Performance of human–wildlife conflicts compensation scheme in Karnataka, India

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Compensation serves as a post-conflict management tool for human–wildlife conflicts. In the Bannerghatta National Park (BNP) region, Karnataka, India, around 57.4% and 95% of the farmers received compensation for crop loss and cattle kill respectively. Compensation claims incurred transportation and paper costs of 60–70% and 30–40% respectively, and it took 7.6–12.3 months on average to receive compensation. Crop loss applications had the lion's share of the total applications, while the compensation paid share was relatively less in the total compensation paid. Inadequacy of compensation was a major constraint. Separate advance fund provisions for crop loss, livestock depredation, property damage and human-related losses in proportion to annual cases can prevent the delay and inadequacy of compensation.

Keywords: Compensation scheme, constraints, human–wildlife conflicts, national park, performance.

CONSERVATION measures are facing challenges due to the threat of human–elephant conflicts (HWCs). Local villages, protected area managers and elephants themselves are also impacted by this issue[1]. Compensation is widely used as a post-conflict mitigation tools[2]. In 2015, a total of 130 compensation schemes were in operation, with the highest prevalence in Europe, followed by North America and Asia, and the least in Africa, South America and Australia[3]. In India, Karnataka and Madhya Pradesh have detailed compensation policies and disburse the highest compensation in response to crop damage and livestock depredation respectively[1]. However, in Karnataka, compensation schemes are not effective because of the bureaucratic nature of claiming compensation[4]. Compensation programmes help people to cover economic losses from HWCs and indirectly spreads the cost of wildlife damage with wildlife conservationists and also improves farmer's attitudes toward wildlife[3]. There is a need for additional efforts to study the views of compensation recipients and how their perspectives are similar or different from those of the practitioners. Understanding different perspectives will help in developing alternative mitigation measures and improving existing compensation schemes[2].

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Materials and methods

Simple random sampling was used to identify 426 farmers in the eco-sensitive zone (ESZ) of Bannerghatta National Park (BNP), Karnataka. Farmers' opinions on compensation schemes, loss estimation methodology, constraints in receiving compensation, etc. were collected from direct interviews through a pretested schedule. The loss estimation, compensation provisions and constraints in implementing the compensation were recorded from the discussions with range forest officers. Secondary data for the period 2017–18 to 2021–22 related to the number of applications for compensation and the amount disbursed for different HWC cases in the BNP region were collected from records of the BNP Head Office. Data for the same parameters for Karnataka were collected from the annual reports of the Karnataka State Forest Department (KSFD).

HWCs compensation provisions and their implementation were evaluated against the ideal features[5], namely fairness, no free lunch, corruption-free, timely payment, minimum demand on personnel and sensitivity to changing ecology. The cost of compensation claims was calculated from the response of farmers who received compensation.

The constraints faced by farmers in claiming compensation were recorded. The rank-based quotient (RBQ) technique assigns ranks to the recorded statements. The technique uses an arbitrary scoring system to determine the relative relevance of certain restrictions[6]. Unlike the simple ranking

Table 1. Performance of human–wildlife conflict (HWCs) compensation scheme in the Bannerghatta National Park (BNP), Karnataka, India region (n = 426)

Conflicts	Reported (%)			Compensation received (%)		Opinion of farmers on loss estimation accuracy (%)			Average compensation claiming costs (INR) incurred by farmers				Time between conflict and payment (months)	Opinion of farmers on satisfaction from compensation (%)	
	Total number of cases	Yes	No	Yes	No	Under	Over	Correct	Transportation	Paper	Corruption	Total		Yes	No
Crop loss	536	64.4	36.6	57.4	42.6	95.2		4.80	211.3 (69.5)	84.9 (30.5)		303.8	7.6	4.8	95.2
Desi cows	109	78.2	21.8	96.7	3.3	95.2	–	4.80	254.36 (64.7)	128.4 (35.3)	–	393.1	9.2	4.8	95.2
Cross breeds	9	88.4	11.6	100	–	100	–	–	220 (59.5)	150 (40.5)	–	370	10	0	100
Goats	47	69.2	30.8	78.3	21.7	100	–	–	260.4 (67.7)	135.4 (32.3)	–	384.2	9.3	0	100
Sheep	42	65.4	34.6	81.2	18.8	100	–	–	250 (65.4)	134.7 (34.6)	–	382.2	12.3	0	100

Figures in parenthesis indicate percentage of total cost.

Table 2. Comparison of crop loss compensation provisions of Karnataka with minimum support price (MSP) or market prices

Crop	Compensation provisions in 2016 (INR/quintal)	Compensation provisions in 2023 (INR/quintal)	MSP/market prices (INR/quintal)	Difference (%)
Mango	–	750–1,800/tree	7,000*	–
Chilly	1,954	3,908	4,200*	–292 (6.9)
Paddy	1,320	2,640	2,183	+457 (+20.9)
Tomato	588	1,176	2,000*	–824 (41.2)
Napier grass	–	–		
Ragi	1,200	2,400	3,846	–1446 (37.6)
Jackfruit	–	350 to 800		
Cowpea	2,400	4,800	4,400*	400 (+9.1)
Castor	4,604	9,208		
Jowar	1,240	2,480	3,225	–745 (23.10)
Field bean	2,242	4,484	10,700	
Coconut	400–2,000/tree	800–4,000/tree	11,750/Q (copra)	
Mulberry		100/gunta		
Groundnut	3,100	6,200	6,377	–177 (2.7)
Banana	160/plant	320/plant	950*	–
Horse gram	–	–	4,999*	–
Red gram	3,100	6,200	7,000	–800 (11.42)
Beans	2,390	4,780	5,480*	–700 (12.8)
Cucumber	–	–	1900*	

Source: Karnataka State Forest Department, the Commission for Agricultural Costs and Prices and Krishi Marata Vahini, Government of Karnataka.
*Indicates market price.

technique, the preferential ranking technique in RBQ considers the overall magnitude and enables constraint analyses through a participatory approach. RBQ can be estimated as[7]:

$$\text{RBQ} = [\sum F_i\,(n + 1 - i)/Nn] \times 100,$$

where F_i is the frequency of farmers for the ith rank of constraint, N the total number of participants and n denotes the total number of identified constraints.

Results and discussion

Table 1 shows that the reported attacks from wildlife were higher (88.4%) in crossbreeds since they were not taken for grazing in the forest and the attacks were outside the forest boundaries, so it was easy to find the carcass and report the same. Even though desi cows were taken for grazing in the forest, reports of attacks on them were substantially higher (78.2%) because of the large body size of the carcass and easy traceability. Attacks on goats and sheep were found to be under-reported (65%) because of the miniature body size of the carcass and difficulty in locating the carcass inside bushes and leopards' handling capacity. Often, the attacks were inside the forest, though grazing is illegal inside the National Parks.

The number of farmers who received wildlife crop loss compensation was low (57.4%) due to variations in crop loss, compensation provisions and numerous applications. For cattle kill, 95% received compensation because of its higher economic value and fewer applications. In general, loss estimation or compensation fixed for all conflicts was less than its monetary value. Transportation and paper costs incurred to claim compensation were around 60% and 40% respectively.

No corruption was reported during compensation claims. The average time gap between compensation application and disbursal was 7.6–12.3 months, whereas individual cases ranged from 6 to 21 months. More than 95% of farmers expressed dissatisfaction with the present compensation scheme. Farmers reported that they did not get compensation for crop damage caused by wild boar, and in a few cases, the compensation received did not cover the cost incurred to apply for the same. The economic value of cows reared for farming purposes is more than for meat, so farmers expect the compensation to be aligned with at least the value of animals for meat. Forest officers who visit the field to validate losses will determine the maximum compensation to be paid within the limits fixed by the Government. The compensation amount can be altered at the Assistant Conservator of Forest and Deputy Conservator of Forest level based on the loss quantified and total sum available for compensation. Thus, the compensation scheme meets the minimum demand on personnel features given by Milind *et al.*[5]. However, around 97% of the farmers reported that they had no say in either the estimation of loss or in the fixation of compensation, which indicates the bureaucratic nature of the procedure. Further, it lacks agricultural experts' advice in estimating crop loss.

Table 2 shows the maximum compensation provision for different crops. Maximum compensation for crop loss, livestock depredation, property damage and human deaths is fixed by KSFD. According to the data available,

Table 3. Analysis of ideal features in the compensation scheme

Feature	Examination	Presence	Particulars
Fairness	Does the compensation package cover the actual direct and indirect loss due to wildlife, or is it underestimated or overestimated?	X	95.2–100% reported compensation as underestimated.
No free lunch	Does any farmer receive benefits without any loss from HWCs?	X	All farmers reported requirement of land records for compensation claiming restricted free claims.
Free from corruption	Does the evaluator favour someone and get a bribe for it, or is he subjective in damage estimation?	✓	No farmer reported practice of corruption by the forest staff.
Timely payment	Time taken for issuing compensation.	X	Time gap varied between 7.6 and 12 months to receive compensation after HWCs.
Minimum demand on personnel	Are local people involved, or do the only officers analyse the loss and compensation amount?	X	Only 2–3 forest officials were involved in loss estimation.
Sensitive to changing ecology	Does the system accommodate changes in crops, and market value of animals regularly in compensation provisions?	X	Compensation fixed in crops was less than 2–37% of the MSP.
Transaction costs	All cost details in claiming compensation.	✓	Transportation costs ranged between 60% and 70% and paper cost was the remaining cost incurred.

Note: ✓ indicates satisfactory feature of compensation with ideal feature and X indicates unsatisfactory feature.

compensation was first fixed in 2010 with Government Order (GO) APG143FWL2010 dated 30/04/2011. Then, after a gap of six years, it was updated with GO APG130 FWL2016 dated 19/09/2016. Further, the compensation amount was doubled from the previous level with GO APG156FWL 2022 dated 18/01/2023. KSFD has fixed Rs 10,000 per cow, bull and buffalo, and Rs 5000 per goat and sheep. Only in the case of paddy and cowpea is the maximum provision compensation fixed more than 20.9% and 9.1% of the minimum support price (MSP) and market price respectively. Groundnut is most vulnerable to damage from wild boars and monkeys, but compensation is less than 2.7% of MSP. Ragi is a major staple crop grown in southern Karnataka; compensation provision is less than 37.6% of the MSP.

Compensation for jowar and red gram is less than 6.9% and 11.42% of the MSP respectively. In the case of mango tree, it is fixed at Rs 750–1800 per tree based on its age, while the average market price of mangoes is approximately 7000 per quintal. Elephants, monkeys and sloth bears are common raiders of mango crops in this region. Compensation for coconut trees varies from INR 800 to 4000 per tree based on its age, while the MSP is INR 11,750 per quintal. Coconut is vulnerable to loss from elephants, wild boars and monkeys. In the case of an elephant attack on a mango or coconut tree, the probability of breaking the whole tree is high. The compensation provision for bananas is INR 320 per plant, aligned with the yield of local varieties but insufficient to cover the level of high-yielding varieties (HYVs). So, attacks on plantations with HYVs bananas cause huge losses. The compensation provision is less than 41.2% of the annual average market price for tomatoes. Mulberry is an alternative to avoid loss from elephants but is prone to damage from deer and Indian gaur. Chilly is suggested to prevent elephant-related crop loss[8], but it is vulnerable to damage from peacocks in this region. However, the compensation provision is 6.9% less than the annual average market price. Similarly, beans are 12.8% less than the market price. Cucumber, Napier grass and horse gram are also vulnerable to damage by wildlife but are not included in the compensation provision list. Therefore, the need of the hour is to include leftover crops, consideration of bases such as MSP or average market price, and agricultural experts' advice in fixing the compensation.

Table 3 shows an analysis of the ideal features of the compensation scheme. The table reveals that 95.2–100% of respondents reported compensation as unfair and underestimated. Moreover, land records were an essential prerequisite for filing compensation claims, thereby ensuring no false claims. None of the farmers reported instances of corrupt practices by the forest staff. However, the timeframe for disbursing compensation was 7.6–12 months after a HWC incident, signifying a notable delay. Globally, among 33 schemes, 82% ($n = 27$) paid compensation in less than six months, while 18% ($n = 6$) took longer than six months[3].

Around 93% of the farmers reported a lack of participation in estimating crop loss since it is done by a few forest officials, excluding beneficiaries, the local community and agricultural experts. As a result, the assessment of losses and subsequent compensation did not cover the actual loss. The compensation fixed for crop-related losses was significantly low, ranging from 2% to 37% of the MSP. Transportation expenses accounted for 60–70%, and the rest for paperwork. From the above discussion, it can be concluded that the HWCs compensation scheme of GoK satisfied ideal features such as no free lunch, free from corruption and minimum demand on personnel; however,

Table 4. Compensation application status for crop loss and livestock depredation from 2017–18 to 2021–22 under BNP

	Crop loss					Livestock loss				
	Applications			Total compensation	Compensation/case	Applications			Total compensation	Compensation/case
Year	Received	Settled (%)	Balance (%)	(INR)	(INR)	Received	Settled (%)	Balance (%)	(INR)	(INR)
2017–18	973	767 (78.8)	206 (21.2)	2,140,869	2,791	43	38 (88.4)	5 (11.6)	227,000	5,974
2018–19	874	781 (89.4)	93 (10.6)	2,634,280	3,373	41	38 (92.7)	3 (7.3)	289,500	7,618
2019–20	831	595 (71.6)	236 (28.4)	2,661,391	4,473	43	28 (65.1)	15 (34.9)	209,000	7,464
2020–21	596	1400		4,821,111	3,444	30	49		412,000	8,408
2021–22	1180	402 (34.1)	778 (65.9)	1,831,875	4,557	28	15 (53.6)	12 (46.4)	100,000	6,667

Source: BNP, GoK.

Table 5. Compensation application status for human injury and kill from 2017–18 to 2021–22 under BNP

	Human injury					Human kill				
	Applications			Total compensation	Compensation/case	Applications			Total compensation	Compensation/case
Year	Received	Settled (%)	Balance (%)	(INR)	(INR)	Received	Settled (%)	Balance	(INR)	(INR)
2017–18	6	4 (66.7)	2 (33.3)	68,957	17,239	4	3 (75)	1 (25)	1,150,000	383,333
2018–19	3	2 (66.7)	1 (33.3)	55,626	27,813	7	5 (71.4)	2 (28.6)	1,652,911	330,582
2019–20	3	1 (33.3)	2 (66.7)	9,972	9,972	0			–	
2020–21	1	2		110,000	55,000	1	2		1,500,000	750,000
2021–22	6	4 (66.7)	2 (33.3)	68,957	17,239	2	2		1,500,000	750,000

Source: BNP, GoK.
Figures in parenthesis indicate percentage of applications received.

Table 6. HWCs compensation applications and compensation disbursed

	Number of applications (%)					Amount sanctioned (%)				
Year	Crop loss	Livestock	Human injury	Human kill	Property damages	Crop loss	Livestock	Human injury	Human kill	Property damages
2017–18	90.8	4.2	0.5	0.3	4.2	57.9	5.48	3.7	30.0	2.8
2018–19	88.8	4.0	0.3	0.7	6.2	56.4	2.14	2.7	39.9	4.0
2019–20	87.7	4.6	0.3	0.00	7.4	86.1	6.74	1.5	0.00	5.5
2020–21	81.4	4.1	0.1	0.1	14.3	38.7	11.3	8.8	32.9	15.6
2021–22	90.4	2.1	0.00	0.2	7.3	51.4	5.2	0.0	34.5	8.1

Source: BNP, GoK.

it was insensitive to changing market prices, faced payment delays, and involved costs in getting compensation. Overall, the compensation scheme was unfair in the opinion of the farmers.

Table 4 represents compensation applications and their status for crop loss and livestock depredation under BNP from 2017–18 to 2021–22. Compensation paid per case has increased over the years based on fund availability. Crop loss applications due to wildlife varied from 596 to 1180 per year. Each year, more than 70% of the applications had been settled, except during 2021–22. Compensation applications for loss from wildlife for livestock depredation varied from 28 to 43 annually. Over 70% of the applications are settled every year.

Table 5 shows that, on average, three human kills occur annually, mainly by elephants. Human injury is also primarily caused by elephants, followed by sloth bears, wild boars and Indian gaurs. Other studies have also reported that elephants had more indirect conflicts with humans[9]. Annually, we observe at least one compensation application for human injury. It was reported that compensation in the case of human injury is paid in the form of medical expenses if it is reported before taking medical aid and direct cash transfer to the injured person if he takes treatment at his own expense. Although there are fewer cases, we found unsettled applications each year.

Table 6 reveals that the share of compensation applications for crop loss ranges from 81.4% to 90.8%, while the share of the amount compensated is 51.4–57.9%. In contrast, applications for livestock range between 2.1% and 4.5%, whereas compensation ranges between 2.1% and 11.3%. Property damage applications are in the range 4.2–14%, whereas the compensation share ranges between 2.8% and 15.6%. Annually, human kill and human injury compensation applications comprise approximately 1%, while compensation disbursement amounts to more than 30% and compensation disbursal for human-related conflicts is prioritized over other applications. The above statistics signify the disproportionate relation between compensation applications and compensation disbursed. Other studies also reported that human casualties are the dominant cost of HWCs in India[9]. Crop-loss compensation applications have the lion's share of the total applications, while the compensation is relatively less. However, another study reported that out of the 122 schemes, livestock loss was the most common reason for wildlife compensation ($n = 103$, 84%), followed by compensation for crop damage ($n = 43$, 35%) and human injury or death ($n = 14$, 11%)[3]. Hence, separate fund provisions for crop loss, livestock depredation, property damage, and human-related conflicts can avoid the pendency of cases and shortfall of funds.

Table 7 provides insights into the trends and patterns of the number of HWCs and the compensation amount dispersed in Karnataka from 2010 to 2020. Variation in compound annual growth rate (CAGR) across different categories suggests varying trends and patterns of HWC cases and the amount sanctioned. The number of cattle killed and property loss shows a CAGR of 8.7% and 16.6% respectively. Similarly, human injury and the total number of HWC cases exhibit small positive growth. Whereas crop damage, permanent disabilities and human death show a small negative growth. This can be attributed to the effectiveness of the preventive measures taken by the Forest Department and the farmers. Analysis of the amount sanctioned for compensation exhibits positive growth in general. Substantial growth in cattle kill and property loss can be attributed to an increase in several cases as well as an increase in compensation provisions, while growth in human injury and permanent disability is due to inflation of medical expenditure and an increase in compensation provisions. Similarly, growth in crop loss, human death and total amounts sanctioned can be attributed to an increase in compensation provisions by KSFD.

In Table 8, the six constraints in obtaining compensation are assigned ranks based on RBQ. The calculated RBQ values range between 27.9 and 53.7 based on the ranks assigned by the farmers. Inadequacy of compensation with RBQ = 27.9 is given the first rank, followed by a delay in obtaining claims (RBQ = 33.02), lack of compensation adjustment to market price (RBQ = 33.5), official bias in loss assessment (RBQ = 49.3), low probability of receiving compensation (RBQ = 52.7), and cumbersome documentation and procedure (RBQ = 53.7).

Other constraints

Farmers of eight villages in the ESZ of BNP reported a land dispute with the Forest Department. Disputed landowners

Table 7. Trend and pattern of HWC cases and compensation sanctioned in Karnataka from 2010 to 2020

Year	Crop damage		Cattle killed		Human deaths		Permanent disability		Human injury		Property loss		Total	
	No. of cases	Amount (INR lakhs)	No. of cases	Amount (INR lakhs)	No. of cases	Amount (INR lakhs)	No. of cases	Amount (INR lakhs)	No. of cases	Amount (INR lakhs)	No. of cases	Amount (INR lakhs)	No. of cases	Amount (INR lakhs)
2010–11	33,555	827.1	751	23.8	44	72.6	5	1.9	211	22.2	22	1.2	34,588	948.8
2011–12	20,312	541.2	656	21.4	30	112.2	10	5.1	158	13.4	53	1.4	21,219	694.8
2012–13	34,496	958.9	1269	43	59	276.7	36	8.8	151	18.9	80	2.5	36,091	1308.8
2013–14	19,137	619.8	832	28	68	322.7	11	5.5	157	15.5	64	2.3	20,269	993.8
2014–15	5,401	631.5	1896	136.7	48	228.8	6	4.2	108	23.3	80	3.9	17,539	1028.5
2015–16	20,981	937.6	2428	177.3	42	178.8	3	4.5	176	64.4	131	5	23,671	1368
2016–17	16,185	832.2	2211	180.4	18	85	3	6.4	109	43.1	79	4.9	19,210	1227
2017–18	20,591	1123	2149	173	37	185	4	17	122	49	203	12	23,480	1563
2018–19	24,740	1422	3019	243	36	237.5	4	16.5	195	100.9	504	30.1	28,559	2164.1
2019–20	31,255	1843.1	4052	399.8	40	265	6	15.5	230	124.7	1307	71.2	36,982	2741.6
CAGR (%)	–0.25	4.3	8.69	15.6	–1.57	2.8	–5.21	8.4	0.15	10.7	16.58	19.9	0.17	5.2

Source: Annual reports, KSFD.

Table 8. Constraints in getting compensation (n = 426)

Constraints	Rank based quotient	Rank
Inadequate compensation	27.9	1
Delay in getting the claims	33.02	2
Compensation amount not adjusted to changes in the market price	33.5	3
Official bias in loss assessment	49.3	4
Probability of receiving compensation is low	52.7	5
Cumbersome documentation and procedure	53.5	6

could not claim compensation because the Forest Department also asserts ownership of the same land. Similarly, farmers with inherited properties and without complete transfer of land titles were unable to claim compensation. 'Vermin' status to wild boars by GOK forbids compensation for damages by them, so farmers do not report such damages. The 'vermin' category deprives the animals of protection under the Wildlife (Protection) Act 1972, thereby allowing for their hunting[10]. Damage by deer is minor, but regular and cumulative; so farmers cannot visualize and quantify immediately and report the same. Finding carcasses of goats and sheep is difficult if not noticed during the attack since leopards easily carry them away. However, the most common negative comments on compensation disbursement from another study were low payments (12%), unsustainable funding (7%) and delay in payments (7%)[3]. Forest officers in the discussion mentioned that E-Prahari, an e-governance app, has been developed and used in the compensation disbursal mechanism. It reduces the cumbersomeness of the compensation scheme and increases the accuracy of the compensation claims. Farmers were less aware of this app since it was used only by the forest officers.

Conclusion

Annual updates to compensation provisions in line with market prices benefit farmers and incentivize them to invest in agriculture. Also, fixing the maximum compensation for livestock based on age and breed will assure the farmers' risk coverage and change their attitude towards wildlife. The present study suggests the involvement of agricultural experts in the estimation of crop loss and fixing the compensation provision to increase accuracy. Land disputes between farmers and the forest department must be resolved through inter-departmental cooperation between the Department of Revenue and Forest Department, GoK. Separate advance provision of funds for crop loss, livestock depredation, property damage and human-related loss can be made in proportion to annual cases to prevent the delay and inadequacy of the compensation.

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