

Cost of Human Wildlife Conflict and its Compensation in Kuno Wildlife Sanctuary

By:

Tilottama Sarkar, MA Sociology, DSE

Sneha Lamba, MA Economics, DSE

Randeep Kaur, MA Economics, DSE

Radhika Kapoor, MA Economics, DSE

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Introduction

Human wildlife conflict inevitably arises when the needs of forest adjacent human settlements collides with those of the wildlife. Rise in crop density, non timber forest produce (NTFP) gathering, livestock grazing and hunting adversely affect forage and prey availability, besides impacting biodiversity through indirect mechanisms (Elisa Distefano). On the other hand, human settlements become attractive targets for wildlife as they are competitively excluded from forest resources (Madhusudhan and Mishra 2003). Relatively defenceless livestock and standing crops in a field are easy preys for wild animals, especially as the wild plants and herbivores have evolved natural defences against foragers. (Polis 1999, Sukumar 1990, Madhusudhan and Mishra 2003). It is then not surprising that crop and livestock depredation, and even loss of human lives are not uncommon in such human settlements, and have been reported from many parts of India. (Johnsingh and Panwar 1992, Prater 1980, Rajpurohit & Mohnot 1988, Studsrød & Wegge 1995, Sekhar 1998).

Official response to address the human wildlife conflict came largely in the form of promulgation of various laws and regulations. The Wildlife Protection Act (1972) prohibited all human activities, except management work and tourism inside *National Parks*, while certain types of rights and activities are permitted inside *Sanctuaries*. Greater levels of human activity are permitted inside Reserved Forests (RFs) and Protected Forests¹, the latter being granted a higher degree of flexibility. These Acts were meant to mitigate the conflict and conserve wildlife, *via* a balanced mechanism of earmarking protected areas and stating conditions under which hunting and trading of animals was permitted. However, over the years, the Wildlife Protection Act underwent various amendments, virtually banning hunting and trading in all forms and excessively concentrating on the conservation of wildlife at the expense of socio-economic rights of the local communities, fracturing their dependencies and relations² with the forest and creating much resentment. (Hales 1989). This was sought to be corrected by the Forest Rights Act 2006, which granted use and title rights and forest management rights to forest dependent communities.

Most conflict resolution methods employed can be broadly classified in two categories: proactive measures which pre-empt conflict, and reactive or mitigative measures which are promulgated post conflict (Madhusudhan and Mishra 2003, Mishra 1997). Proactive strategies include barriers (natural or man made), improved anti predator and livestock management, guarding fields and livestock, etc, while reactive measures include compensation schemes, relocation and granting of rights to natural resources local communities.

¹ First mentioned in the Indian Forest Act, 1927.

² The Wildlife Protection Act 1972 (Management of Over Abundant Ungulate Populations, H.S. Pabla).

This paper attempts to address the gap in understanding of reactive measures in general, and monetary compensation schemes in particular. Compensation schemes have largely been unpopular due to inefficiency, low rate of disbursements and budget constraints of the Governments (especially in developing countries), and also as the inherent moral hazard in the scheme incentivises local communities to exaggerate and exacerbate loss. We suggest measures for improving effectiveness of such schemes by threshing out the major instruments and factors involved in the Human Wildlife conflict near Kuno-Palpur Wildlife Sanctuary. First, the associated costs are analysed and the loss to livestock and crop damage estimated, on the basis of observations in four villages. An attempt is made to determine the impact of social and economic factors and farming practices on the amount of loss suffered. Second, the rates of compensation provided in the scheme are compared with our estimates to measure the proportion of costs mitigated in an ideal situation. Third, the efficacy of the scheme is assessed by its level of sensitivity to the local social and economic situation, and its on ground implementation.

Methods

Survey Area

Kuno wildlife sanctuary, located between latitudes 25degree 30second - 25degree 53second N and longitudes 77degree 07second – 77degree 26second E, is situated in the Sheopur district of north-west Madhya Pradesh. The total area is 344.686 sq km out of which 313.984 sq km is forest land and 30.702 sqkm is revenue land in the Sheopur and Vijapur tehsils of Sheopur district. The flora comprises mainly the palash, khair, kardhai and salai patches of forest, the dhawda, gunja, tendu and various medicinal trees. The kardhai trees outside the Sanctuary are much degraded, as they make good fodder. The fauna comprises the leopard, chital, sambhar, chowsingha, chinkara, neelgai and the others like the wild boar, fox, jackal, wild dogs and hyenas.

The survey covered four villages- Kadwai, Magardha, Dhaurera and Umri, located at increasing distances from the core area of the Sanctuary. The biggest communities by far in the villages are the Dhakars and the Adivasis. Umri is serviced by a pakka road, while the other three have kaccha roads motorable only in the dry season. The terrain is typical of Central Indian highlands, with the soil showing spatial variation in depth. It falls in the semi-arid zone (the average rainfall is 750 mm per year). The four villages are located along the *Kunwari Nadi*, with Umri, Dhaurera, Margardha and Kadwai being downstream in that order. However, not all surveyed fields were located near the river; *Kunwari Nadi* also dried out mid-season in the year. The main crops grown in the region are Bajra (*Indian millet or Pennisetum typhoides*), Petha (*Ash Gourd or benincasa hispida*) and Tilli (*Sesame or Sesamum indicum*) for the Kharif season, and Sarson (*Mustard or Sinapis albae*) and Wheat (*Triticum aestivum*) for the Rabi season. Other crops include Arhar (*Pigeon pea or Cajanus cajan*), Soya bean (*Glycine max*), Chana (*Chikpea or Cicer arietinum*), Peanuts (*Arachis hypogaea*) and Methi (*Fenugreek leaves or Trigonella foenum*). Vegetables, pulses and wheat are grown mostly on irrigated land. Most of the irrigation in this area is rain fed or through open wells, which were mostly dry in the harvesting season under review due to scarce rainfall in the previous year. *Til* was ruined for almost all farmers interviewed due to lack of untimely rainfall, while standing crops of *petha* rotted in most of the fields of Dhaurera, Magardha and Kadwai as monsoon made the seasonal roads intractable.

Methodology

The survey was carried out in four villages (Umri, Magardha, Dhaurera and Kadwai) chosen through purposive sampling, on the basis of levels of crop and livestock depredation and distance from the Sanctuary. Focus group discussions and semi-structured interviews with villagers were used to collect quantitative and qualitative information on crop and livestock depredation, and the implementation of the compensation scheme. Questionnaires were administered to households stratified on the basis of caste to gather information on household composition, land and livestock

holding, crops harvested in the previous Kharif and Rabi seasons. Information was assimilated on the crop loss in the past year, and livestock depredation in the past five years.

Limitations of the study

The estimates of crop and livestock depredation are based on farmers' recall, which tend to underestimate productions and overestimate crop loss (Jeyasingh and Davidar 2003). Further bias could be brought in as negotiations are on between villages and the state for relocation of the former. Also, the study covers just one edge of Kuno Palpur Wildlife Sanctuary, and the implementation of the compensation scheme may be different in these portions of the sanctuary, and across sanctuaries.

Human Wildlife Conflict (HWC) and its compensation: A social and economic paradigm

The actual cost of HWC depends on two factors- the economic cost of HWC, and the perception of this cost. In this paper, we focus on economic cost in terms of farming and livestock rearing, excluding the cost of lack of access natural resources, etc. The economic cost refers to the observable monetary value of the crop and livestock depredation, as well as the opportunity cost of the time and money spent on guarding and protection against wildlife attacks and forgoing occupations like livestock rearing. (Norton-Griffiths and Southey 1995). However, these costs and the costs perceived do not always match. (Bell, 1984; Kangwana, 1993; Naughton-Treves, 1997; Siex & Struhsaker, 1999, Gillingham 2003). The perception of these costs can vary with factors like the economic and social status of the afflicted individual, the structure of household (number of members, family structure- nuclear or joint, role of women, education, etc), awareness of laws and conservation issues, and nature of interaction with the Forest Department.

Implicit economic costs

The term economic cost refers to the value of time, space and opportunity lost either directly to the conflict, or to its prevention. One such measure is the building of a boundary wall around the field as a deterrent. The boundary wall is built from loose rocks and boulders as well as thorny shrubs (called *breviary* “*bagadh*” in local parlance) from the nearby forests and fields. It was observed that the height of the wall was inversely proportional to the loss suffered. Most of the respondents who suffered lower losses had boundary walls with above average height. Also, the height of boundary walls is considerably lower in villages which do not face wildlife conflict. However, only the wealthier farmers could adopt this measure of protection as they have more resources at their disposal to erect sturdier and taller walls. The poorer farmers mostly used smaller boulders and shrubs from the forest, making the walls more vulnerable under attacks. The creation of the sanctuary imposed another cost on the farmers in that the access to these forest resources is restricted³. However, boundary walls are not extremely effective against wildlife attacks, as *nilgai* can easily jump over high boundaries while the wild boar can dig under it.

Boundary walls are usually used in conjunction with other protection measures. One such measure is sleeping in fields at night (referred to as “*basna*”). This protection measure is more effective the more are the number of men in the family who can go for *basna*, and less effective if land holding is widely dispersed. Despite the high psychological and physical costs involved, the practice is almost universally followed except in case of strong deterrents like fear of dacoits, family feuds, etc. Such deterrents are more prevalent in richer farmers. Farmers have been known to take firearms to the fields as an added protection measure, which further escalates the conflict in case of an attack.

³ Under the Forest Rights Act, they are allowed to take out as much of wood, etc as they can carry over their head.

In terms of livestock depredation, the time spent guarding the herd (flock) could be spent in other productive activities. This opportunity cost is particularly high during the time workers are employed on fields. Sometimes the children or the aged are sent to mind the flock, in which case the opportunity cost is the value of education or rest. Since the law prohibits grazing within the boundary of the Sanctuary, the common practice is to either send the livestock to the forest unaccompanied or feed fodder in the house/sheds itself. The former is almost universally true for cows (not very valuable in the area surveyed), the latter for buffaloes and goats. In the first case, there are higher losses of livestock (either attacked by wildlife or captured by forest officials- an irrevocable loss in both cases), in the latter there are higher costs of fodder, space, etc. These factors, particularly the shortage of fodder, have contributed tremendously to the decline of livestock rearing, which was once amongst the most prominent occupations of this region. This might be one of the reasons for the absence of a market for hiring labour for looking after the livestock. On the other hand, the economic cost of rearing livestock can be reduced if the community can reach an arrangement of collective grazing, where the entire pool of livestock in a village is taken for grazing together; members of the group take turns for minding the herd. Such an arrangement was observed in Dhaurera, where the arrangement led to incurring costs of organising the arrangement. In the absence of market rate of such labor, it is difficult to estimate its opportunity cost.

Another cost of this conflict is the declining value from livestock rearing as an alternate profession. The time spent in protection of crops and livestock could also be more gainfully spent in an alternate occupation, and this implicit loss of income also contributes to the economic cost. Such costs are, by their very nature, difficult to quantify.

Distribution/Spread of costs

The impact of the conflict on different sections of society is affected by the underlying economic and social relations. While the current literature focuses on the loss incurred by cultivators and livestock owners, the impact on sharecroppers and wage labourers has not been analysed. The compensation law for crop depredation is silent on the distribution of the payment between the landlord and the tenant in the case of sharecropping. The matter is complicated by the fact that the tenancy contracts are verbal. Similarly, the conflict has an impact on the labourers hired on a daily basis to work on the field. The wages received fluctuates daily according to the demand and supply; while the supply of labour is more or less fixed in the closed labour markets observed, the demand fluctuates according to the crop that is left standing after the depredation by the wildlife. Isolated incidents of crop damage would not have great impact in this regard, but it was observed that incidents of crop depredation are rarely lone incidents. Moreover, the earlier the loss occurs in the crop season, the greater is the number of work days lost by the labourers.

Perception of conflict

The estimation of this loss becomes more complicated due to the differences in perception of the same level of conflict. In some cases, the loss of natural resources may also be seen as economic loss. It is quite likely that the cost of livestock and crop depredation has been accepted as a way of life over generations, by those farming adjacent to the forests and is hence not considered an additional burden. Our field reaffirmed the impact of social hierarchy in the understanding of conflicts. The perception of conflict changes with the wealth and social status of the farmer. Though a bigger farmer is prone to greater losses, he may find it easier to protect his fields effectively, and the losses may still form a small proportion of his total produce. The socially dominant sections of the community may also

acquire an inequitably higher share of the available resources, lowering their perception of the economic losses. Being politically more represented and active, the Dhakar caste were better equipped to take advantage of the prevalent compensation schemes than the Adiwasis who had fewer means of. The perception would also change with social determinants like size of the family, mutual support of the adjacent field owners/croppers and the level of education of the family. A more educated family may be more aware of conservation goals as well as more effective conservation methods. However, such perception of conflict is even more difficult to measure than economic costs.

Observable costs of conflict

The economic costs most readily observable and amenable to measurement are the quantities and monetary values of crop lost and livestock depredated owing to the conflict. These recurring losses, which directly fracture the traditional sources of livelihood of villagers, have definite linkages with preventive measures undertaken, farming practices as well as other household and village specific characteristics.

Our survey underlined these observable costs and included detailed questions on the magnitude of crop and livestock lost to the conflict. We intend to identify clearly the variables that impact the magnitude of these losses. As pointed out earlier, livestock rearing as an occupation has been a major casualty to the interaction with the forest and is increasingly dying out in these regions. Farming is the predominant source of income for most of the villagers. Our analysis, in this section therefore covers the monetary value of crop losses and excludes the livestock losses.

Regression Analysis

The methodology considers the variable of interest as the amount of crop loss suffered per unit area and this variable is regressed on observed farming practices, as well as several household and village specific characteristics.

Our primary objective in this exercise is to assess whether the effect of cropping patterns and protection techniques on losses in the surveyed area is in conformity with the results obtained with prominent existing research.

Dependent Variable

Our dependent variable is the amount of crop loss suffered (LOSS) per unit area of land by each household that form part of the sample. The crop loss is given by the magnitude of per *bigha*⁴ losses suffered in both the Kharif and Rabi seasons of the previous year. Quantity of losses are valued at the market price at which the respective crops have been sold and/or the Minimum Support Price in case of self consumption.

Independent Variables

The first variable of interest is VILLAGE. It is an indicator of the location of the village, with respect to its distance from the core sanctuary and other village level effects on crop damage. We would expect that increasing distance from the sanctuary would sufficiently reduce losses. The categorical variable CASTE accounts for farming practices of alternative castes dominant in these areas. We found that a majority of the households surveyed were *Dhakars* or *Aadiwasis* and that cropping techniques widely varied among the castes. *Dhakars* were also almost always wealthier than the *Aadiwasis*, *Oojhas* and *Prajapatis*.

The variable DIVERSE is a further representative of the farming practices of the villagers, and captures the number of different crops grown by the villagers in both the Kharif and Rabi seasons.

The dummy TRACTOR is used to denote the economic status of the concerned household. This is a reasonable depiction as only extremely wealthy households were found to possess tractors. The variable EDUCATION indicates the highest number of years of education obtained by any member in the household surveyed. We would conventionally expect that higher education would lead to lower losses due to informational gains, and also because it represents the far sightedness and initiative taking capability of the family. However, we found that most schools in this area were not functioning and therefore, high educational attainment of children serves as a clear indicator of wealth. Only the wealthy farmer was found to be in a position to send his children to schools in nearby towns.

The variable NMEN simply denotes the number of men in the household but has connotations for time spent for protection as well as farming on the field. We would expect a greater number of men in the household to significantly contribute in the practice of *Basna* that villagers follow as a crop protecting technique.

⁴ 1 acre=

	<i>Entire Sample (1)</i>	<i>Restrict ed Sample (2)</i>		
	COEFFICIENT	p value	COEFFICIENT	p value
<i>Dependent Variable - LOSS</i>				
VILLAGE	-41.44349	0.286	-39.00296	0.164
NMEN	-57.03686	0.249	-6.438445	0.878
EDUCATION	-27.90725	0.315	-8.160778	0.688
TRACTOR	-482.8606	0.097	-233.3224	0.298
CASTE1	660.51	0.008	415.1222	0.051
CASTE2	394.2086	0.084	-3.146767	0.989
DIVERSIFY	162.3519	0.205	-122.6668	0.192
CONSTANT	431.672	0.306	1158.015	0.003
Note: Restricted sample refers to households suffering only positive losses				

Results

Column 1

We obtain the expected signs with regard to NMEN, VILLAGE and TRACTOR though none of the variables turn out to be statistically significant. We find that both CASTE1 (*Dhakar*) and CASTE2 (*Aadiwasi*) emerges significant, suggesting that *Dhakars* suffer higher losses than other communities. TRACTOR is also significant at the 10% level of significance. Owning a tractor has the effect of reducing losses.

Column 2

We find that CASTE2 (*Aadiwasi*) is no longer significant when we restrict the sample to households suffering only positive losses and it also flips signs. The constant also turns out to be significant at 1% level of significance.

Analysis

With regard to the economic status and wealth of farmers, our results seem to suggest that it is only after a particular threshold that a wealthy farmer was significantly being able to reduce his losses. We found that a villager that owned a tractor was necessarily a *Dhakar*. However, our results clearly show that *Dhakars* suffered higher losses. There are two conflicting forces at play here, since a wealthy farmer owned larger plots of land exposing more crops to wildlife attacks but also had access to more advanced crop protecting techniques (higher fences for instance) and possibly the foresight and resources to diversify his crops to growing those that have a lower probability of being attacked.

When we restrict the sample to only those households that suffered a positive loss in column 3, we leave out mostly *Aadiwasi* households that suffered no losses owing to leaving their relatively small plots of land fallow for the purpose of cultivating *Sarson* in the Rabi season.

This has the effect of alternating the sign for the CASTE2 (*Aadiwasi*) into negative and leaving it insignificant.

Compensation Scheme

The impact of the compensation scheme on conflict is debatable because even if it was implemented flawlessly, it cannot be claimed with absolute surety that the local population would not be antagonistic. The direct costs of livestock and crop damage are a proportion of total economic and social costs faced by the local populations, and the latter can not be fully estimated or compensated due to afore mentioned gaps in information. In an ideal complete and symmetric information scenario, the first best compensation scheme would suggest a full cover for the losses incurred. Under such a situation, the effort and invested in prevention measure could be fully ascertained, and compensated. As actions are fully observable and the opportunity cost of time known (say the value of alternate employment is known), the scheme can incorporate suitable penalties and payments to ensure maximum protection of assets. Thus, the classic case of moral hazard would be averted – the incentive of the local populations to invest in prevention measures would stay intact, while the losses still suffered would be compensated. In this ideal situation, the compensation scheme would fully mitigate human wildlife conflict.

However, actions are not fully observable in the real world; neither can the economic value of time, natural resources, etc be estimated. Thus, it is not feasible to estimate the precise amount of economic loss incurred in say, protection of crop at night. It is not possible to observe for each farmer the number of hours spent in the field at night and the effort put in for vigilance (he may just fall asleep under the stars). Also, the opportunity cost of this time would depend on his ability, productivity from alternate occupations, difference in individual preferences (say utility derived from a good night's rest), etc. The observable crop and livestock loss are but a signal of these factors. However, a scheme which only compensates the observable component of the loss, however efficiently estimated, would never successfully allay the conflict; it will perpetuate till the unobserved costs remain unsettled. There would also be an inbuilt moral hazard situation- there is an incentive for the agent to forgo the protection and preventive measures, and claim compensation for the resultant crop and livestock losses. In fact, such a situation can be observed

The conflict could be resolved by a rough measure, which errs on the side of overestimation of total loss (assuming for argument's sake that the Government has an unlimited corpus of funds for such schemes). Such a scheme could mitigate conflict, but would only exacerbate the moral hazard problem. An unconditional compensation for total economic loss would provide incentives to forgo protection, claim the compensation for observed losses as well as protection measures, and gain higher utility by employing the time in other activities. Full compensation for all possible loss, without any check to ensure the unobservable protection and prevention costs would still indirectly discourage investment in them. Such a scheme will by its nature increase the quantum of crop and livestock depredation, with no certainty of mitigation of conflict.

TABLE 2: ESTIMATED VALUE OF CROP LOSS VS COMPENSATION SCHEME PAYOUT

S.No.	Description	Compensation amount per hectare when crop loss is 25-50% of total crop production	Compensation amount per hectare when crop loss is more than 50% of total crop production	Estimated loss per hectare when crop loss is 25-50% of total crop production ²	Estimated loss per hectare when crop loss is more than 50% of total crop production
1	Small and marginal farmers- 0 hectares-2 hectares of land owned	Rain fed crops- Rs 2000	Rain fed crops- Rs 3000	2141.25	4763.11
		Irrigated crops- Rs 3500	Irrigated crops- Rs 7500		
2	Farmers with more land than small and marginal farmers- more than 2 hectares of land	Rain fed crops- Rs 1500	Rain fed crops- Rs 2500	1924.15	2770.60
		Irrigated crops- Rs 2500	Irrigated crops- Rs 5000		

SOURCE: RULE BOOK OF THE MP STATE GOVT; PRIMARY SURVEY

An understanding of the play of these factors is missing from the currently applicable compensation scheme in Madhya Pradesh⁵. The scheme provides for compensation of livestock and crop depredation according to the severity of the conflict and the wealth of the afflicted, however the scheme targets only the cultivators and there is no sensitisation for different sections of the community. It was also observed that the suggested compensation amounts were not modified according to different locations and years. For instance, the same compensation scheme was applicable for 2008 and 2009, though these were years of normal monsoon and drought respectively. Similarly, the scheme is applicable to all forest areas in Madhya Pradesh. The same scheme is in effect around both Kanha Wildlife Sanctuary and Kuno Wildlife Sanctuary, though the two are not similar in terms of area of the protected forests, flora and fauna, number of tourists attracted, the local infrastructure or characteristics of the local settlements.

By paying a fixed amount of compensation, for given level of farm level characteristics, the scheme disregards the importance of risk sharing in the compensation scheme. However, our analysis of loss suffered reveals that the compensation amounts by different categories are justified, and if they err, they err on the side of generosity⁶. (Table 2). Similarly, the payment amount is generous for livestock

⁵ As given by the Rule Book issued by the State Government- Appendix I

⁶ Estimates based on primary survey in the four villages. The values in the table represents the average loss in the four villages according to the categories mentioned in the compensation scheme.

depredation, though it fails to consider for different breeds of livestock (Table 3). By giving a flat payment for loss of cows and buffaloes, irrespective of breed and dairy produce, the policy discourages adopting better varieties. Also, for given resources, villagers would tend to take better care of more productive livestock (like buffaloes) while neglecting the less productive ones (in this region, cows) and claim compensation for latter in case of loss due to HWC. Thus, the policy artificially incentivises less effort for protection.

TABLE 3: COMPENSATION SCHEME FOR LIVESTOCK DEPREDATION

Depredation of domestic animals	Compensation per animal (in INR)
Buffalo/horse/Camel/Cow	10000
Goat	1000
Donkey	5000
Pig	1500
Calves- Buffalo/horse/cow/camel	5000

SOURCE: MADHYA PRADESH GOVERNMENT RULE BOOK

Moreover, there is no procedure for receiving feedback on the implementation and impact of the scheme from the ground. Neither the deputy ranger on the field, nor the SDO in the Block office in Vijaypur had ever been consulted for updating or formulating the scheme, nor did they know which authority was responsible for framing these rules. A compensation scheme which fails to incorporate the opinions of local forest officials, let alone the local villagers, would not be successful in addressing the nuances of human wildlife conflict. Such a scheme may in fact be ineffective when implemented on the ground, or by its very formulation, difficult to implement at all. In the next section, we analyse such inadequacies of the scheme. -

The impact of the law and compensation schemes seems to be same for different sets of people with varied social standing. Because law is believed to be universal and all-encompassing, it appears to be neutral. Though the compensation scheme is available to all, the field displayed different levels of access to different sets of people, depending on their social status. A well connected Dhakar with sufficient resources would find it easier to seek compensation for his crop or livestock losses than an adivasi who might not have the logistical advantage of advancing with the compensation procedures. A well connected Dhakar, who was one of our respondents admitted to being able to receive compensation twice over a span of five years on account of livestock loss by a wild boar, though this kind of benefits were hardly made available to regular villagers, who complained of never knowing the compensation procedure in its entirety. Laws and schemes thus only appear to be neutral while in reality it caters to specific sections of the society.

Problems in implementation of the Compensation Scheme

The first of these is the flaw in *information dissemination*. In the the villages surveyed, most villagers respondents admitted to having no knowledge of the existence of such a scheme. The villagers were largely unaware of a mechanism which would compensate them for their losses due to wildlife conflict, let alone the finer details like which official to approach and the specified time limits for payment of compensation. None of them had ever seen a copy of the law, and if they had, would probably have been unable to read it. Thus, the other lacuna in the implementation of the compensation scheme occurs due to the divorce between the functions and duties of the Revenue Department and the Forest Department. The responsibilities of both the departments are clearly not specified to the villagers as our respondents often admitted to informing the Forest Department of their losses, though inspection and filing of losses lies in the purview of the Revenue Department. The reporting to either Department is verbatim and hence none of them have any document verifying their claim. The irony is that even if a redressal mechanism existed to ensure follow up of complaints, sufferers could not have availed of it as they have no physical evidence of filing a complaint. Instances of discouragement effect were observed wherein villagers gave reporting crop depredation up as a lost cause after notifying the Agra office several times.

Information was best disseminated in Kadwai, followed by Magardha and Dhaurera in that order, possibly due to the presence of a field office of the Forest Department in Kadwai. However, information dissemination is not uniform within a village, with greater ease of access for the socially and economically advanced sections of the community. The only cases of payment of compensation noted were made to socially well connected, resource rich families. The *Adiwasi* caste universally did not have any information of the scheme, which is surprising given their comprehensive knowledge of other Government schemes. . Though the adiwasis are also affected by the same, them being wage labours, and any depredation in crops would directly impact their daily means of subsistence, a overt disconnect was seen between the Dhakar inhabited areas and the areas inhabited by the adiwasis, in terms of levels of social inclusion. The scheme which is ideally required to take every section of population into account, on ground caters to only a certain section of socially and economically privileged.

The lack of information dissemination is surprising in the light of the recent attempts of the Forest Department to include local communities in conservation efforts. According to forest officials, information has been circulated in the villages where the scheme is applicable through pamphlets, discussions in Forest Management Committees, *Jan Sabha*, *Aapki Sarkar*, etc. Though institutions such as the ones mentioned have been initiated to encourage discussions and dissemination of information at the local level, they were hardly seen to be functional. Villagers spoken to had scanty information of such committees. The effectiveness of pamphlets too, in a region where most of the villagers are illiterate is a debatable question. Reasons for apathy towards taking advantage of Government compensation schemes and an apparent lack of information among them, according to the Conservator of Forest and SDO stem from the villager's disinterest to relocate. An acceptance of prevalent conflict by the locals in these areas would give the Government more foothold to shift the villagers out of these areas. (Moreover, such forums where villagers and forest officials can discuss

issues of mutual concern were observed to be defunct). However, officials maintain, with much justification, that information about these schemes is freely available and that from the highest ranking Forest officials to the lowest cadre make an attempt to stay in tune with the ground realities. While this has been observed by the villagers in terms of visits by DFOs even in remote villages, there has been no impact on the implementation of the scheme. A farmer claimed that he did not receive his compensation even after the DFO recommended it to the ranger. Again, he had no documents to support his claim. Moreover, the fact still stands that the very design of the mechanism demands the most, and perhaps too much, of the overworked and under trained ground staff.

BOX 1: PROCEDURE FOR APPLICATION FOR COMPENSATION

The Government has decided that the villages located inside the forest, or within 5 kilometers of the forest boundary are eligible for compensation for crop losses due to attacks by wild animals, according to the provisions of the Rule Book of the Revenue Department.

The estimation of the loss to the crop fields will be carried out by the officers of the Revenue Department using the methodology then prevalent in the Revenue Department. The compensation due, thus estimated will be paid/approved by the Revenue Department officers of the relevant area; it will then be transferred with the relevant particulars to the Forest officials associated with the area, who will pay the compensation money to the complainant.

The compensation scheme for crop loss is as follows:

- (a) The person affected by the wildlife attack on crop has to inform the nearest Revenue Officer of the same within 24 hours.*
- (b) The estimation of the loss will be carried out by the Revenue Officer by the prevalent practices of the Revenue Department. If so required, the Revenue Officer can avail of the services of the local workers Forest Department or the Department of Agriculture through the local Inspector.*
- (c) After the Revenue Department officers have estimated the loss, the application will be forwarded to the Collector, who will inform the associated Forest officials of the amount of compensation money to be paid with the relevant description of the case.*
- (d) The forest officials have to process and make the required payments within one month of receiving the description of the compensation from the Collector.*

SOURCE: MADHYA PRADESH GOVERNMENT RULE BOOK

Secondly, even if the compensation scheme was made widely known, the preconditions for inspection and estimation of losses appear impracticable. In case of crop depredation, the rules require the loss to be registered for inspection at the nearest Revenue Department within 24 hours of its occurrence. Following this it is the prerogative of the Revenue officer at the Revenue Department to estimate the loss. However, Forest Revenue Department offices may not be accessible for villages located in remote areas and not serviced by *pakka* roads. For instance, out of the four villages surveyed, only Umri has access to a motorable *pakka* road, while the other three are connected by seasonal *kaccha* roads. The constraint of twenty four hours appears harsh, especially as the farmers face a higher

opportunity cost of time during the time of harvest or protection of fields.

Further, applying for compensation in case of livestock depredation requires a diagnosis by a vet, calling who is the responsibility of the complainant. Injured livestock are required to be treated, with the incurred expenditure compensated later while the carcass of dead livestock needs to be inspected to determine cause of death. Such inspection and reports need the presence of medical practitioners who are not always located or available in villages, and who may be unwilling to travel to remote villages. It is possible that the injured or dead livestock is no longer in an inspect-able condition by the time the vet arrives. Moreover, villagers may be too impoverished and unwilling to pay for the livestock's treatment, especially when they can see that chances of survival are dim and reimbursement uncertain.

Conclusion

Monetary compensation schemes are unlikely to be complete solutions for Human Wildlife Conflict given the nature of asymmetric information involved. Research has already established means for minimizing conflict, which can be combined with local knowledge to allay conflict. For instance, research has suggested protection measures which prove more effective than others. Ogada et al established that reinforced pens reduce livestock depredation, while the height of the field boundary height is inversely related to depredation. On the other hand, farmers have discovered that some crops are by their nature less prone to wildlife attacks than others. For example, in the region surveyed, *sarson* rarely faces damage as it is unselectable for the two animal species that cause the most damage, wild boars and *nilgai*. However, conflict can never be fully mitigated due to the very nature of cohabitation of humans and wildlife (Oli *et al.* 1994, Williams and Johnsingh 1996, Jhala and Sharma 1997, Mishra 1997, Nath and Sukumar 1998, Sekhar 1998, Rajpurohit 1999, Rajpurohit and Krausman 2000), and thus, a policy mix that does not incorporate an effective and implementable compensation scheme cannot serve its purpose either.

A compensation scheme to be effective needs to take into account the nature of the economic and social costs involved in the conflict. To minimize the opportunity cost of time involved, if not to reduce the alienation of the local communities, the wrinkles in the scheme need to be ironed out. There should ideally be one location point for reporting losses (say the nearest Ranger or Deputy Ranger's office), which should be responsible for the coordination with the Revenue Department or the vet, as the case may be. A role can also be made by technology in making the scheme effective. The provision of suitable equipment to the local forest officer for capturing and storing evidence from the scene of conflict would not require the urgent presence of the concerned authorities. Moreover, it can be used to ensure that complaints about conflict are duly registered and transmitted to higher authorities without any delay. In this regard, the system can be modified so as to replace the verbatim reporting currently prevalent.

The involvement of the local community with conservation as well as conflict reducing efforts is essential if they have to be successful. The alienation of local communities from conservation objectives can be addressed only when instead of a top-down execution, implementation of these laws is cognizant of ground realities (Hough 1988, Ormsby and Kaplin 2005, Sekhar 1988). An effective remedial action would involve understanding the root cause of depredation, and the best ways in which communities could be engaged in mitigating losses. Effective ways to eliminate night-time guarding through governmental intervention in setting up effective boundary walls would mitigate the losses to a great extent and might also economize the expenditure for the Government. These resolution strategies would benefit from expanding their spectrum to include factors such as social and economic costs of conflict, local administrative and political conditions, etc. Research in Hemis National Park, India has shown that community based, participatory conservation initiatives tend to be successful in alleviating conflict, as well as reducing poaching by making local opinion amenable to conservation goals (Jackson and Wangchuk 2004). This paper is intended to be a pilot study for further research in this field.

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Appendix I- Compensation Scheme

1. The compensation amounts for injury or damage to humans or livestock as decided by the State Government are as follows:

Description	Compensation amount (in INR)
Injury to humans	20000
Permanent disability	75000
Depredation of domestic animals by wild animals	According to the provisions of the Revenue Department rule book

2. Compensation for depredation of domestic animals (From Rule book of revenue department Section 6, Serial no 4)

Depredation of domestic animals	Compensation per animal (in INR)
Buffalo/horse/Camel/Cow	10000
Goat	1000
Donkey	5000
Pig	1500
Children- Buffalo/horse/cow/camel	5000
kid- goat, pig, donkey	5000

By the order of the State Government, the compensation scheme for the crop losses suffered by farmers due to attacks by forest animals is as under:

The Government has decided that the villages located inside the forest, or within 5 kilometers. of the forest boundary are eligible for compensation for crop losses due to attacks by wild animals, according to the provisions of the Rule Book of the Revenue Department.

- (a) The estimation of the loss to the crop fields will be carried out by the officers of the Revenue Department using the methodology then prevalent in the Revenue Department. The compensation due, thus estimated will be paid/approved by the Revenue department officers of the relevant area; it will then be transferred with the relevant particulars to the Forest officials associated with the area, who will pay the compensation money to the complainant.

The compensation scheme for crop loss is as follows:

- (a) The person affected by the wildlife attack on crop has to inform the nearest Revenue Officer of the same within 24 hours.
- (b) The estimation of the loss will be carried out by the Revenue Officer by the prevalent practices of the Revenue Department. If so required, the Revenue Officer can avail of the services of the local workers Forest Department or the Department of Agriculture through the local Inspector.
- (c) After the Revenue Department officers have estimated the loss, the application will be forwarded to the Collector, who will inform the associated Forest officials of the amount of compensation money to be paid with the relevant description of the case.
- (d) The forest officials have to process and make the required payments within one month of receiving the description of the compensation from the Collector.

The Section 6, Number 4 of the rule book of the Rule Book of the revenue department is as follows:

- (a) Compensation for crop loss

S.No.	Description	Compensation amount per hectare when crop loss is 25-50% of total crop production	Compensation amount per hectare when crop loss is more than 50% of total crop production
1	Small and marginal farmers- 0 hectares-2 hectares of land owned	Rain fed crops- Rs. 2000	Rain fed crops- Rs. 3000

		Irrigated crops- Rs 3500	Irrigated crops- Rs 7500
		Perennial crops (crop cycle is less than 6 months)- Rs 5000	Perennial crops (crop cycle is less than 6 months)- Rs 7500
		Perennial crops (crop cycle is more than 6 months)- Rs 7500	Perennial crops (crop cycle is more than 6 months)- Rs 10000
2	Farmers with more land than small and marginal farmers- more than 2 hectares of land	Rain fed crops- Rs 1500	Rain fed crops- Rs 2500
		Irrigated crops- Rs 2500	Irrigated crops- Rs 5000
		Perennial crops (crop cycle is less than 6 months)- Rs 3500	Perennial crops (crop cycle is less than 6 months)- Rs 5000
		Perennial crops (crop cycle is more than 6 months)- Rs 5000	Perennial crops (crop cycle is more than 6 months)- Rs 7500

(b) Compensation for fruit bearing trees, oranges, lemons, papaya, banana, grapes, pomegranate, etc

S.No	Description	Compensation amount when crop loss is 25-50% of total crop production	Compensation amount when crop loss is more than 50% of total crop production
1	Orchards/Vines (Fruits/crops on trees) (Other than crops mentioned in S.No.2)	Rs 200 per tree	Rs 300 per tree

2	Oranges, Lemons, Papaya, Banana, Grapes, Pomegranate, etc	Rs 4000 per hectare	Rs 6000 per hectare
3	Paan etc	Rs 12000 per hectare or Rs 300 per	Rs 2000 per hectare or Rs 500 per

1. If the crop loss is less than the compensation amounts given above, the amount of the loss suffered will be paid. However, the compensation amount will never be less than Rs 500.
2. For crop loss or loss to fruit bearing trees (oranges, lemons, papaya, banana, grapes, pomegranate, etc), the compensation amounts mentioned above, but no compensation amount to the affected individual can exceed the limit of Rs 30000.
3. The farmer does not need to have a bank account. The compensation amount will be paid to the person who has sown and harvested the crop. Thus, if the account bearer is farming his own land, he gets the compensation; if the land has been given to another farmer for cultivation, compensation is paid to that farmer.
4. For paan, baraje, etc, one paari refers to 0.025 hectare land.