



# A study on the profile of a forest fringe village in Pangolakha Wildlife Sanctuary, Sikkim, facing human-wildlife conflict

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## Abstract

A socio-economic study as a component of human-wildlife conflict was conducted in 2019 in a remote village named Talkharka in East Sikkim district on the fringes of *Pangolakha* Wildlife Sanctuary. A structured questionnaire in an interview form was used to solicit information from the village respondents. Descriptive statistics was used to analyze the data. The primary source of income is farming with cardamom being the major cash crop. Located on the forest fringes, the village farmlands are regularly raided by wildlife. The wildlife also prey upon the village livestock, especially poultry. This has led to economic hardships and financial losses over the years. The study revealed that cardamom production has decreased over the last years leading to a decrease in the income status of the villagers. This study will provide baseline data on the socio-economic status of the village families as well as on the issues of human-wildlife conflict faced in terms of agriculture and livestock to form conflict mitigation measures in the future.

**Keywords:** Forest fringe communities, Human-wildlife conflict, Mitigation measures, Socio-economic

## Introduction

Forest fringe communities greatly influence forests since they depend on forests and their resources for most of their livelihoods, however, forests contribute more significantly to the rural populace's income and quality of life. Human interactions with wildlife are positive as they gain material benefits for harvesting species for food or other animal products but in some situations, the interactions can also be negative (Woodroffe et al., 2005). Although the contribution of wildlife to the economy of a country cannot be overemphasized, several problems make wildlife a concern, especially to the socio-economic status of the communities in bordering wildlife-protected areas,

like, conflicts with land uses, poaching, habitat loss, pollution, global warming and introduction of exotic species that results in local people look at wildlife as a liability rather than an economic and social status advantage, thus making conservation efforts be perceived a contradiction to the socio-economic endeavors of local communities (Shemwetta & Kideghesho, 2000).

The state of Sikkim has been witnessing an increase in human-wildlife conflict due to an increase in its wildlife and its increasing requirement for resources to sustain it as a result of conservation efforts (Bhutia, 2017). Sikkim has at present 9 Protected Areas which comprise 1 National Park, 7 Wildlife Sanctuary, and 1 Conservation Reserve that covers 30.77 percent of the total geographical area of the state. 82.31% of the total geographical area of the State is under the administrative control of the State Forest Department (Sikkim Forest and Environment Department). 75% of Sikkim's population is dependent on agriculture (Avasthe et al., 2012). With an escalation in the phenomenon of human-wildlife conflict in recent times, consultations and interviews with communities living next to protected areas in both Sikkim and Darjeeling between 2009 and 2014 have highlighted the fact that HWC is emerging as a core issue, being gone beyond the nominal loss to people having to give up agriculture totally or change their profile of agriculture as an adaptation to the conflict (Rai et al., 2014). Communities living in and around Protected Areas are not included as primary stakeholders. In many instances, these communities are highly marginalized and living in difficult circumstances (Rai et al., 2012). Rai et al. (2014) have also observed that the limited space for people's participation has meant that a core community issue has not gained prominence as much as it should have in policy debates. The present study was hence undertaken to understand the socio-economic status of the residents living on the fringes of a wildlife sanctuary who are on the frontiers of wildlife conflict.

## **Material and methods**

### **Study area**

The study was conducted in Talkharka, located in the East district of Sikkim. It falls under 13 GPU South Regu and is divided into two wards, Talkharka Ward and Regu Dara Ward. It is located at an elevation of 2000 meters on the fringes of *Pangolakha* Wildlife Sanctuary which links the forests of Bhutan and Neora Valley National Park of West Bengal. It is also the last village on the East side of the state. There are 80 families settled in Talkharka. The main source of occupation is farming. Members of some families are also employed in State Government departments. There is one school run by the government named Regu Government School up to 10<sup>th</sup> standard. The

nearest town is Rongli Bazaar situated at a distance of approximately 8-10 km. Transportation is limited in the village with one taxi that makes rounds of the town every day once in the morning and returns in the evening. Other than this, there are a few utility vehicles. One pucca road starting from the end of Rongli runs till the school after which it is under construction. The village has numerous forest patches surrounding the houses as well as the farmlands.

### **Data collection method**

A well-structured questionnaire was designed to collect data from the residents. A total of 50 households out of 80 in the village were visited as part of the survey. Out of the total families interviewed, 32 fell under Talkharka Ward and 18 fell under Regu Dara Ward. Being closest to the forest fringes, all 32 families of the Talkharka ward were interviewed whereas families from the Regu Dara ward were randomly selected. The respondents were all adults ranging from ages 25 to 60 years with a mixture of males and females. The data were collected directly from the families through personal discussions and interviews regarding the various aspects of the socio-economic conditions like age composition, employment and occupational nature, and income distribution. Several households participated in collective responses. The questionnaire was divided into four categories that included personal data, general household information, forest and fuel, and human-wildlife conflict. The questionnaire was designed in English but the interview with the respondents was conducted in Nepali. Interviews were conducted at the houses with some exceptions where other household members were present at a different location or in someone else's house. The interview spanned 20-30 minutes per interviewee. Simple percentages were calculated and tabular analysis was made to arrive at the results.

## **Results**

### **Socio-economic**

The general social status of the villagers is presented in Table 1. The study revealed that out of the total population of 240, the male population (52.08%) constituted a slightly higher percentage than the female population (47.91%). The village had an average of 5 members per household. Talkharka has predominantly Rai ethnicity with a small number of families belonging to *Lepcha*, *Sherpa*, *Gurung*, *Pradhan*, *Subba*, *Bhujel*, and *Thapa* ethnicity. Nepali is the primary language spoken by all the people with periodic usage of a local Rai language. A small number of household members in a few houses also speak Hindi while interacting with outsiders like researchers or tourists. Of the 50 households surveyed, most of the adults in the village are primary school

dropouts (58.79%), the reason, according to the residents, being improper access to educational institutions as well as the absence of proper roads for commuting and transportation. Villagers would often have to walk hours through forest patches to reach school and then lend a helping hand at the farmlands as well, so dropping out of school was considered a rational decision given the circumstances. The table also denotes the number of students who are pursuing school-level education. College-level studies (38.2%) are either being pursued or have been completed by the students. Talkharka has only one school called Regu Government School. Most of the students have to climb up and down miles of mountain forest patches to reach here. In families of school-going children, 37.08% of the children were studying in 1st to 9th standard, 11.24% of children were preparing for matriculation exams and 13.48% were preparing for senior secondary school exams. The students opting for higher studies travel to nearby towns and cities. They often get employed and end up settling there. This is true for approximately half of the households (not shown in the table).

**Table 1.** Social status of the villagers in Talkharka

Total Population	240
Number of families	50
Percentage of male population	52.08
Percentage of female population	47.91
Number of members per family	
2-4	26
5-6	15
$\geq 7$	9
Ethnicity (percentage)	
Rai	74
Gurung	6
Sherpa	5
Lepcha	5
Pradhan	3
Subba	3
Bhujel	2
Thapa	2
Languages spoken (percentage)	
Nepali	50
Rai	9
Hindi and Nepali	41
Adult Literacy (percentage)	
Percentage of literate adult population	41.21
Percentage of adult dropouts from primary school	58.79

Student Literacy (percentage)	
1st to 9th standard	37.08
Students appearing for the matriculation exam	11.24
Students appearing for the senior secondary school exam	13.48
Graduate and Post Graduate	37.08
House type (percentage)	
Ekra	68
Reinforced Cement Concrete	23
Chithra	9
Number of rooms in houses	
2-4	32
5-6	12
$\geq 7$	6
Number of houses with bathrooms outside	50
Number of houses with bathrooms both inside and outside	6
No houses with piped water connection	50

It was found out from the survey that the majority of houses (68%) in Talkharka are made up of *Ekra*, a composition of bamboo walls with a thick coating of mud as well as small amounts of cement. 26% of respondents reported having RCC (reinforced cement concrete) houses that were either a part of a government upgrade scheme or self-constructed. 10% of households reported having houses made of *Chithra* as well (houses made purely of bamboo). Of the total 50 houses surveyed, on average, every house has 4 rooms that also include the kitchen. All the houses have separate bathrooms outside the house with only 11% of houses having both attached to the house as well as separate bathrooms. The residents of the village have a private source of water supply from the nearby *Khola* (stream) due to the lack of water supply management from the government. Few respondents reported to have been facing hardship in collecting water from various sources. The general economic status of the villagers is presented in Table 2. The study revealed that mixed agriculture was the major economic activity of the study area. All the households interviewed practiced cardamom farming which served as the main cash crop, animal rearing (84%) to sell dairy products like *Ghee*, *Churpi*, meat, and eggs, and bee rearing (28%) to sell honey. Besides this, the villagers grew seasonal crops for both selling them to the town vendors as well as self-consumption. Of the 50 households interviewed, all of the families had some secondary source of income from various departments like education, administration, and corporate. 42% of households have members employed by a government organization, i.e., Regu Government School and the Gram Panchayat. Out of all the households surveyed, 40% of households have at least 1

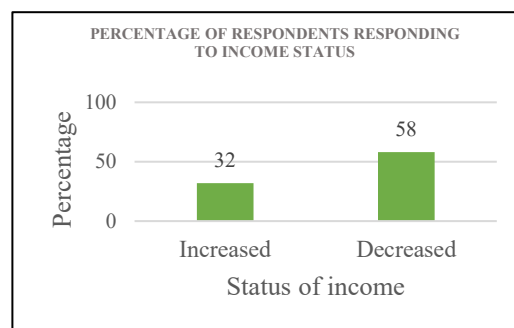
member who has left the village to work in private industrial companies in the capital of Sikkim. 18% of the households had members employed in the tourism industry, having set up homestays and serving as bird or nature guides. A small portion of the villagers (8%) were also manufacturers, mostly involved in carpentry. The earning members in the family were both adult males and females as a primary occupation is farming and according to the residents, it requires an equal amount of hard work from all the adults.

**Table 2.** The economic status of the villagers in Talkharka

Primary source of income (percentage)	
Percentage of families practicing cardamom farming	98
Percentage of families practicing seasonal crop farming	98
Percentage of families rearing livestock	84
Percentage of families rearing bee	28
A secondary source of income (percentage)	
Government sector	42
Tourism	18
Private sector	40
Carpentry	8
Income group (annual) percentage	
<1 Lakh	32
1-3 Lakhs	42
>3 Lakhs	9
Farmland owned (percentage)	
0.5-2 acres	54
2.5-5 acres	14
≥ 6 acres	6
Electrical gadgets (percentage)	
Smartphone (1 per household)	100

Television set	84
Rice cooker	30
Water boiler kettle	14
Percentage of families applying for government schemes	60
Percentage of household members employed in MGNREGA	20
Percentage of houses with MGNREGA cowshed	38
Percentage of women in SHG	54
Number of houses with Improved Cooking Stoves by WWF	22

The study revealed that all the households owned farmland since the primary source of income was farming. The size of the farmland varied from between 0.5 acres to 10 acres. The annual incomes were divided into three categories: houses with an annual income below Rupees 1 lakh, between Rupees 1-3 lakhs, and above Rupees 3 lakhs. 32% of the total households that were interviewed had an annual income of less than Rupees 1 lakh, with the average being Rupees 46037.5 per annum, 42% had an annual income between Rupees 1-3 lakhs with the average being Rupees 4970300 and 9% households had an annual income of more than Rupees 3 lakhs with the average being Rupees 5973900. The status of income over the last five years has decreased for about more than 50% of the interviewed households (Fig. 1). The reason could not be analytically interpreted but according to the household members' narrative could be because of the decrease in cardamom yield. Those houses that reported an increase in income status had members employed in either the government or private sector and were settled in towns like Rongli (nearest to Talkharka) or Gangtok (capital of Sikkim).

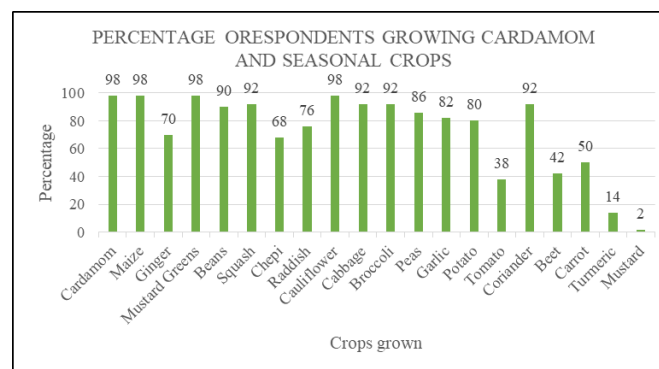


**Figure 1.** Income status over the last five years of Talkharka residents

Of the total 240 residents of the village, 201 members have a bank account, an act that was enabled and motivated as a means of financial empowerment collectively by the Gram Panchayat and various NGOs. Since the village is a fringe forest, villagers do not have sufficient electrical provisions. Every household has tube lights or bulbs but there is inconsistent electricity supply with having to spend sometimes 2-3 days in a row without electricity. At least 1 smartphone is present in every household but since the village has poor connectivity, phones are used to a lesser extent. 84% of houses responded to having a television set. 30% and 14% of households also had an electrical rice cooker and water boiler but they were kept unused due to poor electricity supply. The study noted that 60% of the families in the village actively participated in various government schemes that aimed for the upliftment of the familial, economic, and living conditions of the family. The most common scheme was the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) with 20% of households where at least one member was employed in various temporary jobs like village road construction, setting up signs, etc. 38% of residents implemented the MGNREGA cowshed. 54% of households had women who were members of the village Self Help Group (SHG).

### Agriculture and livestock

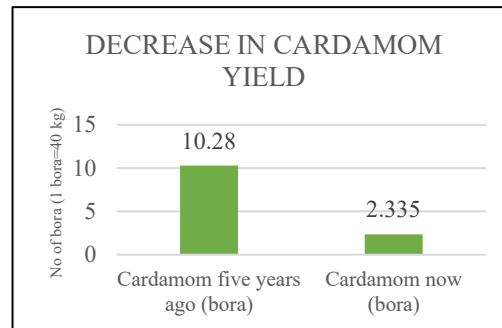
The main source of income in Talkharka is farming. Of the 50 families that were interviewed, all the households reported practicing farming as a source of livelihood. Residents are dedicated to cardamom cultivation which is the major cash crop of the village. Other than this, a variety of seasonal crops are grown throughout the year, for example, corn, cauliflower, radish, broccoli, potatoes, chepi (a kind of local onion), simbi (Beans), garlic, peas, tomato, coriander, beet, ginger, etc (Fig. 2). According to the respondents, the seasonal crops are seldom used for selling and are often consumed by the families except for a few households that sell the farm yield to the nearby town.



**Figure 2.** Percentage of cardamom and seasonal crops grown by the villagers

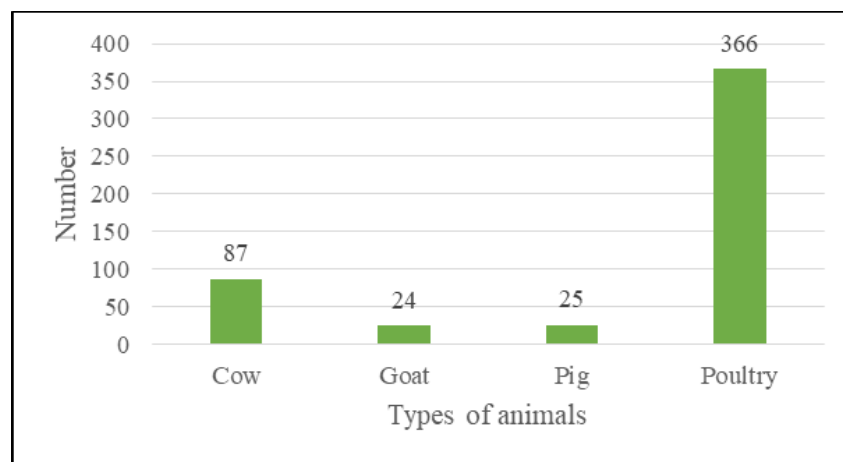


Over the last few years, there has been a drastic loss in cardamom yield in the village. The reason behind the loss is not clear yet. According to a few interviewees, researchers from scientific institutions from outside the state had tried soil testing and related studies but inferred no positive results. Yet a few other residents believe that it is a sort of unknown disease that the plant has acquired that has spread like an epidemic. The price of cardamom in the market has come down from Rupees 20000 per 40 kilograms (1 bora) to Rupees 16000 per 40 kilograms (1 bora). The yield per household has also significantly reduced in the last five years. The study revealed that five years ago, on average there used to be 10 bags of yield per house, whereas, production presently is only 2 bags of yield per house (Fig. 3). Of the total farmland available to the villagers, the majority of it is dedicated to cardamom farming. This being the major cash crop of the village is becoming a major concern for the people of Talkharka.



**Figure 3.** Percentage decrease in cardamom yield over 5 years

Nearly all houses in Talkharka have livestock since it is also a primary source of income. As presented in Fig. 4 there are cows, poultry, pigs, and goats (goats are present in a very low number since the Rai community doesn't believe in domesticating them. It is considered for worshipping and sacrificing to the Gods.



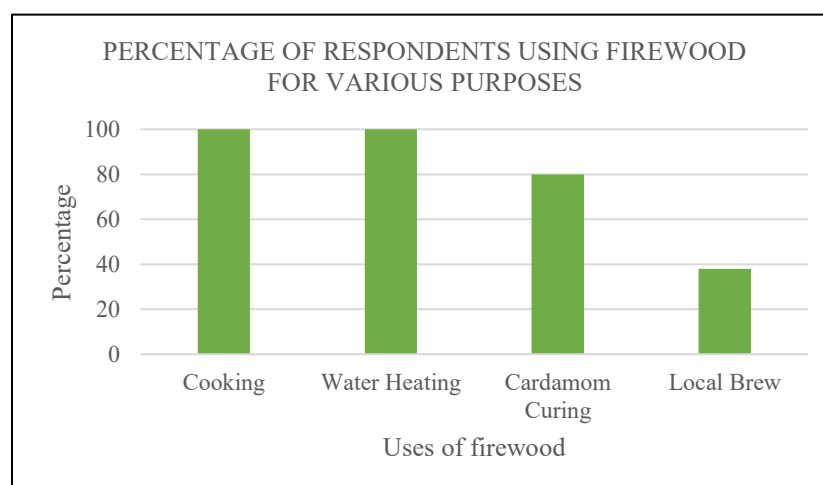
**Figure 4.** Livestock owned by villagers in Talkharka

The local dairy products are *Ghee* (clarified butter) and *Churpi* (a form of fermented milk that is slightly sour). Not all households produce enough to sell the products but those that do either sell it in the village itself or Rongli. Poultry is another domesticated animal that is used to sell eggs or meat. A breed of poultry called Banraja is kept in large numbers (30-50) in approximately 5-6 houses and is used to sell meat in the village. Other than this, pigs are bought and domesticated in a few houses. These are then killed and sold to village residents to be consumed as meat. This cycle is repeated by the alternative houses as per financial convenience. Among the 50 houses that were surveyed, there are 87 cows, 24 goats, 25 pigs, and 366 hens (wild breed and hybrids).

18 households also have bee's boxes but only a few houses practice apiculture. The feeding source for cattle is private land as villages are prohibited from using the forest land. The fodder is heated in traditional stoves (*chulhas*) for the cows and pigs. MGNREGA had selected houses to build a cowshed for cattle. This cowshed had components like a urine pit, manure pit, and space for the calf. Of the 50 houses surveyed, 19 of them had reported to have received the cowshed scheme and had built it along with the components. The rest of the households have kept their cattle in self-constructed cowsheds.

### Forest and firewood

As presented in Fig. 5, the families in Talkharka use wood as fuel to cook, boil water, make local brew, and cure cardamom. The water boiled is used to prepare fodder for cattle and pigs. Of the 50 families surveyed, it was found that fuelwood is used by all 50 of them and 75% had a gas and stove in their houses. Most of the firework is carried out via firewood and gas stove is minimally used.



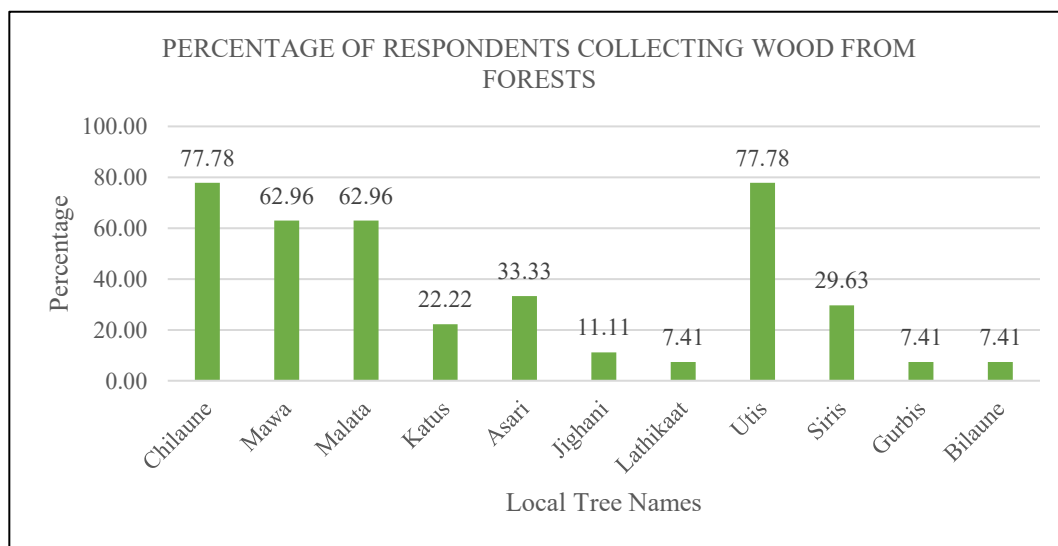
**Figure 5.** Uses of firewood

For forest and fuelwood, residents were asked about the frequency of procurement, and who procures the wood and tree names. As presented in Table 3, the majority of them (77%) procure wood from their field as they are not permitted to procure wood from the forest land that is under the forest department of the state.

**Table 3.** Forest and firewood

Wood Collected By (in percentage)	
Family	56
Hired Labors	32
Males	12
Firewood Procurement (in percentage)	
Own field	77
Purchased	18
Forest	3
Others	2
Sources of cooking (in percentage)	
Firewood	100
Gas	74
Number of houses with Improved Cooking Stoves	22

Few families (18%) purchase wood whereas 3% reported that they occasionally go to the forest to collect wood. The wood is mostly procured by the entire family (56%). However, some families (32%) hire laborers to collect wood for them whereas in certain families (12%), only the male members of the household collect wood. Various tree species are collected by the villagers (Fig. 6) but Chilaune (*Schima wallichis*), Mawa (*Engelhardtia spicata*), Malata (*Macaranga pustulata*), and Uttis (*Alnus nepalensis*) are the types that are collected by most of the respondents. Other tree species were Asari (*Woodfordia floribunda*), Siris (*Albiza lebbeck*), Bilaune (*Maesa chisia*), Gurphis (*Leucosceptrum canum*), Lathikaat (*Glochidion acuminatum*), Kattus (*Castanopsis hystrix*), Jhingani (*Eurya acuminata*), etc.



**Figure 6.** Various tree species in firewood collection by the villagers

After interviewing the families, it was found out that on average one house household requires 21 kilograms of firewood in a day for all purposes as mentioned above. Annually, on average, households require between 7000 to 8000 kilograms of wood. To lessen the usage of firewood and the emission of smoke, WWF Sikkim introduced ICS (Improved Cooking Stoves) in the villages were implemented by 22 households. These stoves were only limited to cooking and not for other uses.

### Issues of Human-Wildlife Conflict

Human-wildlife conflict is one of the major threats to agriculture and livestock rearing at Talkharka since it surrounds the boundary of a forest. The rear part of the village partially overlaps the fringe area of the forest. As a result of this, the villagers have to witness continuous raiding of crops by forest animals as well as predation of poultry. The rate of conflict has also increased over the last five years according to the respondents Fig 7.

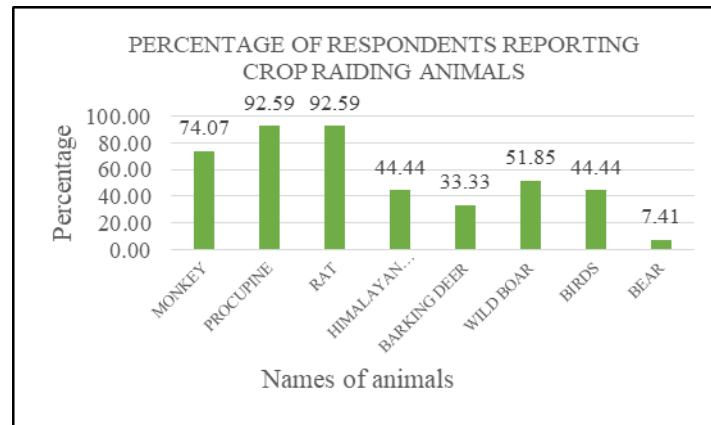
Villagers have not been able to undertake serious measures to mitigate the conflict. As a result, there has been uninterrupted damage not just in crop yield or poultry but to the daily livelihood of the villagers as well. There has been no record of an attack on humans as told by the villagers.



**Figure 7.** Villagers responding to conflict rate with wildlife over the past five years

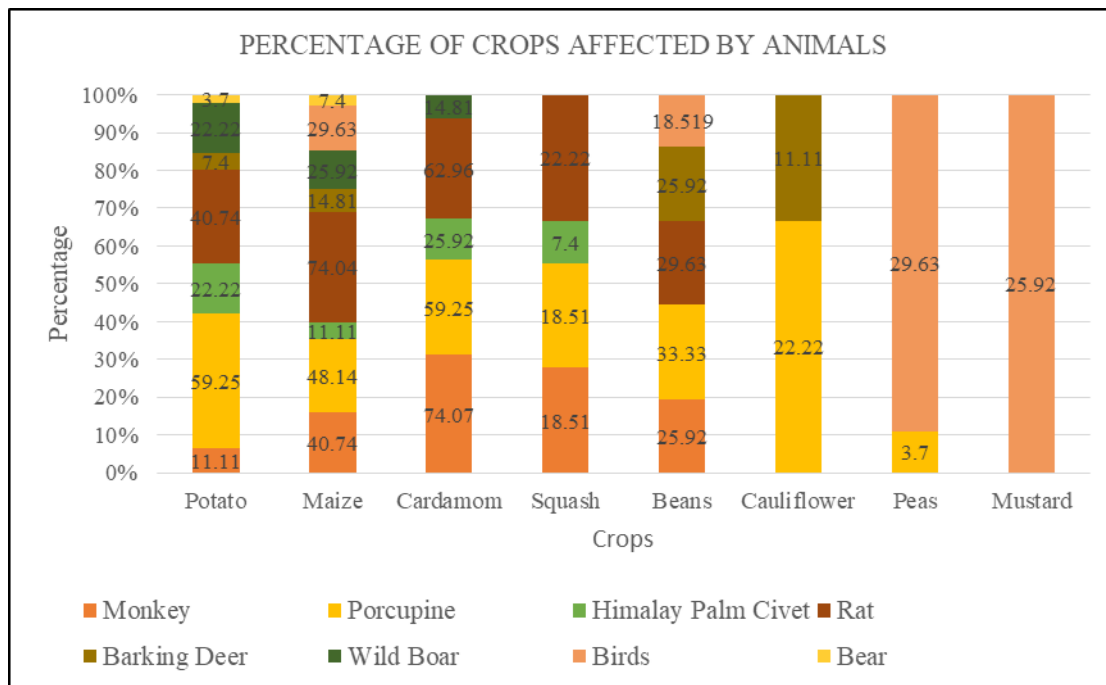
### Challenges faced in agriculture

Thirty of the fifty respondents were interviewed to understand the conflict faced by the villagers in cultivation. During the survey with the households, a few animals were highlighted that consistently were a nuisance to the daily livelihood. Fig. 8 shows the percentage of respondents who mentioned specific animals that consistently raided the fields.



**Figure 8.** Percentage of crops raided by animals

The mentioned animals raid crops like potato, cardamom which is the major cash crop of the villagers, maize, and greens like beans, squash peas, etc. A small sample of the village population, near about 30 families were asked to describe in detail a few major crops damaged by animals. Fig. 9 shows the percentage of particular crops damaged by certain animals as reported by the respondents. The major animals that are known to cause damage more than others are the Monkeys, rats, and porcupines. These animals were reportedly damaging or feeding on all the major crops, such as Cardamom (*Amomum subulatum*), Maize (*Zea mays*), Potato (*Solanum tuberosum*) as well as the seasonal crops like Squash (*Sechium idule*), Beans (*Abrus precatorius*) etc. The major cash crop Cardamom is damaged by Monkey (approx. 63%), Porcupine (approx. 50%), and Rat (approx. 55%). Maize grown by the villagers is damaged primarily by Rats (approx. 66%), followed by Porcupine (approx. 44%) and Monkey (approx. 37%). Potato is raided by Porcupine (approx. 51%), Rats (approx. 37%), Himalayan Palm Civets (approx. 19%), and Wild Boar (approx. 19%). The seasonal crops are also raided by animals but on a smaller scale. Squash and beans are the most raided crops among the vegetables grown in the village.



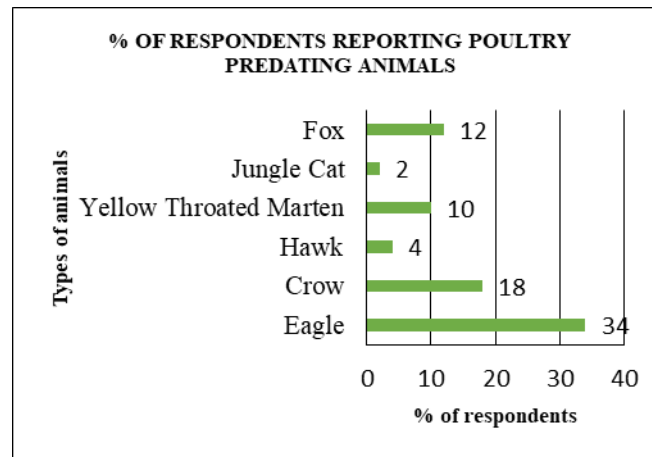
**Figure 9.** Types of animals raiding crops

On average, the respondents reported that, of the total crops that they were growing on the land 40.92% of crops were being affected due to the conflict with the wildlife. This value was not mathematically analyzed, rather it is an average of the percentage as recorded from the individuals. The villagers have an average of 3.4 acres of farmland, with some households having as little as 0.5 acres of land and few houses having as much as 10 acres of land. After interviews, it was found out that a very small number of families had used a few measures like medicines to kill rats but to no avail. Some also guard their lands at night with the help of stones that they use to throw at animals to scare them away. The villagers also guard their fields with the help of local village dogs at night. However such measures are not beneficial to the level of damage to the crops and the losses they have to suffer as a result. Every household reported a conflict with the wildlife when it came to farming.

### Challenges faced in livestock

In Talkharka, the majority of the damage to livestock was in poultry. Poultry is preyed upon by eagles, foxes, Yellow yellow-throated marten, and crows. Fig. 10 shows the animals preying on poultry. Other livestock animals like cattle and pigs do not face any such conflicts with the wildlife as recorded by the respondents. A few respondents (three to four) noted that their cows had died

but that was because of natural causes or because of a disease that couldn't be treated. To prevent predation of poultry, WWF Sikkim introduced coops that were implemented by 17 households.



**Figure 10.** Types of animals raiding poultry

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