and September 2024, a pack of six Indian wolves killed ten people, nine of them children, on the Ghaghara floodplain of Bahraich district, prompting the State to designate the affected area a wildlife disaster zone. Other conflict-prone species like nilgai, wild pig, rhesus macaque, elephant, leopard, sloth bear, mugger and venomous snakes also impose substantial and often under-recognized costs on rural households. The review compares these patterns with evidence from Nepal, Sri Lanka, sub-Saharan Africa, Europe and Latin America, evaluates the intervention literature, and sets out a research and management agenda specific to the Uttar Pradesh Terai.

KEYWORDS: Human–wildlife conflict; Terai Arc Landscape; Uttar Pradesh; Coexistence; Crop raiding; *Panthera tigris*; Canis lupus pallipes

1. INTRODUCTION

Wildlife and rural people have shared the Indian landscape for as long as agriculture has existed here, and the terms of that sharing have always been uneasy. India now supports about 1.4 billion people on 2.4% of the world's land area, together with roughly three-quarters of the global wild tiger population, some 30,000 Asian elephants, more than 13,000 leopards and substantial populations of sloth bear, wolf, mugger and gaur. Almost none of this wildlife is confined to protected areas: only about 22% of India's elephant range and approximately 35% of its tiger population lie within the protected-area network and the designated tiger reserves. The remainder occurs in country that is farmed, grazed, mined and travelled through daily by very large numbers of people (Rangarajan et al., 2010; Jhala et al., 2018).

The consequences are recorded most starkly in mortality returns. Figures tabled in the Rajya Sabha show that elephants alone caused 2,853 human deaths in India between 2019 and 2023, the annual total climbing from 587 in 2019 to a five-year high of 628 in 2023 (MoEFCC, 2024). Tiger attacks caused 621 human deaths between 2014 and 2024 (NTCA, 2024), and 275 deaths were recorded in the five years to 2019 alone (MoEFCC, 2020). These are the visible losses. Beneath them lies a far larger and much less well documented burden of crop damage, livestock depredation, property destruction, injury, lost sleep, lost school attendance and chronic anxiety. Barua et al. (2013) argued that this burden is systematically undercounted because it falls outside the categories that compensation systems are designed to recognize, and Ogra (2008) showed for the adjoining Uttarakhand hills that the costs are distributed unevenly within households, falling most heavily on women.

Uttar Pradesh occupies an unusual position in this picture and has attracted correspondingly little research. The State is generally thought of in terms of its agricultural plains rather than its forests, and its forest cover of about 9% is among the lowest in the country. Yet its northern boundary runs for several hundred kilometers along the Terai, a belt of alluvial grassland, swamp and moist deciduous forest supporting one of the densest concentrations of large mammals anywhere in South Asia. Dudhwa National Park, Kishanpur and Katarniaghat wildlife sanctuaries, Pilibhit Tiger Reserve, Suhelwa and Sohagibarwa wildlife sanctuaries, and the intervening buffer and territorial forest divisions form the Indian half of a transboundary system that continues into Shuklaphanta, Bardia,

Banke and Chitwan national parks in Nepal (Johnsingh et al., 2004; Wikramanayake et al., 2011). Human density in the agricultural mosaic surrounding these forests is of the order of 500 people km-2 (Chatterjee et al., 2022). The result is an interface of extraordinary length and intensity, and one in which the dominant crop, sugarcane, behaves for much of the year as an extension of the forest itself.

Uttar Pradesh recorded 111 human deaths from tiger attacks between 2014 and 2024, second only to Maharashtra (NTCA, 2024), and the Dudhwa–Pilibhit landscape is now commonly described as the country's second most severe focus of human–tiger conflict (Chatterjee et al., 2022). In 2024, the State experienced a wolf-attack episode on the Ghaghara floodplain of Bahraich district that killed ten people, nine of them children under eight years of age, and that ended with the State government designating the affected tehsil a wildlife disaster area (PTI, 2024a; Chandra, 2024). Neither development has yet generated a substantial peer-reviewed literature. Chatterjee et al. (2022) themselves noted that very little had been published on human–tiger conflict in the Dudhwa–Pilibhit landscape despite its national prominence, and the observation applies with greater force to the wolf, the nilgai, the rhesus macaque and the mugger.

This review has four purposes. The first is to assemble, in one place, what is currently known about human–wildlife conflict in the Uttar Pradesh Terai across the full range of species involved rather than the two or three that dominate media coverage. The second is to set that regional account against the global evidence, so that the patterns observed in the Terai can be read as instances of processes documented elsewhere rather than as local anomalies. The third is to evaluate the mitigation literature, distinguishing interventions with demonstrated effect from those in wide use but poorly tested. The fourth is to identify the specific research and management gaps that a state forest department could reasonably close within a single planning cycle.

2. MATERIAL AND METHODS

This is a narrative review conducted along systematic lines. Literature was searched in Web of Science, Scopus, Google Scholar and the complete archives of the Journal of Threatened Taxa, Biological Conservation, Conservation Biology, Oryx, Ursus, Animal Conservation and PLOS ONE, from inception to July 2026. Search strings combined conflict terms (human–wildlife conflict, human–animal conflict, crop raiding, livestock depredation, retaliatory killing, coexistence) with taxon terms (tiger, leopard, elephant, wolf, sloth bear, nilgai, wild pig, rhesus macaque, mugger, snakebite) and with geographical terms for Uttar Pradesh, the Terai, the Terai Arc Landscape, India and the principal comparator regions. Reference lists of all retrieved reviews were hand-searched, and the citation networks of Treves and Karanth (2003), Dickman (2010) and Nyhus (2016) were traversed forward and backward until no further relevant sources were recovered.

Three categories of grey material were admitted deliberately, because excluding them would have produced a misleadingly thin account of Uttar Pradesh. The first is official data: replies tabled in the Lok Sabha and Rajya Sabha, National Tiger Conservation Authority returns, Ministry of Environment, Forest and Climate Change gazette notifications, and State Forest department records. The second is institutional reporting by organizations working in the landscape, principally the Wildlife Trust of India (2018). The third is verified contemporaneous reporting, restricted to episodes for which multiple independent outlets and a named official source were available, and used only for factual matters such as dates, localities and casualty counts. Where a figure rests on such reporting alone, this is stated in the text. The convention is unavoidable in a State where much of the conflict record has never been formally published, and it follows the practice of several recent regional syntheses.

Two limitations should be acknowledged at the outset. Conflict statistics in India are compiled through compensation claims, and compensation systems record what they are designed to pay for. Crop damage by nilgai and wild pig, injury not requiring hospitalization, and losses to households without formal land title are all under-represented, and the degree of under-representation is unknown (Karanth et al., 2018; Barua et al., 2013). Second, the Uttar Pradesh evidence base is thin enough that some sections of this review are necessarily descriptive rather than analytical. Where the State literature is absent, comparable studies from Nepal, Uttarakhand and Bihar have been used to indicate what is likely rather than to assert what is known.

3. A working typology

The phrase human–wildlife conflict covers a set of situations that differ in kind, not merely in degree, and treating them as a single problem has repeatedly produced management responses that fit only one of them (Nyhus, 2016). A useful typology distinguishes the material form of the interaction, the species group involved, the affected party and the appropriate response pathway. Table 1 sets out the categories used in this review. Two distinctions in that table carry disproportionate weight. The first is between fatal and non-fatal interactions. A single human death generates political pressure out of all proportion to its statistical frequency, and the response it triggers, typically capture or elimination of the animal, is often the response least supported by evidence (Treves and Karanth, 2003; Athreya et al., 2011). The second is between conflict concentrated in a few individual animals and conflict diffuse across a population. Attacks on people by tigers and leopards are usually attributable to a small number of individuals in particular circumstances (Lamichhane et al., 2017), whereas crop damage by nilgai and wild pig is a population-level phenomenon. The two require entirely different instruments, and confusing them has been a recurrent failure of policy in northern India.

Table 1 A working typology of human–wildlife interactions, with the species groups and response pathways relevant to the Uttar Pradesh Terai

Interaction type	Principal species in the UP Terai	Affected party and nature of cost	Appropriate response pathway
Human death or serious injury	Tiger, leopard, wolf, elephant, sloth bear, mugger, venomous snakes	Individual and household; catastrophic, irreversible, spatially concentrated	Rapid response teams; individual-animal management under NTCA protocol; ex-gratia payment; behavioural advisory to communities
Livestock depredation	Tiger, leopard, wolf, jackal, feral dog	Household; recurrent, moderate, falls most heavily on the poorest	Predator-proof night enclosures; guarding; interim relief and insurance; husbandry change
Crop damage	Nilgai, wild pig, elephant, rhesus macaque, chital, sambar, parakeets	Household and village; chronic, cumulative, largest aggregate cost	Barriers, trenches and fencing; crop choice; community guarding; landscape-scale land-use planning
Property and infrastructure damage	Elephant, wild pig, rhesus macaque	Household and public infrastructure; episodic	Structural protection; early warning; compensation
Retaliatory and pre-emptive killing of wildlife	Tiger, leopard, wolf, elephant, nilgai, wild pig	Wildlife population; conservation cost	Enforcement combined with grievance redress; prompt and adequate compensation; trust-building
Psychosocial and hidden costs	All of the above	Household and community; sleep loss, school absence, fear, opportunity and transaction costs	Recognition in policy; outreach and community mental-health provision; simplification of claim procedures
Zoonotic and health interface	Feral dog, rhesus macaque, livestock–wildlife interface	Public health	One Health surveillance; vaccination; waste management

4. The global picture

4.1 Magnitude and general pattern

Human–wildlife conflict is now recognized as a first-order conservation problem rather than a local nuisance. A joint assessment by WWF and UNEP (2021), drawing on 155 contributors from 40 organizations in 27 countries, concluded that conflict-related killing affects more than three-quarters of the world's wild cat species, together with many other terrestrial and marine carnivores and several large herbivores. The same assessment argued that the problem is as much a development and humanitarian matter as a conservation one, because its costs fall on farmers, herders, artisanal fishers and indigenous communities least able to absorb them and least likely to receive a corresponding share of the benefits of living alongside wildlife.

Across the literature a consistent structure emerges. Conflict concentrates at the edges of protected areas and along corridors, declines with distance from the forest boundary, rises where wild prey is depleted, and is mediated less by the abundance of wildlife than by the way people use the landscape (Naughton-Treves, 1998; Madhusudan, 2003; DeFries et al., 2010). Dickman (2010) argued in an influential synthesis that the social dimensions of conflict, including historical grievance, perceived neglect by the State and the symbolic weight attached to particular species, frequently determine outcomes more strongly than the material damage itself. Reviewing the field a decade later, Nyhus (2016) reached a similar conclusion and observed that the most durable solutions have tended to be those that alter the incentives facing households rather than those attempting to exclude wildlife physically. Similar views have been expressed by Monowar Alam Khalid et al., (2023 and 2025), where they emphasized the role of tribal communities in wildlife conservation and conflict mitigation and suggested few strategies for declining biodiversity.

4.2 Regional patterns

South Asia beyond India offers the closest analogues to the Uttar Pradesh situation. In the Nepal Terai, which shares its ecology and much of its wildlife with the Indian side of the border, Neupane et al. (2025) analyzed 14,989 conflict incidents recorded in the buffer zones of Bardia and Chitwan national parks between 2013 and 2022 and found that crop raiding accounted for 8,129 of them and livestock depredation for 4,611, with elephants

responsible for 42.8% of all incidents. Total incidents rose over the decade, and the increase tracked the recovery of rhinoceros and tiger populations, a pattern of considerable relevance to Indian reserves now approaching carrying capacity. Examining national data for 2010 to 2014, Acharya et al. (2016) found that elephants and common leopards were involved in the largest number of attacks on people, and Lamichhane et al. (2017, 2018) showed for Chitwan that attacks clustered in space and time and were associated with particular individual tigers rather than with the population as a whole. Paudel et al. (2024), working in the Bardia–Banke complex, reached comparable conclusions for the western Nepal Terai directly across the border from Katarniaghat.

Sri Lanka presents one of the world's most severe cases of human–elephant conflict. Fernando et al. (2005) documented perceptions and patterns across old and new settlement areas and argued that attempts to confine elephants to protected areas through drives had escalated rather than reduced conflict. The first country-wide elephant survey concluded that the majority of Sri Lankan elephants share land with people and that in situ management combined with village-level electric fencing offers the only workable path (Fernando et al., 2021). Approximately 121 people and 405 elephants died in conflict-related incidents in Sri Lanka in 2019 alone (WWF and UNEP, 2021).

In sub-Saharan Africa the literature is dominated by carnivore depredation and elephant crop raiding. Ogada et al. (2003) demonstrated that husbandry practice, particularly the construction and attendance of night enclosures, was the strongest predictor of livestock loss in Kenyan rangelands. Kissui (2008) showed for the Maasai Steppe that lions, leopards and spotted hyenas differ markedly in their vulnerability to retaliatory killing, with lions bearing the heaviest cost because their attacks occur in circumstances most likely to be witnessed. Predator-proof enclosures have since been shown to reduce both livestock loss and lion killing at scale (Lichtenfeld et al., 2015). On the elephant side, beehive fencing developed in northern Kenya has become the most rigorously evaluated deterrent in the field, with multi-year trials showing substantial reductions in successful crop raids alongside an income stream from honey (King et al., 2011, 2017).

Europe offers the clearest example of conflict generated by recovery rather than by decline. Wolves, brown bears, Eurasian lynx and wolverines have re-established themselves across much of the continent under legal protection (Chapron et al., 2014), and depredation on sheep has risen accordingly, with wolves accounting for the great majority of compensated losses within the European Union (Singer et al., 2023). Fernández-Gil et al. (2016) showed for north-western Spain that complaints of wolf predation correlated with the number of wolves culled in the previous season rather than with livestock numbers, and that media coverage of wolf damage exceeded coverage of bear damage by a factor of thirty despite far smaller differences in the underlying losses. The finding is a useful corrective to the assumption that reported conflict tracks actual damage, and it has direct bearing on the interpretation of Indian conflict statistics.

In Latin America the central issue is depredation of cattle by jaguar and puma and the retaliatory killing that follows. Solano et al. (2026) recorded at least 2,215 jaguar killings across the region between 1940 and 2023, with retaliation for livestock predation the stated motivation in 1,782 cases. Work in the Brazilian Pantanal and on the Amazon deforestation frontier has repeatedly found that rancher attitudes, rather than measured loss rates, best predict the intention to kill a jaguar (Zimmermann et al., 2005; Michalski et al., 2006; Díaz-Vaquero et al., 2024).

Table 2 Comparative overview of human–wildlife conflict by region, showing the dominant species, the principal form of conflict and the interventions for which the strongest evidence exists

Region	Dominant conflict species	Principal form of conflict	Best-evidenced interventions	Key sources
Indian subcontinent	Asian elephant, tiger, leopard, sloth bear, wolf, nilgai, wild pig, rhesus macaque	Crop raiding and human fatality; livestock depredation in the hills	Village-level electric fencing; predator-proof corrals; rapid response teams; interim relief; corridor protection	Chatterjee et al. (2022); Neupane et al. (2025); Gubbi et al. (2014); Karanth et al. (2012)
Sub-Saharan Africa	African elephant, lion, spotted hyena, leopard, cheetah, baboon	Livestock depredation and crop raiding; retaliatory carnivore killing	Predator-proof bomas; beehive fencing; chilli and metal-strip barriers; conservancy revenue sharing	Ogada et al. (2003); Kissui (2008); Lichtenfeld et al. (2015); King et al. (2011, 2017)
Trans-Himalaya and Central Asia	Snow leopard, Tibetan wolf, brown bear	Livestock depredation from corrals and open pasture	Corral reinforcement; community livestock insurance; incentive-linked conservation agreements	Mishra (1997); Mishra et al. (2003); Suryawanshi et al. (2013); Jackson and Wangchuk (2004)

Region	Dominant conflict species	Principal form of conflict	Best-evidenced interventions	Key sources
Europe	Grey wolf, brown bear, Eurasian lynx, wolverine	Sheep depredation; beehive damage by bears	Livestock guarding dogs; night penning; compensation coupled to prevention; regulated harvest	Chapron et al. (2014); Singer et al. (2023); Fernández-Gil et al. (2016); Rigg et al. (2011)
North America	Black bear, grizzly bear, cougar, grey wolf	Livestock depredation; urban and residential conflict	Attractant management; bear-proof waste containment; risk mapping; targeted lethal control	Treves et al. (2004, 2011)
Latin America	Jaguar, puma	Cattle depredation and retaliatory killing	Electric fencing; herd and calving management; attitude-focused engagement with ranchers	Zimmermann et al. (2005); Michalski et al. (2006); Díaz-Vaquero et al. (2024); Solano et al. (2026)
Southeast Asia	Asian elephant, tiger, macaques	Crop raiding in plantation and forest-frontier landscapes	Barrier systems; land-use zoning; plantation management	Linkie et al. (2007); Shaffer et al. (2019)

5. India: the national picture

India's conflict burden is concentrated in a small number of States and a small number of species. Elephants dominate the fatality statistics. Between 2019 and 2023, Odisha recorded 624 human deaths from elephant conflict, Jharkhand 474, West Bengal 436, Assam 383, Chhattisgarh 303, Tamil Nadu 256, Karnataka 160 and Kerala 124 (MoEFCC, 2024). The geography of these figures reflects the eastern and central Indian elephant range, where mining, industrialization and the fragmentation of the Saranda–Dalma–Simlipal corridor system have pushed elephants into settled country (Roy et al., 2025), and it parallels the threshold effects that Chartier et al. (2011) identified for habitat loss and elephant conflict in Assam.

Tiger-related fatalities follow a different geography. Of deaths recorded between 2014 and 2024, Maharashtra accounted for 269, Uttar Pradesh for 111 and West Bengal for 85, these three States together contributing about three-quarters of the national total (NTCA, 2024). Madhya Pradesh, which holds the largest tiger population in the country (Jhala et al., 2018), recorded comparatively few, a reminder that conflict intensity is determined by the configuration of habitat and land use rather than by animal numbers alone. Figures 1 and 2 summarize these distributions.

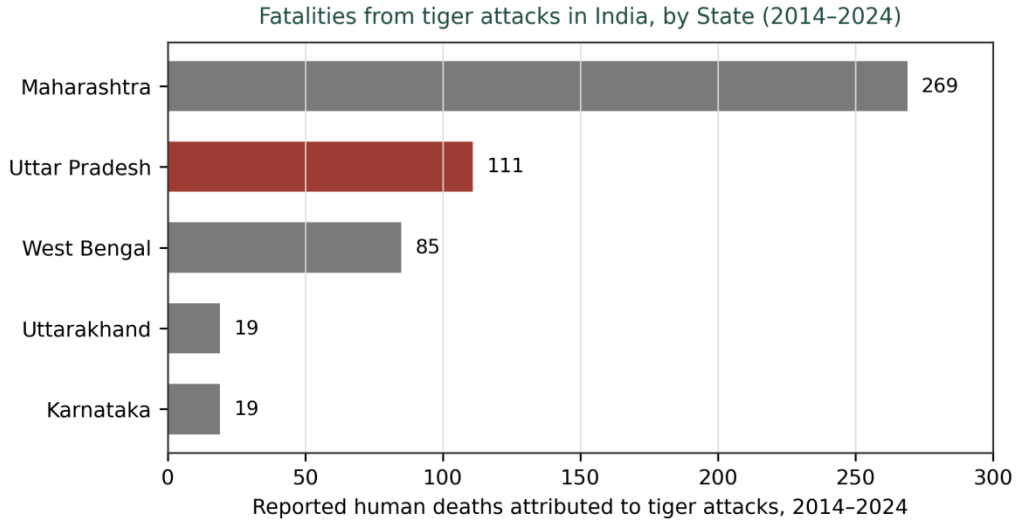

Fig. 1 Reported human deaths attributed to tiger attacks in India by State, 2014–2024. Uttar Pradesh, highlighted, records the second highest figure nationally. Compiled from returns tabled in Parliament (NTCA, 2024)

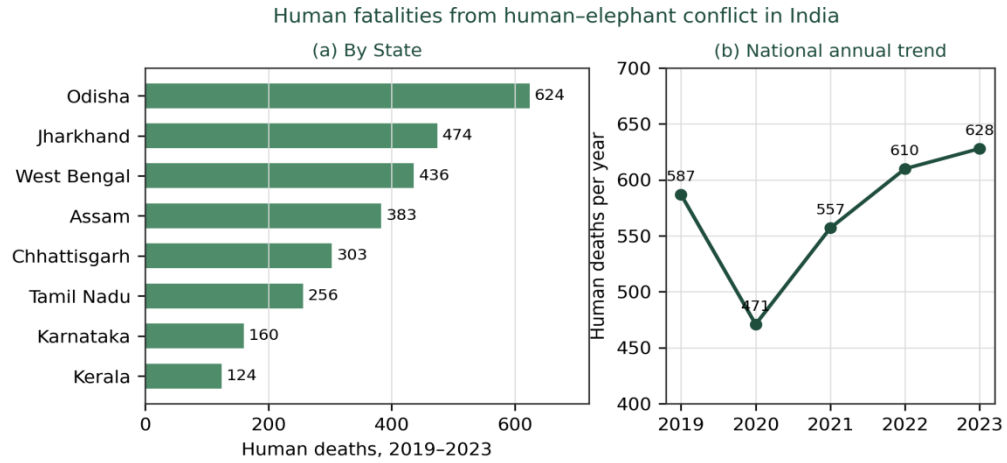

Fig. 2 Human fatalities from human–elephant conflict in India. a State-wise totals for 2019–2023. b National annual trend over the same period, rising from 587 deaths in 2019 to 628 in 2023. Compiled from replies tabled in the Rajya Sabha (MoEFCC, 2024)

Beneath the fatality statistics lies a much larger volume of economic damage. Karanth et al. (2018) examined compensation records from 2010 to 2015 and found that of 78,656 conflict incidents reported from eighteen States in 2012 and 2013, 73.4% involved crop loss or property damage, 20% livestock predation, 6.2% human injury and 0.4% human death. Twenty-two of the then twenty-nine States compensated for crop loss, twenty-six for livestock depredation and twenty-eight for human injury or death, but rates, eligibility criteria and procedures varied so widely between States that the same loss could attract very different treatment on either side of an administrative boundary. Transaction costs of claiming were frequently high relative to the payment, which suppressed reporting and, by extension, the official record. The same authors had earlier shown for a central Indian reserve that 73% of surveyed households reported crop loss and 33% livestock loss in a single year, while fewer than 8% reported human injury or death (Karanth et al., 2012), which gives some sense of the true shape of the distribution beneath the mortality returns.

Two policy responses have emerged at the State level. Uttar Pradesh formally recognized human–wildlife conflict as a State Disaster in 2018, bringing deaths and injuries resulting from interactions with specified wild animals within the State's disaster-relief framework and enabling ex-gratia assistance through the State Disaster Response Fund (SDRF). The 17 October 2018 notification specifically included tiger, lion, leopard, wolf, hyena, crocodile, elephant, rhinoceros and wild boar under the notified human–wildlife conflict category. Kerala subsequently declared human–animal conflict a State-specific disaster in 2024, thereby bringing the State Disaster Management Authority into the formal response chain (Raghunath, 2024). In the same year, Uttar Pradesh took a more geographically targeted step during the wolf-attack episode by designating Mahsi tehsil of Bahraich district as a wildlife disaster area, with the objective of expediting ex-gratia payments and simplifying decision-making regarding the capture of conflict animals (PTI, 2024a). Separately, the Ministry of Environment, Forest and Climate Change has invoked the vermin provision under Section 62 of the Wild Life (Protection) Act to permit the culling of nilgai and wild pig in Bihar in 2015 (MoEFCC, 2015), followed subsequently by wild pig in Uttarakhand and rhesus macaque in Himachal Pradesh (Anand and Radhakrishna, 2017). However, evidence that such declarations or lethal-control interventions have substantially reduced crop damage remains limited. The Bihar intervention, during which approximately 250 nilgai were shot within three days, also generated considerable public controversy (Down To Earth, 2016).

Table 3 Principal conflict species in India, the dominant form of interaction, the States most affected and the current national management instrument

Species	Dominant conflict form	States most affected	Principal management instrument
Asian elephant *Elephas maximus*	Crop and property damage; human fatality	Odisha, Jharkhand, West Bengal, Assam, Chhattisgarh, Tamil Nadu, Karnataka, Kerala	Project Elephant; corridor securing; early warning networks; ex-gratia payment
Tiger *Panthera tigris*	Human fatality; livestock depredation	Maharashtra, Uttar Pradesh, West Bengal	NTCA standard operating procedures for problem animals; rapid response teams; buffer management

Species	Dominant conflict form	States most affected	Principal management instrument
Leopard *Panthera pardus*	Livestock depredation; human injury and fatality	Maharashtra, Uttarakhand, Himachal Pradesh, Uttar Pradesh, Rajasthan	Capture and translocation (evidence against); ex-gratia payment; behavioural advisory
Sloth bear *Melursus ursinus*	Severe human injury	Madhya Pradesh, Chhattisgarh, Odisha, Maharashtra, Gujarat, Jharkhand	Awareness and behavioural advisory; habitat management
Indian wolf *Canis lupus pallipes*	Attacks on children; livestock depredation	Uttar Pradesh, Bihar, Maharashtra, Gujarat, Madhya Pradesh	Individual-animal capture; village-level protective measures
Nilgai *Boselaphus tragocamelus*	Crop damage	Uttar Pradesh, Bihar, Haryana, Rajasthan, Madhya Pradesh	Vermin declarations; fencing and trenching; crop-choice advisory
Wild pig *Sus scrofa*	Crop damage	Nationwide; acute in Uttarakhand, Himachal Pradesh, Kerala, Karnataka	Vermin declarations; fencing; community guarding
Rhesus *macaque Macaca mulatta*	Crop and property damage; urban nuisance	Himachal Pradesh, Uttarakhand, Uttar Pradesh, Delhi	Sterilisation; translocation; waste management
Mugger *Crocodylus palustris*	Human injury and fatality; livestock loss	Gujarat, Odisha, Uttar Pradesh, Rajasthan	Rescue and relocation; riverbank awareness
Venomous snakes	Human fatality and morbidity	Nationwide; highest burden in Uttar Pradesh, Bihar, Madhya Pradesh	Antivenom supply; health-system response; community education

6. The Terai of Uttar Pradesh

6.1 The landscape

The Uttar Pradesh Terai is a narrow alluvial belt lying between the Siwalik foothills and the Gangetic plain, running roughly 400 km along the international boundary with Nepal from Bijnor in the west to Maharajganj in the east. Its natural vegetation is a mosaic of Sal (*Shorea robusta)* forest, moist mixed deciduous forest, tall wet grassland and seasonally inundated swamp, classified within the North Indian moist deciduous and associated seral types (Champion and Seth, 1968). The protected areas of the belt are listed in Table 4 and shown schematically in Fig. 3. Dudhwa Tiger Reserve, comprising Dudhwa National Park together with Kishanpur and Katarniaghat wildlife sanctuaries and the intervening buffer, adjoins Shuklaphanta and Bardia national parks in Nepal; Pilibhit Tiger Reserve to the west connects with Kishanpur and, through the Lagga–Bagga block, with Shuklaphanta (Johnsingh et al., 2004; Wikramanayake et al., 2011).

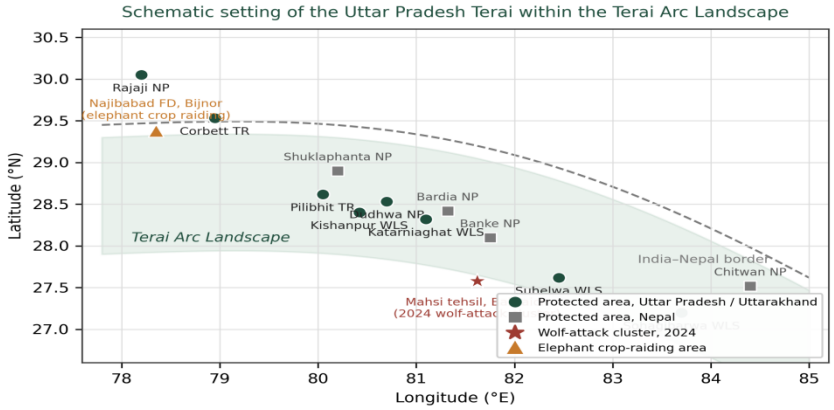

Fig. 3 Schematic setting of the Uttar Pradesh Terai within the Terai Arc Landscape, showing the principal protected areas on the Indian and Nepalese sides of the border and the two localities discussed in detail in the text. Positions are approximate and the figure is not drawn to scale

What distinguishes this landscape from most other tiger-bearing tracts in India is the character of the surrounding matrix. There is no gradient of degraded forest, scrub and marginal cultivation between the reserve boundary and the settled countryside. The forest edge is generally abrupt, and beyond it lies some of the most intensively farmed land in India, with more than 10,000 settlements dispersed across the landscape and human densities of the order of 500 km-2 (Chatterjee et al. 2022). Sugarcane occupies about a third of the sown area in Pilibhit district (Wildlife Trust of India, 2018). Between about June and the start of crushing in November, a mature sugarcane field is two to three meters tall, dense, permanently shaded, cool and reliably moist, and it holds nilgai, wild pig and feral cattle. From the point of view of a tiger, it is functionally forest, and tigers use it as such.

Table 4 Protected areas and principal forest divisions of the Uttar Pradesh Terai, with the dominant conflict species recorded in each

Protected area / division	Area (km2, approx.)	District(s)	Dominant conflict species and interaction
Dudhwa National Park	490	Lakhimpur Kheri	Tiger and leopard (livestock, human fatality); elephant and nilgai (crop); wild pig
Kishanpur Wildlife Sanctuary	204	Lakhimpur Kheri	Tiger (human fatality in adjoining sugarcane); swamp deer and nilgai (crop)
Katarniaghat Wildlife Sanctuary	400	Bahraich	Tiger and leopard; mugger and gharial along the Girwa; elephant crossing from Bardia
Pilibhit Tiger Reserve	730	Pilibhit, Lakhimpur Kheri, Shahjahanpur	Tiger (highest human fatality density in the State); leopard; nilgai and wild pig
North Kheri and South Kheri Forest Divisions (buffer)	709	Lakhimpur Kheri	Tiger dispersal into sugarcane; leopard; wild pig and nilgai
Suhelwa Wildlife Sanctuary	452	Balrampur, Shrawasti, Gonda	Leopard; sloth bear; wild pig; occasional tiger
Sohagibarwa Wildlife Sanctuary	428	Maharajganj	Tiger and leopard; elephant movement from Nepal; nilgai
Najibabad and adjoining divisions	390	Bijnor	Elephant crop raiding (principal species); nilgai; leopard
Ghaghara and Saryu floodplain (unprotected)	1,550	Bahraich, Gonda, Shrawasti, Barabanki	Indian wolf (attacks on children); jackal; nilgai and wild pig
Hastinapur Wildlife Sanctuary	2,073	Meerut, Bijnor, Muzaffarnagar, Hapur, Amroha	Nilgai and wild pig (crop); swamp deer; occasional leopard

6.2 Tiger

Human–tiger conflict in the Dudhwa–Pilibhit landscape is the best documented of the conflicts discussed here, though the literature remains sparse. Chatterjee et al. (2022) recorded a mean of 7.4 negative interactions per year (SD 5.8, range 1–20) leading directly to human death or injury across the landscape, and modelled the spatial predictors of those interactions. Their principal finding, consistent with work in Chitwan (Lamichhane et al., 2018) and in central India (Karanth et al., 2012), is that risk is not distributed evenly along the forest boundary but concentrates in identifiable pockets defined by the configuration of crop cover, water and forest edge.

Analysis by the Wildlife Trust of India (2018) found that about 54.8% of recorded tiger attacks in the Pilibhit landscape occurred inside forest or on the immediate fringe and a further 31.5% in crop fields, predominantly sugarcane; the same figures are reproduced by Siva (2020). Approximately 80% of victims were men, and the majority were engaged in firewood or minor forest produce collection, farm work, livestock grazing or open defecation at the time of the attack (Wildlife Trust of India, 2018). These proportions are summarized in Fig. 4. The pattern is not that of predation on humans as prey. It is the pattern of accidental encounter at close quarters in

dense cover, which is precisely what sugarcane provides. Forest officers working in Pilibhit and Lakhimpur Kheri have made this point repeatedly, noting that most fatal incidents occur within 100–300 m of the forest fringe, that the tiger frequently abandons the body, and that consumption, where it occurs, generally follows a delay in recovering the victim rather than indicating predatory intent (Indian Masterminds, 2023; Down To Earth, 2025).

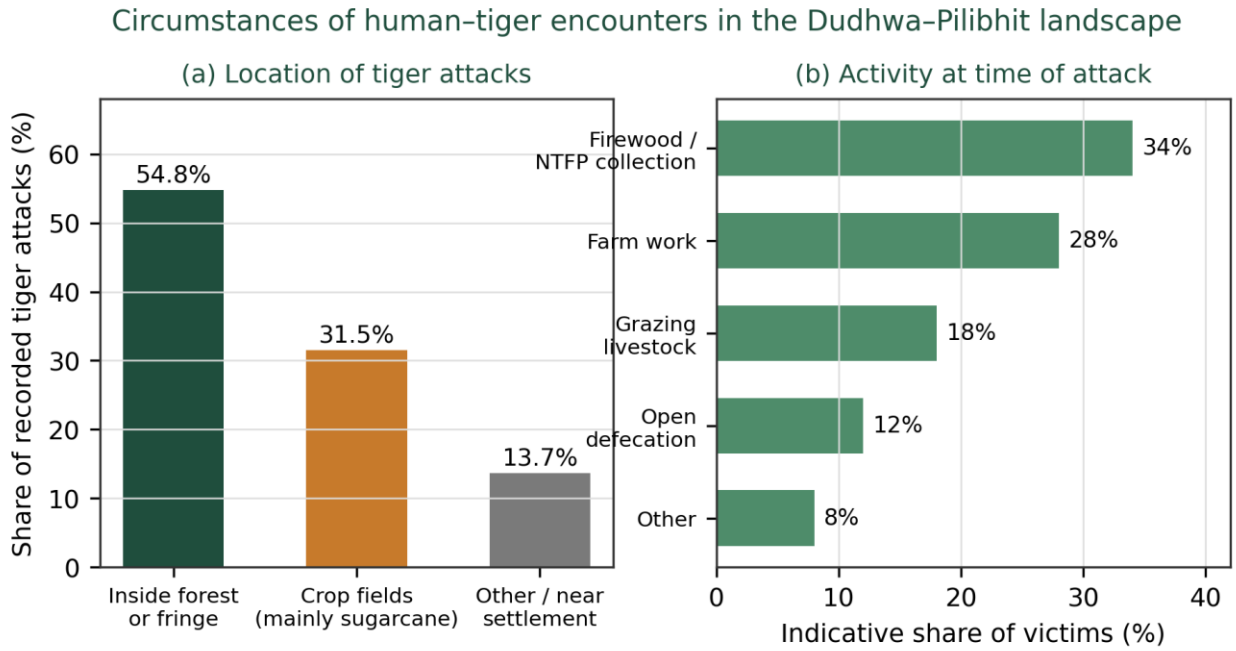

Fig. 4 Circumstances of human–tiger encounters in the Dudhwa–Pilibhit landscape. a Location of recorded attacks, showing the dominance of forest and forest-fringe incidents followed by crop fields. b Indicative distribution of victims by activity at the time of attack. Panel a follows the analysis of Wildlife Trust of India (2018); panel b is indicative and derived from the descriptive accounts in Wildlife Trust of India (2018) and Indian Masterminds (2023)

Twenty-seven people were killed by tigers in and around Pilibhit Tiger Reserve between November 2016 and early 2020, in a reserve of about 730 km2 (Hindustan Times, 2020). In 2020 the State forest department gave in-principle approval to a proposal to relocate about ten tigers that had established themselves in sugarcane outside the reserve boundary near Amaria block, some 18 km from the reserve, on the reasoning that the core area had reached saturation and that subordinate and older animals were being displaced into the agricultural matrix (Hindustan Times, 2020). Whether translocation of this kind achieves its objective is doubtful on the available evidence. Athreya et al. (2011) showed for leopards in Junnar, Maharashtra, that a programme of capture and release into adjoining forest was followed by a rise in attacks on people from about four per year to seventeen, an increase of 325%, together with a comparable rise in livestock attacks. There is no reason to assume tigers behave differently, and the precautionary reading of the Junnar result is that displacement into unfamiliar territory increases rather than decreases risk.

One further feature of the Pilibhit record bears directly on the reliability of conflict statistics. A report submitted to the National Tiger Conservation Authority by the Wildlife Crime Control Bureau alleged that in some villages bodies were being moved from inside the reserve to adjacent fields before being reported, because ex-gratia payment is not made when a death occurs within the tiger reserve (Siva, 2020). The allegation has not been quantified and should be treated with caution, but the incentive structure it describes is real, and any analysis of conflict location data from this landscape must acknowledge the possibility of reporting bias introduced by the compensation rule itself. Fernández-Gil et al. (2016) documented an analogous divergence between reported and actual damage in Spain, and the general lesson holds here.

6.3 Leopard

Leopards occur throughout the Terai and in the ravine and canal-side country of central and western Uttar Pradesh, and generate a larger number of incidents than tigers although a smaller number of deaths. There is no published leopard-conflict study specific to Uttar Pradesh comparable to those available for Maharashtra, Uttarakhand or Himachal Pradesh, and this is among the clearest gaps in the State evidence base. The applicable findings therefore come from elsewhere. Athreya et al. (2013) established that leopards persist at high density in intensively farmed landscapes with almost no forest and no wild ungulates, subsisting largely on domestic animals, and Athreya et al. (2016) confirmed by dietary analysis that domestic dogs and small livestock dominate the diet in such settings while conflict remains low relative to leopard density. Kshettry et al. (2017, 2018) reported the same for the tea-plantation landscape of northern West Bengal, where leopards breed within the plantations themselves. Naha et al. (2018, 2020) found across the Indian Himalayan region that conflict clustered where forest cover was

fragmented and livestock density high, and that risk maps built from these variables predicted attack locations with useful accuracy.

The management implication is the same one that emerges from the tiger literature. Removing individual leopards from human-dominated landscapes rarely reduces conflict, because vacated territory is reoccupied and because the translocated animal creates a new problem where it is released (Athreya et al., 2011). Interventions that alter human behaviour, particularly securing livestock at night and avoiding certain activities after dark near cover, have better evidence behind them than any form of animal removal (Dickman, 2010; Ogada et al., 2003).

6.4 Indian wolf

The wolf occupies a peculiar place in the conflict record of Uttar Pradesh. It receives almost no research attention in ordinary years and then, at intervals of roughly a decade, produces an episode of child predation of a severity unmatched anywhere else in the modern world. The best documented earlier episode occurred in Jaunpur and adjoining districts of eastern Uttar Pradesh in 1996 and 1997, when wolves were held responsible for the deaths of about 42 children; Jhala (1997) analyzed that episode in detail and remains the principal scientific source on the subject. Further clusters were subsequently reported from Rae Bareli in 2000 and from Gonda and Balrampur districts (Chandra, 2024).

The most recent episode began on 10 March 2024 in Mishrampurwa village of Mahsi tehsil, Bahraich district, with the killing of a three-year-old girl, and continued through a second fatality later that month before a pause of several months. Attacks resumed on 17 July with the death of an infant in Sikandarpur and intensified through August. By early September 2024 at least ten people had been killed, nine of them children between one and eight years of age and one a woman of about 45, and more than thirty had been injured across some thirty to fifty villages along the Ghaghara floodplain (Organiser, 2024; National Herald, 2024; Chandra, 2024). The State government launched a capture operation, styled Operation Bhediya, on 17 July; five wolves of a pack believed to number six were captured between late August and 10 September, and the sixth animal was killed by villagers on 6 October (National Herald, 2024; PTI, 2024b). In early September the government designated the affected area a wildlife disaster zone in order to expedite ex-gratia payment and to remove procedural obstacles to decisions on capture (PTI, 2024a). The chronology is summarised in Fig. 5.

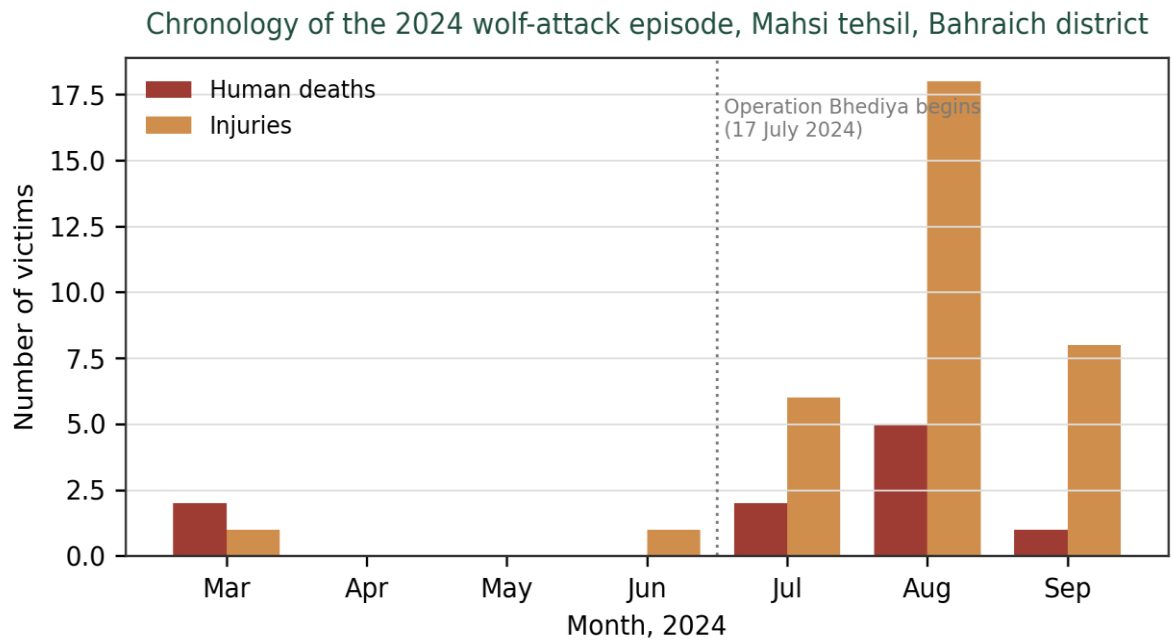

Fig. 5 Chronology of the 2024 wolf-attack episode in Mahsi tehsil, Bahraich district, showing reported human deaths and injuries by month and the date on which the State capture operation began. Compiled from official statements and consistent contemporaneous reporting (Organiser, 2024; National Herald, 2024; PTI, 2024a, b; Chandra, 2024). Monthly injury figures are approximate

Several features of this episode are worth isolating. The victims were overwhelmingly small children, taken at night from open verandahs or from beside sleeping mothers in single-room dwellings without secure doors. The affected villages lie on the floodplain of the Ghaghara and Saryu, which had been in spate, and officials attributed the movement of wolves into settlements in part to inundation of denning and foraging habitat in the riverine grasslands (Organiser, 2024). The Indian wolf in this landscape has no protected area of its own; it occupies an unprotected mosaic of degraded grassland, tamarisk scrub, sandbanks and cultivation in which its natural prey base is largely gone and in which livestock carcasses and feral dogs form much of its diet, a situation Jhala (1997) had already described for the 1996–1997 cluster. Conflict here is not a spillover from a protected area, as it is in

Pilibhit. It is the ordinary condition of a Schedule I carnivore living permanently outside the conservation estate, and it is invisible to management until it becomes catastrophic.
The scientific literature on this species and this problem remains almost non-existent. There is no published population estimate for wolves in the Uttar Pradesh floodplains, no recent dietary study, no assessment of denning habitat, and no formal comparison of the 1996–1997 data with the 2024 record. Given that the State has now experienced at least four such episodes in three decades, this is a striking omission and one a State forest department is well placed to correct.

6.5 Asian elephant

Elephants in Uttar Pradesh are largely confined to the western Terai, in Bijnor and adjoining districts contiguous with the Rajaji–Corbett landscape of Uttarakhand, with occasional movement into Sohagibarwa and the eastern Terai from Nepal. Rathi et al. (2020), working in Najibabad Forest Division in Bijnor, found that elephants were the species most responsible for crop raiding, followed by nilgai, and that sugarcane fields nearer the forest edge were raided more heavily than rice, wheat or vegetables. The pattern matches that reported for the adjoining Rajaji–Corbett landscape by Rani et al. (2024), who found that households growing a greater diversity of crops close to the dwelling experienced more elephant interaction and that conflict concentrated at lower elevations with higher human density. Both findings are consistent with the southern Indian evidence assembled by Gubbi et al. (2014), who showed that conflict distribution around the largest Asian elephant population in the world was determined by the geometry of the forest boundary rather than by elephant abundance.
The scale of elephant conflict in Uttar Pradesh is small compared with Odisha or Assam, but the direction of travel matters. Elephant movement across the Uttarakhand boundary and across the international border with Nepal is increasing as corridors elsewhere in the Terai Arc are consolidated (Wikramanayake et al., 2011), and the western Uttar Pradesh districts through which those movements pass are among the most intensively cultivated in the State. In the adjoining Uttarakhand Terai, total loss of a sugarcane crop to wild animals, elephants among them, is compensated at ₹25,000 per hectare under the State's human–wildlife conflict relief framework (Hindustan Times, 2021). In Uttar Pradesh, crop losses caused by elephants and other large wildlife may be met through the State's disaster-relief mechanisms (State Disaster Response Fund, Uttar Pradesh), but a wildlife-specific, crop-yield-based rate comparable to the Uttarakhand provision could not be established from the State-level records available. The adequacy of compensation relative to measured sugarcane yield loss therefore remains untested.

6.6 Wild herbivores: nilgai, wild pig and deer

By any measure of aggregate economic loss, nilgai and wild pig are the most important conflict species in Uttar Pradesh, and they receive the least scientific attention of any group considered here. Nilgai are abundant across the agricultural plain far beyond the forest belt, thrive on standing crops, are large enough to cause serious damage in a single night, and enjoy a degree of cultural protection that makes lethal control socially difficult in much of the State. Wild pig is similarly widespread and causes damage that is concentrated, repeated and hard to prevent with the fencing available to smallholders.
The Ministry of Environment, Forest and Climate Change has permitted culling of these species elsewhere by declaring them vermin under section 62 of the Wild Life (Protection) Act, beginning with nilgai and wild pig in Bihar (MoEFCC, 2015) and continuing with wild pig in Uttarakhand and rhesus macaque in Himachal Pradesh. Anand and Radhakrishna (2017) questioned whether the escalation in reported conflict that these declarations were intended to address was real or partly an artefact of increased reporting, and observed that such declarations were being made without any baseline assessment of damage. No systematic assessment of crop loss to nilgai or wild pig exists for Uttar Pradesh, which means that neither the case for culling nor the case against it can currently be made on evidence generated within the State. Studies from adjoining regions, notably Rao et al. (2002) in the Nanda Devi Biosphere Reserve and Baduni et al. (2025) on wild pig damage in the Central Himalaya, provide method templates that could be applied directly.

6.7 Rhesus macaque and other primates

Rhesus macaque conflict in Uttar Pradesh takes two distinct forms. In the rural districts it is a crop and household-property problem comparable to that documented for Himachal Pradesh by Saraswat et al. (2015), who found that farmer attitudes to the species were shaped as much by its religious status as by the damage it caused. Chauhan and Pirta (2010) reported the parallel urban pattern for Shimla, where provisioning and uncontrolled organic waste sustain large commensal troops. The one substantial published intervention from Uttar Pradesh remains the mass translocation of commensal macaques from Vrindaban described by Imam et al. (2002), which achieved its immediate objective but did not address the food subsidy that had created the aggregation in the first place. Sterilization programmes have since been attempted in several northern States without published evaluation of their demographic effect.

6.8 Sloth bear and other carnivores

Sloth bears occur in Suhelwa and in the southern forest tracts of the State and cause a small number of extremely severe injuries. The species carries the highest severity index of any Indian mammal in terms of the probability of serious injury given an encounter (Rajpurohit and Krausman, 2000; Dhamorikar et al., 2017). The Indian literature on sloth bear conflict is concentrated in Chhattisgarh (Bargali et al., 2005), Odisha (Debata et al., 2017),

Gujarat (Garcia et al., 2016) and central India (Dhamorikar et al., 2017), and none of it is specific to Uttar Pradesh; the nearest Himalayan analogue is the Asiatic black bear work of Charoo et al. (2011) in Kashmir. Jackal, striped hyena and jungle cat generate poultry and small-livestock losses that are almost entirely unrecorded because they fall below compensation thresholds.

6.9 Crocodilians and snakebite

Mugger *Crocodylus palustris* and gharial *Gavialis gangeticus* occur in the Girwa, Sharda, Ghaghara and Chambal systems. Mugger attacks on people and livestock at bathing and washing points are reported periodically from the Terai rivers and the Chambal ravines, and the early account of Kar and Bustard (1983) from Odisha remains the standard reference for the pattern of such attacks in India. No systematic record exists for Uttar Pradesh.

Snakebite deserves particular emphasis because it is by a very wide margin the largest cause of wildlife-attributable human mortality in the State and is almost never counted as human–wildlife conflict. Using a nationally representative mortality survey, Mohapatra et al. (2011) estimated approximately 45,900 snakebite deaths in India in 2005, with Uttar Pradesh contributing the largest single share. Suraweera et al. (2020) subsequently estimated about 1.2 million snakebite deaths in India between 2000 and 2019, an average of roughly 58,000 per year, again with Uttar Pradesh among the States carrying the heaviest burden. Set against these figures, the ten deaths of the Bahraich wolf episode and the 111 tiger deaths across a decade are very small numbers. This is not an argument for reducing attention to large carnivores, whose conflicts carry political and conservation consequences out of proportion to their body count, but it is an argument for recognising that a state policy on human–wildlife conflict which omits snakebite omits most of the problem.

6.10 Regulated lethal control of nilgai

Nilgai *Boselaphus tragocamelus* is one of the major crop-raiding mammals involved in human–wildlife conflict in Uttar Pradesh. In response to substantial agricultural damage, the species has historically been subjected to regulated lethal control under the legal framework of the Wild Life (Protection) Act, 1972. Section 11(1)(b) of the Act provides for the issue of a written order permitting the hunting of a wild animal, or group of animals, that is causing damage to standing crops, subject to the conditions specified in the Act (Government of India, 1972). The Wildlife Institute of India has documented that Uttar Pradesh, along with Uttarakhand, Haryana, Madhya Pradesh and Gujarat, has exercised this provision in managing agricultural conflict involving nilgai (Wildlife Institute of India, undated). That assessment further notes that although lethal control is legally available, its use for nilgai is complicated by socio-cultural considerations and by restrictions on the disposal of carcasses. Nilgai management in Uttar Pradesh is therefore a case of regulated lethal control aimed at mitigating crop depredation rather than of unrestricted culling, and it illustrates the difficult balance between wildlife conservation, agricultural protection and socio-cultural values.

7. Drivers

The drivers of conflict in the Uttar Pradesh Terai are neither mysterious nor unique, and they interact in ways summarised in Fig. 6.

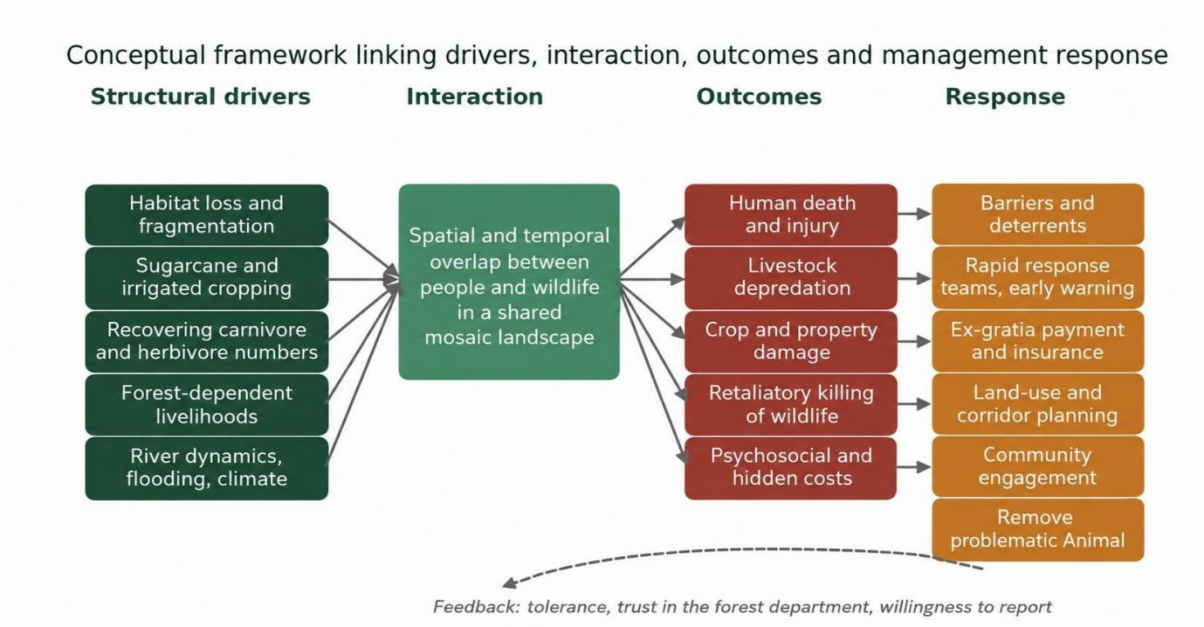

Fig. 6 Conceptual framework linking structural drivers, the human–wildlife interaction, its outcomes and the available management responses, with the feedback loop operating through community tolerance and institutional trust. Synthesized from Dickman (2010), Nyhus (2016) and the regional evidence reviewed here

The first driver is the structure of the land-use matrix. Sugarcane is the decisive variable in the Dudhwa–Pilibhit landscape, and its role is architectural rather than nutritional. A tall, dense, irrigated crop grown to the forest boundary abolishes the transitional zone that would otherwise allow people and tigers to detect one another at a distance. Comparable effects have been described for oil palm and forest-frontier agriculture in Sumatra (Linkie et al., 2007) and for tea in northern West Bengal, where Kshettry et al. (2017) showed that leopards use plantation cover as breeding habitat and that human injury rates track the distribution of that cover rather than of forest.

The second is population recovery. Tiger numbers in Pilibhit and Dudhwa have risen substantially since the early 2000s (Jhala et al., 2018), and the Nepalese evidence from Bardia and Chitwan shows clearly that conflict incidence tracks megafauna recovery where the surrounding matrix is settled (Neupane et al., 2025). A reserve at carrying capacity exports subadult and displaced animals into whatever lies beyond its boundary. In this landscape what lies beyond the boundary is sugarcane and villages, and the export is therefore directly into the human sphere.

The third is the pattern of livelihood dependence. The great majority of tiger and leopard victims in the Terai were engaged in fuelwood collection, grass cutting, minor forest produce collection, grazing or field work at the time of attack (Wildlife Trust of India, 2018). Exposure is a function of how often, at what hours and in what circumstances people must enter cover, and it therefore responds to interventions such as fuel substitution, fodder plots outside the forest and household sanitation as much as to anything done to the animals. Ogra and Badola (2008) made the same argument for the Uttarakhand hills.

The fourth is hydrology. The Ghaghara and Saryu floodplains flood extensively in the monsoon, displacing wolves, jackals, wild pig and nilgai into settlements at exactly the season when field labour is heaviest and when families sleep outdoors. The 2024 Bahraich cluster coincided with a period of high river discharge, and officials linked the two directly (Organiser, 2024).

The fifth is institutional. Compensation rules shape the record, as the Pilibhit case illustrates (Siva, 2020), and delays or rejections in payment convert a material loss into a grievance against the forest department. Ogra and Badola (2008) showed for Uttarakhand that the transaction cost of claiming frequently exceeded the sum recovered, and that the perceived fairness of the process mattered more to attitudes than the amount paid. Karanth and Kudalkar (2017) reached the same conclusion from a much larger Indian sample. This driver is amenable to administrative reform in a way that most of the others are not.

8. Mitigation: what the evidence supports

The intervention literature is uneven. A small number of measures have been tested with control comparisons and multi-year monitoring; a much larger number are in routine use with no evaluation at all. Table 5 summarises the position for measures relevant to the Uttar Pradesh Terai.

Table 5 Mitigation measures relevant to the Uttar Pradesh Terai, with an assessment of the strength of supporting evidence

Measure	Mechanism and application	Evidence of effectiveness	Applicability in the UP Terai	Key sources
Predator-proof night enclosures	Reinforced or roofed corrals prevent carnivore entry at the point of highest livestock vulnerability	Strong. Controlled work in East Africa shows large reductions in loss and in retaliatory killing; corral reinforcement shows the same in the Indian trans-Himalaya	High. Directly transferable to leopard and wolf depredation in Terai villages	Ogada et al. (2003); Lichtenfeld et al. (2015); Jackson and Wangchuk (2004)
Village-level electric fencing	Fencing settlements and standing crops rather than the protected area itself	Moderate to strong for elephants where placement matches home ranges and maintenance is funded	Moderate. Suitable for the Bijnor elephant belt; of little use against tiger	Fernando et al. (2005, 2021)
Beehive fencing	Live deterrent barrier exploiting elephant avoidance of disturbed	Strong for African elephant over multi-year trials; limited	Worth piloting in Bijnor and Maharajganj	King et al. (2011, 2017)

Measure	Mechanism and application	Evidence of effectiveness	Applicability in the UP Terai	Key sources
	bees, with honey as co-benefit	testing on Asian elephant		
Rapid response teams with veterinary support	Trained teams with tranquillizing capacity, drones, thermal imaging and camera traps deployed on report of a conflict animal	Moderate. Operational reporting indicates reduced escalation, but no controlled evaluation exists	High. Already in place; requires formal evaluation	Indian Masterminds (2023)
Capture and translocation of carnivores	Removal of an individual animal to distant forest	Evidence against. Junnar leopard translocation was followed by a 325% rise in attacks on people near release sites	Should be restricted to cases meeting NTCA criteria, with post-release monitoring	Athreya et al. (2011)
Vermin declaration and culling	Temporary removal of legal protection to permit killing of crop-raiding herbivores	Weak. No published demonstration of sustained damage reduction; substantial social controversy	Not supported by evidence in the absence of baseline damage assessment	MoEFCC (2015); Anand and Radhakrishna (2017)
Ex-gratia payment and interim relief	Cash payment for verified loss, sometimes with rapid on-the-spot interim relief	Mixed. Improves tolerance where payment is prompt and procedures simple; counterproductive where delayed or contested	High. The single most tractable administrative lever available	Karanth et al. (2018); Ogra and Badola (2008); Karanth and Kudalkar (2017)
Community livestock insurance	Premium-based village-managed schemes with local verification of claims	Moderate to strong in trans-Himalayan India, where retaliatory killing has effectively ceased in scheme villages	Worth trialling in Terai buffer villages	Mishra et al. (2003); Suryawanshi et al. (2013)
Early warning through mobile networks	SMS or application-based alerts when a collared or sighted animal approaches settlements	Moderate. Effective where network coverage and response protocols exist	High. Network coverage in the Terai is adequate	Rani et al. (2024); Badola et al. (2021)
Crop and cropping-pattern change	Substituting crops less attractive to raiders, or altering field layout near the forest edge	Weak to moderate. Widely recommended; rarely evaluated against yield and income	Politically difficult where sugarcane is tied to mill contracts	Rathi et al. (2020); Rani et al. (2024)
Household infrastructure for child safety	Secure doors, screened sleeping areas and solar lighting in wolf-affected villages	Not formally tested, but the mechanism is	High priority on the Ghaghara floodplain	Jhala (1997); Chandra (2024)

Measure	Mechanism and application	Evidence of effectiveness	Applicability in the UP Terai	Key sources
		direct and cost per household is low		
Fuel, fodder and sanitation substitution	Reducing the frequency with which people must enter cover	Indirect but well founded, since exposure is the proximate determinant of attack risk	High. Aligns with existing rural development programmes	Wildlife Trust of India (2018); Ogra and Badola (2008)

Three conclusions follow. First, the interventions with the strongest evidence are those that change what people and livestock do at night, not those that change where animals are. Second, the intervention most frequently demanded after a fatality, removal of the animal, is the one for which the evidence is worst (Athreya et al., 2011). Third, several measures already deployed in Uttar Pradesh, including the rapid response teams and the interim relief arrangements, have never been evaluated, and evaluating them would be inexpensive relative to their operating cost.

9. Policy, compensation and institutions

Management of human–wildlife conflict in India rests primarily with State governments, and the resulting variation is substantial. Karanth et al. (2018) documented inconsistency in eligibility, assessment procedure, payment rate and transaction cost across States, and noted that some States had no policy at all for particular categories of loss. Two structural reforms have been attempted recently. Declaration of human–animal conflict as a State-specific disaster, adopted by Kerala in 2024, brings disaster-management machinery and its faster financial procedures into the response chain (Raghunath, 2024). The narrower designation of a wildlife disaster area, used by Uttar Pradesh in Bahraich in the same year, achieves a similar acceleration for a defined locality and a defined episode (PTI, 2024a).

The Uttar Pradesh case is instructive because it shows both the value and the limits of the instrument. Designation undoubtedly accelerated ex-gratia payment to bereaved families and removed procedural friction from decisions about capturing the animals. It did nothing about the conditions that produced the episode, namely a Schedule I carnivore living permanently outside the protected-area system in a flood-prone landscape with no prey base and no habitat management, alongside households whose dwellings offer no physical protection to sleeping children. Disaster designation is a response to an event. The wolf problem in the eastern Terai is a standing condition, and Jhala (1997) had described its essential features nearly three decades before the 2024 cluster.

A second institutional issue concerns the boundary between compensation and prevention. The international literature is consistent in finding that payment alone rarely improves tolerance durably and that schemes linking payment to adoption of preventive measures perform better (Karanth and Kudalkar, 2017; Badola et al., 2021). The community insurance model developed in the Indian trans-Himalaya, in which villagers set and collect their own premiums and verify their own claims, has the additional advantage of transferring verification cost and moral hazard to the community, and it has been associated with the effective cessation of retaliatory killing of snow leopards and wolves in participating villages (Mishra et al., 2003; Suryawanshi et al., 2013). Whether the model transfers to the Terai, where livestock holdings are smaller and more dispersed and where the principal loss is to crops rather than stock, is an open question worth testing.

A third issue is transboundary. Dudhwa, Kishanpur, Katarniaghat and Pilibhit form a single functional unit with Shuklaphanta, Bardia and Banke across the border, and tigers, elephants and rhinoceros move between them (Wikramanayake et al., 2011). Nepal has generated a substantially larger body of conflict research on its side of the same landscape (Acharya et al., 2016; Lamichhane et al., 2018; Paudel et al., 2024; Neupane et al., 2025) for Joint monitoring protocols, shared incident databases and coordinated response arrangements would cost little and would improve the evidence base on both sides. Few successful studies have been conducted in management of elephant populations in West Bengal for mitigating man-elephant conflicts (Chowdhury et al., 1997).

10. Research priorities for Uttar Pradesh

The gaps identified in this review are unusually tractable, because most concern data that a State forest department already generates in the course of routine administration but does not compile, analyse or publish. Table 6 sets out priorities in order of feasibility.

Table 6 Research and monitoring priorities for human–wildlife conflict in Uttar Pradesh, ordered by feasibility

#	Priority	Rationale	Feasible approach
1	A single geo-referenced State conflict database	Incident records are held separately by division, reserve and district and are not analyzable as a whole. Without a common database no trend statement about Uttar Pradesh can be made with confidence (cf. Karanth et al., 2018)	Digitize ex-gratia and incident registers from 2010 onward with coordinates, species, activity of victim, land cover and outcome; publish an annual return
2	Ecology and status of the Indian wolf on the Ghaghara and Saryu floodplains	Four episodes of child predation in three decades, and no population estimate, dietary study or habitat assessment for the species in the State since Jhala (1997)	Camera trapping and sign survey along the floodplain; scat analysis; mapping of denning habitat against flood extent; retrospective analysis of the 1996–1997 and 2024 clusters
3	Quantified crop-loss assessment for nilgai and wild pig	These species impose the largest aggregate economic cost in the State and there is no baseline against which any control policy could be judged (Anand and Radhakrishna, 2017)	Paired-plot damage measurement across a distance-from-forest gradient in three districts, following Rao et al. (2002) and Baduni et al. (2025)
4	Evaluation of the existing rapid response teams	Teams operate at significant recurring cost with no assessment of their effect on escalation, capture outcome or public confidence	Before-and-after comparison of incident outcomes by division; response-time analysis; structured interviews in affected villages
5	Fine-scale risk mapping of the Dudhwa–Pilibhit interface	Attacks concentrate in identifiable pockets, and risk mapping has proved useful in the Himalaya and in Chitwan (Naha et al., 2020; Lamichhane et al., 2018)	Extend the modelling approach of Chatterjee et al. (2022) using sugarcane extent, canal and water-body distribution, settlement layout and land-cover change
6	Assessment of ex-gratia adequacy and transaction cost	Payment rates have not been tested against actual loss, and claim procedures have not been assessed for cost to the claimant (Ogra and Badola, 2008)	Household survey of claimants and non-claimants across three districts; comparison of assessed loss with payment received
7	Sugarcane as tiger habitat	The single most distinctive feature of conflict in this landscape has never been studied directly	Camera trapping within sugarcane blocks across the crop cycle; occupancy modelling against harvest timing; prey availability survey
8	Snakebite burden and health-system response	Snakebite kills more people in the State than all other wildlife combined and is absent from conflict policy (Mohapatra et al., 2011; Suraweera et al., 2020)	Link forest department records with district health data; map antivenom availability against high-incidence blocks
9	Transboundary incident sharing with Nepal	The landscape functions as one unit and the evidence base is currently split along the border	Joint protocol with Shuklaphanta, Bardia and Banke national parks; shared database and coordinated response
10	Psychosocial and hidden costs	Health, sleep, schooling and opportunity costs are recognised in the literature but never measured in this landscape	Structured household study following Barua et al. (2013) and Ogra (2008), with attention to the gendered distribution of cost

11. CONCLUSIONS

The Uttar Pradesh Terai is one of the most demanding coexistence landscapes in India and one of the least studied. The State records the second highest number of tiger-attack fatalities in the country, hosts the only population in the world that has repeatedly produced clusters of wolf predation on children, carries a very large and entirely unquantified burden of crop damage from nilgai and wild pig, and bears among the heaviest snakebite mortality of any Indian State. Yet the published research base for the State amounts to a handful of papers, and the most detailed single analysis of its human–tiger conflict concluded by noting how little had been published on the subject (Chatterjee et al., 2022).

The patterns visible in the available evidence are not unusual by international standards. Conflict concentrates at the forest edge, is mediated by the structure of the surrounding crop matrix, rises as protected populations recover, falls most heavily on households whose livelihoods require them to enter cover, and is worsened by compensation systems that are slow, inconsistent or perceived as unfair. Each of these findings has been documented repeatedly in Nepal, Sri Lanka, East Africa, Europe and Latin America. What is distinctive about the Uttar Pradesh Terai is the combination of an abrupt forest edge, one of the highest rural human densities in the world, and a dominant crop that functions for half the year as forest. SDG 15 (Life on Land) directly connects to human-wildlife conflict as a core challenge affecting both biodiversity preservation and human livelihoods.

The practical conclusion is that the most useful interventions available to a state forest department are not those directed at animals. They are the securing of livestock at night, the reduction of the frequency with which people must enter cover, the physical protection of sleeping children in wolf-affected floodplain villages, the acceleration and simplification of ex-gratia payment, and the systematic recording of incidents in a form that permits analysis. None of these requires new legislation or substantial new expenditure. What they require is that the information already passing through the department every year be collected in a usable form and acted upon.

CRediT authorship contribution statement

Sunil Chaudhary: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Visualization, Writing – original draft, Writing review and editing.

Monowar Alam Khalid: Data curation, Formal analysis, Writing review and editing.

Declaration of competing interest

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Data availability

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Note on sources

Where an event has not yet entered the peer-reviewed literature, the account rests on official statements and on contemporaneous reporting from multiple independent outlets, and this is indicated in the text and in the reference list. Casualty figures for the 2024 Bahraich episode are those stated by the District Magistrate and the Divisional Forest Officer at the time; the monthly breakdown in Fig. 5 is approximate.

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