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Farmer's perception and willingness to pay for mitigating human-wildlife conflict in Wayanad District of Kerala

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Abstract

The study examines the complex and escalating dynamics of human-wildlife conflict (HWC) in Wayanad district of Kerala, a region characterised by extensive forest cover, agriculture-based livelihoods, and high vulnerability to wildlife intrusion. Using a multi-stage random sample of 120 farmers, the research integrates perception analysis, Rank-Based Quotient (RBQ) ranking, and contingent valuation, to assess the drivers, impacts, preventive measures and economic preferences related to HWC. Results reveal that increasing wildlife populations, resource scarcity within forests, and inadequate preventive infrastructure constitute the major perceived causes of conflict. Elephants and wild boar were identified as the most destructive crop raiders, while leopards and tigers dominated livestock depredation. Farmers reported significant constraints in accessing compensation, including cumbersome procedures, assessment bias, and delays, which undermine institutional credibility. Among preventive measures, solar fencing, net fencing, and night watching by farmer were viewed as the most effective, while maintenance gaps limited the performance of institutional interventions such as electric fences and trenches. The contingent valuation analysis estimated a mean willingness to pay (WTP) of ₹513.22 for improved conflict mitigation, with WTP significantly influenced by distance from forests, farm size, and education. Reasons for unwillingness to pay reflected strong expectations of government responsibility and limited trust in implementing agencies. The study underscores the need for integrated, transparent, and community-responsive strategies that strengthen preventive infrastructure, streamline compensation mechanisms, and enhance participatory approaches to ensure sustainable coexistence in conflict-prone landscapes.

Keywords: Human-wildlife conflict, willingness to pay, farmers' perception

Introduction

Human-wildlife conflict (HWC) has emerged as one of the most complex challenges at the interface of conservation and rural livelihoods worldwide. Driven by population growth, land-use change, infrastructure expansion, and conservation success in protected areas, interactions between humans and wildlife have intensified across many developing regions (König *et al.*, 2020; Gross *et al.*, 2025)^[10, 7]. These conflicts manifest through crop depredation, livestock predation, property damage, and, in severe cases, loss of human life. While wildlife conservation has generated substantial ecological benefits, the costs of coexistence are often disproportionately borne by rural households residing near forest fringes, raising critical

concerns about equity, sustainability, and long-term conservation outcomes (Badola *et al.*, 2021; Stevens *et al.*, 2023)^[3, 17].

Beyond its ecological dimensions, HWC represents a significant socio-economic issue, particularly in agrarian economies where livelihoods depend heavily on land and natural resources (Yeshey *et al.*, 2023)^[20]. Crop loss, livestock damage, and insecurity of production impose direct financial costs on households, while indirect impacts such as psychological stress, food insecurity, and increased labour allocation remain largely undocumented. From an economic perspective, HWC reflects a classic externality problem, wherein the benefits of wildlife conservation accrue to society at large, while the associated costs are

privately absorbed by farmers. Understanding these costs, along with farmers' perceptions and behavioural responses, is therefore central to designing compensation, prevention, and participation-based mitigation strategies.

In India, human-wildlife conflict has intensified in recent decades, particularly in biodiversity-rich states such as Kerala, Karnataka, West Bengal, and Assam. Large mammals such as elephants, wild boar, leopards, and primates are frequently involved, with elephants causing severe economic damage due to their wide-ranging behaviour and high consumption levels (Agarwal *et al.*, 2016) ^[2]. The policy response to HWC in India has predominantly relied on post-damage compensation schemes administered by forest departments. While compensation is intended to reduce economic hardship and foster tolerance toward wildlife, several studies report procedural delays, partial assessments, institutional inefficiencies, and limited coverage, which undermine farmer confidence in existing mechanisms. Consequently, compensation alone has proven insufficient to address the growing intensity and persistence of conflict.

Kerala presents a particularly relevant context for examining these dynamics due to its high population density, fragmented forest landscapes, and close proximity between agricultural land and wildlife habitats. Districts along the Western Ghats experience recurrent crop and livestock losses, prompting rising compensation claims and increasing fiscal strain on public agencies (Pavithra *et al.*, 2025) ^[13]. Despite this, empirical studies in Kerala have largely focused on ecological patterns of conflict, species behaviour, or descriptive assessments of damage incidents. There remains a notable gap in systematic economic evaluations that integrate farmers' perceptions, quantify constraints in compensation access, and assess their willingness to participate financially in preventive or risk-sharing mechanisms.

Addressing this gap is crucial for moving beyond reactive conflict management toward more participatory and preventive approaches. Valuation-based tools such as contingent valuation offer insights into how affected households perceive risk, responsibility, and institutional credibility. Willingness to pay (WTP) estimates, in particular, help assess the feasibility of community-based insurance, cost-sharing mechanisms, and decentralized mitigation strategies, while econometric analysis enables identification of socio-economic factors shaping farmer participation. Such evidence is essential for designing policies that balance conservation objectives with livelihood security.

Against this background, the present study examines human-wildlife conflict in Wayanad district of Kerala, one of the most conflict-prone regions in the state due to its extensive forest cover, agriculture-dependent population, and high incidence of wildlife intrusion. The study analyses farmers' perceptions of the causes of conflict and coexistence measures, identifies key wildlife species responsible for crop and livestock damage, evaluates preventive measures adopted by both farmers and forest departments, and assesses constraints in accessing compensation. Further, it estimates farmers' willingness to pay for HWC mitigation using a double-bounded contingent valuation framework and identifies the socio-economic

determinants influencing this willingness through probit analysis. By integrating economic valuation with perception-based and institutional analysis, the study contributes empirical evidence to inform more effective, equitable, and participatory approaches to human-wildlife conflict management in Kerala and similar agro-ecological settings.

Methodology

Study area and characteristics

Wayanad is a highland district in the northeastern part of Kerala characterised by high-intensity human-wildlife conflict due to its extensive forest cover and agriculture-based livelihood systems. The district spans an area of 2,131 km², with elevations ranging from 700 to 2,100 metres above mean sea level. It shares boundaries with Kodagu district of Karnataka to the north, Mysuru and the Nilgiris to the east, and Kozhikode and Kannur districts to the south and west. With a population of 817,420 and a population density of 383 persons per km², Wayanad is the least densely populated district in Kerala and has a substantial tribal population, with Scheduled Tribes accounting for approximately 18 per cent of total inhabitants. The district experiences a tropical monsoon climate, receiving an average annual rainfall of 2,632 mm, with particularly high precipitation in areas such as Lakkidi, Vythiri, and Meppadi. Forests occupy nearly 79 per cent of Wayanad's total geographical area of 212,966 hectares, while about 54 per cent of the land is under cultivation. The terrain consists of undulating hills, valleys, and fertile lowlands, with four major soil types: laterite, brown hydromorphic soil, forest loam, and riverine alluvium. Agriculture forms the economic backbone of the district, with major crops including pepper, ginger, banana, paddy, and coffee. Wayanad is a leading contributor to Kerala's agricultural output, producing around 44 per cent of the state's ginger and 79 per cent of its coffee.

The close proximity of agricultural lands to forest fringes, combined with the district's rich wildlife habitat, has resulted in frequent and severe human-wildlife conflicts (Sumitha and Shaharban, 2022) ^[18]. Compensation claims for crop damage have increased sharply from 10,036 cases in 2021-22 to 22,713 cases in 2022-23 (Issac and Prasad, 2022; GOK, 2025). Wayanad was purposively selected for the present study due to its consistently high incidence of conflict within Kerala (GOK, 2023). Administratively, the district comprises three forest divisions—Wayanad Wildlife Division, North Wayanad Forest Division, and South Wayanad Forest Division—the latter two reporting the highest frequency of conflict incidents.

Sampling design and data collection

A multi-stage random sampling design was employed to select respondents for the study. Wayanad district constituted the primary sampling unit, followed by the selection of all three forest divisions. From each division, 40 farmers who had previously received compensation for wildlife-related damage from the Forest Department were selected randomly, resulting in a total sample size of 120 respondents.

Both primary and secondary data were utilised. Primary data were collected through personal interviews using a well-

structured, pre-tested interview schedule designed in accordance with the study objectives. Information was obtained on household characteristics, species involved in conflict, types and effectiveness of preventive measures adopted, and experiences related to compensation schemes. Secondary data relating to the study area—including demographic characteristics, rainfall patterns, land-use distribution, cropping patterns in forest fringe areas, wildlife attack types, and compensation statistics were collected from official reports and published sources.

Analytical tools

Likert scale

The Likert scale is a psychometric tool commonly used to quantify individuals' attitudes towards specific statements or issues. Likert scales typically present respondents with a range of ordered response options, among which the five-point scale is most widely applied (Mirahmadizadeh *et al.*, 2018) [12]. In the present study, a five-point Likert scale was employed to assess farmers' perceptions of various aspects of human-wildlife conflict, where responses ranged from 1 (strongly disagree) to 5 (strongly agree).

The Rank-Based Quotient

The Rank-Based Quotient (RBQ) method was applied to identify the relative importance of wildlife species causing damage, crops most affected by conflict, and major constraints encountered by farmers while accessing compensation. This technique converts ordinal rank data into quantitative scores, thereby facilitating prioritisation of issues (Mehjabeen and Durai, 2020) [11]. RBQ values were computed following the procedure proposed by Sabarathnam (1988) [15]:

$$RBQ = \left[\sum F_i (n+1-i) / N n \right] \times 100$$

Where, F_i denotes the frequency of respondents assigning the i^{th} rank, N represents the total number of respondents, and n indicates the total number of items ranked.

Contingent Valuation Method (CVM)

CVM is the best approach to get the Willingness to Pay (WTP) / Willingness to Accept (WTA) for the total economic value of an environmental improvement (Carson

and Hanemann, 2005) [4]. Basically, people are asked how much they would be willing to pay or accept for the damages caused by the wild animal. We analysed the WTP of farmers to safeguard their crops against potential losses due to HWC utilising the Double Bounded Dichotomous Choice Contingent Valuation (DB-DC CVM) methodology. To provide context, a comprehensive explanation was provided to enhance understanding of the hypothetical framework, suggesting that a reputed institution would provide insurance coverage for crop damage caused by wildlife. Farmers were asked about their WTP to insure against wildlife-related damages under the scheme, clearly stressing that without this insurance coverage, compensation for wildlife damage would not exist.

Respondents were then prompted to evaluate their WTP for the suggested amount. The bid amount was subsequently adjusted based on participants' feedback, with each individual being asked about the revised bid. If the response to the initial closed-ended question was affirmative ("yes"), the bid amount was increased (approximately doubling). Conversely, if the response was negative ("no"), the bid amount was decreased (approximately halved).

Probit analysis is employed to evaluate the determinants affecting the willingness to pay among stakeholders (Unniravisankar *et al.*, 2023) [19]. Where WTP is taken as dependent variable and Maximum Likelihood Estimation is used to analyse the mean willingness to pay among stakeholders (Aditya *et al.*, 2020) [1].

Results and Discussion

Perceived causes of human-wildlife conflict

Based on farmers' responses (Table 1), the increase in wildlife populations emerged as the most widely acknowledged cause of human-wildlife conflict, recording the highest mean score of 4.44. A substantial proportion of respondents identified this factor as a major driver of conflict incidents in the study area. Shortage of food and water resources within forest ecosystems ranked second, with a mean score of 4.36, suggesting that habitat degradation and declining resource availability are compelling wildlife to forage in adjacent agricultural fields. Inability to predict animal movement patterns ranked third (mean score: 4.35), reflecting farmers' perceived uncertainty and vulnerability to sudden wildlife incursions.

Table 1: Farmers' perceptions of major causes of human-wildlife conflict in Wayanad district

Sl. No	Reasons for conflict	SA	A	N	D	SD	Mean score	Rank
1	Increase in wildlife population	81	25	3	8	3	4.44	1
2	Shortage of food resources in the forest	79	23	3	12	3	4.36	2
3	Decrease in forest area	29	32	20	20	19	3.27	6
4	Unable to predict the animal movement	81	21	5	5	8	4.35	3
5	Lack of preventive measures from the forest department	60	30	7	17	6	4.01	4
6	Improper preventive measures by farmers	8	5	23	51	33	2.20	7
7	Increase in Exotic weeds in the forest	30	16	63	6	5	3.50	5

Note: SA- Strongly Agree; A - Agree; N - Neutral; D - Disagree; SD - Strong Disagree.

Institutional inefficiency was also identified as a significant contributing factor. Lack of adequate preventive measures by the Forest Department of Kerala ranked fourth, with a mean score of 4.01, indicating that insufficient maintenance of electric fences, trenches, and delayed responses to wildlife intrusions have exacerbated conflict situations.

Conversely, most farmers did not attribute conflict to their own agricultural practices, as reflected in the low mean score for inappropriate preventive measures by farmers. This perception highlights the importance of participatory and decentralised approaches to human-wildlife conflict management.

Perceptions regarding coexistence with wildlife

Farmers' perceptions regarding factors facilitating coexistence with wildlife are presented in Table 2. Timely and adequate compensation for wildlife-induced losses emerged as the most important factor, with a mean score of 4.35. Compensation remains a critical policy instrument for mitigating financial losses and is widely regarded as essential for sustaining tolerance towards wildlife (Hemminger *et al.*, 2025) [8]. Provision of food and water resources within forest areas ranked fourth (mean score: 4.21), indicating farmers' awareness that ecological resource scarcity within forests is a fundamental cause of

conflict.

The results further revealed that farmers strongly favoured physical and technological interventions over broader ecological restoration measures. Establishment and maintenance of electric fences (mean score: 4.32), wildlife monitoring sensors (4.22), and trenches (3.75) were perceived as effective and necessary forms of protection. This preference for 'hardware-based' solutions reflects farmers' dependence on agriculture for livelihood security and their prioritisation of immediate, tangible protective measures over long-term ecological interventions.

Table 2: Farmers' perceptions of factors facilitating human-wildlife coexistence

Sl. No	Factors for co-existence	SA	A	N	D	SD	Mean score	Rank
1	Rehabilitation of animal pathways	25	44	28	15	8	3.53	9
2	Establishment of wildlife monitoring sensors	69	26	12	8	5	4.22	3
3	Provision of food resources	75	16	14	9	6	4.21	4
4	Timely and adequate compensation	77	26	7	2	8	4.35	1
5	Strengthening the wildlife protection squad	41	48	18	9	4	3.94	6
6	Establishment of trenches	47	28	20	18	7	3.75	8
7	Establishment and maintenance of electric fences	83	16	5	8	8	4.32	2
8	Control measures for maintaining the wildlife population	68	24	10	13	5	4.14	5
9	Control the infestation of the exotic weed	30	64	16	7	3	3.93	7

Note: SA- Strongly Agree; A - Agree; N - Neutral; D - Disagree; SD - Strong Disagree.

Control measures aimed at managing wildlife populations also received considerable support, ranking fifth among coexistence factors. In the prevailing context of increasing wildlife populations, non-lethal approaches such as fertility control were viewed as more acceptable than culling. As noted by Hobbs *et al.* (2000) [9], fertility control methods are relatively cost-effective and ethically preferable compared to lethal population control strategies.

Wildlife species responsible for crop and livestock damage

The relative importance of wildlife species responsible for crop damage is presented in Table 3. Elephants (*Elephas maximus*) were identified as the most destructive crop raiders, recording the highest Rank-Based Quotient (RBQ) value of 85. Wild boar (*Sus scrofa*) ranked second, with an RBQ value of 84.29, followed by monkeys (*Macaca spp.*), which ranked third with an RBQ of 70.71. Deer ranked fourth, while species such as Malabar giant squirrel, peafowl (*Pavo cristatus*), and porcupine (*Hystrix indica*) were reported less frequently and ranked substantially

lower.

Table 3: Major wildlife species responsible for crop damage

Sl. No.	Crop raiders	Rank frequencies							RBQ value	Rank
		1	2	3	4	5	6	7		
1	Elephant	58	31	9	17	3	0	0	85.00	1
2	Wild pig	32	61	18	7	0	0	0	84.29	2
3	Monkey	27	9	45	27	6	0	0	70.71	3
4	Deer	3	18	40	48	0	2	0	62.5	4
5	Malabar giant squirrel	0	0	0	5	56	32	13	31.55	5
6	Peafowl	0	1	0	12	18	43	31	26.79	6
7	Porcupine	0	0	8	4	28	21	39	21.67	7

Note: RBQ - Rank-based Quotient.

Livestock depredation patterns differed from crop damage trends (Table 4). Leopards (*Panthera pardus*) emerged as the primary livestock predator, with an RBQ value of 84.17, followed by tigers (*Panthera tigris*) with an RBQ of 77.50. Wild dogs (*Cuon alpinus*) were ranked third, indicating that large carnivores pose a pronounced threat to livestock-based livelihoods in forest-adjacent areas.

Table 4: Major wildlife species responsible for livestock depredation

Sl. No.	livestock depredator	Rank frequencies				RBQ values	Rank
		1	2	3	4		
1	Tiger	39	58	21	0	77.5	2
2	Leopard	61	48	8	0	84.17	1
3	Wild dog	15	14	87	0	57.5	3

Note: RBQ - Rank-based Quotient.

Perceived severity of crop damage

Farmers perceived tapioca and banana as the crops most severely affected by wildlife damage (Table 5). Tapioca ranked first with an RBQ value of 74.83, closely followed by banana with an RBQ of 73.83, underscoring their high vulnerability to wildlife intrusion. Coconut and arecanut also suffered substantial damage, ranking third and fourth,

respectively. These crops are particularly attractive to wildlife due to their high starch and moisture content (Ramkumar *et al.*, 2014) [14]. In contrast, crops such as coffee, pepper, ginger, and cardamom were consistently ranked lower, indicating relatively lower levels of perceived damage.

Table 5: Relative severity of crop damage caused by wildlife based on farmers' perceptions

Sl. No	Major crops damaged	Rank frequencies										RBQ value	Rank
		1	2	3	4	5	6	7	8	9	10		
1	Tapioca	47	29	6	11	5	0	3	0	0	0	74.83	1
2	Banana	30	41	22	5	1	0	0	0	0	0	73.83	2
3	Coconut	4	23	27	44	9	2	0	0	0	0	69.58	3
4	Arecanut	19	19	40	8	1	0	0	0	0	0	61.92	4
5	Paddy	12	4	16	25	43	3	0	0	0	0	61	5
6	Coffee	6	1	5	18	29	38	12	0	2	0	54.25	6
7	Pepper	0	0	0	3	18	27	39	15	0	7	39.33	7
8	Greater yam	1	3	4	5	7	20	11	16	1	31	30.92	8
9	Ginger	1	0	0	1	4	10	27	29	31	0	29	9
10	Cardamom	0	0	0	0	3	1	0	20	32	28	14.58	10

Note: RBQ - Rank-based Quotient.

Preventive measures adopted by farmers and forest department

Preventive measures adopted by farmers and the Forest Department, along with their perceived effectiveness, are presented in Table 6. Among farmer-managed interventions, solar fencing, net fencing, and night guarding by farmer were the most commonly adopted measures. Approximately 60 per cent of respondents had installed solar fencing, and the majority rated it as either partially effective or effective, particularly in deterring large animals such as elephants and wild boar. Net fencing was also widely used and was perceived as effective against smaller animals, including

deer and monkeys. Night guarding by farmer, despite being labour-intensive, was considered highly effective by all respondents practising it, underscoring the continued relevance of traditional preventive strategies where mechanical barriers prove insufficient.

Barbed wire fencing exhibited minimal adoption owing to high installation costs and was largely perceived as ineffective against large wildlife species. The adoption of preventive measures was influenced by factors such as financial constraints, labour availability, and maintenance requirements.

Table 6: Effectiveness of preventive measures adopted by farmers and forest department

Preventive measures adopted by farmers					
Preventive measures	NP	P	NE	PE	E
Solar fencing	48 (40.00)	72 (60.00)	5 (6.94)	23 (31.94)	44 (61.11)
Fire cracker	69 (57.50)	51 (42.50)	15 (29.41)	8 (15.69)	28 (54.90)
Acoustic device	57 (47.50)	63 (52.50)	16 (25.40)	17 (26.98)	30 (47.62)
Net fencing	45 (37.50)	75 (62.50)	10 (13.33)	28 (37.33)	35 (46.67)
Barbed wire fence	113 (94.17)	7 (5.83)	0 (0.00)	1 (14.29)	6 (85.71)
Night guarding by farmer	63 (52.50)	57 (47.50)	0 (0.00)	0 (0.00)	57 (100.00)
Preventive measures adopted by the forest department					
Electric Fence	0 (0.00)	120 (100.00)	25 (20.83)	35 (29.16)	60 (50.00)
Trenches	0 (0.00)	120 (100.00)	65 (54.16)	47 (39.16)	8 (6.66)
Guards of the forest department	36 (30.00)	84 (70.00)	32 (26.67)	19 (15.83)	69 (57.50)

Note: NP-Not practicing; P-Practicing; NE-Not effective; PE-Partially effective; E-effective.

With respect to institutional interventions, electric fences and trenches had been established across most sites by the Forest Department. Electric fencing was rated as effective or partially effective by nearly 80 per cent of respondents. Trenches were considered less effective due to inadequate maintenance. Deployment of forest guards was perceived positively, with around 70 per cent of farmers acknowledging their partial or full effectiveness in controlling wildlife movement.

Overall, farmer-managed preventive measures were perceived as more effective at the local level due to greater adaptability and direct supervision. In contrast, large-scale institutional interventions were viewed as potentially effective but heavily dependent on regular maintenance and

administrative responsiveness.

Constraints in accessing compensation

Major constraints faced by farmers in accessing compensation for wildlife-induced damage are presented in Table 7. The tedious application procedure emerged as the most severe constraint, recording an RBQ value of 81.94. This was followed by officers' bias during loss assessment (RBQ: 63.75) and delays in compensation disbursement (RBQ: 58.47). These procedural inefficiencies reflect administrative opacity and subjective evaluation practices that often result in partial or delayed reimbursements for genuine losses.

Table 7: Constraints faced by farmers in accessing compensation for wildlife damage

Sl. No	Major constrains	Rank frequencies						RBQ value	Rank
		1	2	3	4	5	6		
1	Tedious procedure for the application	36	24	21	34	20	28	81.94	1
2	Officers bias in loss assessment	40	25	9	8	10	14	63.75	2
3	Delay in getting compensation	20	19	36	9	13	9	58.47	3
4	Not adjusted to the market rate	10	34	24	15	11	12	56.25	4
5	Probability of getting is low	8	16	19	30	35	21	53.47	5

The perceived low probability of receiving compensation (RBQ: 53.47) further discouraged farmers from filing claims, indicating that institutional inefficiency, rather than compensation amount alone, constitutes the primary barrier to participation in compensation programmes. Although compensation is widely supported in principle, implementation-related shortcomings substantially weaken policy credibility.

Willingness to pay for prevention of human-wildlife conflict

The distribution of farmers' willingness to pay (WTP) for human-wildlife conflict mitigation is presented in Table 8. Bid values ranged from ₹100 to ₹3,000. Of the 120 respondents surveyed, 38 farmers (31.67 per cent) expressed no willingness to pay, while the remaining 82 farmers (68.33 per cent) reported positive WTP at varying levels.

Analysis of response patterns indicated a clear inverse relationship between bid amount and willingness to pay. At the lowest bid value of ₹100, only 15.83 per cent of respondents expressed unwillingness, whereas the proportion of unwilling respondents increased sharply at bid values of ₹1,000 and above. This pattern reflects price sensitivity among farmers and aligns with standard economic theory, wherein demand declines as cost increases. The observed trend also highlights liquidity constraints faced by smallholder farmers.

Table 8: Distribution of farmers' willingness to pay for human-wildlife conflict mitigation

Distribution of the final bid			
Sl. No	Bid value (in Rs.)	No. of respondents	Percentage
1	0	38	31.67
2	100	19	15.83
3	200	11	9.17
4	300	8	6.67
5	400	3	2.50
6	500	17	14.17
7	600	6	5.00
8	700	3	2.50
9	800	2	1.67
10	1000	8	6.67
11	1200	1	0.83
12	2000	3	2.50
13	3000	1	0.83

Using maximum likelihood estimation (Table 9) under the assumption of a log-normal distribution of WTP values, the estimated mean willingness to pay was ₹513.22, with a median value of ₹346.80, indicating a right-skewed distribution. The 95 per cent confidence interval for mean WTP ranged from ₹411.78 to ₹614.66, suggesting moderate yet constrained financial capacity among respondents.

Table 9: Parameters of maximum likelihood estimation of Willingness to Pay (WTP)

Parameter	Value
Mean log (μ)	5.848
SD log (σ)	0.885
Mean WTP	513.218
Median WTP	346.802
Lower 95% CI	411.779
Upper 95% CI	645.200

Determinants of willingness to pay

Results of the probit regression analysis identifying factors influencing farmers' willingness to pay are presented in Table 10. Distance of farmland from forest boundaries exhibited a positive and statistically significant relationship with WTP at the one per cent level. This implies that farmers located farther from forests were more likely to express willingness to pay, possibly due to higher income stability and stronger risk aversion to potential future losses. Farm size exerted a negative and statistically significant influence on willingness to pay at the five per cent level, indicating that smaller landholders were relatively more willing to contribute financially towards conflict mitigation. Smallholders rely heavily on agricultural income and therefore face higher relative risk, motivating stronger interest in preventive measures. Larger farmers, by contrast, tend to possess diversified income sources and greater access to institutional support, reducing their willingness to participate in collective financing mechanisms.

Table 10: Probit model estimates of factors influencing farmers' willingness to pay

Sl. No	Coefficients	Estimate	Std. Error	P value
1	Intercept	-0.783	0.9725	0.4205
2	Distance from the farm land to the forest	0.003	0.0001	0.005***
3	Size of farmland	-0.245	0.1075	0.0225**
4	Age	0.024	0.0170	0.1658
5	Total family income	-0.073	0.0748	0.3326
6	Education	0.718	0.2876	0.0126**

*** and ** denotes significance at 1 and 5% level, respectively

Education had a positive and significant effect on willingness to pay, suggesting that better-educated farmers are more aware of mitigation benefits, demonstrate greater institutional trust, and are more receptive to participatory approaches. Other variables, including age and total family income, were not statistically significant, indicating limited explanatory power in determining WTP decisions.

Reasons for unwillingness to pay

Reasons cited by farmers unwilling to pay for conflict

mitigation are summarised in Table 11. Nearly half of these respondents (47.36 per cent) perceived wildlife management as the responsibility of the government. A substantial proportion (26.31 per cent) believed that wild animals are inherently uncontrollable, while others expressed distrust in implementing organisations or cited economic and technical burdens.

This perception reflects strong dependence on state-led compensation mechanisms and limited exposure to community-based mitigation models. Evidence from community-managed insurance programmes in Nepal indicates that locally operated, low-premium schemes can enhance accountability and trust (Sherchan *et al.*, 2021)^[16], suggesting potential pathways for improving participatory HWC governance in Kerala.

Table 11: Reasons for farmers' unwillingness to pay for wildlife conflict mitigation

Sl. No	Reasons	Response
1	No faith in any organisation	9 (23.68%)
2	It is impossible to control wild animals	10 (26.31%)
3	Economic and technical burden	1 (2.63%)
4	The government must take care of the issue	18 (47.36%)

Conclusion

The present study highlights the persistent and intensifying challenge of human-wildlife conflict in Wayanad district, where increasing wildlife populations, resource scarcity within forests, and close proximity between agricultural land and wildlife habitats generate frequent conflict incidents. Farmers clearly identified ecological stressors and institutional shortcomings as primary drivers of conflict, with elephants, wild boar, monkeys, leopards, and tigers posing significant threats to crops and livestock.

Although compensation remains central to farmers' tolerance towards wildlife, the study reveals substantial implementation challenges, including procedural complexity, assessment bias, and delayed disbursement, which erode confidence in institutional responses. Preventive measures managed directly by farmers were perceived as more effective than large-scale institutional interventions, highlighting the importance of decentralised and locally adaptive strategies.

The estimated mean willingness to pay of ₹513.22 reflects cautious willingness among farmers to participate financially in mitigation efforts, conditioned by economic capacity and institutional trust. Willingness to pay was significantly influenced by distance from forest boundaries, farm size, and educational status, indicating differentiated vulnerability and participation incentives across farmer groups.

Overall, the findings underscore that sustainable management of human-wildlife conflict in Wayanad requires an integrated approach that strengthens preventive infrastructure, improves institutional efficiency, ensures timely and transparent compensation, and promotes participatory mechanisms aligned with local socio-economic realities. Integrating ecological management with economic incentives and community engagement will be essential for safeguarding both rural livelihoods and biodiversity in conflict-prone landscapes.

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