Evaluating Human-wildlife Conflict and Its Consequences on Agriculture: Insights from Villagers' Perceptions

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study tries to evaluate the HWC and its consequences on the basis of villager's perception. For this study survey was conducted for collection and interpretation of data through semi-structured questionnaire and personal interviews. Data collected were qualitative and quantitative on the basis of respondent opinion. Data was collected for livestock loss, human loss, crop loss and its economic analysis. A significantly maximum 60% loss was due to elephant was a serious menace, 70% of crops are being destroyed alone by monkeys and livestock loss was observed minimum. In addition, threat ranking (according to 3×3 matrix) is given for various key threats in the area

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observed during survey, this data information can be helpful for decision makers to frame sustainable policies and plans to reduce HWC. Most of the respondent considered HWC as a serious threat for agriculture.

Keywords: Human wildlife conflict; threat ranking; crop loss; livestock depredation.

1. INTRODUCTION

Human-wildlife conflict (HWC) is defined as "any interaction between humans and wildlife that results in negative impacts on human social, economic or cultural life, on the conservation of wildlife populations, or on the environment" [1]. Since time immemorial human and wild animals has been living in harmony with nature utilizing resources for the survival, but from last few decades problem of human and wild life conflict is increasing due to human population explosion, moving into previously uninhabited areas to compete for limiting resources with the previous inhabitant of those places – the native flora/fauna and their encroachment in forest land which results in natural habitat destruction. Humans are exploiting resources and wild animals are protecting their territories this leads to the generation of human wildlife conflicts. In modern times human wildlife conflict is a critical and much debated term as it has become a major threat to both the survival of wildlife and human population in different regions of the world. Consequences are no better for wild species which bear the brunt in the form of retaliatory killing and lethal control [2,3,4,5,6].

Sometimes nature also helps to generate the problem such as climate change and forest fire. Due to rise in temperature in Russia 52 polar bears invade a small town in February 2019 due to melting of ice caps and glaciers [7]. Similarly in Australia kangaroos have been spotted in human settlements (https://economictimes.indiatimes. com/news/new-updates/in-rare-fatal-attack-australian-man-killed-by-pet-kangaroo/articleshow/94170935.cms). In southern Africa where the droughts are more frequent pushing the elephants towards human habitations for food and water [8].

Shivani, [9] reported to Times of India newsletter, HWC worsened in Uttarakhand in 2020, with 63 live losses to fatal encounters with wild animals, as compared to 53 deaths in 2019; While, The India Express newsletter (https://indianexpress. com/article/india/uttarakhand-62-dead-in-human-animal-conflict-in-2020-over-half-in-sept-dec-7168324/) reported that 62 people died and 286 were injured in man-animal conflicts in 2020. The

maximum numbers of casualties 30 deaths and 85 injuries were by leopard attacks, followed by snake bites (15 deaths and 53 injuries), elephant attacks (11 deaths and 8 injuries) and bear attacks (86 injuries) as per the record of forest department [10]. In Odisha 195 humans were killed in the last 5 years by elephants, humans in retaliation killed 98 elephants and badly injured 30 elephants [11]. Several other deaths of human due to elephants attack have been reported in the Chamarajanagar in Mysore (https://timesofindia.indiatimes.com/city/mysuru/in-last-four-years-30-died-in-jumbo-attacks-in-kodagu/articleshow/102408795.cms?from=mdr). Tiger attacks have killed 16 people in the Chitwan National Park over the last year, out of total 13 were killed near the buffer zone surrounding the national park [12]. Various persons were killed by different leopard attacks from Sanjay Gandhi National Park [13]. Several conflicting situations have also being reported in the overlapping regions of Jim Corbett national park where the NP and human habitation collides.

According to Monica [14], different communities living near the protected areas of the Uttarakhand are experiencing hundreds of HWC incidents every year which involves depredation upon livestock, crop raiding and attacks on humans are some issues that human populations face whereas the wild animals often face retaliatory actions inflicting severe injury or even death.

A newspaper article from Times of India mentioned that in Jim Corbett national park 9 tigers, 21 elephants and 6 leopard were found dead from 2014 to May, 2019 and mentioned that first time it was seen that tigers are killing elephant and eating them showing tiger-elephant conflict (https://timesofindia.indiatimes.com/india/tigers-killing-and-eating-elephants-in-corbett-national-park-government-study-reveals-worrying-phenomenon/articleshow/69811871.cms).

In Hindustan time article (https://www. hindustantimes.com/cities/pune-news/105-killed-in-2022-as-man-animal-conflict-reaches-its-peak-

in-maha-101673976767525.html) the man-animal conflict was at its highest in 2022 when approx. 100 humans lost their lives in Maharashtra, and this death was increased after 2019. In 2019 death of 39 people, in 2020-87, 2021-84, 2022-105 according to forest department data. Most victims were from tiger attack, during this period compensation also given to people for man-animal conflict and crop damages due to wild animals. Total compensation given 2019-20 across Rs.7035 lakhs increased to Rs. 8022 lakhs in 2020-21 and Rs. 8004 lakhs in 2021-22 and Rs. 8137 lakhs in 2022-23 [15].

In India, data from the Union Ministry of Environment, Forest and Climate Change indicates that over 500 elephants were killed between 2014-2015 and 2018-2019, mostly due to human-elephant conflict. During the same period, 2,361 people were killed as a result of conflict with elephants, (https://www.downtoearth.org.in/news/wildlife-biodiversity/human-wildlife-conflict-among-greatest-threats-to-animal-species-wwf-and-unep-report-77863).

Jumbo attacked two men near Gohri range of Rajaji national park, cause death of one and other got injured, (https://timesofindia.indiatimes.com/city/dehradun/jumbos-trample-seer-to-death-injure-another-in-rajaji-national-park/articleshow/89910398.cms). The habitats of the wild animals are shrinking fast following increasing human habitation in the areas adjacent to the Rajaji Tiger Reserve. Herds of elephants are devastating sugarcane and rice fields the leopards are prowling around, preying on the domesticated cattle and livestock of the villagers. The ongoing expansion work on National Highway, rail tracks cutting through the forest areas, high- tension electricity wires hanging here and there and explosion of the human population living in the vicinity of the forest are some of the factors that are accentuating such conflicts [16].

Elephants in Uttarakhand's Corbett landscape, Rajaji National Park landscape and Tarai areas have been a major concern for wildlife officials and create ruckus around these areas [17]. On 26t July, 2022 Indian express newspaper (https://indianexpress.com/article/explained/telling-numbers-toll-human-animal-conflict-tigers-elephants-8051231/) has reported that between 2018-19 and 2020-21, 222 elephants were killed by electrocution across the country, 45 by trains, 29 by poachers and 11 by poisoning. Among tigers, too, 29 were killed by poaching between 2019 and 2021, while 197 tiger deaths are under scrutiny. In the same report they have mentioned human casualties of conflict with animals, elephants killed 1,579 humans in three years — 585 in 2019-20, 461 in 2020-21, and 533 in 2021-22, while tigers killed 125 humans in reserves between 2019 and 2021. 533 humans were killed by elephant in 2021-22.

Table 1. Data showing for tiger conflict for three years

Tigers	2019	2020	2021
Humans killed by tigers	50	44	31
Tigers: natural death	44	20	4
Un natural; not poaching	3	0	2
Tiger death under scrutiny	22	71	104
Poaching death	17	8	4
Seizure	10	7	13

(Source: Express news service:https://indianexpress.com/article/explained/telling-numbers-toll-human-animal-conflict-tigers-elephants-8051231/)

Table 2. Data showing for elephant conflict for three years

Elephants	2018-19	2019-20	2020-21
Humans killed by elephants	-	585	461
Elephants killed by train	19	17	12
By electrocution	81	76	65
By poaching	6	9	14
By poisoning	9	0	2

(Source: Express news service:https://indianexpress.com/article/explained/telling-numbers-toll-human-animal-conflict-tigers-elephants-8051231/)

Table 3. Data presents elephant killing state wise for three years

Elephant killed by electrocution	2018-19	2019-20	2020-21
Andhra Pradesh	2	5	1
Assam	9	11	13
Chhattisgarh	6	2	7
Jharkhand	1	5	5
Karnataka	9	8	9
Kerala	6	4	2
Meghalaya	0	5	0
Nagaland	4	2	1
Odisha	24	9	8
Tamilnadu	10	15	9
Uttarpradesh	3	3	0
Uttarakhand	3	2	NR*
West Bengal	4	5	10

NR: information not received from state. Source: MoEFCC, loksabha (sourcs: Express news service:https://indianexpress.com/article/explained/telling-numbers-toll-human-animal-conflict-tigers-elephants-8051231/)*

Such conflicts have negative impacts on wildlife populations and economic, social & cultural existence of humans [1]. To evaluate risk of human wildlife conflict threat matrix is a potential attributes to measure significant threat to set management priorities [18,19]. Uttarakhand due to its unique geographic and climatic diversity different types of forests are found from the foot to hills of Himalayas and hold the most diversifying species of the country; it is the home for thousands of endemic, threatened and endangered species of plants & animals.This study mainly focuses on the human wildlife conflict with the local communities, current or traditional practices use to minimize the conflict and a baseline depredation data for some areas of Dehradun Uttarakhand.

2. METHODOLOGY

2.1 Study Area

The state of Uttarakhand has an area of 53, 483 sq. km of which 86% is mountainous and 65% is forested [20]. Rajaji National Park is one of the state's significantly recognized national park, several villages are situated in 10 km periphery of Rajaji National Park, and neighboringvillagers are dependent on nearby forest resources for their livelihood. The study was conducted in 3 villages of Dehradun namely Choila, Dudhaliand Patiowala. All the three villages are located in Rajaji National Park territory.

2.2 Data Collection

Data was collected through qualitative and quantitative approaches, respondent opinion, in-depth interviewing and semi-structured questionnaire surveys. Data collection was done for livestock, crops depredation and human loss. The distance between the pasture land and village was also recorded.

A thorough semi-structured questionnaire survey was conducted with individual household across the three villages in Dehradun district. Families/Individuals were interviewed to obtain information on livestock depredation, crop and human damage. The interviews were held in an informal manner with a person making a casual conversation regarding conflicts.

2.3 Threat Ranking Matrix

Threat matrix is a tool that is used to assess the various risks of hazards. These risks are evaluated by severity of the threat on an area and its intensity. A risk assessment matrix have a set of values for a probability in an area and its intensity. A 3*3 matrix has 3 levels of probability. A standard 3*3 matrix comprises following values:

Area: High (H), Medium (M), Low (L)

Intensity: High (H), Medium (M), Low (L)

	H	M	L
H	H	H	M
M	H	M	L
L	M	L	L

Chart 1. Threat ranking matrix
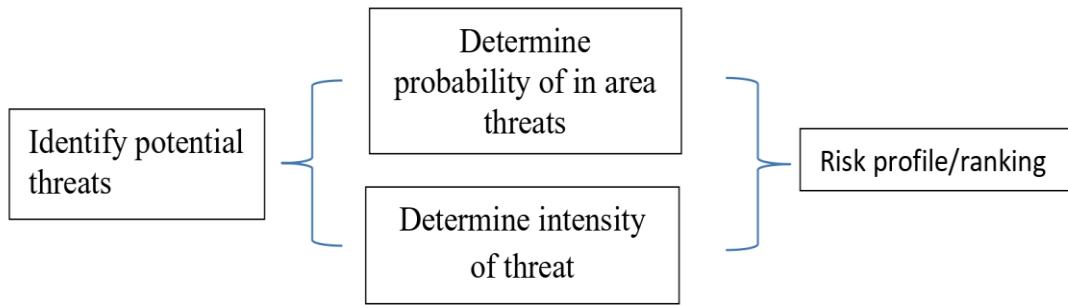
Chart 2. Various methodologies and techniques for analyzing threat ranking

By multiplying area and intensity values, calculated the risk and accordingly provide the rank to the mentioned threats.

The objective of threat ranking is to evaluate potential threats, vulnerability and risk to the area. Threat ranking is establishes for mitigation measures to be planned, designed and implemented to protect lives of people and to reduce damages against potential threats where data are not sufficient [19].

There are various methodologies and techniques for analyzing threat ranking. One approach is to assemble the results of a threat on an area and its intensity to determine threat ranking.

Threat ranking approach can be applied for quantitative and qualitative data to provide ranking for mentioned threat. That was supported by logical arguments and factual data. It is based on the methodology used by The Federal Emergency Management Agency (US). This methodology compiled the result of threat assessment area and intensity to give numeric data.

Threat ranking = A × I

A= threat rate in area, I = intensity

2.4 Crop Loss Estimation

Estimate of crop losses due to wild animals was given by the respondents. On the basis of which we calculated the cost-effectiveness of crop produce and crop damages, we multiplied crop yield with the local cost for wheat, rice, sugarcane and maize that is Rs. 15/kg, Rs. 13/kg, Rs. 100/quintal and Rs. 10/kg, respectively. For calculation, we have taken the government-subsidized price for wheat, rice, sugarcane and maize; are usually grown for livelihood in study sites [21].

2.5 Formula

Crop loss due to a depredator (kg crop in one season) = Average crop produced per family in the given village (for that season) ×Average crop damage in percentage (%) inflicted by that particular depredator species in the given village.

3. RESULTS AND DISCUSSION

3.1 Household Sampling

The household survey and interviews were done randomly in the villages to the available locals. Table 4 depicts number of questionnaires filled and the demographic data of the villages as per responses given by locals. According to the respondent it was said that not all the households present in the villages are doing agricultural production.

3.2 Crop Loss Due to Wildlife

The villagers are mainly dependent upon the agriculture for their livelihood sources. In all three villages majority of the farmers mainly grew few cash crops, wheat, maize, and rice as a source of income (Table 8). Along with cash crops, they also cultivate millets, vegetables and fruits.

In Dudhali village main agriculture crop is sugarcane and fruit crop is mango and litchi. Due to more cultivation of sugarcane elephants are more attracted towards the agricultural lands of local farmers and they destroy approximately 60% of sugarcane and became an intolerant threat to local people and causes economic loss (Table 9). Whereas, in Choila village wheat is the main cultivated crop, as per interviews it was analyzed that out of total wheat production in Choila village maximum loss is due to monkey (*Rhesus macaque*) (60-70 % of loss) and porcupine (*Hystrix indica*) (10 % of loss). While in

Patiowala village maximum cultivation is for wheat and rice, whereas maximum loss due to monkey and porcupine was analyzed about 60% and less than 10% respectively whereas other species causes 3-5 % of crop loss. The loss of mango and litchi were due to monkey was about 20-35 % in all three village. Out of all animal species average percent crop loss assessed due to monkey was highest (Fig. 1). Agricultural crops and fruit orchards are often raided by wild animals and birds which cause damage to both food crops and young shoots of crops and plantations [22,23,24].

As per the study, majority of the villagers are experiencing the losses due to monkeys as compared to other animals (Fig. 1), because monkey's population is very high in all the three villages where survey was conducted. Farmers of the area noticed that major problem is due to monkey since more than 4-5 years and causing nuisance. A significantly maximum 60% loss was due to elephant was a serious menace, 20% loss

due to wild pig and 10-15% loss due to porcupine. According to farmers monkey is the most serious crop depredator i.e. more than 60% loss (Table 9), the wild boar (*Sus scrofa*) is the another depredator, porcupine and others are subsequently. Crop damage was maximum in Petiowala, Choila and Dudhli villages respectively due to monkey. Crop damage due to elephant was maximum in Dudhali village and lower in Choila and Patiowala. Maize damage due to monkey and other animals remained maximum in Choila and Patiowala villages (Table 10).

Economically, per family crop production was assessed to be around Rs. 25460, Rs. 57145 and Rs. 82605 for Choila, Dudhali and Patiowala villages respectively (Fig. 2). For each crop projected damages due to wildlife per family are shown in Table 4. If we compare economically sugarcane crop showed maximum damage according to respondent estimates.

Table 4. Villages listed for each number of individual household questionnaires filled (N)

Study site	Total area of the village (in hectares rounded up to one decimal place) (ha.)	Total population (approx.)	Number of households	N
Choila	90	910	200	50
Dudhali	106	1229	272	50
Patiowala	85	1030	150	35

Table 5. Major crops grown in the villages

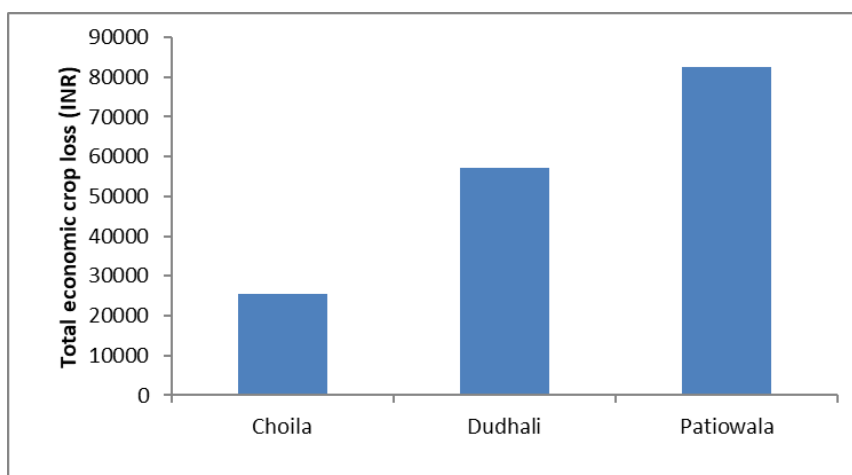| Village	Crops
Agriculture crops	Wheat, rice, maize, sugarcane, mustard, barley and various types of vegetables
Horticulture crops	Mango, Litchi
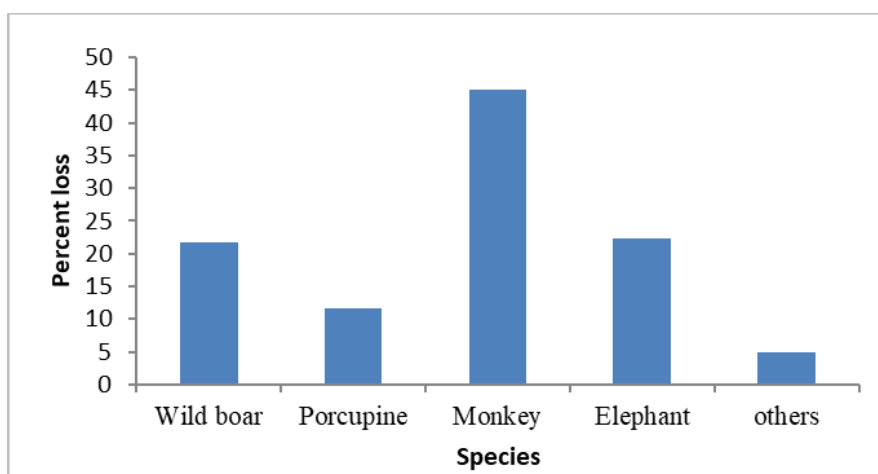
Fig. 1. Average percent losses due to wild species

Fig. 2. Total economic losses (INR) for each village

Table 6. Percent crop loss due to wild species for each village

Species	Crop depredation %			Fruit loss (%)		
	Choila	Dudhali	Patiowala	Choila	Dudhali	Patiowala
Wild boar	20	25	20	0	0	0
Porcupine	10	10	15	0	0	0
Monkey	**70**	**50**	**75**	35	20	20
Elephant	2	**60**	5	0	0	0
others	5	3	7	8	5	5

Table 7. Average potential crop produce and estimated economic crop loss due to wildlife in the study villages

Village	Potential average crop produced per family (kg)				Average economic loss by predator in INR			
	Wheat	Rice	Maize	Sugarcane	Wheat	Rice	Maize	Sugarcane
Choila	1000	600	1000	3000	8400	5460	3000	3000
Dudhali	500	550	1504	6000	3000	3575	6016	36000
Patiowala	700	700	700	2690	3150	6370	2450	5380

According to survey responses, it was analyzed that monkey population has been increased since last few years and had become a nuisance only in the last 7-8 years. According to few local people's perception monkeys are considered as a God Hanuman [21] which restricts them to take any retaliatory measures. In one of the study [25] in Uttarakhand at Jardhargaon reported that crop losses due to rhesus macaque were increased from 10% to 50-90 % since 5-10 years. Rhesus macaque population has been improved in Himachal Pradesh and in other parts of northern India over the last couple of decades [26,27,28]. It was mentioned by Chauhan [29] that rhesus has become an agricultural pest only in more recent years. People used several strategies to scare monkeys and other wild species such as throwing stones, use of fire-crackers, drums/tin cans beat and used dogs to guard against the wild animals causing crop loss. Some of the respondent stated that sometime these strategies are not effective against wild animals. According to Neeraj [17], Uttarakhand state primarily reports man-leopard, man-elephant and man-monkey conflicts.

3.3 Analyzing Livestock Depredation

Livestock depredations as per the local villagers perceptions collected during the interviews were not high and sufficient to draw the interpretation for livestock depredation of the villages. The conflict with livestock- wildlife was assessed low in all the three villages. As per survey Choila and Patiowala village has very low influence of leopard (*Panthera pardus*) in comparison to

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Dudhali village. Maximum loss of livestock was evaluated in Patiowala village 10 numbers and minimum in Choila village 5 numbers (Table 8). Most of the respondent believed that livestock depredation by leopards had decreased since decade ago and also there were continuous decrease in livestock population of the villages. The reason for decrease in livestock number is due to finding other sources of income as per the interview conducted. As per survey record it was analyzed that maximum loss of livestock is due to disease, which is 400, 150 and 200 for Choila, Dudhali and Patiowala villages respectively in last two year as shown in Table 8. Odisha's Forest and Environment Minister Bikram Keshari Arukh informed the state assembly on Monday that 406 elephants died in Odisha due to various reasons in the last five years [30].

3.4 Human- Wildlife Conflict

As per the village survey and interviews conducted it was found that the conflicts between wild animals and humans were not so much high in the selected study villages. In the selected village elephant and leopard was observes some threat for humankind. According to responder it was also said that there were decrease in the wildlife conflict with human since 10-20 years ago. As the previous study reveals that the conflicts between wild animals and humans have always been a serious concern since historic times. According to survey data it represents that there was no killing of human since last 2 years due to wildlife, whereas human injuries was estimated about 10, 7 and 5 in Choila, Dudhali and Patiowala village respectively (Table 8) mostly due to monkeys and elephant.

According to the views of local people in all three villages wild animal attacks was not much frequent. The presence of elephant near the villages was only seen due to human encroachments and construction of roads. Sometimes, leopard attacks are also being experienced in villages. According to responder maximum loss because of wild animals was seen with crop, livestock & human respectively and responder also said that elephants, pose a serious threat to the human wildlife conflict. Several times road accidents also happen due to their unusual movement of wildlife. Ahuja & Mishra, 2023 reported that from 2000 year to 2022, a total 1054 people fell victim to wildlife attacks, while additional 5112 individuals were injured in such attacks. In 2023 (from January to April) six people lost their lives in man-wildlife conflict and 23 people got injured.

The result only shows the qualitative data because peoples are not able to remember the exact numbers of attack.

3.5 Potential Threat of Human Wildlife Conflict (HWC)

In this study we used threat ranking method to analyze the influence of potential threat of HWC, it is an easy method to interpret which is covered with ambiguity and uncertainty. The local people perceptions on issues such as crop depredation by wildlife have been a key factor in deriving the threats mentioned (Table 9). Poor staff strength and facilitating mechanism prevailing in the area have given rise to many issues such as irregular monitoring of wildlife deaths in the region. Crop depredation by wildlife is a more of village centric issue and mostly caused by monkey, elephant, wild boar and porcupine has been assigned as rank one (Table 9). The threat of high livestock grazing causing habitat degradation and prey depletion; poaching; preventive measures taken by wildlife/forest department have assigned rank three. HWC- livestock, negative community perception towards wildlife conservation, lack of awareness and sensitivity for conservation, awareness about government compensation scheme and poor staff strength and facilitating mechanism have all be assigned second rank because of the area that they impact and the intensity with which they strike is considered medium. The threats falling under rank second are not of the first order threats but have a potential to likely be very effective in the coming future if not regulated at the early stages. The problems of human and wildlife conflict are not very area intensive in the study villages along with poaching of wildlife assigning it the third rank.

From Table 9 depicts that rank one is given to crop loss due to wildlife and listed as high threat for humankind, which is further classify to analyze its threat. Table 10 shows that there is different threat to crop loss out of which crop loss due to wildlife was ranked one. This reveals that wild animals are one of the high threats to crop loss for the villagers on the basis of area covers and intensity of the incident. Crop loss due to drought/ flood has been ranked second due to low intensity of occurrence, main factor involve weather pattern for the particular area. Whereas crop loss due to weeds and due to diseases has been ranked third because of the area they impact and intensity and the threat is not so intensive.

**Table 8. Estimated livestock and human loss due to wildlife for each village**

Village	Death of livestock due to disease in last 2 year	Number of livestock killed by predator in last 2 year	Human killed by predator in last 2 year	Human injured by predator in last 2 year
Choila	400	5	0	10
Dudhali	150	5	0	7
Patiowala	200	10	0	5

Table 9. Threat ranking for the conflict

S. No.	Threats	Area	Intensity	Total	Rank
1	HWC-Crop Depredation	E	H	H	1
2	HWC-Livestock	E	L	M	2
3	HWC-Human	L	L	L	3
4	Community awareness towards wildlife conservation	M	M	M	2
5	Over-grazing	L	L	L	3
6	Awareness about compensation scheme	E	L	M	2
7	Preventive measures taken by government department	L	L	L	3

Table 10. Threat ranking for crop depredation

S. No.	Threats	Area	Intensity	Total	Rank
1	Loss due to drought/flood	E	L	M	2
2	Loss due to wildlife	E	H	H	1
3	Loss due to diseases/pests/weeds	L	L	L	3
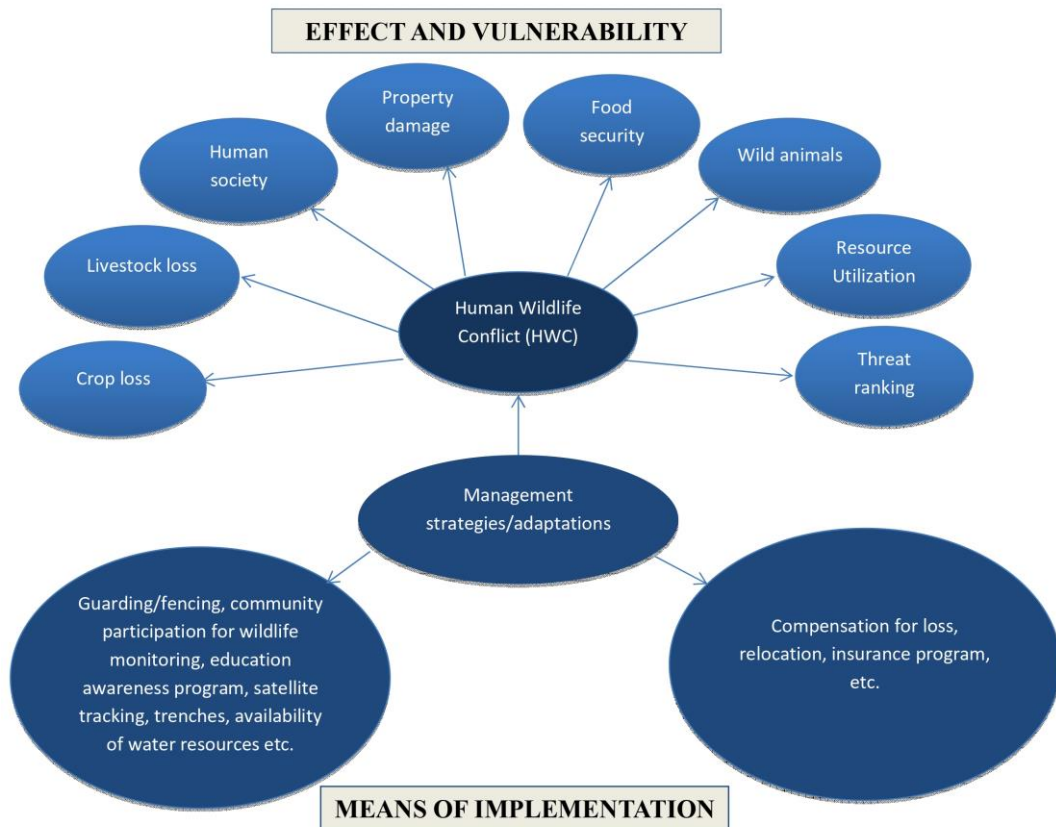
Fig. 3. Representation of the consequences of HWC and management strategies

3.6 People's Perception to the Conflict

As per the interviews we enquired that most of the events occurred in areas those are near to forest, while some of the incidents occurred during grazing and fodder collection. Whereas crop loss instances due to wild species mostly occurred in the agriculture fields. However, compensation schemes were there for the victims but most of the people were not actively complains about the loss due to various reasons and difficulty in filings complain. From the survey only one person from Choila village got compensation of Rs. 2500.00 for the loss of five bigha land by the government. Local community views were also asked for the possible solutions to the conflict. The major solutions they proposed are fencing and active participation of government agencies and institutes, other management practices are given in Fig. 3.

4. CONCLUSION

Humans have complicated relationship with wildlife species and shows combination of fright, suffering, sympathy and mastership. After conducting different types of surveys, question answer sessions, interviews with the local people of these villages we came to know how animals and humans come into contact with each other that results into the negative effects on both wildlife and humans. While the depredation of crops and livestock by other animals is also becoming a menace but the frequency of monkey attacks is much greater than other animal. Approximately 70 % of crops are being destroyed by monkeys in the studied areas. People perceived monkey as serious agricultural threat. Wild boars and elephants are also present in those areas but their frequency of attacks is very low. According to people perception average 50-60%crops get damaged by wildlife. Most of the people which are living in these areas are dependent in agricultural practices, other forests produce but due to conflicts with wild animals they lose their crops and livestock for that there must be a fair compensation by the government towards these people but unfortunately most of the local people claim that there is no compensation provided by the government to the people for their losses or they doesn't complain about these issues due to long procedure. According to this study it was perceived that the crop damage percentage in Dhudhali village has caused greater damage for the sugarcane by elephant. However in this study no direct assessment of crop losses was estimated but only farmer's perception is compared between the villages. Results of our study only compare the conflict and crop damages and require more study to quantify the crop damages by wild animals. For the management strategy it is required to make people more aware about the problem, collaborative & interdisciplinary approaches for co-existence, policies for wildlife and crop loss for which government participation is also important. Neeraj, [17] mentioned in his report that forest officials said about 280km long fencing stretch will be set in different parts of the Uttarakhand that cost over Rs. 18 crore. In this report it is also mentioned that Uttarakhand forest department has started Rs 39 crore man wildlife mitigation project in Himalayan areas. Principal chief conservator of forests (PCCF) Rajiv Bhartari said the ministry of environment, forests and climate change has provided ₹ 39.7 crore under CAMPA (Compensatory Afforestation Fund Management and Planning Authority (CAMPA) fund to the state forest department for man-wildlife conflict mitigation. Fencing the forest for elephants has seen to be a failure in neighbouring Sri Lanka because elephants live on both sides. They do not accept the notion of a fence. Community managed fences around croplands are much more effective. Only a combination of a good understanding of wildlife outside Protected Areas and combining it with a focus on the human dimension in a proactive way is the way forward to shift from conflict to a more peaceful relationship between wildlife and humans in India. A relationship that is as old as our civilization [31]. Threat matrix would be useful to identify critical research gaps and types of impact that is needed to monitor.

Divisional forest officer (DFO) of the tarai central forest division, Vaibhav Kumar Singh said, to minimize such conflicts, the department has implemented various strategies and initiatives. This includes the establishment of dedicated task forces comprising experienced forest officials, wildlife experts, and local stakeholders. The forest department in collaboration with local organizations conducts regular workshops and awareness campaigns to educate residents on best practices for living alongside wildlife [32]. For further study refer national human wildlife conflict mitigation strategy and action plan for India (2021-26), holistic, inclusive and sustainable approach to mitigate human wildlife conflict [33-36].

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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