



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
© Agronomy
NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; SP-9(9): 315-321
Received: 11-07-2026
Accepted: 15-08-2026

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Assessment of human-wildlife conflict through GIS And RS in India

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DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i9Sd.6597>

Abstract

Human-wildlife conflict (HWC) in India occurs through three principal pathways crop raiding, livestock depredation and human injury or death shaped by distinct ecological and socio-economic drivers. This review synthesizes peer-reviewed literature on these three categories across four nested spatial scales (India, Maharashtra, Vidarbha, and Akola district), comparing the species studied, methods used, data inputs, key findings and study extent reported in each. Rigorous spatial methodologies kernel density estimation, MaxEnt modelling and land-use/land-cover (LULC) covariate analysis are well established in specific landscapes including Junnar (Pune), Chandrapur, Keonjhar, Jharkhand, Assam and the Southern Western Ghats. By contrast, Akola district returns no published study, spatial across any of the two conflict categories. In addition to comparing spatial coverage, this review compiles the constraints and limitations that individual researchers reported within their own studies including reliance on non-spatial methods, single species or single-site focus and reporting bias in compensation based records into a single comparative table, offering a consolidated view of where existing methods fall short even in well-studied landscapes. We argue that closing the Akola gap requires both extending validated spatial methods to the district and addressing the methodological constraints already identified elsewhere in the literature.

Keywords: Geospatial analysis, crop raiding, livestock depredation, human-elephant conflict, human-leopard conflict, kernel density estimation

Introduction

India supports large populations of elephants, tigers and leopards while also having a very high human population. The close sharing of landscapes by people and wildlife has made human-wildlife conflict (HWC) an important concern for wildlife conservation, agriculture and the safety of rural communities. HWC in India is generally divided into three categories crop raiding by herbivores, livestock depredation by carnivores and human injury or death from direct encounters (Karanth, *et al.*, 2012) ^[14]. Crop raiding, mainly by elephants and wild boar, is the most widespread form of conflict and affects farmers across almost every state with forest cover nearby. Particularly elephants can destroy an entire season crop in a single night and damage tends to be worst in villages close to forest edges (Naha, *et al.*, 2020) ^[18]. In Central India, some of this damage goes unrecorded because farmers do not always file for compensation (Kshetry, *et al.*, 2021) ^[15].

Livestock depredation is mostly caused by leopards and tigers preying on cattle, goats and other domestic animals grazing near forest boundaries. This form of conflict is closely tied to how livestock is managed weak enclosures and free grazing near forest edges increase the risk significantly (Donikar *et al.*, 2011) ^[8]. Leopard presence alone does not always predict how severe depredation will be since some high-density leopard landscapes report comparatively low livestock losses (Athreya *et al.*, 2020) ^[2].

Human injury and death are the least common but most serious form of conflict, usually resulting from sudden encounters with elephants, tigers or leopards near forest-edge areas, water sources or during resource collection activities such as firewood gathering or non-timber forest product (Dhanwatey *et al.*, 2013) ^[7]. Despite being less frequent than crop, livestock losses and human casualties account for the largest overall economic and social cost of HWC in India

(Gulati *et al.*, 2021) ^[10].

For a long time, HWC in India was studied mainly through household surveys, incident counts and compensation records (Karanth *et al.*, 2012) ^[14]. These methods are useful for understanding local experiences but cannot easily predict where conflict is likely to occur next. Over the past two decades Geographic Information Systems (GIS) and remote sensing (RS) have made this possible, using tools such as kernel density estimation, hotspot analysis and MaxEnt modelling combined with land-use/land-cover (LULC) data. These methods have been applied successfully in places like Junnar (Habib *et al.*, 2020) ^[11], Keonjhar (Tripathy *et al.*, 2021) ^[26], Jharkhand (Roy *et al.*, 2025) ^[25], Assam (Athira *et al.*, 2026) ^[1] and the Southern Western Ghats (Pavithra *et al.*, 2025) ^[20].

This progress, however is uneven. Vidarbha, a region with well-documented conflict around Tadoba-Andhari Tiger Reserve (Bayani *et al.*, 2016; Dhanwatey *et al.*, 2013) ^[4, 7] and Pauni Wildlife Sanctuary (Jha, Jha, & Dahake, 2022) ^[13], has only one GIS based study, conducted in Chandrapur (Habib *et al.*, 2022) ^[12]. Akola district, part of this same region, has no GIS based study for any of the three conflict categories, though descriptive farmer perception evidence is now available for crop raiding specifically (Khekade *et al.*, 2025) ^[16].

Objective

To review GIS and remote sensing-based mapping of human-wildlife conflict across India, Maharashtra, Vidarbha and Akola.

Methodology

We collected English-language scholarly publications (journal articles, institutional reports and edited-volume book chapters) that referred to geospatial (GIS/remote sensing) approaches to mapping human-wildlife conflict (HWC) in India, as well as descriptive studies documenting crop raiding, livestock depredation and human injury/death in the absence of spatial modelling. We included articles focused primarily on GIS/RS-based hotspot mapping and those that documented conflict through non-spatial means such as household surveys or compensation-claim analysis, so that the two approaches could

be compared directly. We used the search engines Google Scholar, Web of Science and institutional repositories including the Wildlife Institute of India (WII) and the Indian Institute of Forest Management (IIFM).

We used the following keywords singly and in combination: human-wildlife conflict, human-elephant conflict, human-leopard conflict, crop raiding, livestock depredation, human injury wildlife, GIS, geospatial, remote sensing, hotspot mapping, kernel density estimation, MaxEnt and land-use/land-cover. We added geographic identifiers to these search terms, including India, Maharashtra, Vidarbha and Akola, as well as named landscapes appearing in the literature, such as Junnar, Chandrapur, Keonjhar, Jharkhand, Assam and the Western Ghats. We examined and included where appropriate related articles identified through citation linking on Google Scholar. We also searched for relevant literature cited within the articles returned by our initial searches (backward/snowball citation sampling).

No lower date restriction was applied included studies span 2004 to 2026. Publications were excluded if they addressed HWC outside India, focused solely on non-target taxa or were opinion pieces or commentaries without original data.

For each publication, we documented author names, year of publication, conflict category addressed (crop raiding, livestock depredation and human injury/death) and spatial scale addressed (India, Maharashtra, Vidarbha and Akola). We classified each publication methodology as either GIS/spatially explicit employing kernel density estimation, Optimized or Emerging Hotspot Analysis, MaxEnt species distribution modelling, or LULC-based covariate regression, typically implemented in ArcGIS or an equivalent platform or descriptive/non-spatial, relying on household surveys, damage assessments, incident-count reporting without formal spatial modelling. We further recorded for each publication the specific spatial technique used (where applicable) the landscape or protected area studied the species implicated in conflict and the time period covered by the data. Locations of GIS-based studies were noted by district and state to allow comparison across the four nested spatial scales examined in this review.

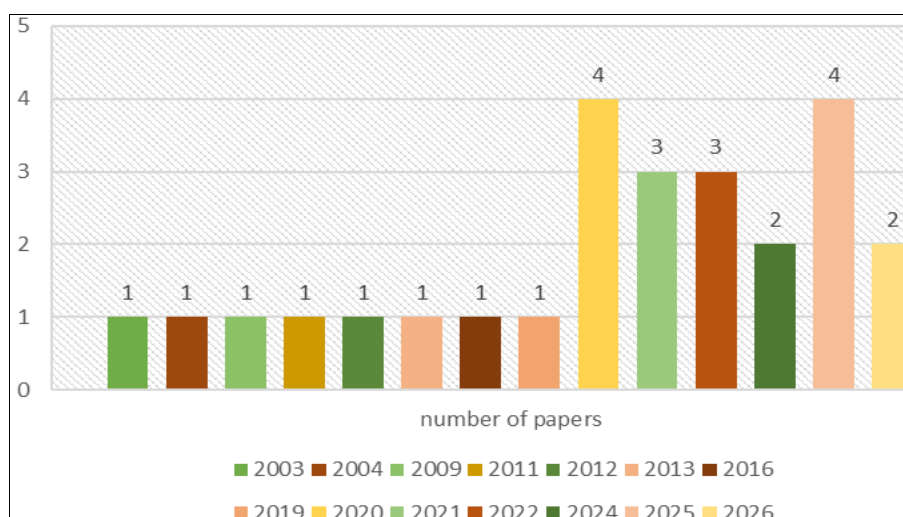


Fig 1: Distribution of reviewed Literature by year of publication (2003-2026)

Results and Discussion

Overview of geospatial coverage by scale

Across the three conflict categories a consistent scale-dependent pattern emerges. GIS/RS-based hotspot mapping is well established at the national scale, present but narrower at the state

scale, limited to a single district at the regional (Vidarbha) scale and now partially represented at the district (Akola) scale. This pattern held across all three conflict categories, suggesting it reflects a structural gap in research effort rather than a feature specific to any one conflict type.

Crop Raiding

Table 1 presents that the crop raiding is best documented at the national level. In India, the species causing crop damage is the Asian elephant studied and used MaxEnt modelling by Naha *et al.* (2019, 2020) ^[18, 19], Rani *et al.* (2024) ^[24], while Pavithra *et al.* (2025) ^[20] used kernel density estimation combined with kriging and these studies used satellite based data such as Landsat and Sentinel land-use/land-cover change data, along with tree loss data, elevation data and road network data as inputs, the key findings were that villages within 1.5 km of the forest edge are affected the most and that mapped a total of 34,596 conflict incidents across the Southern Western Ghats, with these studies covering large landscapes including North Bengal, the Rajaji Corbett landscape in Uttarakhand and the Southern Western Ghats Pavithra *et al.* (2025) ^[20]. In Maharashtra, Pawar & Mule (2025) ^[21] analyzed 19,050 human-wildlife incidents across 2,659 villages in the Marathwada region, using negative binomial regression modelling with

NDVI, distance to waterbody and elevation as spatial covariates to map conflict risk hotspots and pattern of compensation access, covering an area of 64,590 km² of Maharashtra identified in this review. In Vidarbha, the species causing crop damage are wild boar, sambar, chital, and nilgai, studied by Bayani *et al.* (2016) ^[4], who has not use any GIS or remote sensing method and instead used distance-decay analysis, measuring how crop damage changed based on distance from the forest boundary, using field damage surveys collected along the Tadoba-Andhari Tiger Reserve boundary as their only data and finding that more than half of all crop damage occurred near that reserve boundary, with their study covering only the area immediately around the Tadoba-Andhari Tiger Reserve. Akola Khekade *et al.* (2025) ^[16] surveyed 120 farmers across four villages in patur tahsil using structured interview findings that wild boar (100%) and blue bull (94.17%) were the dominant species causing damage while 93.06% observed yield reduction, with the study covering villages in Akola district

Table 1: Assessment of crop raiding under HWC through GIS and RS interventions

Parameters	Akola	Vidarbha	Maharashtra	India
Species causing damage	Khekade <i>et al.</i> , 2025 ^[16]	Bayani <i>et al.</i> , 2016 ^[4]	Pawar & Mule 2025 ^[21]	Naha <i>et al.</i> , 2019 ^[19]
Spatial /mapping method used	Khekade <i>et al.</i> , 2025 ^[16]	Bayani <i>et al.</i> , 2016 ^[4]	Pawar & Mule 2025 ^[21]	Naha <i>et al.</i> , Rani <i>et al.</i> , 2024 ^[24] & Pavithra <i>et al.</i> , 2025 ^[20]
Data inputs used	Khekade <i>et al.</i> , 2025 ^[16]	Bayani <i>et al.</i> , 2016 ^[4]	Pawar & Mule 2025 ^[21]	Naha <i>et al.</i> , 2019 & 2020 ^[18, 19] ; Pavithra <i>et al.</i> , 2025 ^[20]
Key spatial findings	Khekade <i>et al.</i> , 2025 ^[16]	Bayani <i>et al.</i> , 2016 ^[4]	Pawar & Mule 2025 ^[21]	Naha <i>et al.</i> , 2019 & 2020 ^[18, 19] Pavithra <i>et al.</i> , 2025 ^[20]
Scale/extend of study	Khekade <i>et al.</i> , 2025 ^[16]	Bayani <i>et al.</i> , 2016 ^[4]	Pawar & Mule 2025 ^[21]	Naha <i>et al.</i> , 2020 ^[18] ; Rani <i>et al.</i> , 2024 ^[24] ; Pavithra <i>et al.</i> , 2025 ^[20]

Livestock Depredation

Table 2 shows that, at the national level large carnivores and big herbivores are studied together for livestock killing. In India, the species involved are large carnivores and megaherbivores studied broadly by Ramesh *et al.* (2020 & 2022) ^[22, 23], who used spatial predation-risk modelling with landscape-level ecological covariates across the Eastern and Western Ghats, finding mapped predation-risk patterns and the drivers of human-megaherbivore interaction, with their study covering the Eastern and Western Ghats across multiple states. In Maharashtra, the species involved is the leopard, studied by Habib *et al.* (2020) ^[11] using Optimized and Emerging Hotspot Analysis in ArcGIS, building on the earliest GIS-based leopard-conflict study in India done by Athreya *et al.* (2004) ^[3], using 20 years of depredation records from the Junnar Forest Division as their data input and finding that a high leopard density of 10 per 100 square kilometers still resulted in a low livestock loss of 0.45 per square kilometer per year with zero human deaths at one site, as shown by Athreya *et al.* (2020) ^[2], while Donikar *et al.* (2011) ^[8]

found that poor livestock enclosure quality, not leopard density was the main driver of depredation in Ratnagiri district, with these studies covering the Junnar Forest Division and Ratnagiri district. Additionally, Krithivasan *et al.* (2009) ^[17] has documented wolf-livestock conflict in Ahmednagar district using GIS based mapping of attack locations combined with wolf density estimation, introducing wolf as third Maharashtra species alongside leopard and also contribute carnivores side conflict patterns from their Marathwada wide analysis, covering the junnar forest division, Ratnagiri Ahmednagar district and the Marathwada region. In Vidarbha, the species involved are leopard and tiger studied by Habib *et al.* (2022) ^[12] using the same ArcGIS hotspot analysis method, with depredation incident records from the Chandrapur Forest Division as their data input, finding clear depredation hotspots identified across the Chandrapur landscape, with their study covering Chandrapur district. In Akola, no study on livestock depredation was found at all so there is no species, method, data input, finding or study area available for this district.

Table 2: Assessment of livestock depredation under HWC through GIS and RS interventions

Parameters	Akola	Vidarbha	Maharashtra	India
Species causing damage	-	Habib <i>et al.</i> , 2022 ^[12]	Pawar & Mule 2025 ^[21] ; Habib <i>et al.</i> , 2020 ^[11] ; Athreya <i>et al.</i> , 2004 & 2020 ^[2, 3] ; Donikar <i>et al.</i> , 2011 ^[8] ; Krithivasan <i>et al.</i> , 2009 ^[17]	Ramesh <i>et al.</i> , 2020 & 2022 ^[22, 23]
Spatial /mapping method used	-	Habib <i>et al.</i> , 2022 ^[12]	Habib <i>et al.</i> , 2020 ^[11] ; Krithivasan <i>et al.</i> , 2009 ^[17] Athreya <i>et al.</i> , 2004 ^[3]	Ramesh <i>et al.</i> , 2020 & 2022 ^[22, 23]
Data inputs used	-	Habib <i>et al.</i> , 2022 ^[12]	Pawar & Mule 2025 ^[21] ; Habib <i>et al.</i> , 2020 ^[11] ; Krithivasan <i>et al.</i> , 2009 ^[17]	Ramesh <i>et al.</i> , 2020 & 2022 ^[22, 23]
Key spatial findings	-	Habib <i>et al.</i> , 2022 ^[12]	Athreya <i>et al.</i> , 2020 ^[2] Donikar <i>et al.</i> , 2011 ^[8] ; Krithivasan <i>et al.</i> , 2009 ^[17]	Ramesh <i>et al.</i> , 2020 & 2022 ^[22, 23]
Scale/extend of study	-	Habib <i>et al.</i> , 2022 ^[12]	Pawar & Mule 2025 ^[21] ; Habib <i>et al.</i> , 2020 ^[11] & Donikar <i>et al.</i> , 2011 ^[8] ; Krithivasan <i>et al.</i> , 2009 ^[17]	Ramesh <i>et al.</i> , 2020 & 2022 ^[22, 23]

Human Injury

Tables 3 shows that human injury is the most spatially advanced category at the national scale, In India, the species involved is

the Asian elephant, studied by Tripathy *et al.* (2021) ^[26], Roy *et al.* (2025) ^[25], and Athira *et al.* (2026) ^[1], Tripathy *et al.* (2021) ^[26] used kernel density estimation with temporal-phase mapping

in Keonjhar, using fatality records across three time periods as their data input and found 345 human deaths between 2001 and 2018, with the at risk population rising from 14,724 to 65,444 people over that time, while Roy *et al.* (2025) ^[25] and Athira *et al.* (2026) ^[1] used Landsat land-use/land-cover data combined with kernel density estimation in Jharkhand and Assam, finding 1,340 deaths among 1,740 incidents in Jharkhand and 1,468 deaths among 1,806 incidents in Assam and Gulati *et al.* (2021) ^[10] additionally found that human casualties are the single biggest cost of human-wildlife conflict across India overall, with these studies covering Keonjhar Forest Division, Jharkhand state and Assam state. In Maharashtra, the species involved is the leopard, studied by Habib *et al.* (2020) ^[11] using Emerging Hotspot Analysis in ArcGIS with 20 years of attack records from the Junnar Forest Division, finding clear human-attack hotspots identified at Junnar and by Deshmukh and Jaybhaye

(2024) ^[6], who conducted a household survey without GIS methods in Kothale village, documenting village-level conflict patterns there, with these studies covering the Junnar Forest Division and Kothale village. In Vidarbha, the species involved are tiger and leopard, studied by Dhanwatey *et al.* (2013) ^[7], who did not use GIS and instead used case records from around the Tadoba-Andhari Tiger Reserve periphery, finding that attacks cluster near forest-edge resource-collection activities such as firewood gathering and by Habib *et al.* (2022) ^[12], who used ArcGIS mapping with incident records from Chandrapur, finding attack hotspots across the Chandrapur landscape, with these studies covering the Tadoba-Andhari periphery and Chandrapur district. In Akola, no study on human injury or death was found at all, so there is no species, method, data input, finding, or study area available for this district.

Table 3: Assessment of human injuries under HWC through GIS and RS interventions

Parameters	Akola	Vidarbha	Maharashtra	India
Species causing damage	-	Dhanwatey <i>et al.</i> , 2013 ^[7]	Habib <i>et al.</i> , 2020 ^[11] ; Deshmukh & Jaybhaye, 2024 ^[6]	Tripathy <i>et al.</i> , 2021 ^[26] ; Roy <i>et al.</i> , 2025 ^[25] ; Athira <i>et al.</i> , 2026 ^[1]
Spatial /mapping method used	-	Habib <i>et al.</i> , 2022 ^[12] ; Dhanwatey <i>et al.</i> , 2013 ^[7]	Habib <i>et al.</i> , 2022 ^[12] Dhanwatey <i>et al.</i> , 2013 ^[7]	Tripathy <i>et al.</i> , 2021 ^[26] ; Roy <i>et al.</i> , 2025 ^[25] ; Athira <i>et al.</i> , 2026 ^[1]
Data inputs used	-	Habib <i>et al.</i> , 2022 ^[12] ; Dhanwatey <i>et al.</i> , 2013 ^[7]	Habib <i>et al.</i> , 2020 ^[11] Deshmukh & Jaybhaye, 2024 ^[6]	Tripathy <i>et al.</i> , 2021 ^[26] ; Roy <i>et al.</i> , 2025 ^[25] ; Athira <i>et al.</i> , 2026 ^[1]
Key spatial findings	-	Dhanwatey <i>et al.</i> , 2013 ^[7]	Habib <i>et al.</i> , 2020 ^[11] Deshmukh & Jaybhaye, 2024 ^[6]	Tripathy <i>et al.</i> , 2021 ^[26] ; Roy <i>et al.</i> , 2025 ^[25] ; Athira <i>et al.</i> , 2026 ^[1] ; Gulati <i>et al.</i> , 2021 ^[10]
Scale/extend of study	-	Habib <i>et al.</i> , 2022 ^[12] & Dhanwatey <i>et al.</i> , 2013 ^[7]	Habib <i>et al.</i> , 2020 ^[11] Deshmukh & Jaybhaye, 2024 ^[6]	Tripathy <i>et al.</i> , 2021 ^[26] ; Roy <i>et al.</i> , 2025 ^[25] ; Athira <i>et al.</i> , 2026 ^[1] ; Gulati <i>et al.</i> , 2021 ^[10]

Cross-category comparison

The all three tables shows that GIS/RS sophistication is not uniform across conflict categories at any given scale. Livestock depredation and human injury/death both have a direct methodological line running from Junnar (Maharashtra) to Chandrapur (Vidarbha), since both categories were addressed in the same two studies (Habib *et al.*, 2020, 2022) ^[11, 12]. Crop raiding has partial equivalent line at the Maharashtra scale through Pawar & Mule (2025) ^[21], though this has not yet been extended to Vidarbha region or Akola using a comparable Vidarbha scale, where the only Vidarbha and Akola evidence remains non-spatial, distance-based finding (Bayani *et al.*, 2016; Khekade *et al.*, 2025) ^[4, 16].

Gap and Constraints Identified by researchers

Fig 2 represents the constraints faced by researchers within their own studies, not gaps identified by this review. In Vidarbha Bayani *et al.* (2016) ^[4] did not have access to GIS tools and had to measure distance from the forest boundary manually, while Dhanwatey *et al.* (2013) ^[7] worked with a small, localized set of case records from one reserve and could not apply spatial analysis and Jha *et al.* (2022) ^[13] collected conflict data through

field documentation alone, without any GIS infrastructure to map incident locations. In Maharashtra, Athreya *et al.* (2020) ^[2] based their findings on a single study site, so their results on leopard density could not be generalized elsewhere, while Donikar *et al.* (2011) ^[8] relied on people's personal accounts and attitudes rather than direct measurements of enclosure quality and Habib *et al.* (2020, 2022) ^[11, 12] built their method specifically around leopard conflict, meaning it could not be applied directly to other species like elephants or wild boar without changes. Deshmukh and Jaybhaye (2024) ^[6] faced a similar limitation, restricting their household survey to a single village and using no GIS tools, which limits how far their findings can be applied elsewhere. At the national level, Tripathy *et al.* (2021) ^[26] used a descriptive approach and did not attempt predictive modelling such as MaxEnt within their study and Kshetry *et al.* (2021) ^[15] had to rely on compensation records that were incomplete, since some farmers did not file claims for religious reasons. Across all these studies, the constraints show that even well-known GIS and non-GIS studies were limited by small sample size, single-species focus, or incomplete data, meaning any future study on Akola should try to avoid repeating the same limitations.

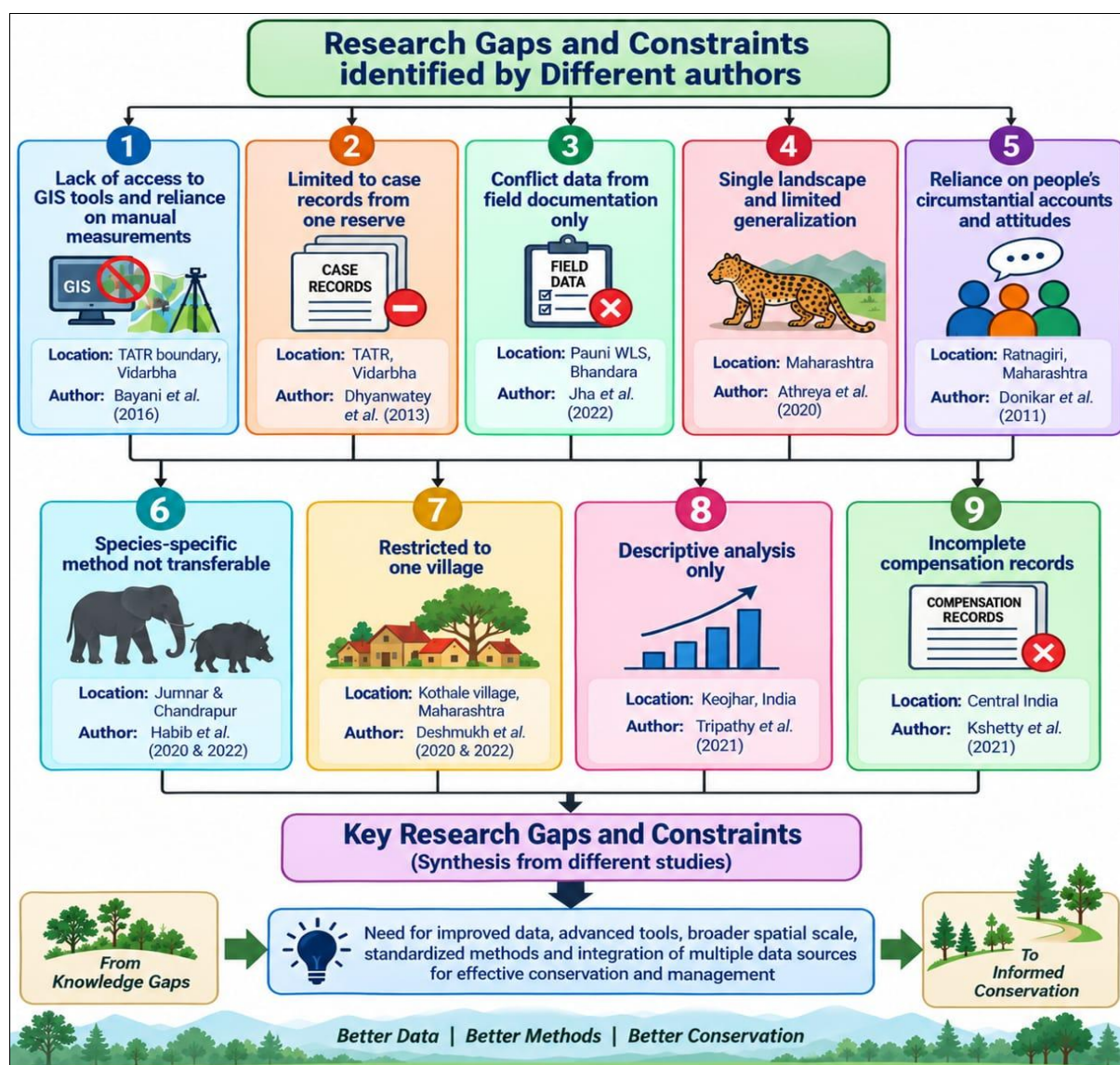


Fig 2: Research gap and Constraints identified by different authors

Discussion

The consistent presence of Habib *et al.* (2020, 2022) ^[11, 12] across both the livestock and human-injury tables indicates that GIS adoption in Maharashtra and Vidarbha has been driven largely by a single research program (Wildlife Institute of India, Junnar and Chandrapur), rather than broad-based regional uptake. While crop raiding has now an additional, independent entry point through Pawar & Mule (2025) ^[21] in Marathwada region showing that GIS based crop raiding research is beginning beyond the WII program specifically.

This pattern also suggests a direct, low-cost extension pathway since the Chandrapur methodology (Habib *et al.*, 2022) ^[12] was itself adapted from the earlier Junnar framework (Habib *et al.*, 2020) ^[11] and since Pawar & Mule (2025) ^[21] have now demonstrated a working regression-based crop raiding model in Marathwada, either approach could reasonably be extended to Akola using Khekade *et al.* (2025) ^[16] & Bayani *et al.* (2016) ^[4]. Beyond extending existing spatial methods, recent conservation scholarship argues that human-wildlife conflict should also be addressed through adaptive, governance-level frameworks rather than site-specific hotspot mapping alone (Batar, 2026) ^[5], suggesting that any future Akola-focused model should be paired with broader institutional and community-level mitigation planning not spatial modelling alone.

A limitation of this comparison is that the absence of a Maharashtra scale crop-raiding study and the absence of any Akola-scale study across all three categories, reflects only what was retrievable through this review's search strategy and does not rule out the existence of unpublished Forest Department records or internal assessments not indexed in the databases searched.

Research gap

Lack of study on GIS or remote sensing has been done for Akola district for livestock depredation or human injury/death this remains the main gap this review finds, though descriptive, farmer-perception data is now available for crop raiding (Khedkar *et al.*, 2025). Crop raiding has recently been mapped using GIS in Maharashtra at the Marathwada scale (Pawar & Mule, 2025) ^[21], but this has not yet been extended to Vidarbha or Akola. Most of the GIS work in Maharashtra and Vidarbha still comes from a small number of research groups (WII at Junnar and Chandrapur; Pawar and Mule in Marathwada), so methods have not yet spread broadly across independent researchers. Leopard density alone does not predict conflict well studies show that things like poor cattle sheds, wolf presence or local behavior matter more so future models should not rely on density alone.

Future aspects

A GIS-based hotspot study should be carried out for Akola district for livestock depredation and human injury/death using the ArcGIS methods already validated at Junnar and Chandrapur. For crop raiding, Akola now has a head start farmer survey data could be paired with the regression-based spatial approach demonstrated in Marathwada, rather than building a method entirely from scratch. Future livestock-conflict studies should avoid relying on leopard density alone and should instead include factors like cattle-shed quality, wolf presence, and local grazing behavior. Any new hotspot model should be paired with a household-level survey, similar to so, that on-ground reporting patterns are checked against the GIS output. Researchers should also track what happens after a hotspot is identified, and any future mitigation framework for Akola should consider governance level approaches alongside spatial modelling.

Conclusion

Geospatial methods for mapping human-wildlife conflict in India kernel density estimation, MaxEnt modelling, negative binomial regression and LULC-based fragmentation analysis are now well validated in specific landscapes Junnar and Chandrapur in Maharashtra, Marathwada, Keonjhar, Jharkhand, Assam, and the Southern Western Ghats at the national scale. Livestock depredation and human injury/death have benefited most from this progress, largely through a single research program operating at Junnar and Chandrapur in Maharashtra, though some independent regional work on carnivore conflict has also emerged outside that core program. Crop raiding, once entirely unmapped at the Maharashtra scale, now has a working GIS precedent in one region of Maharashtra, though this has not yet reached Vidarbha or Akola using spatial methods.

Akola district is no longer entirely undocumented but has descriptive, farmer based evidence of crop raiding is now available in Akola district, identifying wild boar and blue bull as the dominant species, though this evidence does not use any spatial or GIS based technique. Livestock depredation and human injury/death remain completely undocumented for the district, spatially or descriptively. Closing this remaining gap does not require an entirely new methodology the Chandrapur study shows that the ArcGIS framework developed at Junnar can be transplanted to a new district, and the Marathwada study shows that a regression-based approach can be built independently of the WII program either could reasonably extend to Akola for livestock depredation and human injury/death, existing survey data offers a ready foundation for a future spatial model of crop raiding specifically. Any such future work should also account for the constraints already flagged by earlier researchers, and should consider governance-level frameworks alongside spatial modelling, so that an Akola-specific approach reflects the actual distribution of conflict rather than reproducing known weaknesses in the data and methods it is built on.

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