ASSESSMENT OF LIVESTOCK OWNERS-WILDLIFE CONFLICT IN THE VICINITY OF NATIONAL PARK

THESIS SUBMITTED TO THE
ICAR-NATIONAL DAIRY RESEARCH INSTITUTE
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IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE OF

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IN

AGRICULTURAL EXTENSION EDUCATION

BY
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M.Sc. (Agricultural Extension Education)

DIVISION OF DAIRY EXTENSION
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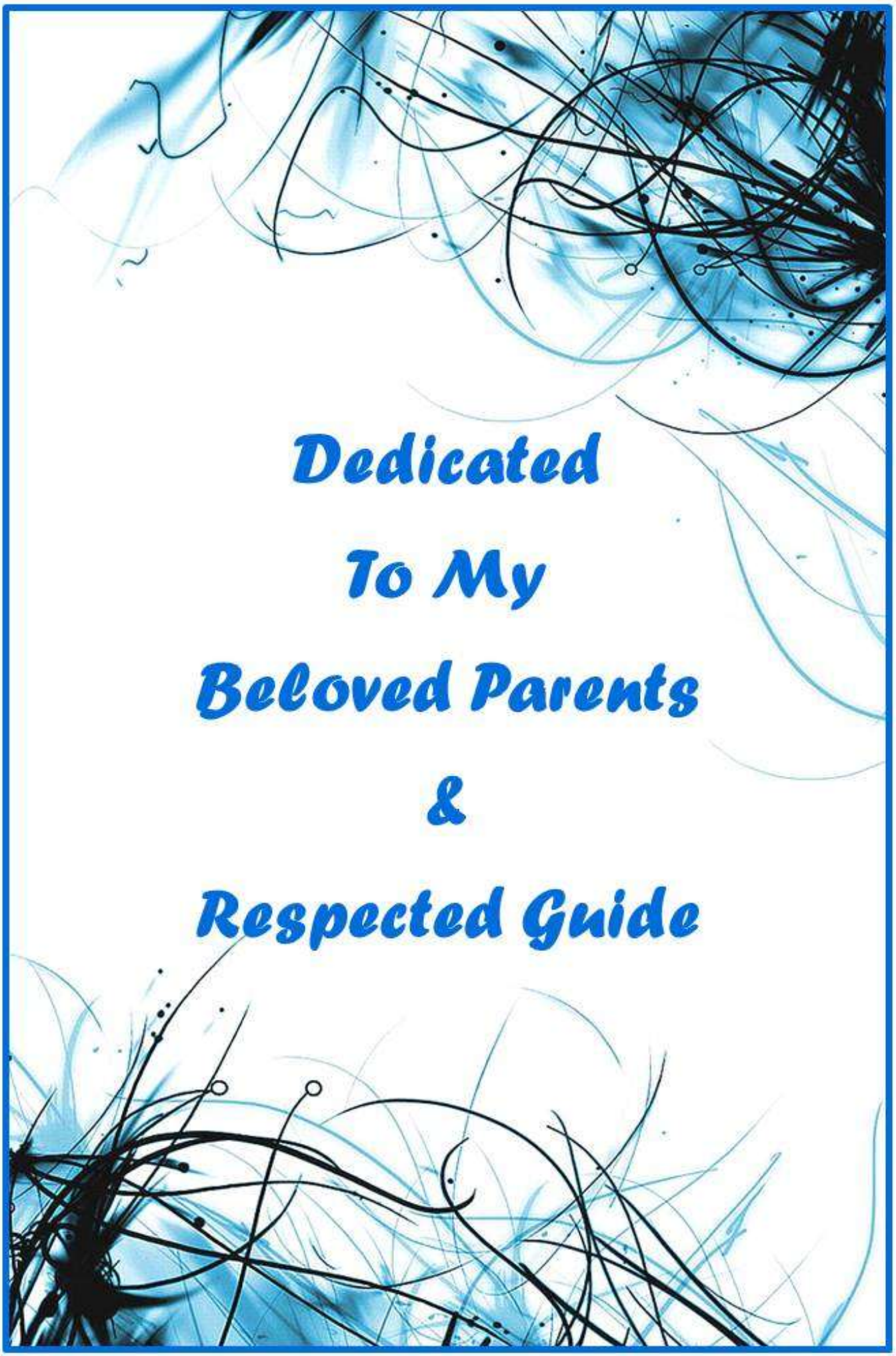
Dedicated
To My
Beloved Parents
&
Respected Guide

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This is to certify that the thesis entitled, **"Assessment of Livestock Owners - Wildlife Conflict in the Vicinity of National Park''** submitted by **MUKESH KUMAR** in the partial fulfilment of the award of the degree of **DOCTOR OF PHILOSOPHY** in **AGRICULTURAL EXTENSION EDUCATION** of the **ICAR-National Dairy Research Institute (Deemed University)**, Karnal, Haryana, India, is a bonafide research work carried out by him under my supervision, and no part of the thesis has been submitted for any other degree or diploma. The assistance and help received during the course of this investigation has been acknowledged.

Dated: November, 2017

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WITH HEARTFELT GRATI TUDE……

It's the solemn benediction of God who has given the opportunity to prepare this manuscript and provided wonderful nature to live and work. All my sincere gratitude goes to him for his blessings.

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This list is obviously incomplete but allow me submit that the omissions are inadvertent and I once again record my deep felt gratitude to all those who cooperated with me in this endeavour.

Place: Karnal

Date : /November/2017 *Mukesh Kumar*

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ABBREVIATIONS

%	Percentage
A.I.	Artificial Insemination
Acre	Acre
AH	Animal Husbandry
DAHDF	Department of Animal Husbandry, Dairying & Fisheries
DFID	Department for International Development
DFO	District Forest Officer
et.al	And others
Etc.	*et cetera (* other things)
FAO	Food and Agriculture Organization
Fig.	Figure
FO	Forest Officer
g	Gram
g/d	gram/day
GDP	Gross Domestic Product
GOI	Government of India
HH	Household
HWC	Human-Wildlife Conflict
ICAR	Indian Council of Agricultural Research
ICT	Information and communication technology
IKSL	IFFCO Kissan Sanchar Limited
INR	Indian Rupee
ITKs	Indigenous Technical Knowledge

IUCN	International Union for Conservation of Nature
KNP	Kalesar National Park
KVK	Krishi Vigyan Kendra
L.E.O	Livestock Extension Officer
LOWC	Livestock owners wildlife conflict
LVI	Livelihood Vulnerability Index
MOA&FW	Ministry of Agriculture and Farmers Welfare
MOEF&CC	Ministry of Environment, Forest and Climate Change
MRS	Mean Relevancy Score
MT	Metric Tonne
NDRI	National Dairy Research Institute
NP	National Park
NTFPs	Non-timber forest products
PAs	Protected Areas
PS	Purposively Selected
RML	Reuters Market Light
RS	Randomly Selected
RW	Relevancy Weightage
SAUs	State Agricultural Universities
SHGs	Self-help groups
SMS	Subject Matter Specialist
SMS	Short Message Service
SPSS	Statistical Package for the Social Sciences

T.B.	Tuberculosis
V.O.	Veterinary Officer
WWF	World Wide Fund for Nature

ASSESSMENT OF LIVESTOCK OWNERS -WILDLIFE CONFLICT IN THE VICINITY OF NATIONAL PARK

ABSTRACT

The study was conducted in Haryana state. Haryana state have two National Park namely Sultanpur National Park, Gurugram and Kalesar National Park, Yamunanagar.Out of two national parks, Kalesar National Park (KNP) was selected purposively. Because this National Park have large number of wildlife species, which damaged the agricultural crops and livestock farming in the vicinity. As per the forest department of Haryana, 15 villages of Yamunangar district have adjoining boundary within Kalesar National Park. Out of 15 villages, ten surrounding villages within 5 KM vicinity of KNP were selected randomly. From the selected villages, 20 dairy farmers were selected from each village and 30 forest officials were also selected by applying random sampling. Thus, total 230 respondents were interviewed to get first-hand information. The collected data were analysed by using Livelihood Vulnerability Index, Perception Scale, Tolerance Scale and Garret ranking in order to draw meaningful conclusions. The findings of the study revealed that majority (54.00 %) of the respondents belonged to middle age group; had nuclear family type (76.00%), small family size (44.50%), medium category of annual income (49.00%), medium (18-28 years) experience in dairying, medium level of extension contact (42.00%), low social participation (52.50%). Medium category of herd size and 31.55 per cent of respondents keep buffalo, 30.85 per cent Goat, 23.08 per cent indigenous cow and 14.52 per cent cross bred cow respectively. Most of respondents reported that crop raiding were mostly by wild animals and causes average loss of INR 4373.49. Wild life disease risk perception revealed that majority of the respondents (66.00%) had medium wildlife disease risk perception. Results regarding Livelihood Vulnerability of livestock owners revealed that 43.00 percent of the respondents had high livelihood vulnerability (score range-0.70 to 0.82) and only 12 per cent respondents were very high vulnerable towards their livelihood (LVI value >0.82). Among all, Social vulnerability was the most critical indicator in terms of the vulnerability among livestock dependents. Regarding perception of Livestock owners wildlife conflict (LOWC) revealed that near about half of the respondents (48.00 %) perceived medium level of conflict and only 18.50 per cent respondents perceive high level of wildlife conflict. Majority (65.00 %) of the respondents fall in medium level of tolerance and only 10 per cent respondents had high level of tolerance towards LOWC. Guarding of livestock during grazing and crop field were most important mitigation strategies.

राष्ट्रीय पार्क क्षेत्र में रहने वाले वन्य जीव व पशुपालकों के बीच में संघर्ष का अवलोकन

सारांश

यह अध्यन हरयाणा राज्य में किया गया था, एवं इस राज्य के दो राष्ट्रीय उद्यान में से एक, कलेसर राष्ट्रीय उद्यान का चुनाव अध्यन के लिए सौद्देश्य–पूर्ण रूप से किया गया । कलेसर राष्ट्रीय उद्यान के आस पास बसे कुल १५ गांवों में से उन १० गांवों को अध्यन के लिए लिया गया जो की उद्यान के ५ किलोमीटर के परिधि के अंतर्गत आते थे । हर एक गांव से २० डेयरी आधारित किसानों का चुनाव यादृच्छिक तौर पर लिया गया और साथ ही साथ ३० वन्य-अधिकारियों का भी चुनाव किया गया , इस तरह कुल २३० उत्तरदाताओं से प्राथमिक एवं प्रत्यक्ष जानकारी पाने के लिए साक्षात्कार लिया गया । साक्षात्कार से प्राप्त आंकड़ों का विश्लेषण जीवन-आजीविका जोखिम सूचकांक, धारणा पैमाना अथवा स्केल, सहिष्णुता पैमाना अथवा स्केल व गर्रेट श्रेणी पद्धति के प्रयोग से अर्थपूर्ण निष्कर्ष निकलने में किया गया । इस अध्यन से यह पता चलता है की ज्यादातर उत्तरदाता (५४.०० प्रतिशत) मध्यम उम्र वर्ग, एकल परिवार (७५ .०० प्रतिशत), मध्यम सालाना आय वर्ग (४९.०० प्रतिशत), डेयरी में मध्यम अनुभव (१८ से २८ साल), मध्यम विस्तार संपर्क (४२.०० प्रतिशत), व कमतर सामाजिक भागीदारी (५२.५० प्रतिशत) वर्ग से संबंध रखते हैं । इससे आगे इस बात की भी सूचना मिलती है की ज्यादातर उत्तरदाता (५४.०० प्रतिशत) मध्यम वर्ग में पशु-धनो की संख्या रखते थे जिनमे ३१.५५ प्रतिशत उत्तरदाता भैंस, ३०.८५ प्रतिशत बकरी, २३.०८ प्रतिशत देशी गाय एवं १४.५२ प्रतिशत संकर नस्ल के गाय क्रमशः रखते थे । ज्यादातर किसानों के अनुसार फसलों की क्षति जंगली जानवरों के द्वारा की जाती थी और ये लगभग ४३७३.४९ रूपये औसत होती थी । वन्य जीव व्याधि अवधारणा यह बताती है की ज्यादातर उत्तरदाताओ के पास (६६.०० प्रतिशत) मध्यम वन्य जीव व्याधि जोखिम की अवधारणा हैं । जीवन-आजीविका जोखिम सूचकांक के अनुसार यह पाया गया की पशु-धान रखने वाले किसानों के बीच ४३.०० प्रतिशत किसान उच्च जोखिम (अंक श्रेणी : ०.०७ से ०.८२) के वर्ग में पाए गये और सिर्फ १२ प्रतिशत (०.८२ से अधिक) किसान अत्यंत उच्च जोखिम वर्ग में पाए गये । इन सभी सांकेतिक इंडिकेटर के बीच सामाजिक जोखिम को पशु-धान रखने वाले किसानों के बीच अत्यंत महत्पूर्ण माना गया । जब वन्य जीव व पशुपालकों संघर्ष अवधारणा के बात होती है तो यह पाया गया की करीब आधे उत्तरदाताओ (४८.०० प्रतिशत) में मध्यम वर्ग के संघर्ष अवधारणा व सिर्फ १८.५० उत्तरदाताओ के मध्य उच्च वर्ग के संघर्ष अवधारणा पायी गयी ।ज्यादातर किसान (६५.०० प्रतिशत) मध्यम वर्ग के सहिष्णुता वर्ग में पाए गये जबकि सिर्फ १० प्रतिशत किसानों उच्च वर्ग के सहिष्णु पाए गये । वन्य जीव व पशुपालकों संघर्ष से बचने के विभिन्न योजनाओ में पशुओ को चरने व खेती किसानी के दौरान निगरानी को महत्पूर्ण माना गया।

INTRODUCTION

"An Odessey starts with single step……"

1. INTRODUCTION

India is the second most populous country of world having 2.4 per cent of global geographical area, supporting 17.50 per cent and 11.60 per cent of total world human and livestock populations respectively. Agriculture plays a vital role in employment generation in the Indian economy, with nearly half of the Indian populace being dependent on agriculture and allied activities for livelihood. Livestock sector plays a crucial role in rural economy, livelihood and act as a best insurance for farmers against vagaries of nature like drought, flood and other natural calamities. Indian economy is predominantly rural and agriculture oriented, where the declining trend in farm holding poses a serious challenge to the sustainability and profitability of the farming community. India is endowed with the largest livestock population (512.05 million) in the world. The total Bovine population (Cattle, Buffalo, Mithun and Yak) is 299.9 million numbers, which accounts for about 57.83 per cent of the world's buffalo (108.70 million) population and 15.06 per cent of the cattle (190.90 million) population (19th Livestock census, 2012). The total bovine population shows a decline of 1.57 per cent over previous census. But the livestock population has increased substantially in the state of Gujarat (15.36%), Uttar Pradesh (14.01%), Assam (10.77%) and Punjab (9.57%). The number of milch animals (in-milk and dry) in cows and buffaloes has increased from 111.09 million to 118.59 million, an increase of 6.75 per cent. The distribution of livestock, as a liquid asset to poor families, is more egalitarian as compared to land (Ali, 2007 and Taneja, 2012). However, the recent trend in livestock sector growth suggests that in order to meet the emerging demand for livestock based products, both in domestic and global markets, there is a need to reorient the production system by enhancing the efficiency and creating quality consciousness. With the adoption of the Millennium Development Goals, the international community made the eradication of extreme poverty and hunger one of its primary targets. Livestock contribute to the livelihoods of an estimated 70 per cent of the world's rural poor by providing a small but steady stream of food and income, raising whole farm productivity, increasing assets and diversifying risks. Livestock also have an important role in improving the nutritional status of low-income households, confer status, are of cultural importance, and create employment opportunities within and beyond the immediate household. The increasing demand for animal protein in low and middle-income countries provides an opportunity for the rural poor to improve their livelihoods (Ahuja *et al.,* 2008). Livestock sector is expected to emerge as an engine of

agricultural growth in the 12th plan and beyond in view of rapid growth in demand for animal food products. Achieving growth rate of 5-6 per cent, however, would require addressing challenges of shortage of feed and fodder and frequent occurrence of some deadly diseases (Taneja, 2012). Dairy farming plays a significant role in improving the rural economic growth and providing gainful employment. Several measures have been initiated by the Government to increase the productivity of milch animals, which has resulted in increasing the milk production significantly from the level of 102.6 million tonnes at the end of the Tenth Plan (2006-07) to 155 million tonnes in 2016-17. The growth rate for production of milk is about 6.26 per cent in 2015-16. The credit for making India, the top milk producers goes to the millions of small producers, dispersed throughout the rural areas rearing an average herd of one or two milch animals, comprising cows and/or buffaloes. While the unfolding of the livestock revolution is likely to result in a rapid increase in the demand for quality livestock services, the policies and institutions in a number of countries are not geared up to meeting that challenge. There are no mechanisms in place to identify the constraints to livestock production, the service needs of poor livestock keepers and the ways and means to deliver them at minimum cost. From the time when the Yellowstone National Park was established as the first protected area in 1872, the establishment of National Parks and other forms of protected areas (PAs) has been a basic component of the conservation and protection strategies of many countries (Studsrod and Wegge, 1995). Protected areas offer a number of direct and indirect benefits such as biodiversity, protection of wildlife, recreation/tourism, ecological processes, education and research, and other consumptive and non-consumptive values (Dixon and Sherman, 1991) and thus remain a cornerstone of biodiversity conservation and an integral part of sustainable development strategies (Ervin *et al.,* 2010 and Butchart *et al.,* 2012). Peoples were driven out from their traditional land and various rules and regulations were imposed to restrict utilization of natural resources in the vicinity of protected area, resulting in negative consequences and serious conflicts between local people and the park authorities (Mishra, 1985; Shrestha, 1996). Even after creation of PAs and National Park, the management of these protected areas continues to face a number of challenges including widespread poverty, particularly among people living adjacent to these parks, rapid population growth, and political instability (Naughton-Treves *et al.,* 2005). Every human community develops its approach for survival depending up on natural environment and change in abiotic and biotic components of that environment.

Community adapts those changes in long run through modification in its socio-economic components.

1.1 Background of the study

Forest protection and environmental conservation in developing countries of the world have become a critical issue. The conservation of relatively undisturbed, virgin forests in the world has been gaining interest in the past two decades because extensive deforestation and other types of destructive economic activities have significantly decreased the spatial extent of these valuable forests (Veen *et al.,* 2010). In vicinity of protected area, livestock owners' wildlife conflict is one of the foremost threats to conservation, house hold safety, food security and rural incomes. Human wildlife conflict is of increasing concern in many parts of the globe and has been the focus of recent conservation efforts (Else and Lee, 1986 and Naughton Treves, 1998). With increasing human populations especially in the developing countries more human and wildlife populations are coming into direct competition for resources (Strum, 1987). Crop raiding is defined as wild animals moving from their natural habitat into agricultural land to feed on the crops that humans grow for their own consumption and trade (Sillero –Zubiri and Switzer, 2001). Crop raiding and livestock lifting by wild animal is neither a new phenomenon nor a rare one. Crop raiding was taken as a surrogate for food and livelihood insecurity for the people of developing world, particularly in the boundary of protected area. Losses of crops through wildlife raiding and livestock depredation have direct negatively impacted on rural food and livelihood security. Beside visible or direct impacts, Livestock owners wildlife conflict (LOWC) has indirect or hidden impacts as well (Barua *et al.,* 2013). Hidden or Indirect impacts include disruption of livelihood and food security through crop or livestock loss. It also involves health impacts, transaction (time and money spent in mitigation measures and claiming compensation) and opportunity cost (lost income) and are often psychological or social in nature (Barua *et al.,* 2013 and Ogra, 2008). Extensive damage to field crops by wildlife usually resulted in shortages of nutritional supplements and inadequate food reserves. In many parts of rural Africa and Asia, it is perceived to be an increasingly serious issue by farmers and conservationists (Damiba and Ables, 1993; Thouless, 1994 and Sukumar 1992). The adjoining communities of protected area practice mainly subsistence agriculture. The types of crops grown are mainly cereals, which attract all sorts of forest animals that keep attacking the farmers' crops. The increased frequency of attack, livestock lifting,

livestock depredation and crop damage from these animals has posed a serious challenge to both the neighboring farmers and the conservationists. Earlier research focused on the issues related to crop damage by elephants and rodents (Hill and Plumptre, 2002), yet other animals such as primates and ungulates are also important pests in agricultural areas. In addition, the study also evaluated and developed a framework for response mechanisms to establish the efficacy of the mitigation measures that were employed at base level to address crop raiding and livestock lifting. Response mechanisms in this study were evaluated to generate information, relevant to LOWC resolution and transformation. The concern was whether the reporting systems indeed contributed positively to the mitigating of the crop raiding and livestock depredation.

1.2 Justification of the Study

Livestock rearing in India is an integral agricultural activity among most rural households. There is much evidence, which shows that livestock rearing has a positive impact on equity of income and employment for resource poor rural households as distribution of livestock assets is more egalitarian compared with land (Ali, 2007; Birthal and Ali, 2005; Birthal and Singh, 1995). Park farmers' conflict in Kalesar National Park (KNP) often centers on the issue of poverty and meeting basic survival needs. These conflicts pose serious challenges to conservation of biodiversity as well as livelihood of farmers around Kalesar National Park. Farmers who once enjoyed free access to the resources are no longer able to extract natural resources due to restriction placed by park authority or government laws after creation of the National Park which create reasons of Livestock Owners Wildlife Conflict (LOWC). Hence, in this context it becomes important to study what detrimental effects these restrictions and conflict have especially among the livestock owners who lack access to alternatives. Also, each year significant loss of crop, number of livestock and wild animals are lost due to conflicts. These wildlife damages, crop loss and livestock depredation are not equally distributed among the households and depend upon a number of factors. It becomes important to study what factors as geographical location of farms, crop types, size and numbers of livestock and household's effort to defend their fields can better explain these damages and suggest ways to mitigate these damages. Since, crop damages and livestock depredation can have a substantial impact on the local people, it becomes important to study what effect these loss have on the livelihood and wellbeing of the people living in the vicinity of the National Park. Additionally, benefits of conservation have failed to trickle to the grassroots levels of society and nearby people as well as compensation measures have

been found to be ineffective in mitigating LOWC. In this context, it is important to study what perception and people tolerance have towards wildlife and the park itself and what are the factors that shape these attitudes. This study aims at generating new sets of information regarding these indicators through regular monitoring of socio-economic indicators and wildlife damages and to be helpful in minimizing LOWC.

Finally, considering that crop damages and livestock loss often represent a serious threat to their livelihood, perception and tolerance of nearby farmers' employe a number of measures in mitigating these damages. Protection measures against wildlife damages represent a significant investment in terms of money and time for the households but few quantitative evaluation exits. Hence, it becomes important to study the types of mitigation methods employed by these people and at the same time quantify the cost of these measures. Despite all the efforts and mechanisms put in place to curb the interactions and conflicts between people and wildlife, wild animals still continue to destroy crops, kill livestock and attacks human. The local people also still seek some vital resources from the park e.g. pasture, building materials, bush meat etc. despite the Wildlife Protection Act, 1972. These conflicts are very prevalent and predominant in vicinity of National Parks. Livestock, wildlife and human interface tend to cause serious problems, losses and conflicts in the park and in the adjacent ranches and farms. There is therefore an urgent need for a research undertaking to investigate issues in the resource use conflicts and come up with practical solutions to curb the conflicts. These data can provide the decision makers with additional insight into the problems and helping them to acquire knowledge and tools to deal with the complex problem (Bailey, 2011). Therefore, keeping this background in importance some research questions has formulated for the present study and these are as:

1. What are the losses occurs due to livestock - wildlife conflict?
2. What extent the livestock owners' livelihood are vulnerable to livestock - wildlife conflict?
3. What are the perception and tolerance level of livestock owners towards the wildlife disturbances?
4. What are the strategies to mitigate chronic and persistent disasters by wild animals and the effectiveness of existing strategies in the vicinity of National Parks?

The broad objective of the study deals with four aspects, Such as wildlife damages, crop loss and livestock depredation and second aspect is livelihood vulnerability of farmers, third is perception towards wildlife and tolerance level of

livestock owners and finally yet importantly is regarding the mitigation strategies adopted by households in dealing with these damages. This study tries to examine how these conflicts affect people's livelihood and change their perception and form tolerance level. This study is based on framework provided by United Kingdom Department for International Development (DFID, 1999) (Sustainable Livelihood Framework).

The answers of these questions can be getting through a systematic and comprehensive study. By keeping this view in mind the present study" **Assessment of Livestock Owners - Wildlife Conflict in the Vicinity of National Parks**" was taken with the following specific objectives;

1. To estimate the losses of crops and livestock due to livestock owners - wildlife conflict.
2. To assess the vulnerability of livestock owners livelihood due to wildlife.
3. To measure the perception and tolerance of livestock owners towards wildlife.
4. To identify and study the effectiveness of existing strategies to mitigate the livestock owners-wildlife conflict.

1.3 SCOPE OF THE STUDY

1. The present investigation is the efforts to focus, document and highlight the effect on livestock owners due to wildlife conflicts.
2. The study will reveal the information related to livestock owners wildlife conflicts in the study area and this information will be helpful for the farmers, forest official, Forest department, developmental institute and also for the different organisation.
3. The study will help in identifying the valuable data on socio-economic and socio-personal characteristics of livestock owners in relation with vulnerability, perception, tolerance, livelihood and different mitigation strategies.
4. The study will highlight the social, economic, cultural and personal behaviour of the farmers towards wildlife.
5. The study will also analyse the structural and functional change occurs due to livestock owners wildlife conflicts in the study area.
6. The comprehensive outcome of the study will be helpful for preparing plans for the farmers to sustain their interest in the future and also useful for the line departments and forest department involved directly and indirectly in dairy sector vis-à-vis wildlife conservation and help the policy makers and administrators to modify the conservation

practices as well as protection of wildlife and same time must focus on the livelihood of the livestock owners.

1.4. SIGNIFICANCE OF THE STUDY

1. The study would help to understand the livestock owners' wildlife conflicts and different mitigation strategies adopted to minimize these conflicts by livestock owners.
2. The finding of the present research would give a brief view on the different aspect of vulnerability and livelihood security through livestock rearing.
3. The outcome of the research would provide the different conducive and limiting factors with their magnitude, which would ultimately help to know the real condition of the whole scenario, to make a proper planning by keeping all the factors in account.
4. The study would ultimately helpful to develop a mechanism to reduce livestock owners' wildlife conflict and help to identify different mitigation strategies in different part of the world and which can be used as a policy tools.

1.5 LIMITATIONS OF THE STUDY

The study has been conducted by a scholar investigator, although every efforts has been made to make this study comprehensive as far as possible, it is subjected to the limitations inherent. Following are some of limitations of the study;

1. The study was carried out in the vicinity of Kalesar National Park (KNP), Yamunanagar district of Haryana within the usual constraints of time and money of a single student project to a particular geographical area.
2. The findings were based on the expressed views of respondents in the locale and hence care had to be taken while generalizing the findings.
3. The data for the study was collected by group discussion and survey method. Therefore, the objectivity of the data was limited to the extent that the farmer was able to recollect from the past memories as most of the farmers had improper maintenance of farm records regarding dairying and losses due to wild animals.
4. Due to limitation of time and other resources, the study could not use the larger sample for qualitative and quantitative assessment.
5. In spite of the above limitations, due attention was given to make this study as more useful and deep and systematic as possible.

1.6 PRESENTATION OF THESIS

The dissertation has been organized in five chapters in logical sequence:

1. **Introduction:-** This chapter deals with the relevant background information, importance of the study, research objectives, statements of the problem, scope of the study and limitations of the study.
2. **Review of Literature: -** This chapter deals with the work done by the other researchers on the similar line of investigation. The earlier studies significant to the present study are reviewed in the this chapter on status of socio-personal and socio-economic, causes of livestock owners-wildlife conflict, crop loss, livestock lifting and human casualties by wild animals, vulnerability of livestock owners' livelihood due to conflict, people's perception and attitude towards wildlife conflict, different mitigation method and tolerance among livestock owners.
3. **Research Methodology: -** Research methodologies refer to strategies used in designing and carrying out the research, such strategies as the ones used in identifying the research areas and the population of interest, designing tools for gathering all necessary information and the implementation of data collection methods. Further this chapter explains in detail the research methodology used in investigation such as sampling procedures, variables, measurement of variables, procedures and techniques used for preparation of certain tools, instrument of data collection and statistical methods employed and analyze the data.
4. **Results and Discussion: -** The findings of the present study along with results and discussions are presented in this chapter.
5. **Summary and Conclusions: -** This chapter provides a summary of the study by presenting the conclusions drawn from this research. Also, based on weaknesses of this study important recommendations for future research are discussed in this concluding section.
6. **Bibliography and Annexure:-** The source from which information has been taken for using in the study are presented at the end.

REVIEW OF LITERATURE

"We are so because of our past…"

2. LITERATURE REVIEW

It is an essential preliminary task to be undertaken in a research study. Review of pertinent works and thinking by others, help to enlarge, enrich and clarify one's own work and thinking. Comprehensive review provides proper background information to design the research programme, analyze the data and to interpret the findings. It helps the researcher to acquaint with the available body of knowledge in the area of interest. Reviewing of literature brings clarity and focus to the concerned research problem which further helps to improve the methodology and also broaden the knowledge base within the area of planned research.

This chapter provide a better understanding of Livestock Owners Wildlife Conflict (LOWC) worldwide and to highlight common problems across local, regional and national vis-à-vis global levels. LOWC is more intense in the tropics and in developing countries where livestock holdings and agriculture are an important part of rural people's livelihoods and incomes. In these regions, competition between local communities and wild animals, for the use of natural resources, is particularly intense and direct and resident human populations are very vulnerable. Of course, the relative impact of wildlife damage on farm production and household income varies greatly according to the amount of land owned and people's economic dependence on rural activities (Messmer, 2000). Clearly people with a low standard of living are particularly at risk, as are agro-pastoralists who depend exclusively on production and income from their land. Human-wildlife conflict is a global issue, which has been extensively studied all over the world.

This overview confirms that conflict is particularly common in reserve vicinity, where species that rely on extensive territories come into contact with human settlements. Therefore, the reviews, which were authentically available and felt relevant based on the objective, have been presented in the following order.

2.1 Socio-Personal and Socio-Economic Profile of Respondents

2.2 Causes of Livestock Owners-Wildlife conflict

2.3 Crop loss, livestock lifting and human casualties by wild animals

2.4 Vulnerability of livestock owners' livelihood due to conflict

2.5 People's Perception and attitude towards wildlife conflict

2.6 Different mitigation method and Tolerance among livestock Owners

2.1. Socio-Personal and Socio-Economic Profile of Respondents

2.1.1. Socio-Personal Profile of Respondents

(Karanth *et al.,* 2012) surveyed households around Kanha National Park and revealed that household respondents were largely men (87%), with many (77%) having completed 8th grade or less education. Majority of households (93%) were engaged in agriculture, 88 per cent legally owned land with average land size of 4.3 acres. Households reported growing 12 different crops. The major crops grown were rice, millet and legumes, and the average length of time for crops in the field was 5 months (range 4-12 months). Mc Guinness and Taylor (2014) found that majority (76%) of interviewees considered themselves subsistence farmers (i.e., not involved in selling their produce at market). Nyamwamu (2016) conducted study in Laikipia county among 200 smallholder agro-pastoralists and revealed that more than half (61.1%) males participate in farming activities than females (38.9%) and study also established that of the 200 respondents, 19.10 per cent were aged 40 years and below while 80.90 per cent were aged 41 years and above and also found that about 26.90 per cent of the respondents had no formal education, more than half (57.30%) had at least primary education, 11.90 per cent had up to secondary education while only 3.90 per cent had up to tertiary education. Although men are more at risk overall than women, both men and women are almost equally at risk when working in fields or near their homes (Packer *et al.,* 2009). Singh (2011) reported that in Faizabad district 61.66 per cent respondents found in middle age group (37 to 58 years) and observed to be literate (81.67%), belonging to scheduled caste (40%), residing in joint families (50.83 %) and 84.16 per cent respondents having 5 to 13 members in their family. The maximum (54.16 %) respondents residing in mixed type of houses. The maximum numbers of respondents (78.33 %) were found having material possession satisfactory. The radio (93.33 %) and mobile (81.66 %) were observed as main communication media with respondents. The maximum number of (88.33 %) respondent reported 2 to 15 litres of milk production. Subash (2011) in his study showed that majority (38.00 %) of the farmers had low exposure to mass media, 34.67 per cent were in medium category of mass media exposure and 27.33 per cent were in high category of mass media exposure. The study conducted at Rajasthan about improved dairy farming practices and observed from the data that the majority (82.50%), (76.50%), (75.50%), (75%), and 68 per cent of the tribes respondents used, fellow farmers, neighbors, village quack, friends and tribes leader a main sources of information regarding improved dairy

farming. Pooled data about source credibility shows that Gram sewak, neighbours and KVK personnel were on 1st, 2nd and 3rd ranks, respectively followed by progressive farmers, tribal religious leaders, tribal leader, Livestock development officers, village quack, Co-operative officer and BDO were on 4th, 5th, 6th, 7th, 8th, 9th and 10th ranks, respectively (Meena and Meena, 2012). Meena (2015) reported in Rajasthan that 43.33 per cent belongs to the middle age group 36-50 years, 32.29 per cent in the old age group more than 60 years , 23.75 per cent the young age group up to 35 years respectively. Rathod et al. (2012) reported that majority of dairy farmers 55 per cent respondents were in middle age group followed by 35 per cent young age group, 10 per cent come under old age group. Meena (2015) reported in Rajasthan that 23.33 per cent of the fodder growing farmers are illiterate, 17.50 per cent up to the senior secondary, 15.00 per cent are graduate or acquired the education beyond the graduation whereas also reported that nearly half of the fodder growing farmers had large sized family having more than 7 members, 9.16 per cent having small sized family less than 3 members, and 44.18 per cent having medium sized family 3-7 members. Chand (2011) reported that most of the (51.33%) of the respondents were having large sized family more than 10 members whereas 29.33 per cent having medium size family ranging from 7 to 10 members, 19.34 per cent having low size family i.e. 6 members. Sachan (2013) revealed that majority 67.00 per cent of the respondents were having medium family size ranging from 5 to 7 members followed by the small size family i.e. up to 5 members and large size family more than 7 family sizes which were 21.00 per cent and 12.00 per cent respectively. Meena (2015) reported in Rajasthan that 10.42 per cent of the fodder growing farmers occupation is agriculture and dairy, 25.83 per cent are doing agriculture, dairy and business 37.92 per cent are agriculture, dairy and labour, 17.08 per cent are doing agriculture, dairy and service, 2.50 per cent are doing agriculture, service and business, 6.25 per cent are doing agriculture, dairy, business and labour. Chand (2011) reported that 42.67 per cent of the dairy farmers engaged in agriculture with dairy, 26.67 per cent in Agriculture + Dairy + Service, 14.00 per cent in agriculture + dairy + business, 13.33 per cent in agriculture + dairy + service, whereas, only 3.33 per cent of the respondents engaged in dairy + service + business. Darshan (2015) reported that 45.00 per cent of the farmers were practicing crop + dairy combination as occupation, 23.00 per cent are doing crop + dairy farming + business and 20.00 per cent of respondent are doing Service + crop + dairy farming and 12.00 per cent doing crop only. Mohammad (2006) reported that 62.25 per cent of the respondents having medium level of social participation. Murai

(2009) reported that majority of the 20.00 per cent respondents had no any kind of social participation, followed by 20.00 per cent in one organisation, 25 per cent in more than one organisation, whereas 35.00 per cent were office bearer in one organisation. Meena (2015) reported in Rajasthan that 20.42 per cent (49) of the fodder growing farmers are having high level of social participation, 63.33 per cent (152) having medium level social participation, 16.25 per cent (39) having low level of social participation while 35.83 per cent of the respondent having semi-medium land holding (2.01 to 4.0 ha), 29.69 per cent farmers having small size of land holding (1.01 to 2.0 ha), 16.25 per cent having medium size land holding (4.01 to 10.0 ha) 8.33 per cent having large size of land holding more than 10 ha as well as 63.33per cent of the respondent maintain medium herd size (3-6 animals), 20.0 per cent have small herd size (up to 2 animals), 16.67 per cent having large herd size more than 6 animals. Darshan (2015) reported with respect to land holding, 35.00 per cent farmers had marginal land holdings (up to 1 ha.) and 35.00 per cent were having small land holding (1-2 ha.) followed by medium (12.00%) and then semi-medium and large (10.00%) and (8.00%) respectively whereas he also revealed that majority (60.00%) of the dairy farmers had medium herd size and were rearing 4-6 numbers of animals. Whereas, 12.50 per cent of the dairy farmers had more than 5 animals and 27.50 per cent farmers were having up to 2 dairy animals in their herd. Tiwary et al. (2007) reported that main crops cultivated during *kharif* season are paddy, maize, sorghum, cowpea, etc. And during *rabi* season wheat, berseem, *lahi* (*Brassica campestris var. toria*) etc. and also revealed that the pooled population, landless, small and large farmers owned 3.9, 29.8and 66.3 per cent of the total cattle and buffalo population. Verma (2012**)** observed that 41.33 per cent of the farmers fell in medium category of milk production, (producing 6.11 to 10.07 liters milk per day) followed by 32.67 per cent and 26.00 per cent of the farmers belonged to low and high categories of milk production , respectively. Meena (2015) reported that majority of the respondent 68.75 per cent fell in medium category of milk production producing 4-13 liters milk per day, 16.68 belongs to the low category producing less than 4 liters milk per day, 14.57 per cent comes under high category producing more than 13 liters milk per day. Garai (2007) found that majority (72.22%) of the respondents had medium level of extension contact followed by high and low extension contact who constituted 15.56 and 12.22 per cent respectively. Meena (2015) reported that majority 61.25 per cent of respondent are having medium level of extension contact, whereas 22.50 and 16.25 per cent of them had low and high level of extension contact respectively. Mohammad (2006) revealed that majority of 70.31 per

cent of the respondents are having medium level of mass media exposure and mass media exposure was found positively correlated with the knowledge level of the farmers. Murai (2009) reported that majority 78.33 per cent had medium level of mass media exposure whereas 6.66 per cent having high mass media exposure and 15 per cent had low level of mass media exposure. Meena (2015) reported that 47.50 per cent of the respondent having low level of mass media exposure, whereas 40.41 per cent medium and 12.09 per cent having high level of mass media exposure. Shah et.al. *(*2002) reported that majority of the dairy farmers belonged to middle age category and were educated up to high school and primary school, respectively. They had medium level of experience in dairy farming and low level of social participation. Sharma (2004) found that more than 70.00 per cent of the livestock farmers were highly literate and 55.00 per cent of the farmers' family educational status was medium. Sikhakolanu (2007) reported that majority of the livestock farmers had low herd size 57.10 per cent followed by medium 24.60 per cent and high 18.30 per cent. Phand (2008) reported that most (35.38%) of the respondents had at least primary education followed by high school (33.33 %) and nearly 12.50 per cent of respondents fell in the categories of read and write. Moreover, about 10.00 per cent of the respondents were graduates. Singh (2003) reported that 50 per cent farmers were having medium level of mass media exposure and 31 per cent had low level. Majority of radio listener farmers were upper middle class in socio economic status. Ani and Baba (2010) reported that the mass media methods generally, are useful in reaching a wide audience at a very fast rate. They are useful as sources of information to farmers and as well constitute methods of notifying farmers of new developments and emergencies. They could equally be important in stimulating farmers' interest in new ideas and practices. Ganesan et al. (2013) reported that IFFCO Kissan Sanchar Limited (IKSL) and Reuters Market Light (RML) are providing services through SMS and voice messages about agriculture related information. He also reported that the main source of information for prices, weather forecast and advice on different farming practices is the farmer's own observation and experimentation followed by a conversation with other farmers.

2.1.2. Socio-Economic Profile of Respondents

Singh et.*al.* (2011) revealed that 46.50 per cent farmers were found under fair economic status group followed by 24 per cent belonging to poor economic status group and 22.50 per cent to good economic status group. Only 7 per cent farmers were found falling under

better economic group. The findings indicated that about 30 per cent farmers were having good or better economic status showing their capacity to pay for extension services. Rathod (2012) reported that majority of dairy farmers 61 per cent had low income followed by 36 per cent medium and 3 per cent high income groups. Meena (2015) reported that majority 72.91 per cent of respondent are come under medium income category followed by 15.42 per cent in high income group 11.67 per cent in low income group. Darshan (2015) reported that 60.00 per cent of respondent fall under medium income group, 22.50 per cent low income group, 17.50 per cent fall under high income group. The majority of the respondents (62.50 %) were having marginal land holding, (40.83 %), their family annual income ranges from Rs 40001 to 80000 with agriculture as the main occupation (80.33%) and half of them are associated with one organization (Singh *et al.,* 2016). McGuinness and Taylor (2014) stated that thirty per cent of respondents were willing and able to provide an estimate of annual monetary loss to crop raiding. These estimates varied between farmers, with a mean loss of 51,500 (SD 17,127, i.e., range 34,373-68,627) Rwandan Francs or ca. 53-105 US$ (2013 exchange rate) whereas crop raiding was perceived as occurring exclusively during daylight hours, either in the morning (15.00 %), afternoon (17.00 %), or at any time (68.00 %) and also find that current mitigation strategies were limited to active guarding, with 96.00 % of respondents claiming to guard crops, usually through the use of children (54.00 %). Of alternative feasible mitigation strategies, such as increased fencing, relocation or removal of problem animals, changing crops to those less palatable or accessible to raiders seemed popular. Livestock owner wildlife conflict not only affects rural and vulnerable communities, but also commercial cattle ranches. In this concern, Patterson *et al.* (2004) evaluated the level of impact of two private cattle ranches that lie adjacent to the boundary of the Tsavo East National Park in Kenya. In this study, three carnivore species were determined to be responsible for attacks: lions and spotted hyenas, which target large domestic animals such as cattle, bulls, steers; and cheetahs, which take only smaller adult stock and young cattle. In a four-year study the ranches have lost an average of 2.40 per cent of the total herd per annum which represented 2.60 per cent of their economic value and amounted to US$ 8,749. According to Bowman and Eagles (2004) the economic benefits arise when money spent reflect an increase in economic activity within the defined area that would not have occurred without the park. Agricultural producers in the western region of the United States reported the highest economic losses due to wildlife damage (Conover, 2002). Page (2007) identified four economic benefits of

tourism which are the generation of income for the local community; the creation of new employment opportunities; improvements to the structure and balance of economic activities within the locality; and the encouragement of entrepreneurial activity. According to Page (2007); Dwyer, Forsyth and Spurr (2005) and Mathieson and Wall (1982) the magnitude of the economic impact of tourism depends on the following aspects like the total number of tourists who visit an area/national park; The duration of stay; The average spending of tourists in that area/national park; and the circulation (multiplier) of tourism expenditure through the area. Any wildlife population can be thought of as a valuable resource that provides a multitude of societal benefits (Conover, 1997) including increased wealth, well-being, or quality of life. Other aspects of wildlife are negative and have the opposite effect. For instance, positive values of deer include their recreational value to hunters and wildlife watchers; negative values include the economic and human health problems that result from deer–automobile collisions. Qualitative data revealed helplessness, bitterness and revenge tendencies by farmers due to wildlife losses, which contributed to their poverty (Mwangi *et al.,* 2016).

Naughton-Treves (1997) in Uganda analyzed the incidence of socio-economic variables on local perception of the conflict around the Kibale National Park, where 54.00 per cent of the land within 1 Km from the National Parks border is cultivated. The study area was almost entirely confined within 200m from the edge of the park where farmers lost on an average of 4-7 per cent of their crop per season and reported the use of defensive strategies (mainly guarding and to a lesser extent fencing and trenches). Amaja *et.al.,* (2016) in their respective study revealed that the major economic activities of the sampled household in the study area were subsistence agriculture, which includes crop farming, livestock rearing and/or a mixture of animal rearing and crop farming. About 70.00 per cent of the respondents earn their income from mixed agriculture (crop farming, animal rearing and bee rearing). The remaining 16.70 per cent depends only on crop farming and 13.30 per cent depends on both crop farming and other income sources such as daily labour works. Compensation and insurance schemes can be used to reduce the monetary risks of crop raiding, although their geographic extent and level of capitalization are often limited and their effectiveness is undermined by difficulties in verifying claims (Boitani, Ciucci, and Raganella-Pellicioni, 2010; Bowen-Jones, 2012; Karanth, Gopalaswamy, DeFries, and Ballal, 2012; Ogra and Badola, 2008). Most (61.9%) of the small-scale farmers in Laikipia County are poor, earning less than kshs. 60,000 as income annually and only 38.10 per cent earning at least kshs. 60,000 or more

This means that most farmers in Laikipia County are of low income status (Nyamwamu, 2016).

The common type of land tenure in the surveyed area was where the households owned the land without title deeds (57.00 %), followed by households that owned the land communally (18.00 %), and then those who owned the land with title deeds (16.00 %). The rest of the households either had borrowed the land (1.00 %), leased the land (1%) or were squatters on the land (6.00 %). Majority of the households (68.00 %) owned land of less than 12 acres. Households that owned land ranging between one and 3.99 acres were 25 per cent , while 21.00 per cent of the households owned land between four and 6.99 acres, 11.00 per cent owned land ranging between seven and 9.99 acres, and 11.00 per cent owned land in the range of 10 to 12.99 acres (Makindi et al., 2014).

2. 2. Causes of Livestock Owners - Wildlife Conflict

2.2.1. Global perspective

The major cause of human-wild animals conflict were habitat disturbance due to expansion of subsistence agriculture around forest edge, coffee plantation, proximity to natural forest reported by Amaja *et al.* (2016). According to Dublin and Hoare (2004), conflict causes due to combination of crop damage and complex social dimension while conflicts can be mitigated by educating the local people, with special reference to marginal farmers. Wildlife laws, attitude of local people, habitat recovery and conservation efforts are the main factors to reduce the human-wildlife conflict in many areas (Mech, 1995; Breitenmoser, 1998 and Naughton-Treves *et al.,* 2005). Woodroffe et al. (2005) stated that Conflicts between wildlife and humans are increasing worldwide, especially in and around protected areas and also revealed that human-carnivore conflicts are universal and people's near ubiquitous negative behaviour to carnivores in the conflicts are a major challenge to biodiversity conservation whereas Naughton-Treves et al., (2003) reported that, lifestyle of urban areas attracted local people, who lived in contact with wildlife, which led to the alteration of the structure of forest boundary and increased the conflicts. In a survey conducted of U.S. agricultural producers, Conover (1998) reported that more than 89 per cent of those responding experienced conflicts with wildlife. Scarcity of resources is the ultimate reason for human-wildlife conflict opinioned by Nyhus *et al.* (2003). Romanach *et al.* (2007) suggested that, competition for resources will be enhanced by the increasing human population, encroachment and fragmentation of the forest habitat which led to conflicts. Zhang (2006) reviewed the

challenges faced by the traditional nature reserves. Land-use planning with combined approach for the conservation of wildlife was recommended. Many conflict areas are characterized by the lack of spatial sampling and modeling (Peterson *et al.,* 2010) and by rectifying these, the efficacy of management and conservation of wildlife will be improved (White and Ward, 2011). Rearing the livestock in the immediate fringe areas of the forest attracted the carnivores, which is the fundamental cause of conflict in many areas (Naughton-Treves *et al.*, 1998; Linnell *et al.,* 1999; Stahl and Vandel, 2001; Ogada *et al.,* 2003; Rossler *et al.,* 2012). Studies on economic and social impacts associated with raiding of crops were conducted by Mackenzie and Ahabyone (2012). Fernando *et al.* (2005) and Davies *et al.* (2011) described that the growing human population causes increasing demand for land rights is resulting in continual habitat fragmentation through unsustainable extraction of forest products and agriculture, causing conflict between elephants and people. Wang and Macdonald (2006) expressed that Human-Wildlife Conflict (HWC) is a common phenomenon from the ancient times and has become a significant problem throughout the world and also revealed that subsequent increases in wildlife populations resulted in increased threats to humans, crops and livestock which results heavy losses in terms of property damage by wildlife; crop loss by direct feeding and destruction; the loss of use of arable land due to fear of crop damage; livestock depredation by wildlife; and harassment, injury, or death of local people. Elephants are more dangerous than other herbivore species, causing more human deaths and injuries and as a result they often elicit fear in rural communities revealed by Parker *et al.* (2007). Kilpatrick *et al.,* (2009) revealed that interactions between wildlife and domestic livestock have created conflict for centuries because of pathogen transmission, competition for space, food and predation. Dickman (2010) identified that despite decades of research and significant financial resources invested, we still lack a fundamental understanding of which ecological and social factors drive human–wildlife conflicts. Gubbi (2012) reported that Human-elephant conflict is major threat to the Asian elephant. Nearly 400 people and 100 elephants lose their lives due to conflict every year. Singh (2012) reported that decreased prey base in protected area which was caused by poaching of herbivores has resulted in carnivores moving out of forest in search of prey and indulge in cattle lifting and thus causes conflict to reduce conflict allocation of funds to the area of high depredation of crops was recommended. Another study indicated that, attitude towards wildlife is the key factor needed for managing and conserving the wildlife (Jacobs *et al.,* 2014 and Manfredo *et al.,* 2009). Consequently, some of the

greatest conflicts for food and space between livestock and wild herbivores have been observed to occur on the grasslands and shrub lands. The competition has been serious especially among cattle, sheep and goats, buffaloes (Oleleboo *et al.*, 2012). Direct conflicts between wildlife and agro-pastoralists have manifested themselves in damage to structures (e.g. fences, watering points, and even homesteads), and human or livestock injuries or deaths (Nyamwaro, 2006).

2.3. Crop Loss, livestock lifting and human casualties by wild animals

2.3.1. World scenario

Human-wildlife conflict (HWC) is a growing issue and crop damage by wild animals is one of the major worldwide problem (Dublin and Hoare, 2004 and Anthony *et al.*, 2010). Human casualties, crop raiding and livestock depredation are the most serious nature of conflict among all. Human-wildlife conflicts arise when they are compelled to share a common limited resource such as land, game, livestock or fish exposed by Schwerdtner and Gruber (2007). Amaja *et al.* (2016) revealed that 50 per cent of respondents were both problem of crop damage and livestock predation, while 22 per cent reported only crop damage, and 28 per cent did not face any conflict and also reported that crop damage is the most observed problems in the community (72%) in the study sites. Gusset *et al.* (2009) conducted a study on human-wildlife conflict in northern Botswana, with special reference to livestock predation by endangered African wild dog (*Lycaon pictus*) and other carnivores and found that livestock owners were not satisfied with the disbursement of ex-gratia and recommended the improvement on livestock husbandry practices. Sitati *et al.* (2005) revealed that Households in closer proximity to reserves, surrounded by tree cover, and growing a diversity of palatable crops to be more prone to loss. Wolf causes the most numerous livestock kills, while the bear is the one that causes the highest economic losses by killing larger livestock like cattle and horses reported by Stoynov (2005). Goodrich (2010) reviewed the impacts of human-tiger conflict and opinioned that it led to major threats to tigers by changing the attitude of local people when its population increased. Chapron *et al*. (2008) studied the depletion of prey and human-tiger conflict with special reference to poaching. Brown and Conover (2008) surveyed the wildlife professionals where the occurrence of human-carnivore conflict was high. People responded in various ways, either fight back or inactive modes, based on the nature of attacks by carnivores. Dar *et al.* (2009) studied human-carnivore conflict in Machiara National Park, Pakistan and found that the damage caused by leopards was highest than

other carnivores. Schiess-Meier *et al.* (2007) studied the human-carnivore conflict in Botswana. Predators generally consumed the wild species than domestic animals, when the natural prey was available. It fed on livestock as an alternate food, if the availability of natural prey was low. Michalski *et al.* (2006) Study on "Human–Wildlife Conflicts in a fragmented Amazonian forest landscape: determinants of large felid depredation on livestock" was revealed that clear peaks of depredation during the peak calving period at the end of the dry Season. Kolowski and Kolowski (2006) reported that spotted hyenas, leopards (*Panthera pardus*) and lions (*Panthera leo*) were responsible for 53 per cent, 32 per cent, and 15 per cent of attacks on livestock, respectively. Sprague and Iwasaki (2006) in Japan showed that crop damage by monkeys may be more intensive than other animals in terms of monetary cost. WWF (2007) Study on "Human-Wildlife Conflict in Nepal" done by the Jhapa and Bardia were revealed that the most severely and about equally affected by human-elephant conflict in terms of crop damage, were every year a household losses nearly a quarter of their total annual income from crop production. Namgail *et al.* (2007) reported in Himalayan region that high populations of domestic livestock have led to increased predation of domestic species by wild carnivores. Holmern *et al*. (2007) reported in Tanzania that livestock depredation was caused most often by spotted hyena (*Crocuta crocuta*) (97.7%), leopard (*Panthera pardus*) (1.6%), baboon (*Papio cynocephalus*) (0.4%), lion (*Panthera leo*) (0.1%) and lastly black-backed jackal (*Canis mesomelas*) (0.1%) at the same time livestock owner reported average annual financial loss of 19.20 % of their cash income and majority of livestock killed were goats (55.50%), followed by sheep (30.1%), cattle (13.6%), pigs (0.7%) and donkeys (0.1%). Ogra and Badola, (2008) and Inskip and Zimermann (2009) reported that Crop raiding, property damage, livestock depredation and human casualties are the most common forms of conflicts with wildlife animal. Sangay and Vernes (2008) revealed in Bhutan that leopards killing significantly more livestock (70% of all kills), than tigers (19%), bears (8%) and snow leopards (2%) and About 50 per cent of livestock killing were of cattle and about 33 per cent were of horses, with tigers, leopards and snow leopards killing a significantly greater proportion of horses than predicted from availability. Karanth *et al.* (2013) reported that Crop loss was reported by 64 per cent of households and associated with growing cotton, sugarcane, coffee and rice. Livestock loss was reported by 15 per cent of households, and associated with grazing animals inside reserve and in another studied it reported that wild animal causes 82 per cent crop loss and 27 per cent livestock loss. Alexander *et al.* (2015) reported in North West China that

depredation was the most common event affecting livestock, compared with natural disasters or disease, and represented a total loss of 3.6 per cent of the livestock population. Most (53%) depredation losses were attributed to lynx, while snow leopards were held responsible for only 7.8 per cent of depredation losses. Our results indicate that the majority (75%) of the respondents suffered from crop raids and livestock depredation by wildlife (Mwangi *et al.,* 2016) and on their part, residents killed wildlife for: subsistence (41%), revenge (35%), bush-meat trade (22%), and other undisclosed reasons. Human wildlife conflict manifests itself as crop damage, livestock injury or death, human injury or even death, competition for pasture or infection of livestock with zoonotic diseases (Musimbi, 2013 and Waithaka, 2012). Among farmers in Nigeria, crop damage is sometimes up to 98 per cent, in Botswana farmers sometimes stop farming due to wildlife menace (Dasgupta, 2013). It was estimated that in Cameroon, up to 28.4 ha of crop was destroyed by wildlife around Campo-maan area and two people were killed in 2004 (Eyebe, 2012). Crop damage by wildlife reduces yield by up to 50% in Uganda (Hill and Wallace, 2012). Although on a national scale the loss of 2ha of maize to wildlife on a single day may be considered insignificant, to the family concerned it may mean a loss of food supply for a year (Graham *et al*., 2010). The average financial loss in revenues on mono-specific maize fields was USD 415.83 ± 61.92 from perceived damage by local farmers. On the same farming plots USD 205.79 ± 36.89 were lost from actual damage at nett present value for 2006/7 and 2007/8 farming seasons in Luangwa Valley.

2.3.2. Indian scenario

Reasons for human-elephant conflict in Rajaji National Park were due to the competition for food and elephant deaths were due to train collision. The casualties of elephants were controlled by reducing the speed of trains reported by Williams *et al*. (2001). Prashanth *et al.* (2013) opinioned that feeding habits of Gaur as a generalist feeder *i.e*. feeding upon variety of food items like grasses, leaves, herbs, shrubs, fruits, bark etc. Their diet also includes cultivated foods like tender, paddy coconut saplings etc. thus these animals are capable of damaging most agricultural and horticultural crops. Ahmed *et al*. (2012) reported in central India that livestock depredation events were reported during the household survey, Leopard was found to be involved in 27 incidents (47%), followed by Tiger in 21 incidents (37%), Jackal in 5 incidents (9%) and wolf involved in 4 incidents (7%). Mostly the predators attack on Cow (23.43%) and least number of attacks on horse (1.2%). Kala and Kothari (2013) in Uttarakhand exposed that 90.3 per cent of adult cattle

were killed by leopard. Prashanth *et al.* (2013) uncovered in Karnataka that 80 per cent crop raiding was done by wildlife animal like gaurs and damages mostly agricultural and horticultural crops and also suggest that better conservation can be achieved through management of conflicts and providing pastures in form of grasslands to the herbivores so that grass is available year round to minimize crop-raiding cases. Awasthi and singh (2015) revealed in his study "Human-Wildlife Conflict in buffer zone area: A Study of Banke National Park, Nepal" The major crops grown were maize, wheat, mustard and paddy. The damage per household per year of maize was highest, than of wheat and of paddy. Average damage each household per year of maize was 583.4 kg and that of wheat was 243.21 kg. In monetary terms, maize damaged accounted for about 49.83 per cent of total economic yield. Among the others crops wheat and mustard accounted for about 31.15 per cent and 11.42 per cent of the total economic yield respectively. Bachman *et al.* (2011) reported in Rajaji Corbett National Park that tiger killed 23 cattle and leopard caused loss of 241 livestock within two year. Nigam (2002) reported the crop damage by elephants in Jharkhand and indicated that, habitat degradation was the cause of conflict. Gubbi (2012) postulated that human-elephant conflict was high in the places where the human settlements and undisturbed forest areas were confronted. Chauhan *et al.* (2009) investigated the human-wild pig conflict in the five States of India. The study reported that, attitude of local people towards this species was always negative, which adversely affected the conservation efforts. Singh *et al.* (2011) reported that, Indian crested porcupine (*Hystrix indica*) consumed 19 varieties of sugarcane in Lucknow, India. Human-macaque conflict and pest behaviour of long-tailed macaques (*Macaca fascicularis*) were studied in Kuala Selangor Nature Park by Hambali *et al.* (2012). Karanth *et al.* (2012) surveyed households around Kanha National Park and reported that crop loss listed 17 species as crop raiders including 10 herbivores, 4 carnivores, 2 primates and peacocks. Animals reported causing the most crop damage were wild pig (*Sus scrofa*) chital and langur (*Semnopithecus entellus)* and used multiple mitigation measures.

2.4. Vulnerability of livestock owners' livelihood

Campbell (1999) identified that farmers having adequate coping strategies is therefore a key part of reducing vulnerability and this has long been integral to traditional communities who regularly face environmental hazards. Naughton-Treves *et al*. (2005) reported that if livestock owner is wealthy, has alternative sources of income and/or

engages in social reciprocity with their family and community then they could actually be less vulnerable than other people. Maikhuri *et al.* (2001) and Nepal and Weber, (1995) revealed that rural people in many developing countries are vulnerable to the policies associated with the establishment and management of protected areas, as they depend primarily on locally available resources for their livelihoods and spiritual needs. Wang and Macdonald (2006) and Wang *et al. (*2006) reported that subsequent increases in wildlife populations resulted in increased threats to humans, crops and livestock. Rode *et al.* (2006) Studies investigating the biophysical aspects of crop-raiding focus on crop-loss and the landscape factors that render farms vulnerable. The loss of life, crops or live-stock to wildlife has significant consequences for people's livelihoods, their food and agricultural security Barua *et al.* (2013).

Communities dependent on their farmsteads for the food they eat, living close to the margins of protected areas and in economically marginalized parts of the world, are particularly vulnerable to the effects of crop damage (Chiyo and Cochrane, 2005; Naughton-Treves, 1998). Reduced food security resulting from this can be an important consequence of crop raiding (Barua *et al*., 2013)

2.5. People's Perception and attitude towards wildlife conflict

Local community perception of conflict does not always correspond to reality; in some cases negative impact is only perceived and may result from confounding ecological factors. As the socio-political issues in the buffer areas are very high, the local people always have a negative attitude towards the Reserve Forest (Maikhuri et al., 2002). Webber *et al.* (2007); Campbell-Smith *et al.* (2012); Karanth and Nepal, (2012) reported that individual respondent attitudes towards wildlife and these reserves vary widely and making it challenging to easily implement general strategies in such a diverse landscape.

WWF (2007) reported people's perception towards conservation that both Bardia and Shukla were more positive towards conservation than Jhapa. This is mainly because of the fact that most respondents here generally accepted the conservation friendly ideas such as reducing disturbance to wildlife habitats, protecting elephants for religious sentiments, and the need for trans-boundary cooperation to conserve the elephant populations. Dickman (2010) reported in UK that perceptions are influenced by multiple factors including the physical and behavioural characteristics of a species, knowledge and understanding of a species and experiences of risky events attributed to wildlife whereas Li *et al.* (2013) identified in Tibet that Wolf causes highest livestock losses and rank first

in the animal depredation, due to high damage by wolf local herders disliked most and showed negative behavior to the wolves. Kansky *et al.* (2014) reported in South Africa that role in damaging livestock may not always be the dominant factor for determining attitudes towards wildlife and he identified that Elephants (65%) elicited the most positive attitudes, followed by primates (55%), ungulates (53%), and carnivores (44%) and also assessed that urban residents presented the most positive attitudes (80%), followed by commercial farmers (51%) and communal farmers (26%) towards the wildlife (Karanth *et al*., 2012).

2.6 Different mitigation method and Tolerance among livestock Owners

Mitigating crop and livestock loss to wildlife and improving compensation distribution are important for conservation efforts in landscapes where people and wildlife co-occur outside protected areas (Karanth *et al.,* 2012). Considering the actual population growth rate of humans, increasing demand for natural resources and the growing pressure for access to land, it is clear that the human wildlife conflict will not be eradicated in the near future, however it needs to be managed urgently. A wide range of different management tools has been developed worldwide to address LOWC, but most of these are strongly site and species/genera specific and are not widely or easily accessible (IUCN, World Park Congress 2005). Spatial separation has been proved to be a successful strategy when physical barriers enclose a large reserve (Distefano, 2005). In the study area, other types of barriers are under experimentation, such as rubble walls and barbed wire fencing, which have been constructed along some sections of the reserve's boundary (Vijayan and Pati, 2002). A remarkable study was undertaken by Ogada *et al.,* (2003) who looked at Eastern African traditional systems of livestock husbandry and explored the effectiveness of various types of fencing as well as good husbandry practices based on traditional approaches demonstrate the ability to limit depredation by large carnivores. Distefano (2005) reported that Human-wildlife conflict can be managed through prevention strategies at the initial stage and take action towards addressing its root causes, a protection strategy are implemented when the conflict is certain to happen or has already occurred and mitigation strategies attempt to reduce the level of impact and lessen the problem. The main approached programs for this are community awareness at local level, direct and/or indirect compensation in the event of loss, voluntary relocation of local communities, guarding animals, translocation of problematic animals and human-wildlife education toolkit for farmers and communities. Dodd *et al.* (2007) revealed in his study

that Wildlife crossing structures in combination with wildlife fencing have been shown to reduce WVC's with large mammals by over 80 per cent in areas where extensive continuous wildlife fencing (covering many miles) has been implemented. Prashanth *et al.* (2013) reported in his Studies that Farmers use many methods to protect crop fields and orchards from wildlife. These methods include patrolling the fields or personal guarding, keeping dogs, fencing with thorny twigs etc. The most commonly used crop protection strategy is guarding their fields by constant vigilance during night hours. This method is used by 71 per cent of the farmers in the study area. 10 per cent of field owners protect the field by pipe or stone fencing. Few farmers (about 7 %) use dogs. 8 per cent of farmers use dangerous methods like high voltage electric fencing in which Gaurs are usually killed or seriously injured. While the remaining 4 per cent use other miscellaneous methods like scaring the Gaurs away, twigs and thorns fencing etc. Khatiwada (2008) study on "People Wildlife Conflict in Lelep and Tapethok VDCs of Kangchenjunga Conservation Area (KCA)" showed that local people adopted the different techniques to protect croplands from wild animals. Fencing, Scarecrow, stone throwing and sound producing were common techniques to protect the crop land from wild animals. Local people guard their crop field during crop ripening seasons. This study also showed that mike and cassette supported by KCAP to chase wild animals from croplands in Tapethok was ineffective after 2/3 days of its establishment. Now a day the wild animals became habitual for all chasing techniques and ignored them easily, Obstacles creation as stone wall fencing, trench and electric fencing are only way to protects crops from wild animals but these all are unfeasible in the study area due to the sparse croplands. Perera (2009) showed that in Namibia different methods both traditional and modern were employed at a field level to keep wildlife away from humans and human property, with varying levels of success. The major methods were artificial barriers (electric fences, protection of water points, chilli pepper fences, chilli bombs), alternative water points for elephants, elephant trip alarms and improved livestock husbandry. This also showed that one technique alone will not be sufficient – a package of different techniques should be designed that is specifically tailored to meet the needs of the local situation. HWC varies enormously spatially, temporally and between species, and therefore responses and management approaches must be flexible. Kansky *et al*. (2014) revealed that the concept of tolerance in the HWC literature has generally been used interchangeably with the attitude concept. Karanth *et al.* (2013) reported that households using mitigation measures (lighting, fencing, guarding of animals), and with

more resources (land size, people to guard) to be less prone to loss Decker *et al*. (2012) reported the attitude concept has been extensively applied in research into the human dimensions of wildlife management. Karanth and Nepal (2012) and Karanth *et al.* (2013) reported in India and Nepal that people exhibit some tolerance for wildlife despite experiencing substantial losses to different species. Karanth *et al*. (2013) reported in Western Ghats of India that Common mitigation measures for crop protection were night watching (46%), fencing (34%) and scare devices (34%); and for livestock protection were closer watch on animals (7%), guard animals (3%) and fencing (2%) reported losses were similar across all reserves with higher losses incurred by households closer to the reserves. Singh and Chauhan (2016) reported in Nepal that Most of the people applied one or more measures to cope with HWC. One common feature observed in the cultivated area was the vocal sound by the people (shouting with loud singly or in group, clapping in group). Other methods included were noise making tools such as clapper (Locally k/a Kole) and drum, stone and dust throwing, chasing with fire, regular watching wild animal through high point (Locally k/a Atta) and dog releasing during encounter with wild animals. During certain period of high crop vulnerability, farm HH members would take the turns to guard the field crops. They used the different methods to cope with HWC. Distefano (2005) and Lamarque *et al.* (2009) Broad-based reviews of HWC resolution show that preventative measures comprising interventions including fencing; guarding; resettlement and integrated land-use planning have received quite a lot of attention. These kinds of approaches are, however, less effective for addressing ape-human conflict given the intelligence, adaptability and dexterity of the great apes. Dickman (2010), Lee and Priston (2005) reported in their studies that reactive measures, comprising lethal removal or relocation of problem animals, which are used in some case are not appropriate for social, protected animals like apes while Improving fences with the addition of a roof would substantially reduce the economic losses (Butler, 2000). Mitigation measures reported by (Karanth *et al*., 2012) in surveyed households around Kanha National Park such as fencing or lighting, appeared noticeably more important and revealed that in surveyed households to use these mitigation measures to protect property and lives. To protect crops the most common mitigation measures were night watching (67%) and scare devices (49%) and to protect livestock measures deployed by households were closer watch on animals (48%) and physical structures (47%). Measures aimed at mitigating HWC include physical barriers, guarding, noise, lethal removal, and relocation (Woodroffe *et al.,* 2005) and may be directed at the individual household or the entire

community. Although physical barriers such as fences, walls, and ditches can protect property from wildlife damage (Hockings, 2009), their widespread use is limited by the costs of construction and maintenance (Hayward and Kerley, 2009; Pérez and Pacheco, 2006; Thapa, 2010). As a result, alternative mitigation measures have emerged, such as the burning of chilli powder, release of specific deterrent pheromones, solar-powered lights, and the tagging and monitoring of problem animals (Hill, 2012; Parker and Osborn, 2006; Schlageter and Haag-Wackernagel, 2011). Active guarding is also widely adopted (Naughton-Treves, 1998), and has included the use of domesticated animals (Gehring, VerCauteren, and Landry, 2010; Hill *et al*., 2002). Aside from children frequently being given the task of guarding, women are also expected to be custodians of crops (Ogra, 2008). Indigenous knowledge has been effective in human-wildlife conflict management since local people have managed the land on which they live and the natural resources which surround them (Naidoo *et al.,* 2011). Human-wildlife conflicts cannot be managed solely by using indigenous knowledge. Intervention strategies endeavour to avoid the conflict from occurring in the first place and take action towards addressing its root causes (Distefano, 2009). If properly designed, constructed and maintained fences can be almost completely effective in preventing HWC and, apart from mitigating HWC fences also help prevent the transmission of certain endemic diseases such as foot and mouth diseases stated by Distefano (2009). Fences have also been effective in managing HWC compared to digging ditches to keep wildlife at bay (Mwangi, 2015). In general, the majority (61.70%) of the farmers had medium level of tolerance toward HWC, whereas 25.40 per cent and 12.90 per cent belonged to a high and low category, respectively. The mean tolerance level of the farmer's encountering HMC is low (8.77) among the other three wild animal conflicts (Senthilkumar *et al.,* 2016).

RESEARCH METHODOLOGY

"Zeal for work is key to success…."

3. RESEARCH METHODOLOGY

The present chapter is considered to be a "blue-print" of the research architect. It enlightens the research objectives and a suitable methodology to achieve selected objectives. Research methodology in social science introduces the overall methodological approach for investigating research problems, indicate how the approach fits the overall research design, describe the specific methods of data collection, explain how to analyse results, provide contextual as well as background information and a rationale for methodologies that are unfamiliar for readers and provides a justification for subject selection and sampling procedure. According to Ray and Mondal (2008), research design enables the investigators to answers research questions objectively, accurately and economically as possible. Thus, Research methodology provide outline for the research exertion that helps in describing the various procedures and techniques used to accomplish the research programme. It helps the researchers to keep his work going in right and appropriate track or path. It further helps in the interpretation as well as explanation of the findings. It has been organized under the following sections:

Research Methodology has been organized under the following sections:

3.1 Locale of the study

- 3.1.1 Description of the study area
- 3.1.2 Profile of the study area

3.2 Design of the study and sampling plan

- 3.2.1. Selection of state
- 3.2.2. Selection of district
- 3.2.3. Selection of blocks
- 3.2.4. Selection of villages
- 3.2.5. Selection of respondents

3.3 Variables and their measurements

3.4 Operationalization of variables

3.5 Tools and techniques used for data collection

3.6 Statistical tools used for data analysis

3.7 Facilities utilised for the research work

3.1. LOCALE OF THE STUDY

The present study was undertaken in the state of Haryana. The said state was purposively selected because of the following reasons:

India has huge biodiversity in flora and fauna, socio-cultural values, agriculture and animal husbandry practices. The present study was conducted in Haryana, which was purposively selected because Haryana is an agrarian state with more than 80.00 per cent of its land under cultivation and livestock as an integral part. State contribute second highest food grain to the total grain production of the India. More than 65 per cent of the state population depends on agriculture and livestock contributing 36.10 per cent of state agriculture gross domestic product. Haryana state has one of the highest irrigated cultivated lands (84 %) in the country. Per capita availability of milk in the state is second top in the country with 767 gram per day (Rajeshwarn et. al, 2014). Although Haryana State is deficient in natural forests but it has rich bio-diversity, which makes it suitable for variety of wildlife particularly local and migratory bird species. Haryana is having highest number of buffaloes for per 1000 household in the country and second highest milk producing state in India (2012-13). In India highest crop losses due to blue bull is reported in Haryana which constitute 60.00 per cent of total crop loss of state (ICAR, 2009). The state consists of two national parks namely Kalesar National Park and Sultanpur National Park. From these two National Parks, Kalesar National Park was selected purposively. Among these two national parks in the state, Kalesar National Park having threatened animals like Blue bull (Rojh), Monkey, leopard, tigers, elephant, Ghoral, Barking deer, Sambar, Chital, Python. Antelopes are represented by the Nilgai or Blue bull, which occurs in the more open areas bordering Yamuna plain. Wild boar is also fairly common in the park and it also raids on crops. The Rhesus macaque is most common monkey in the park and most of these were released in the park area from outside and most of the time these monkeys attack villagers and go for crop raid.

3.1.1. Brief Description of the Study Area (Haryana)

This section, explain the details about the historical background, agricultural and livestock status of the state, selected district along with brief social contact with its general profile. General information regarding the geographical location, land-use pattern, agro-climatic conditions including soil and rainfall, financial institutions and some other

basic information of the study area. It provides background for analysis, interpretation and discussion of the results and helps in drawing noteworthy conclusions.

Fig: 3.1 Map of India **Fig: 3.2 Map of Haryana**

3.1. PROFILE OF THE STUDY AREA (HARYANA)

S. No.	Particulars	Values
1.	Total geographical area	44,212 Km^2
2.	Districts	22
3.	No. of sub-divisions	6
4.	No. of blocks	126
5.	Total No. of Panchayats	6083
6.	No. of Villages	6841
7.	Total population Rural population Urban population Male population Female population	253.53 lakh 69.79 % 30.21 % 135.05 lakh 118.48 lakh
8.	Livestock population (As per 19th livestock census, 2012) Total Cattle (CB and Indigenous) Buffalo	8.81 million 1808.12(000) 6085.31(000)
9.	Literacy rate	76.60 %
10.	Population growth (2001-11)	19.9 %
11.	Density / km^2	573
12.	Sex ratio (per 1000)	877

(Census, 2011)

3.1.2.1 STATUS OF AGRICULTURE IN THE STATE

Haryana is an agriculture leading state in country. About 70 per cent of the population depends on agriculture and allied sector for their livelihood. Total food grain production of the state is 152.36 lakhs tonne (2014-15). Haryana is at second position in terms of food grain production in the country and also second largest contributor to India's central pool of food grains. It is contributing about 15.6 per cent of the total food grain production of country within 1.60 per cent area. Haryana is also producing about 60 per cent of exportable basmati rice of the country. The main crops are Rice, Wheat, Barley, Sugarcane, Cotton, Oilseeds, Gram, Corn, Millet etc. The major Kharif crops are rice, Jowar, bajra, maize, cotton, jute, sugarcane, sesame and groundnut. The major Rabi crops are wheat, tobacco, gram, linseed, rapeseed and mustard. Haryana is located in the northwest part of the country having the arid to semi- arid climate with average rainfall of 354.5 mm. The state is divided in two agro climatic zones north-western part and southwestern part. The total geographical area of Haryana is 4.52 million ha, but the cultivable area is around 3.7 million ha. About 75.00 per cent of the area is irrigated, through tube wells and an extensive system of canals. The cropping intensity of state is 184.91 per cent while national average is 135.00 per cent.

3.1.2.2 DAIRY FARMING

Total livestock population of Haryana is 8.81 million and the contribution of Buffalo is highest i.e. 69.00 per cent of the total livestock population followed by Cattle 20.50 per cent, Goat 4.19 per cent, Sheep 4.11 per cent. (19^{th} livestock census, 2012) There is a proverb “Desaan main desh Haryana, ‘Jite doodh dahi ka khaana”, which means "Among places Haryana is the place, where the staple food is milk and yogurt". Total milk production of state has reached 7.9 million tonnes (2014-15). Per capita availability of milk is 767 grams of per day (Rajeshwarn et. al., 2014), ranks at second in the country as against the national average of 262 grams. That’s why it is known as the ‘Milk Pail’ of the country. There is a vast network of milk societies that support the dairy industry. The National Dairy Research Institute (NDRI) at Karnal and the Central Institute for Research on Buffaloes at Hisar are the premier institute playing important role in development of new breeds of cattle and propagation of these breeds through embryo transfer technology. The Murrah breed of water buffalo from Haryana is world famous for its milk production. There is a proverb about Murrah buffalo is “Jiske ghar me kali usake ghar har din

Diwali". Means the person having Murrah buffalo at his/her home having every day Diwali festival.

3.2. DESIGN OF THE STUDY AND SAMPLING PLAN

Kerlinger (1983), defined research design is the plan, structure and strategy of investigation to obtain answers to research questions and to control variance. The *ex-post-facto* research design was adopted for this study since the phenomenon has already occurred. Ex post facto research is a systematic empirical inquiry in which the scientist does not have direct control on independent variables because their manifestations have already occurred (Kerlinger, 1983). A random sampling technique was applied to draw the sample of the study. Sampling for this study is given as follows:

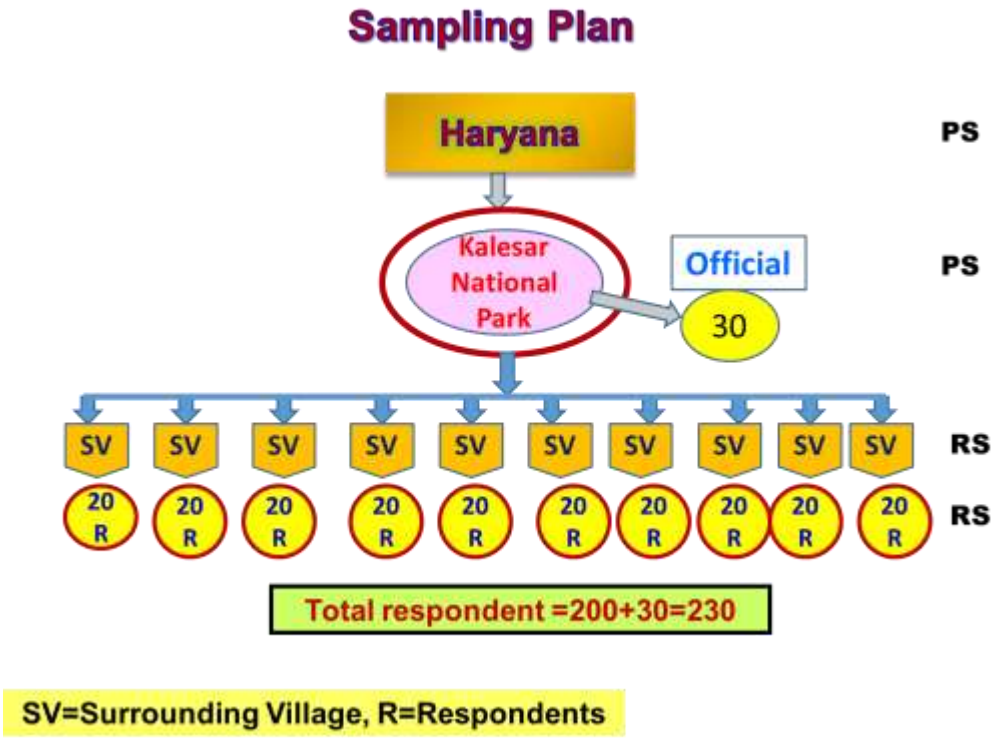


Fig: 3.3 Sampling Plan

3.2.1 SELECTION OF STATE

Haryana was selected purposively because it is well known for bovine wealth and 2nd largest food bowl of country. It is also the home tract of Haryana cow and Murrah buffalo. It holds a special place in the field of milk production and it is truly known as the 'Milk Pail' of the country. From state Haryana one district, Yamunanagar was selected and from Yamunanagar, Kalesar National Park was selected and then 20 respondents from 10

surrounding village were selected randomly. Finally, 200 respondents from selected surrounding village those having at least 2 dairy animals and 30 forest official were selected and interviewed. Interview Schedules was developed and Data were collected personally, which was analysed by using various statistical tools.

3.2.2 SELECTION OF DISTRICT

The study was conducted in purposively selected district Yamunanagar of Haryana. The state consists of 22 districts. Out of these 22 districts, one district namely Yamunanagar district was selected purposively because Yamunanagar districts having National Park and having significant population of wildlife, cattle and buffalo and also having livestock owners- wildlife conflicts occurring frequently in the vicinity of National Park. Brief description of the selected districts has been given below.

Table-3.2: Livestock population in Yamunanagar

S. No.	Yamunanagar	Population
1.	Cattle	117383
2.	Buffaloes	218163
3.	Goats	10146
4.	Total Livestock	361736

(Source: 19th Livestock census, 2012)

ABOUT YAMUNANAGR DISTRICT

Yamunanagar district came into existence on 1st November, 1989. Its area is 17568 square km, in which 475 Panchayats, 655 revenue villages, 4 tehsils namely Jagadhri, Chhachhrauli, Bilaspur and Radaur and three Sub-Tehsils namely Sadhaura, Mustafabad and Khijrabad are existed. Before being named Yamunanagar it was known as Abdullapur. Large part of the district lies under the Shiwalik foothills. Wheat, Rice and Sugarcane are main crops of the district. It is an important industrial town having metal, utensil and plywood industries. Yamuna Nagar district is bounded by the state of Himachal Pradesh in the north, by the state of Uttar Pradesh in the east and south east by the districts of Yamuna Nagar and Kurukshetra in the south west and by Ambala district in the west. The district has a sub-tropical continental monsoon climate where we find seasonal rhythm, hot summer, cool winter, unreliable rainfall and great variation in temperature. In winters, frost sometimes occurs during December and January. The district also gets occasional winter rains from cyclones. The rainfall is mostly restricted to rainy season. The district has Shivalik hills and foothill rolling plain in the north and

north- east, and flood - plain along the Yamuna river in the east and south- east. The important rivers/ streams of the district are Yamuna, Sarasvati, Chautang, Rakshi, Somb, Boli, etc. Yamuna river after rising from the snow-clad peaks of the middle Himalayas at Yamunotri, enters the district from its north-eastern corner through a narrow corridor in the Shivaliks. It is a perennial river. Boli river joins the Somb river near Dadupur and then the combined Somb and Boli rivers and join the Yamuna River at Mehar majra. The rakshi stream takes its birth in the rolling foothill plain while the Chautang and Sarasvati rivers originate in the lower hills. Generally, the slope of the district is from north-east to south- west, in which direction most of rivers/ rainfed torrents flow down.

Yamuna Nagar district is divided into one sub-division and six-development blocks viz. Bilaspur, Chachrauli, Jagadhri, Mustafa bad, Radaur and Sadhaura. The district is mainly drained by the rivers Yamuna, Markanda and its tributaries. Markanda is tributary of river Ghaggar and drains major part of the district. The high land between Markanda River and small rivulets of River Yamuna acts as basin boundary between west flowing rivers of Indus system and east flowing rivers of Ganga basin. Yamunanagar district is bestowed with rich water resources, both surface as well as ground water resources. The ground water is major sources of irrigation in the district. Nearly 40 per cent of areas are irrigated by canal. Distributaries in the district are 21.45 km long. Two major canals passing through the district are Western Yamuna canal and augmentation canal. The soils in the district are mainly silty loam (Khadar), loam (Bhangar and Nardak), and light loam (Seoti). The soils as classified by The National Bureau of Soil Survey and Land Use Planning (NBSSandLUP), one among the foremost National Resource Management (NRM) institutes of ICAR, Nagpur, Maharastra. The district has mainly udalfs, aquents-fluvents and ochrepts-orthents types of soils. The underground water in the district is generally fresh and suitable for domestic and irrigation purposes. The district has favorable climate for the growth of rich vegetation due to reasonably good rainfall and elevation. Shisham (Dalbergia sissoo), Kikar (acacia nilotica), Mango (mangifera indica), Jamun (syzygium cumini), pipal (ficus religiosa), Bodhi Tree (ficus bengalensis) Neem (azadirachta indica), etc. are the important tree species grown in the area. Safeda (eucalyptus hybrid) has been introduced since 1963 in forest areas as well as on private land and popular is grown on private land and along the road routes. The natural vegetation is mainly of forest growth and its degradation stages. Tropical dry deciduous forests and sub-tropical forests are found here.

Table - 3.3: Salient Information about the Study area

S. No.	Yamunanagar	Description
1.	Came into existence	1 November, 1989
2.	Area (In Sq.km)	1756 Km^2
3.	Sub-division	2
4.	Block	6
5.	Village	636
6.	Total Population	12,14,205
7.	Sex Ratio	877
8.	Literacy	77.99
9.	Density/Km^2	687

(Source: Census, 2011)

Fig: 3.4 Map of Yamuna Nagar district

KALESAR NATIONAL PARK and WILDLIFE SANCTUARY IN YAMUNANAGAR DISTRICT

Kalesar National Park (KNP) is situated in the foothills of Shiwalik ranges of mighty Himalayas. On map it is located between $30^0$18' to $30^0$27' North latitude and $77^0$25' to $77^0$35' East longitude. It falls under Yamunanagar district of Haryana and sharing boundary with three states viz., Himachal Pradesh and Uttaranchal and U.P. The Yamuna

rive form the Eastern boundary with Uttar Pradesh, the main Shiwalik ridge separates state boundary among Haryana, Himachal Pradesh and Uttarakhand in the north. Kalesar National Park is named after the Kalesar (Shiva) temple located in protected area. The whole area is full of bio-diversity having dense Sal forest, Khair forest and patches of grass lands, which supports an amazing variety of plants and animal species.

The park was declared as National Park on 8th December 2003 vide S.O 144/C.A53/72/S/35/2003 having an area of 11570 acres. Just adjacent to the National Park is Kalesar Wildlife Sanctuary and it was notified on 13th December 1996 vide S.O 161/C.A.53/72/S.26/A/96 and 121-Ft-4-2000/749 date 13.01.200, having an area of 13209 acres.

Yamunanagar-Ponta Sahib state highway passes through the Kalesar National Park. It is around 45 KM from Yamunanagar, 15 KM from Ponta and 55 KM from Dehradun. It is well connected by road and having good services from Yamuna Nagar and Ponta Sahib. The nearest railway station is at Yamunanagar.

Fig. 3.5 Map of Kalesar National Park

Statement of Significance

Kalesar National Park has got lot of significance in terms of bio-diversity and ecological stability in this part of the country. In terms of bio-diversity it is store house of numerous

medicinal plants. It houses many threatened animals like Leopard, Ghoral, Barking deer, Sambar, Chital, Python, King Cobra, Monitor lizard etc. Occasionally Tigers and Elephants visit this park from Rajaji National Park. If little improvement in habitat management is done in this park, tigers and elephants may stay throughout the year. So this park is very important in conservation of highly threatened animals like tiger and elephant. This habitat can provide alternate home for these two animals coming from Rajaji National Park. The Shiwaliks formed by debris from the older Himalayan ranges, are composed of sedimentary rocks such as sand stone, clays and conglomerates and is a highly fragile system. Extensive erosion takes place due to rapid run off during heavy rains. Gullies and landslides are common and the valley bottoms and nallas are mostly strewn with boulders and pebbles. During monsoon torrents carry boulders and muddy water and cause flash floods in the plains. So this protected area play vital role in preventing that kind of flash floods and helps in maintaining ecological stability. In Haryana it is the only National Park having good natural forest supporting such a large bio-diversity. So it has got a special significance in terms of conservation, education, tourism and research opportunities.

Boundaries

The entire National Park and wildlife sanctuary area is duly notified and demarcated on the ground with the help of pillars and natural boundaries like rivers and torrents. To the north of National Park, Simbalwada Wildlife Sanctuary (Himachal Pradesh) is there separated by ridge line and marked by pillars. To the East Yamuna river makes boundary of park with Uttar Pradesh. To the south agriculture lands of village's viz., Tajewala Araynwala, Naggal, Tiberian, Khizri, Baghpat, Khillanwala, Kansli, Darpur, Chickan, Jatanwal and Kot are situated. The western side is bounded by the crop fields of villages Faqirmajra and Ibrahimpur.

Animals

Corresponding to the considerable diversity of habitat types, the wild animals of Kalesar protected area show a good variety of species. Although numbers are rather low at present, due to the full protection provided by park authorities, the population will increase to the full carrying capacity of the area within few years. Among herbivores Sambhar is common, especially in the more densely forested areas on gentle slopes,

groups of 2 to 4 are often seen. Chital is another common herbivore found in open grassy patches and fire lines. Barking deer is found especially in forest areas with ample ground cover. The Goral is found in the park occupying a specialized niche on the relatively bare rocky slope at the top of Shiwalik ridges. Antelopes are represented by the Nilgai or Blue bull (Rojh) which occurs in the more open areas bordering Yamuna plain. Wild boar is also fairly common in the park and it also raids on crops. Elephant is an occupational visitor from Rajaji National Park. Elephants use to stay at Kalesar Protected Area for few weeks and used to go back to Rajaji National Park. If good waterholes are made available it may stay for long time. The Rhesus macaque is most common monkey in the park and most of these were released in the park area from outside. Presently, there number is too high for these monkeys also feeds on eggs of Red Jungle fowl, so there is a apprehension that there is a decrease in Red Jungle Fowl number. Most of the time these monkeys attack on villages and also go for crap raids. Among the carnivores in Kalesar Protected Area leopard take pride place. There are about 10-12 leopard in the entire Protected Area. The tiger is also an occasional visitor from Rajaji National Nark. It stays for few days and goes back. If there is increase in prey base it can permanently stay in the park.

FAUNA

It houses many threatened animals like 16 male and female leopards, Ghoral, Barking deer, 19 Panthers, Sambar, Chital, Python, King Cobra, Monitor lizard etc. Occasionally Tigers and Elephants visit this park from Rajaji National Park. Therefore, this park is very important in conservation of highly threatened animals like tiger and elephant. This habitat can provide alternate home for these two animals coming from Rajaji National Park.

FLORA

Kalesar forest has large variety of Flora, mainly the forest has Sal trees and Khair, Shisam, Tun, Sain, Chhal, Jhingan, Sain and Amla. Kalesar forest is the only forest in Haryana with a natural ‘Sal’ tree belt.

3.2.3. SELECTION OF BLOCKS

The third stage of sampling process involved selection of blocks. The present study was conducted in Yamunanagar district of Haryana. From Yamunanagar, Kalesar National

Park was selected purposively. Yamunanagar district consist of three tehsils i.e. Jagadhri, Chhachhrauli and Bilaspur. These are further divided into six development blocks: Bilaspur, Sadaura, Mustafabad, Radaur, Jagadhri and Chhachhrauli. From these blocks ten surrounding villages of Kalesar National Park were selected randomly and data was collected for the research.

3.2.4. SELECTION OF THE VILLAGES

The study was conducted in the vicinity of Kalesar National Park of the Haryana which was selected purposively. Further 10 surrounding villages within 5 Kilometres vicinity of Kalesar National Park was selected based on simple random sampling method.

Table-3.4: List of villages, block and number of respondents from selected districts

Name of District	Name of Block	Name of villages	No. of Respondents
Yamunanagar	Bilaspur	Kalesar	20
		Tajewala	20
	Sadaura	Jattanwala	20
		Baghpat	20
	Mustafabad	Khizri	20
		Kot	20
	Radaur	Faqirmajra	20
		Ibrahimpur	20
	Chhachhrauli	Tiberia	20
		Chickan	20
Forest Department , Haryana	Forest Official		30
Total			**230**

3.2.5. SELECTION OF THE RESPONDENTS

The last stage of sampling process involved selection of respondents from each of the ten selected villages. For the present study, information was gleaned from 200 livestock owners, 20 from each selected village, who had at least two milch animal at the time of investigation.

A list of farmers was prepared for every surrounding village of Kalesar National Park. A sample size of 20 dairy farmers from each surrounding village was selected randomly. From each surrounding villages, livestock owners having 2 dairy animals were randomly selected. The livestock owners in the selected villages were post categorized on the basis of herd size as small, medium and large by using cumulative square root frequency method. Other than livestock owners from the surrounding villages of Kalesar National Park, 30 forest officials were also selected randomly. Thus, total 230 respondents were interviewed for present study. The data were collected through using PRA techniques such as Village Resources Map, Transect Walks, Seasonal calendars and semi- structured interview schedule. The collected data were scored, compiled, tabulated and subjected to the appropriate statistical tools to draw meaningful conclusions.

3.3 VARIABLES AND THEIR MEASUREMENTS

For any study undertaken in social science research, it is customary to precisely mention the variables used for the study with their working concepts and measurement procedures. After going through the literature review, consultation and discussion with the experts, relevant variables were selected for the study. The following table is showing the selected variables and their operational definition and measurement procedures.

Table- 3.5: Variable and their measurement

S. N.	Variables	Measurement
1.	Age	Direct questioning
2.	Gender	Observation
3.	Family type	Direct questioning
4.	Family Size	
5.	Education	Direct questioning, Somasundaram scale (1995) with slight modification)
6.	Family education status	Schedule was developed
7.	Operational land holding	
8.	Livestock composition	
9.	Herd size	
10.	Occupation	
11.	Annual income	
12.	Cropping Pattern/Cropping Intensity	
13.	Grazing system	
14.	Milk production, consumption and sale	
15.	Milk marketing Channel	

16.	Change in farming after creation of National Park	
17.	Training Received	
18.	Social Participation	
19.	Extension contact	
20.	Mass media exposure	
21.	Resource collection	
22.	Predators in National Park	
23.	Loss of crops and livestock	
24.	Vulnerability of livelihood	Index was developed
25.	Perception towards wildlife	Scale were developed
26.	Tolerance of livestock owners	
27.	Effectiveness of existing Mitigation Strategies	Direct Questioning, PRA Technique, Semi-structured interview Schedule and Garret ranking

3.4. OPERATIONALISATION OF SELECTED VARIABLES

Operationalization is the process of defining a concept to make the concept clearly distinguishable or measurable and to understand it in terms of empirical observations. In a wider sense, it refers to the process of specifying the extension of a concept. The "operational definitions" of the variables have been given below:

A) SOCIO-ECONOMIC VARIABLES

3.4.1 AGE

It was operationalized as number of completed years of the respondents at the time of Interview and it was determined by direct questioning. The respondents were classified on the three categories young , middle and old age groups according to the procedure followed in population census report, 2011 (GOI).

Category	Years
Young	Less than 35 years
Middle	35-50 years
Old	Above 50 years

3.4.2 GENDER

It was operationally defined as gender is the distinction between male or female, and genders which are a combination of male and female, or neither male nor female, as reported by a respondents. It was determined by observation. The respondents were classified on the two categories. Further, score 1 was accorded for male and 2 for female.

3.4.3 FAMILY TYPE

Family type refers either to nuclear or joint family. This was ascertained by direct questioning. According to blood relations living together, the respondent's families were categorised into Nuclear family and Joint family. *Nuclear Family* was a family where a husband, wife and their unmarried children living together. *Joint Family* was a family where family comprising of more than one couple with married children living together. Further, score 1 was accorded for nuclear family and 2 for joint family.

3.4.4 FAMILY SIZE

It refers to the number of individuals living under the same roof and sharing kitchen together in a household that include husband, wife, children and other dependent members. It was measured by assigning one score to each family member. The respondents were classified into three categories i.e. small, medium and large family size on the basis of cumulative square root frequency method.

3.4.5 EDUCATION

It was operationalized as the level of formal education achieved by an individual respondent. It was measured by direct questioning. The scoring procedure was followed (Somasundaram, 1995) with slight modification. The respondents were assigned score as:

Category	Score
Illiterate	0
Functionally literate	1
Primary	2
Middle	3
Secondary	4
Higher Secondary	5
Graduate and above	6

3.4.6 FAMILY EDUCATION STATUS

It refers to the educational status of all the members of family eligible for formal education, i.e. above six years of age. The family education status was measured with the help of the following formula and the response was further categorized by using cumulative square root frequency as low, medium and high.

$$\textbf{Family Eduction Status} = \frac{\textbf{Total education score of family}}{\textbf{Number of eligible members in the family}} \text{ X } 100$$

3.4.7 OPERATIONAL LAND HOLIDING

It was operationally defined as the total number of hectares of land owned and leased in by the individual family to operate the farming system by own at the time of study. It was determined by a schedule developed for the same. The respondents were classified into landless, marginal, small, semi-medium, medium and large categories as follows (Suggested by G.O.I., 2001):

Category	Score
Landless	0 ha
Marginal	<1 ha
Small	1-2 ha
Semi-medium	2-4 ha
Medium	4-10 ha
Large	>10 ha

3.4.8 HERD SIZE

It refers to the total number of cattle, buffaloes, goat and pig owned by the respondent at the time of investigation. It was determined by a schedule developed for the same. The respondents were classified into small, medium and large herd size based on cumulative square root frequency method. The herd was converted in to standard livestock unit given by Patel, 1981.

For Cattle and Buffalo,

Category	Score
Low	less than 3 animals
Medium	3-5 animals
High	More 5 animals

For Goat,

Category	Score
Low	Less than 4 animals
Medium	4-7 animals
High	More than 7animals

3.4.9 LIVESTOCK COMPOSITION

It referred to total number of cattle, buffaloes, poultry birds and goats owned by the respondents at the time of investigation. It was ascertained by direct questioning. Based

on livestock composition, the respondents were categorized on the basis of cumulative square root frequency method.

3.4.10 OCCUPATION

Occupation is the means of livelihood of a person or a family. Operationally, it was defined in terms of the farmer's source of earning viz., agriculture, dairying, labour, services, business, etc. For this, schedule was developed and respondents were asked to indicate their source of livelihood. Cumulative square root frequency method was used to classify the respondents.

3.4.11 TOTAL ANNUAL INCOME (₹)

Total annual income operationally defined as the income generated from various sources in one year by the respondents. Incomes from different enterprises were enquired from the respondents with the help of the developed schedule at the time of investigation. Respondents were categorized into low, middle and high categories of annual income based on cumulative square root frequency method.

3.4.12 CROPPING PATTERN/ CROPPING INTENSITY (CI)

It was conceptualized as type of food and fodder crop and fallow undertaken by farmer throughout the year and their area and sequence followed by the respondents at the time of data collection. The cropping intensity of each respondent was calculated as per formula and was determined by interview schedule.

$$\text{Cropping intensity (\%)} = \frac{\text{Total cropped area}}{\text{Total cultivated area}} \times 100$$

1. Up to100 per cent CI = 1
2. 101-150 per cent CI = 2
3. 151 – 200 per cent CI = 3
4. More than 200 per cent CI = 4

3.4.13 GRAZING SYSTEM

Gazing system was operationalized as 'where and when to move grazing animals'. Finally, the respondents were categorized on the basis of cumulative square root frequency method.

3.4.14 MILK PRODUCTION, CONSUMPTION AND SALE

a) TOTAL MILK PRODUCTION (Litre / day/ household)

It was defined as total quantity of milk produced (in litres) by the lactating animals (cows and buffalo), one day prior to investigation. It was determined by developing a schedule for the same. The respondents were classified into low, medium and high milk production on the basis of cumulative square root frequency method

b) MILK CONSUMPTION (Litre / day/ household)

It was operationalized as the total quantity of milk consumed (in litres) by the family members, one day prior to investigation. It was determined by developing a schedule for the same. The respondents were classified into low, medium and high on the basis of cumulative square root frequency method.

c) MILK SALE (Litre / day/ household)

It was referred as the total quantity of milk sold (in liters/day) by the household, one day prior to investigation. It was determined by developing a schedule for the same. The respondents were classified into low, medium and high on the basis of cumulative square root frequency method.

3.4.15 MARKETING CHANNEL

Marketing channel was operationalized as the people, organizations, and activities necessary to transfer the milk from the point of production to the point of consumption. It is the way products get to the end-user, the consumer. Finally, the respondents were categorized on the basis of cumulative square root frequency method.

3.4.16 CHANGE IN FARMING AFTER CREATION OF NATIONAL PARK

It was operationalized as livestock owners changes their farming after the creation or starting of national park. The respondents were categorized on the basis of cumulative square root frequency method.

3.4.17 TRAINING RECEIVED

It was operationalized as the training received by the livestock owners regarding the clean milk production, vaccination, animal husbandry and management, primary disease treatment as well as protection from the wildlife.

3.4.18 SOCIAL PARTICIPATION

Social participation referred to the degree of involvement of the respondents in any formal and /or informal social organization as a member or office bearer of SHGs, NGOs, Kisan Club and Youth club etc. The respondents were assigned one score for participation in any one or each organization and zero for no participation. Based on the total score obtained by the respondents. The respondents were classified in terms of having low, medium and high participation on the basis of cumulative square root frequency method.

Category	Score
Non-member	0
Member of one organization in past	1
Member of organization in present	2
Past office bearer	3
Present office bearer	4

3.4.19 EXTENSION CONTACT

It is the degree to which an individual maintained contacts with extension personnel, animal husbandry department, university, agriculture officers, to get information and technical assistance regarding dairy farming and agricultural activities. The frequency of contact with extension personnel was measured through five point continuums viz., weekly once, fortnightly once, monthly once, once in six months and never with scores of 4, 3, 2, 1 and 0 respectively. Finally, the respondents were categorized on the basis of cumulative square root frequency method.

3.4.20 MASS MEDIA EXPOSURE

It refers to the degree of utilization of different mass media such as newspaper, radio, TV, Mobile, Internet and Magazines etc. by the respondents with respect to various aspects of dairying and animal husbandry. It was measured by using a structured schedule and a score of 2, 1, and 0 were assigned to the respondents for the responses, regularly, seldom and

never, respectively. The obtained scores of the respondents were calculated in terms of having low, medium and high mass media exposure on the basis of cumulative square root frequency method.

3.4.21 RESOURCE COLLECTION

It refers to collection of different resources like wood, grasses, leaf, timber and fodder by the respondents from the vicinity of the national parks. Data were collected by developing interview schedule.

3.4.22 PREDATORS IN NATIONAL PARK

It is operationalized as various types of predator residing at the National Park. Data were collected by developing interview schedule.

3.4.23 LOSS OF CROPS AND LIVESTOCK

It is operationalized as loss of crops and animals through crop raiding and livestock killing by wild animals. To assess the crop damage/loss questions were incorporated in interview scheduled related to name of crop, type of crop, wild species involved, season, land sown, loss in output of crop, market price of the crop and monetary loss were asked. For livestock depredation questions on type of livestock, wild animals, and market price of species were asked. To assess the loss occurred due to attack on human was calculated using number of working days lost due to injury, current rate of wage, expenditure of treatment, expenditure of travel to hospital and number of lost working days of one care taker (as one member of the family has to stay at home to take care of the injured person mainly affecting agricultural and livestock related work). All the livestock owners were asked whether they have reported the case to Forest Department or not. The information on status of Livestock owners wildlife conflict (LOWC) was collected for three year, thus the loss occurred for three years for all types of conflicts were collected. The respondents were categorized on the basis of cumulative square root frequency method

Following equations have been used to calculate loss due to wildlife:

Crop damage = Area raided under crop (acre) × production of crop per acre

Economic loss = Total crop damaged × market price of the crop

Total agricultural loss = Loss of crop1 + crop2 + crop3 + …… crop n

Loss due to livestock lifting = Number of the individual animal × market price of a Species

Loss due to attack on human = (Number of working days lost due to injury × Wage rate of area)+ Expenditure on treatment + Expenditure on travel to hospital + (Loss number of working days of one care taker × Wage rate of area)

Total loss due to conflict = Loss due to (crop damage +livestock loss +human attack)

3.4.24 VULNERABILITY OF LIVELIHOOD

It was operationalized as the degree to which farmers are at risk of crop damage, livestock depredation and human injury combined with individual ability to cope with damage. Vulnerability is a combination of exposure to risks, sensitivity to shocks and lack of resilience. Livelihood was operationalised as the means and ways of living to meet the basic minimum necessaries of the individual as well as the family. A livelihood comprises the capabilities, assets (material and social resources) and activities required for a means of living. A livelihood is sustainable when people cope with and recover from shocks and crises (e.g. seasonal, environmental and economic) and can maintain or enhance their capability and assets both now and in the future, while not undermining the natural resource base. For the study of livelihood vulnerability of livestock owners' livelihood vulnerability index (LVI) was developed.

3.4.24.1 Methodology Development of Livelihood Vulnerability Index (LVI)

A) Selection of Dimensions: The livelihood vulnerability has multidimensional aspects. It includes Human Assets, Natural assets, Social assets, Financial assets and Physical assets. Therefore, it was important to select dimensions, which were representative indicators of all these sectors of human-life. The availability of authenticated literature and through discussion with experts in wildlife conservation, forest official and extension expert played an important role in the identification of these dimensions. Broadly, these dimensions were grouped into three categories: i) Biophysical vulnerability ii) Social vulnerability iii) Institutional vulnerability. The identified dimensions of LVI were operationalized as given below:

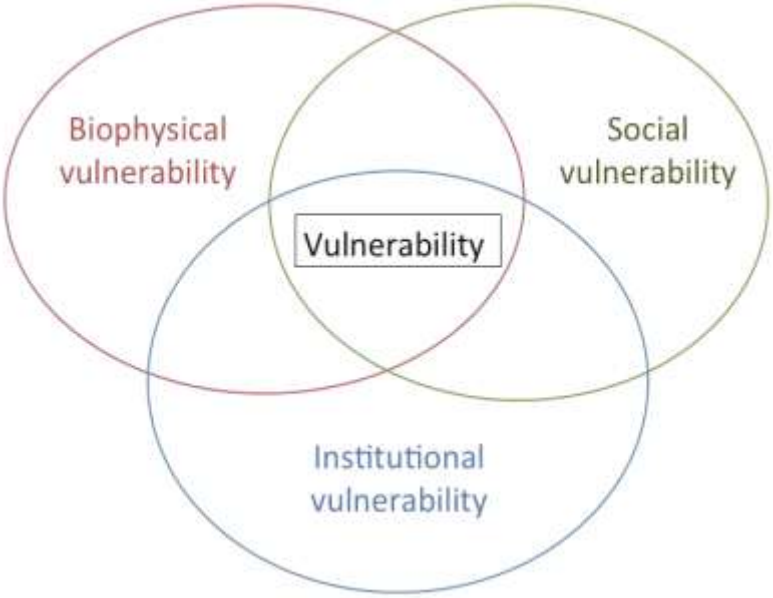


Figure 3.6: Three-dimensional approach to the vulnerability concept.

1. **Biophysical Vulnerability:** Biophysical vulnerability was operationalized as the exposure of livestock owners, their family and wildlife to natural extreme events and as a consequence to hazard to conflict mitigation skill, awareness regarding conflict mitigation, traditional knowledge, training, injury to human by wild animals, reduction in crop cultivation area, decrease land holding, decline crop yield, herd size reduction, impact on crop and farm diversification, reduction in water availability for crop, availability and scarcity of natural resources and destruction of natural habitat etc. in the vicinity of national park.
2. **Social Vulnerability:** Social vulnerability was operationally defined as the inability of livestock owners including threats to family, penalties by Government, Social migration due to conflict, Membership of Cooperatives, Socio-political participation due to conflicts in the vicinity of national park.
3. **Institutional Vulnerability:** Institutional vulnerability refers to the inability of individual livestock owners to cope with change and recovery from wildlife- livestock owner's conflicts in terms of physical, financial and institutional level that include the crop loss due to wild animals, loss of livestock due to depredation, impact on major source of family income, household that experience damage to infrastructure, food loss or shortage causes hunger etc.

B) Determination of Scale Values: It has decided to give specific weights (Scale Values) to each dimension of the LVI based on their perceived significance. The

Normalized Rank Order Method suggested by *Guilford (1954)* was used for determining the scale values. The method has a unique advantage that it can be used with any number of variables and does not require a large number of judges. As per the method, three different dimensions of LVI were ranked by the group of judges according to their perceived significance in determining the status of livelihood vulnerability of livestock owners. Ranking was obtained from judges who involved experts in the field of wildlife conservation, forestry, social science, extension education, rural development and farming systems. The performa containing dimensions of LVI was sent by post, through e-mail, Google forms and also handed over personally to the total 55 judges for ranking (1 to 3) dimensions according to their relevance in the vulnerability of livelihood of livestock owners. Out of 55 judges 40 judges had returned the same set of indicators after duly recording their judgements in a stipulated span of 2 months. Out of 40 responses, 9 responses were found unsuitable for item analysis and eliminated after careful examination of responses. The remaining 31 responses were considered for the item analysis. The rankings given by all 31 judges were summarised and presented in Table 3.3. In the next step, the proportions were worked out for the ranks assigned by all the judges. The formula is

$$p = \frac{(R_i - 0.5) * 100}{n},$$

Where,

$R_{i=}$ Stands for the rank value of the dimension *i* in the reverse order as 3 to 1.

n= Indicates the number of dimensions ranked by the judges.

Here we needed the middle area of the dimensions ranked. The *p* is the centile value which indicated the area of the dimensions in the normal distribution. The *p* values were worked out for all the ranks shown in Table 3.6. Thus, the *p* values for the ranks ranged from the lowest 10.00 to 90.00.

The next step is to find out the C values for all the ranks. The correct rank order (1 to 3) is given in the column under r_i in Table 3.5. The second column R_i in Table 3.3 is the reverse rank order (3 to 1). The C values were determined for each rank from the Table-M (Guilford, 1954). These values can be traced by putting the finger on the column extreme left of the Table-M, on the number which indicates the number of stimuli used in the experiment. In the case of this experiment the numbers of stimuli (Dimensions) were 3, and also the number of stimuli to be ranked. While moving the finger from this number

3 towards right, stop at the number which indicates the rank number (r_i, 3). Above the rank number you can find the respective C value 4 for the rank 7 and this can be entered in the Table 3.3 under the letter C. The C values are from 1 to 9 only. The same procedure may be adapted in finding out the C values for all the ranks (r_i) from the Table-M.

The next step is to find out the $\sum f_{ji}$ C value for all the dimensions. This value for every dimension was obtained by multiplying the frequencies found in the columns of the respective dimension by the C values of the rank (r_i), and summing up the products for each dimension and entering the same in the row against $\sum f_{ji}$ C. The mean of the total frequencies, that is for the whole data of the matrix was (982/155= 6.33) 6.33, and the mean of the C values was (32/5= 6.40) also 6.40. Then the $\sum f_{ji}$ C values for each dimension was divided by the total number of judges 31, which resulted in obtaining the $M_c = R_j$ value for each dimension. This was the mean value (M_c) and also the response value (R_j) for each dimension. The mean values were shown in the row against $M_c = R_j$. The treatment of data can be stopped at this stage and the Mc values can be accepted and treated as the Scale Values. The total value was 32 which was also the total sum of the C values, and the mean of the M_c or R_j or R_c values was 6.34. The standard deviation and standard error of the M_c values was 0.15 and 0.03, respectively. The obtained Scale Values (R_c) were shown in Table 3.6 against row M_c or R_j or R_c.

Table- 3.6: Weightage to the indicators of Livelihood Vulnerability Index

ri	Ri	Five Sub dimensions of Livelihood Vulnerability Index					∑	p	C
		Human Assets	Natural Assets	Social Assets	Financial Assets	Physical Assets			
1	1	6	5	8	6	4	31	90.00	8
2	2	7	5	7	4	8	31	70.00	7
3	3	8	7	4	7	7	31	50.00	6
4	4	3	4	7	5	6	31	30.00	6
5	5	7	10	5	9	6	31	10.00	5
∑f		31	31	31	31	31	155	250	32
∑fC		198	191	204	193	196	982		
Mc or Rj or Rc		6.39	6.16	6.58	6.23	6.32	31.68	M= 6.34 σ= 0.15 Standard error for Mc=0.03	

ri = Correct rank order, Ri = Reverse rank order, ∑ = Sum, *p*= Proportion, C = C values of respective ranks,Mc = Mean value, Rj = Response value, Rc = Scale Value, σ = Standard Deviation,

Standard Error= σ/√N=0.15/31=0.15/5.57=0.03

C) Selection of Indicators: Indicators under each sub-dimension of LVI were selected through expert consultation and literature scan. Special care was taken to include all relevant items. The procedure involved could ensure the efficiency of the instrument to measure the household livelihood vulnerability by ascertaining content validity. The following steps were followed for selecting relevant indicators under each dimension of LVI.

1) Collection and Editing of Indicators: By referring the available literature on relevant subject, a total 60 indicators were collected covering the almost entire universe of content. The researchers, farmers and extension experts were also consulted for selecting indicators. The indicators were edited as per 14 informal criteria suggested by Edwards (1957) as outcome 10 indicators were eliminated. Finally, 60 indicators were retained after editing and considered for judge's rating.

2) Response to Indicators: The performa containing 60 indicators on three point continuums i.e. Most Relevant, Relevant and Not Relevant was sent by post, through Google forms, through e-mail and also handed over personally to the total 55 judges. These judges were experts in the field of forestry, wildlife conservation, extension education, social science and rural development etc. The judges were requested to indicate their response by tick mark in suitable continuum in front of each indicator. Also the judges were requested to make necessary modifications and additions or deletions, if they desired so. Out of 55 judges 40 judges had returned the same set of indicators after duly recording their judgements in a stipulated span of one month. Out of 40 responses, 9 responses were found unsuitable for item analysis and eliminated after careful examination of responses. The remaining 31 responses were considered for the item analysis.

3) Relevancy Test: Item analysis is an important step while constructing valid and reliable index. It is possible that all the indicators collected may not be relevant equally in measuring the status of livelihood vulnerability of livestock owners. Hence, these indicators were subjected to scrutiny and their subsequent screening for inclusion in the final index. The judges were asked to indicate degree of relevancy on each indicator with three point continuums 'Most Relevant, Relevant and Not Relevant' with scoring 3, 2, and 1, respectively. The Relevancy Weightage (RW) and Mean Relevancy Score (MRS) were worked out for all the selected indicators individually by using the following formula;

$$RW = \frac{\text{More relevant response } X\ 3 + \text{Relevant response } X2 + \text{Not relevant response } X\ 1}{\text{Maximum possible score}}$$

$$MRS = \frac{\text{More relevant response } X\ 3 + \text{Relevant response } X\ 2 + \text{Not relevant response } X\ 1}{\text{Number of judges}}$$

By using these two criteria, the indicators having Relevancy Weightage (RW) > 0.70 and Mean Relevancy Score (MRS) > 2.25 were considered for including in the Livelihood Vulnerability Index (LVI). By this procedure, final indicators of respective sub-dimensions of LVI were selected, modified and rewritten as per the comments of judges. The various set of items/statements was prepared under each indicator for final data collection from the respondents. The finally selected sub-dimensions of LVI and their respective indicators with respective relevancy weightage and mean relevancy score were shown in table 3.7.

D) Computation of the Composite Index: Each sub-dimension of LVI consists of number of indicators and hence, their range of total scores was different. Therefore, the total score of each sub-dimension was converted into unit score by using simple range and variance as given below,

$$U_{ij} = \frac{Y_{ij} - Min\ Y_{ij}}{Max\ Y_j - Min\ Y_j}$$

Where,

U_{ij} = Unit score of the i^{th} respondents on j^{th} sub-dimension

Y_{ij} = Value of the i^{th} respondent on the j^{th} sub-dimension

Max Y_j = Maximum score on the j^{th} sub-dimension

Min Y_j = Minimum score on the j^{th} sub-dimension

Thus, the score of each sub-dimension range from 0 to 1 i.e. when Y_{ij} is minimum, the score is 0 and when Y_{ij} is maximum the score is 1. Then, the unit scores of each respondent was multiplied by respective scale value of the each sub-dimension and summed up. Thus, the score obtained was divided by the sum of scale values in order to get the LVI for each respondent.

$$LVI_i = \frac{\sum U_{ij} * S_j}{Sum\ of\ scale\ values}$$

Where,

LVI_i = Livelihood Vulnerability Index of i^{th} respondent

U_{ij} = Unit score of the i^{th} respondent on j^{th} component

S_j = Scale value of the j^{th} component

$\sum$= Sum

The status of respondent's livelihood vulnerability was calculated based on the total index score of all the indicators. The classification of respondents into the categories of very low, low, medium, high and very high livelihood vulnerability status was based on the range of total livelihood vulnerability index scores by cumulative square root of frequency method.

E) Standardisation of the Index: The validity was ascertained for standardisation of the index. It is the property that ensures the obtained test scores as valid, if and only if it measure what it is supposed to measure. An index is said to be valid if it stands for one's reasoning. The validity was measured by content validity. The content validity of the index was tested by experts' judgement. The content validity is the representative or sampling adequacy of the content, the substance, the matter and the topics of a measuring instrument. This method was used in the present index to determine the content validity of the index. The content of the index was thoroughly covered through literature scan and expert opinions. The indicators had at least 80 per cent judges' agreement were retained. This indicated validity of the index content. As the scale values, relevancy weightages and mean relevancy scores of all the dimensions and indicators had discriminating values, it seemed reasonable to accept the index as valid measure of the desired dimension.

Table 3.7: Livelihood Vulnerability Index for farmers

Livelihood Vulnerability Index			
Dimensions	**Sub-dimension**	**Indicators**	**R weight**
Biophysical Vulnerability	**Human Assets**	Age of head of household	0.90
		Diverse conflict mitigation skill	0.89
		Awareness regarding conflict mitigation	0.87
		Traditional knowledge	0.91
		Training received	0.80
		Working manpower in family	0.76
		Hired man force	0.88
		Injury to human by wild animals	0.78
	Natural Assets	Crop cultivated area	0.84
		Land holding	0.80
		Crop yield	0.87
		Herd size	0.86
		Per cent of households that utilize natural water source	0.77
		Crop diversification	0.88
		Water availability for crop	0.89
		Average ground water level	0.76
		Farm diversification	0.91
		Natural hazards	0.88
		Firewood	0.87
Social Vulnerability	**Social Assets**	Family size	0.80
		Membership of SHGs	0.77
		Legal penalties by Government	0.81
		Culture and taboo	0.85
		Social migration due to conflict	0.86
		Membership of Cooperatives	0.77
		Forest rules and regulation	0.87
		Role of social leader in conflict management	0.82
		Socio-political participation	0.86
		Festivals and religious activity	0.77
Institutional Vulnerability	**Financial Assets**	Saving form Agricultural activity	0.81
		Average Family Income	0.85
		Occupation	0.84
		Off-farm employment opportunities	0.86
		Crop loss due to wild animals (Area)	0.89
		Crop loss due to wild animals (In Rupees)	0.94
		Remittances	0.88
		Compensation for loss/ damage	0.89
		Government supported mitigation	0.86
		Per cent of household access credit facilities	0.83
		Major source of family income	0.88
	Physical Assets	Livestock	0.91
		Household that experience damage to infrastructure	0.90
		Shelter	0.87
		Access to information	0.83
		Tools and equipment in farming	0.83
		Food loss or shortage causes hunger	0.892

3.4.25 Perception towards wildlife

The perception, in psychology, is mental organization and interpretation of sensory information. It is the opinion expressed by the respondents. It was operationalized as the act or faculty of apprehending by the means of the senses or of the mind, cognitive and understanding of something by the people towards wildlife. Perception towards wildlife was determined by using perception scale. The method of summated rating suggested by Likert (1932) and Edward (1957) was followed in the development of the scale. The following steps were considered for developing the perception scale.

a) Collection of Statements: The first step in the construction of perception scale was to collect statements related to the livestock owners' perception towards wildlife conflict. A care was taken to include positive and negative (60:40) statements in the list. A tentative list of 42 statements was prepared from available literature, consultation with experts in the field of wildlife conservation, forest officers, wildlife inspector and progressive farmers.

b) Editing of Statements: The statements were edited as per 14 informal criteria suggested by Edwards (1957) as outcome 14 statements were eliminated. Finally, 28 statements were retained after editing and considered for judge's response.

c) Response to Raw Statements: The Performa containing 28 raw statements on three point continuums i.e. Agree, Uncertain and Disagree was sent by post, through e-mail, though Google forms and also handed over personally to the total 50 judges. These judges were experts in the field of extension education, wildlife conservation, forest officers, wildlife inspector and progressive farmers. The judges were requested to indicate their response by tick mark in suitable continuum in front of each statement. Also the judges were requested to make necessary modifications and additions or deletions, if they desired so. Out of 50 judges 44 judges had returned the same set of statements after duly recording their judgements in a stipulated span of 2 months. Out of 44 judge's responses, 12 responses were found unsuitable for item analysis and eliminated after careful examination of responses. The remaining 32 responses were considered for the item analysis.

d) Item Analysis: Item analysis is an important step while constructing valid and reliable scale. The judges were asked to indicate their degree of agreement or disagreement on each statement with five point continuums that is Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree with scoring 5, 4, 3, 2, and 1, respectively

for positive statements and vice-versa for negative statements. The total individual score of judges was calculated by summing up the response score of each statement given by individual judge.

e) Calculation of 't' Values: Based upon the total individual scores, the judges were arranged in descending order. The top 25 per cent of judges with their total individual scores were considered as high group and the bottom 25 per cent as the low group so that these two groups provided criterion groups in terms of which to evaluate the individual statements. Thus, out of 32 judges to whom the statements were administered for the item analysis, 8 judges with highest and 8 judges with lowest scores were used as criterion groups in terms of which to evaluate the individual statements. The critical ratio, that is the 't' value which is a measure of the extent to which a given statement differentiates between the high and low groups of the respondents for each statement was calculated by using the formula given by Edwards (1957).

$$t = \frac{\bar{X}_H - \bar{X}_L}{\sqrt{\frac{\sum(X_H - \bar{X}_H)^2 + \sum(X_L - \bar{X}_L)^2}{n(n-1)}}}$$

Where,

$$\sum(X_H - \bar{X}_H)^2 = \sum {X_H}^2 - \frac{(\sum X_H)^2}{n}$$

$$\sum(X_L - \bar{X}_L)^2 = \sum {X_L}^2 - \frac{(\sum X_L)^2}{n}$$

$\bar{X}_H$ = The mean score on a given statement for the high group

$\bar{X}_L$ = The mean score on a given statement for the low group

$\sum X_H^2$ = Sum of squares of the individual score on a given statement for high group

$\sum X_L^2$ = Sum of squares of the individual score on a given statement for low group

$\sum X_H$ = Summation of scores on given statement for high group

$\sum X_L$ = Summation of scores on given statement for low group

n = Number of judges in low and high groups

t = The extent to which a given statement differentiate between the high and low groups.

$\sum$ = Summation

The ‘t’ value is a measure of the extent to which a given statement differentiates between the high and low groups. As a crude and approximate rule of thumb, we may regard any ‘t’ value equal to or greater than 1.75 as indicating that the average response of high and low groups to a statement differs significantly. Thus, 12 (8 positive and 4 negative) statements for measuring the livestock owners perception towards wildlife with significant‘t’ values were retained in the final scale (Table 3.8).

f) Standardisation of the Scale: The validity and reliability was ascertained for standardisation of the scale. The reliability and validity was measured by split half method and content validity, respectively.

i) Reliability of the Scale: A scale is reliable when it gives consistently the same results when applied to the same sample. The final set of the 12 statements which represent the livestock owners’ perception towards wildlife, was administered on five point continuums to a fresh group of 20 livestock owners in the vicinity of protected area (10% of actual sample size for the study) from non-sample area and which was not included in the actual sample size of study. The designed perception scale for the study was pre-tested for its reliability by using the split half method in which a scale is divided into two halves. One half (one set) contains the odd numbered statements (1, 3,..,7) and the other half (other set) contains the even numbered statements(2, 4,...,8). The total individual score of each livestock owners was calculated by summing up the responses given by livestock owners on two halves of the statements. The correlation coefficient (rhh) between scores of two halves of statements was 0.71. The positive and significant correlation between the two sets of scores indicated that the scale was reliable. The reliability coefficient of whole scale was calculated by the formula given by Spearman (1910) and Brown (1910) as follows;

$$r_{SB} = \frac{2 * r_{hh}}{1 + r_{hh}}$$

Where,

r_{SB} = Reliability coefficient of the whole scale

r_{hh} = Reliability coefficient of the half-scale, found experimentally i.e. 0.71

$$r_{SB} = \frac{2 * r_{hh}}{1 + r_{hh}} = \frac{2 * 0.71}{1 + 0.71} = \frac{1.42}{1.71} = 0.83$$

The reliability coefficient of whole scale was 0.83, which found significant and positive indicated that the whole scale was reliable.

ii) Validity of the Scale: It is the property that ensures the obtained test score as valid, if and only if it measure what it is supposed to measure. A scale is said to be valid if it stands for one's reasoning.

The content validity of the scale was tested by experts' judgement. The content validity is the representative or sampling adequacy of the content, the substance, the matter and the topics of a measuring instrument. This method was used in the present scale to determine the content validity of the scale. The content of the perception scale was thoroughly covered through literature scan and expert opinions. The statements had at least 80% judges' agreement were retained. This indicated validity of the scale content. As the scale value difference for almost all the statements included had discriminating values, it seemed reasonable to accept the scale as valid measure of the desired dimension.

g) Administration of the Scale: The final scale consisting of 12 (Table 3.7) statements can be administered to the livestock owners' perception towards wildlife on a five continuums viz., Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (D) and Strongly Disagree (SDA) with a score of 5,4,3,2 and 1, respectively for positive statements and reverse scoring system for negative statements. The overall possible maximum and minimum score ranges between 60 to 12. Scores were summed up to get the total score for perception of each respondent. Then the respondents were categorized into very low, low, medium, high and very high categories by cumulative square root of frequency method.

Table:- 3.8 A list of selected statements of perception for final scale construction with their **respective 't' values.**

Perception Scale		
S.N.	**Statement**	**t-value**
1*	Crop raiding, livestock depredation, killing of pet animals, household items destroyed by wildlife are the reasons for Livestock Owners-Wildlife Conflict	2.10
2*	Carnivore animals are threat to livestock and people near National Park	1.93
3	The protection of wild animal is important for ecological balance	1.94
4*	In the vicinity of National park farmers fear to work in their field during odd hours due to wild animal.	2.22
5	There may be chance of spreading zoonotic diseases due to Wild animals	2.36
6	Wildlife have as much right to exist on protected areas land as we have	1.94
7*	Restriction of farming in the vicinity of the National park can reduce Livestock Owners- Wildlife Conflict	2.30
8	Livestock owners felt more risk from wildlife than non-livestock owners	2.13
9	Current laws are sufficient to protect wildlife and fauna of the National Park	2.21
10	Fuel woods from National Park is important source of energy for local communities	1.85
11	Promotion of Livestock insurance scheme may reduce the Livestock Owners- Wildlife conflict	1.90
12	Proper Fencing around the National Park may reduce the Livestock Owners- Wildlife conflict	1.79
*= Negative Statement		

3.4.26 Tolerance of livestock owners

It was operationalized as the capacity to endure continued subjection to something such as a crop loss or livestock depredation without adverse reaction. Data on tolerance was determined by using tolerance scale.The method of summating rating suggested by Likert (1932) and Edward (1957) was followed in the development of the scale. The following steps were considered for developing the tolerance scale.

A). Collection of Statements: The first step in the construction of tolerance scale is to collect statements related to the tolerance of livestock owners towards wildlife. A care was taken to include positive and negative (60:40) statements related to livestock owners' tolerance in the list. A tentative list of 30 statements was prepared from available literature, consultation with experts in the field of wildlife conservation, forest officers, wildlife inspector and progressive farmers.

B). Editing of Statements: The statements were edited as per 14 informal criteria suggested by Edwards (1957) as outcome 13 statements were eliminated. Finally, 17 statements were retained after editing and considered for judge's response.

C). Response to Raw Statements: The Performa containing 17 raw statements on five point continuums that is Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree was sent through Google forms, post, e-mail and also handed over personally to the total of 50 judges. These judges were experts in the field of wildlife conservation, forest officers, wildlife inspector and progressive farmers. The judges were requested to indicate their response by ticking in suitable continuum in front of each statement. Also the judges were requested to make necessary modifications and additions or deletions, if they desired so. Out of 50 judges 40 judges had returned the same set of statements after duly recording their judgments in a had returned the same set of statements after duly recording their judgments in a stipulated span of 2 months. Out of 40 judges' response, 8 responses were found incomplete and unsuitable for item analysis. Hence, they were eliminated. The remaining 32 responses were considered for the item analysis.

D). Item Analysis: Item analysis is an important step while constructing valid and reliable scale. The judges were asked to indicate their degree of agreement or disagreement on each statement with five point continuums that is Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree with scoring 5, 4, 3, 2, and 1, respectively for positive statements and vice-versa for negative statements. The total individual score of judges was calculated by summing up the response score of each statement given by individual judge.

E). Calculation of 't' Values: : Based upon the total individual scores, the judges were arranged in descending order. The top 25 per cent of judges with their total individual scores were considered as high group and the bottom 25 per cent as the low group so that these two groups provided criterion groups in terms of which to evaluate the individual statements. Thus, out of 32 judges to whom the statements were administered for the item analysis, 8 judges with highest and 8 judges with lowest scores were used as criterion groups in terms of which to evaluate the individual statements. The critical ratio, that is the 't' value which is a measure of the extent to which a given statement differentiates between the high and low groups of the respondents for each statement was calculated by using the formula given by Edwards (1957).

$$t = \frac{\bar{X}_H - \bar{X}_L}{\sqrt{\frac{\sum(X_H - \bar{X}_H)^2 + \sum(X_L - \bar{X}_L)^2}{n(n-1)}}}$$

Where,

$$\sum (X_H - \bar{X}_H)^2 = \sum X_H{}^2 - \frac{(\sum X_H)^2}{n}$$

$$\sum (X_L - \bar{X}_L)^2 = \sum X_L{}^2 - \frac{(\sum X_L)^2}{n}$$

$\bar{X}_H$ = The mean score on a given statement for the high group

$\bar{X}_L$ = The mean score on a given statement for the low group

$\sum X_H^2$ = Sum of squares of the individual score on a given statement for high group

$\sum X_L^2$ = Sum of squares of the individual score on a given statement for low group

$\sum X_H$ = Summation of scores on given statement for high group

$\sum X_L$ = Summation of scores on given statement for low group

n = Number of judges in low and high groups

t = The extent to which a given statement differentiate between the high and low groups.

$\sum$ = Summation

The 't' value is a measure of the extent to which a given statement differentiates between the high and low groups. As a crude and approximate rule of thumb, we may regard any 't' value equal to or greater than 1.75 as indicating that the average response of high and low groups to a statement differs significantly. Thus 15 (11 positive and 4 negative) statements on farmers' perception towards reduction in farm vulnerability through integrated farming systems with significant 't' values were retained in the final scale (Table 3.9).

F). Standardisation of the Scale: The validity and reliability was ascertained for standardisation of the scale. The reliability and validity was measured by split half method and content validity, respectively.

i) Reliability of the Scale: A scale is reliable when it gives consistently the same results when applied to the same sample. The final set of the 10 statements which represent the livestock owners' tolerance towards wildlife, was administered on five point continuums to a fresh group of 20 livestock owners in the vicinity of protected area (10% of actual sample size for the study) from non-sample area and which was not included in the actual sample size of study. The designed tolerance scale for the study was pre-tested for its reliability by using the split half method in which a scale is divided into two halves.

One half (one set) contains the odd-numbered statements (1, 3, 5 etc.) and the other half (other set) contains the even numbered statements (2, 4, 6 etc.). The total individual score of each livestock owners was calculated by summing up the responses given by livestock owners on two halves of the statements. The correlation coefficient (rhh) between scores of two halves of statements was 0.73. The positive and significant correlation between the two sets of scores indicated that the scale was reliable. The reliability coefficient of whole scale was calculated by the formula given by Spearman (1910) and Brown (1910) as follows;

$$r_{SB} = \frac{2r_{hh}}{1 + r_{hh}}$$

Where, r_{SB} = Reliability coefficient of the whole scale

r_{hh} = Reliability coefficient of the half-scale, found experimentally i. e. 0.73

$$r_{SB} = \frac{2 * r_{hh}}{1 + r_{hh}} = \frac{2 * 0.73}{1 + 0.73} = \frac{1.46}{1.73} = \mathbf{0.84}$$

Where, The reliability coefficient of whole scale was 0.84 which found significant and positive indicated that the whole scale was reliable.

ii) Validity of the Scale: It is the property that ensures the obtained test scores as valid, if and only if it measure what it is supposed to measure. A scale is said to be valid if it stands for one's reasoning.

The content validity of the scale was tested by experts' judgment. The content validity is the representative or sampling adequacy of the content, the substance, the matter and the topics of a measuring instrument. This method was used in the present scale to determine the content validity of the scale. The content of the tolerance scale was thoroughly covered through literature scan and expert opinions. The statements had at least 80% judges' agreement were retained. This indicated validity of the scale content. As the scale value difference for almost all the statements included had discriminating values, it seemed reasonable to accept the scale as valid measure of the desired dimension.

G). Administration of the Scale: The final scale consisting of 10 (Table 3.8) statements can be administered to the livestock owners' tolerance towards wildlife on a five continuums viz., Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (D) and Strongly Disagree (SDA) with a score of 5,4,3,2 and 1, respectively for positive statements and reverse scoring system for negative statements. The overall possible

maximum and minimum score ranges between 50 to 10. The high score will indicate that respondent will have high level of tolerance towards wildlife. Then the respondents were categorized into very low, low, medium, high and very high categories by cumulative square root of frequency method.

Table:- 3.9 A list of selected statements of tolerance for final scale construction with their respective 't' values.

Tolerance Scale		
S.N.	**Statement**	**t-value**
1	I believe that farmers having more land have high tolerance towards wildlife	1.78
2	I feel that farmers who have adopted crop insurance have more tolerance to wild animals	1.94
3	I feel that farmers who have adopted livestock insurance have more tolerance to wild animals harm	2.47
4	The farmers having alternate sources of income are more tolerant than other farmers	3.06
5*	Livestock depredation by wild animals create high intolerance among farmers	2.07
6*	Farmers feel intolerable especially to large, highly symbolic animals	1.85
7	Farmer tolerate the ordinary safety hazards associated with some wildlife	3.31
8	I believe that surety of compensation increase the tolerance towards wildlife menace	2.15
9	Social benefits/beliefs about the value of wildlife and appreciation of its existence improve the tolerance among farmers	4.08
10	In my view tolerance was linked to guarding and watching services	1.86
*= Negative Statement		

3.4.27 Mitigation strategies

It was operationalized as the methods or strategies designed to reduce or eliminate risks to crops, livestock, people and property from wildlife. Different mitigation strategies followed by respondents was direct asked by using a semi-structured interview schedule. Then in the actual data collection the respondents were asked to rank each of the ten factors relevant to them according to the degree of importance as perceived by them. As all the items may not be ranked by all the respondents the method of combining of incomplete order of merit ratings as suggested by Garret (1981) was followed.

3.4.27.1 Mitigation strategies to alleviate damage

It was operationalized as the methods or strategies designed to reduce or eliminate risks to crops, livestock, people and property from wildlife. For identifying the strategies, an open-ended questionnaire was developed. In the preliminary survey the respondents were asked to list out the mitigation strategies which was followed by the respondents. A final screening and sorting out of the mitigation strategies were undertaken depending on their frequency of use. The top ten most frequent mitigation strategies were selected for the purpose of their final prioritization by means of using Garret Ranking Technique.

Then in the actual data collection the respondents were asked to rank each of the ten strategies relevant to them according to the degree of importance and effectiveness as perceived by them. As all the items may not be ranked by all the respondents the method of combining of incomplete order of merit ratings as suggested by Garret (1981) will be followed.

The formula for per cent position as suggested by Garret (1981) is

Per cent position = **100 (R - 0.5) ÷ N**

Where R is the rank of the individual item in the series and N is the number of individual items ranked. Scores for each of the factors after transmutation of orders of merit as per Garret (1981) was found out. To obtain the final order of merit, the scores for all the respondents for each of the factor will be summated and the mean value will be calculated. In finding out the mean values, the sum of the scores for each item was divided by its frequency of responses.

3.5 TOOLS AND TECHNIQUES USED FOR DATA COLLECTION

3.5.1 Pilot Study

After locating the area of the study and nature of objectives prior to preparation of information collecting devices, pilot study was conducted to find out relevant information about the tract pertaining to study. Prior to preparation of devices, a field survey was necessary to get specific knowledge of the area and the various problems of investigation. The schedule was readjusted, corrected and finalized in the light of experiences gained out of such pilot study for the actual collection of data.

3.5.2 Instrument Used for Data Collection

Instrument is the device used to collect the data. There are two sources of data collection- primary and secondary sources. Primary sources provide first-hand information while secondary data are those already recorded for some other purpose but used in research.

The instrument used for collecting data in the study was interview schedule. Based on the understanding of facts and related reviews, a semi-structured interview schedule was developed to investigate in depth various dimensions of the study. Data collection tools was prepared by giving due consideration to various variables, objectives and respondents. Pre-testing was done on non-sampling population. Based on pre-testing, the necessary modifications and changes was made in the interview schedule. Some variables like sources from national park, migration pattern, risk taking ability, etc. found irrelevant during pretesting were removed and some new variables like wildlife disease risk perception, benefits from wildlife, etc. relevant to study were added in the interview schedule.

The interview schedule consists of five parts (Annexure-IX and X). The first part dealt with Socio-economic profile characteristics of the respondents. The second part dealt with the wildlife disease risk perception by the respondents in the study area. The third part dealt with the losses of crop and livestock due to livestock owners- wildlife conflict in the study area. The fourth part dealt with the vulnerability of livestock owners' livelihood due to wildlife. The fifth part dealt with the perception and tolerance of livestock owners' and different mitigation method used to reduce the conflicts.

3.6. STATISTICAL TOOLS USED FOR ANALYSIS OF DATA

The data collected from the respondents were tabulated statement wise with respect to each variable of the study. Master sheets containing the pooled scores were prepared for respective categories. The collected data was scored, compiled, tabulated and subjected to various appropriate statistical tools to draw meaningful results and logical conclusion. The analytical techniques used in this study include average, frequency, per centage, and cumulative square root of frequency. Index for LV (Livelihood Vulnerability) and Scale for Perception as well as Tolerance and Garret ranking technique etc. Data were analysed for the most part by using the tabular method techniques for analysis which was intensively used for its inherent quality to present the true picture of the assessment of livestock owners- wildlife conflict in the simplest form. The statistical analysis was done

with the help of computer software, namely MS-Excel-2013, XLSTAT-2014 and SPSS v21.

3.7 FACILITIES UTILISED FOR THE RESEARCH WORK

Since the study was mostly related to fieldwork, no special facility such as laboratory work was used. However, for consultation of relevant literature, Library of National Dairy Research Institute, Karnal, and for data collection in the vicinity of Kalesar National Park, Guest house of Kalesar National Park was fully utilized.

RESULTS AND DISCUSSION

"Arise, awake, and stop till not, reach your goal…."

4. RESULTS AND DISCUSSION

This chapter deals with the results achieved from the statistical analysis of the data collected from livestock owners of the research area in accordance with the objectives of the study. The outcomes have been presented under the following heads.

4.1. Socio-personal and socio-economic profile of the livestock farmers

4.2. Losses of crops and livestock due to livestock owners-wildlife conflict

4.3. Assessment of vulnerability of livestock owners' livelihood due to wildlife

4.4. Perception of livestock owners towards wildlife

4.5. Tolerance level of livestock owners towards wildlife

4.6. Perceived feedback of respondents about the mitigation strategies

4.1. SOCIO-PERSONAL AND SOCIO-ECONOMIC PROFILE OF THE LIVESTOCK FARMERS

The socio-personal and socio-economic profile of livestock owners were studied and measured by using different statistical tools such as SPSS v21, XLSTAT-2014 and Excel 2013. The variables for present study were selected as age, gender, family size, family type, education of the respondents, family education, family income, size of land holding, herd size and herd composition, experience in livestock rearing, mass media exposure, extension contacts and training undergone, which have been presented under separate headings. The data were presented in Table.

4.1.1 AGE

Table 4.1 revealed that majority (54.00 %) of the respondents belonged to middle age group that ranges from 35-50 years followed by young age group (< 35 years) and old age group (>50 years) which accounts for 35 per cent and 11 per cent respectively. The finding of present study are in line with the studies of Singh *et al.* (2011) who revealed that in Faizabad district 61.66 per cent respondents found in middle age group (37 to 58 years) in the surveyed household and Nyamwamu (2016) conducted their study in Laikipia county among 200 smallholder agro-pastoralists and found that more than half (61.10 %) were males participate in farming activities than females (38.90%) and study also established that of the 200 respondents, 19.10 per cent were aged 40 years and below. While 80.90 per cent were aged 41years and above. It was observed that the age of the respondent in the study area ranges from 34 to 78 years. The average age of the

respondent was 49.57 years. Thus they were having sufficient experience on livestock rearing and farming.

4.1.2 GENDER

The finding regarding gender presented in the Table 4.1 depicted that even gender split with majority i.e. 80 per cent of the respondents were male while female belonged to only 20 per cent. The findings are in line with earlier studies of Karanth *et al*. (2012) who revealed that household respondents were largely men (87.00 %), around surveyed household at Kanha National Park. The results shown that majority of the male member involved in agricultural or farm activities whereas female were engaged with livestock rearing at household in the surrounding villages of national park.

4.1.3 FAMILY TYPE

The assembled data described in the Table 4.1 clearly showed that majority of the respondents (76.00 %) were living in nuclear family while only 24 per cent respondents were found to be from joint family. Joint family influences the various farming activities in terms of family labour availability.

4.1.4 FAMILY SIZE

Findings regarding family size presented in Table 4.1 revealed that 27 per cent of the respondents were having medium sized family ranging from 5-8 members followed by large sized family, more than 8 and small family size (less than 5) which were 28.50 per cent and 44.50 per cent respectively. The finding of present study are contrary with Chand (2011) who found that majority of the (51.33%) of the respondents were having large sized family more than 10 members and Sachan (2013) revealed that majority 67.00 per cent of the respondents were having medium family size ranging from 5 to 7 members. Throughout the data collection, it was observed that the family size in the study area ranging from 3-15 members and mean value of family size was 5.08.

4.1.5 EDUCATION

Education is an important source of human assets. A swift look on Table 4.1 showed that 26.50 per cent were functionally literate, 32.00 per cent were primary level, 12.00 per cent were middle level and 14.00 per cent were educated up to secondary level. Sharma (2004) found that more than 70.00 per cent of the livestock farmers were highly

literate and 55.00 per cent of the farmers' family educational status was medium. It was also observed that about 12.50 per cent of the respondents fall under senior secondary and only 3.00 per cent respondents had graduate and above. The finding of the present study are aligned with finding of Meena (2015) who reported that 23.33 per cent of farmers are illiterate, 17.50 per cent up to the senior secondary, 15.00 per cent are graduate or acquired the education beyond the graduation. This shown that primary to secondary level education respondents involved in farming and livestock rearing. The finding showed that most of the respondents were educated, thus the different ICTs tools were used to gaining a better understanding for assisting in conflict mitigation and to better understand the livelihood and at the same time easy to understand the implementation of programmes to reduce livestock depredation and crop loss.

Table-4.1: Distribution of respondents according to Socio-personal profile

(n=200)

S. N.	Variables	Categories	Frequency	Per centage	Total
1.	Age (in years)	Young (<35)	70	35.00	100
		Middle (35– 50)	108	54.00	
		Old (>50)	22	11.00	
2.	Gender	Male	160	80.00	100
		Female	40	20.00	
3.	Family Type	Nuclear	152	76.00	100
		Joint	48	24.00	
4.	Family Size	Small(<5 member)	89	44.50	100
		Medium (5-8 members)	54	27.00	
		Large (>8 member)	57	28.50	
5.	Education	Functionally literate	53	26.50	100
		Primary	64	32.00	
		Middle	24	12.00	
		Secondary	28	14.00	
		Senior Secondary	25	12.50	
		Graduate and Above	6	3.00	
6.	Family education status	Low (< 2.29)	86	43.00	
		Medium (2.29-3.84)	80	40.00	
		High (>3.84)	34	17.00	

4.1.6 FAMILY EDUCATION STATUS

The findings regarding family educational status of the respondent presented in Table 4.1 revealed that majority of the respondents (43.00 %) belonged to low level education status followed by medium and high education status, which accounts for 40.00 per cent and 17.00 per cent respectively. The finding of the present study are in harmony with Sharma (2004) who found that more than 70.00 per cent of the livestock farmers were highly literate and 55.00 per cent of the farmers' family educational status was medium. The average score of education status was 2.64 and it is good indication to preserve the indigenous technical knowledge (ITKs) and used ITKs to mitigate from wildlife conflicts and livestock depredation in the area.

Table-4.2: Distribution of respondents according to occupation, operational land holding, annual income and experience.

(n=200)

S. No.	Variable	Category	Frequency	Per centage
1.	Occupation	Agriculture (crop) + Dairying	89	44.50
		Agriculture + Dairy + Labour	36	18.00
		Agriculture + Dairy + Service	46	23.00
		Agriculture + Dairy + Business	29	14.50
2.	Annual Income (In Rs.)	Low(<134215)	70	35.00
		Medium (134215-185845)	98	49.00
		High (>185845)	32	16.00
3.	Experience in dairy (years)	Low (<18)	67	33.50
		Medium (18-28)	85	42.50
		High (>28)	48	24.00

4.1.7 OCCUPATION

Finding in the Table 4.2 exposed that 44.50 per cent farmers were engaged in agriculture along with dairy, 23.00 per cent in agriculture + dairy + service, 18.00 per cent in agriculture + dairy + labour whereas only 14.50 per cent in agriculture + dairy + business. The outcome of the present study are in agreement with study of Darshan (2015) who reported that 45.00 per cent of the farmers were practicing crop + dairy combination as occupation, 23.00 per cent are doing crop + dairy farming + business and 20.00 per cent of respondent are doing Service + crop + dairy farming and 12.00 per cent doing crop

only. While Meena (2015) conducted their study in Rajasthan found that 10.42 per cent of the fodder growing farmers occupation was agriculture plus dairy, 25.83 per cent are doing agriculture plus dairy plus business 37.92 per cent are agriculture plus dairy plus labour, 17.08 per cent are doing agriculture plus dairy plus service, 2.50 per cent are doing agriculture plus service plus business, 6.25 per cent are doing agriculture plus dairy plus business plus labour. It was clearly seen that farmers were engaged in subsistence agriculture for their basic livelihood.

4.1.8 ANNUAL INCOME

The main source of income was the agriculture as 44.50 per cent of people had major source of income along with other sources for basic livelihood. Annual income of the respondents from all the sources were presented in the Table 4.2 and it was found that 49.00 per cent of the respondents were in medium category followed by low and high category of annual income comprising of 35.00 per cent and 16.00 per cent respectively. The results were bring into line with outcome of Meena (2015) reported that majority 72.91 per cent of respondent are come under medium income category followed by 15.42 per cent in high income group 11.67 per cent in low income group and also contrary with finding of Rathod *et al*. (2012) described that majority of dairy farmers 61.00 per cent had low income followed by 36.00 per cent medium and 3.00 per cent high income groups. The average income of respondents in the study area was Rs.148660/annum. The farmers were earning income from agriculture and dairying.

4.1.9 EXPERIENCE IN DAIRYING

The results in Table 4.2 revealed that majority (42.50%) of the farmers were under medium category of experience (18-28 years) in dairying followed by low (33.50 %) and high (24.00%) category of experience, respectively. The results of the present study matched with Shah *et al*. *(*2002) who reported that majority of the dairy farmers belonged to middle age category and were educated up to high school and primary school, respectively. They had medium level of experience in dairy farming and low level of social participation. The findings conclude that the respondents were having much experience in all the aspects of dairying farming. They were rearing livestock to standardise livelihood of their family by selling milk and their by-products and goat for meat purpose. Therefore, Government must be focused on development of facility for scientific dairy farming practices.

4.1.10 OPERATIONAL LAND HOLDINGS

The results presented in Table 4.3 revealed that all of the respondents had their own land in which 45.50 and 24.00 per cent of the respondents were in small and semi-medium land holding category respectively and that share 69.50 per cent of the respondents. It further reveals that 17.50 per cent were in marginal, 13.00 per cent were in medium category. It was surprise to note that none of the respondents were found to be in large category. The finding of the present study are in hormony with the observation made by with Meena (2015) who described that 35.83 per cent of the respondent having semi-medium land holding (2.01 to 4.0 ha), 29.69 per cent farmers having small size of land holding (1.01 to 2.0 ha), 16.25 per cent having medium size land holding (4.01 to 10.0 ha) 8.33 per cent having large size of land holding more than 10 ha. The average operational landholding of sampled farmers was 3.06 acre. However, land holding of farmers ranged from 0 to 19 acre.

Table-4.3: Distribution of respondents according to operational land holding (Acre)

(n=200)

Variable	Marginal (n=35)	Small (n=91)	Semi-medium (n=48)	Medium (n=26)	Pooled (n=200)
Category	<1 ha	1-2 ha	2-4 ha	4-10 ha	
Frequency	35	91	48	26	200
Per centage	17.50	45.50	24.00	13.00	100
Total land(acre)	26.25	145.60	161.40	166.40	499.53
Share in total area (%)	5.25	29.15	32.29	33.31	100.00

4.1.11 HERD SIZE

Herd size indicate the number of animals reared by the respondents at the time of investigation. The classification of respondents were done with respect to their standard animal unit as presented in Table-4.4.

Table–4.4: Distribution of respondents according to Herd Size

(n=200)

Categories	Frequency	Per centage
Small (<7 animals)	41	20.50
Medium (7-10 animals)	108	54.00
Large (>10 animals)	51	25.50

The livestock rearing is an integral part of the farming in Haryana. All of the households had the multiple livestock's comprised by Cattle, Buffalo, Goat and Chickens. The people had the different purpose for rearing the livestock and chicken. The Table 4.4 illustrated that majority of the respondents (54.00%) were under medium category. Similarly, it was also found that 25.50 per cent and 20.50 per cent were under large and small category, respectively. The above finding are in contrast with outcome of Sikhakolanu (2007) who reported that majority of the livestock farmers had low herd size 57.10 per cent followed by medium 24.60 per cent and high 18.30 per cent. The average standard animal unit (herd size) in the study area was 5.03 per household. However, some of the respondents were having 11.30 (large category) standard animal units.

Table- 4.5: Total Livestock population among dairy farmers

(n=200)

S. N.	Animals	Indigenous	Crossbred	Buffalo	Total
1.	In milk	73	61	198	332
2.	Dry	97	47	78	222
3.	Heifer	59	41	62	162
4.	Calves	46	26	48	120
5.	Adult male	19	10	16	45
6.	Goat				393
Total		294	185	402	1274

Further collected and compiled data was analysed to view the category wise distribution of total livestock population among dairy farmers (Table-4.5) in the research area. The results indicated that the respondents possess 294, 185, 402 and 393 indigenous cow, crossbred cow, buffalo and Goat respectively. The farmers had more preference towards buffalo than cattle. The reason behind it was higher fat content in milk, comparatively less productive and reproductive issues, survive on low quality fodder and handsome sale price of the buffaloes. However, cattle towards the end of their lifecycle would not be productive, and hence the cost of production would increase. This would drive farmers towards buffalos.

4.1.12 HERD COMPOSITION

It was found that in the study area buffaloes and indigenous cattle dominated. Some of the farmers were used to rear crossbred cow for milch purpose and goat for the meat purpose. They also used to rear pig and few farmers kept horse for transportation purpose like transporting wood, cow dung/cow dung cake and food grains. Large number of the farmers kept dogs for protection of the dairy animals and agriculture field from the

monkey and other wild animals. Stelfox *et al*. (1986) reported that the competition has been serious especially among cattle, sheep and goats, buffaloes. The results of the study as presented in the Table 4.6 clearly reveal that in the overall livestock composition of the respondents there were 31.55 per cent of buffalo, 30.85 per cent Goat, 23.08 per cent indigenous Cow and 14.52 per cent cross bred cow in study area.

Table-4.6: Category wise distribution of Herd Size (n=1274)

Particulars	Categories	Frequency	Per centage	Overall %
Indigenous	Small(<3 animals)	76	25.85	23.08
	Medium (3-5 animals)	134	45.58	
	Large (>5 animals)	84	28.57	
	Total	294	100.00	
Cross Bred	Small(<3 animals)	31	16.76	14.52
	Medium (3-5 animals)	52	28.10	
	Large (>5 animals)	102	55.14	
	Total	185	100	
Buffalo	Small(<2 animals)	83	20.64	31.55
	Medium (2-4 animals)	116	28.86	
	Large (>4 animals)	203	50.50	
	Total	402	100.00	
Goat	Small(<7 animals)	216	54.96	30.85
	Medium (7-10 animals)	124	31.54	
	Large (>10 animals)	53	13.49	
	Total	393	100.00	

4.1.13 CROPPING INTENSITY

The finding presented in Table 4.7 clearly revealed that slightly more than one-third (43.00 %) of the respondents were having more than 200 per cent cropping intensity while 29.50 per cent of the respondents were having cropping intensity between 151-200 per cent.

Table-4.7: Distribution of respondents according to cropping intensity of Field (n=200)

Intensity (%)	Frequency	Per centage
Up to 100	21	10.50
101-150	35	17.50
151-200	58	29.50
More than 200	86	43.00

It was also observed from the table-4.7 that 10.50 per cent respondents were having cropping intensity up to 100 per cent. Similarly, 17.50 per cent farmers whose cropping intensity was slightly higher i.e. between 101-150 per cent in vicinity of Kalesar National Park, Yamunanagar district of Haryana. Thus, from the ongoing discussion it is clear that majority of respondents were having more than 200 per cent cropping intensity which was good sign for the farmer's economy and prosperity. The variation in the level of cropping intensity among the respondents were mainly attributed to the availability of irrigation facilities.

4.1.14 GRAZING SYSTEM

It could be seen from the table 4.8 that 81.00 per cent farmers followed grazing system with herder while 19.00 per cent farmer followed grazing system without herder. Majority of respondents uses herder/ Cowboy for grazing their livestock. Li *et al.* (2013) identified in Tibet that Wolf causes highest livestock losses and rank first in the animal depredation, due to high damage by wolf local herders disliked most and showed negative behavior to the wolves. These herders protect the livestock from the wild animal and at the same time act as a watch dog and minimize agricultural loss through entry of livestock into the crop field. Grazing land adjoins the northern and north-western perimeter of Kalesar National Park.

Table-4.8: Distribution of respondents according to their Grazing System

(n=200)

Particulars	**Categories**	**Frequency**	**Per centage**
Grazing System	Grazing with Herder	162	81.00
	Grazing without Herder	38	19.00
		200	100.00

Particulars	**Categories**	**Morning**	**Evening**
Timing	Summer	6 am-11 am	4:30 to 6:30 pm
	Winter	9 am - 1 pm	3am - 5 pm
Grazing hours	Summer	5 hours	2 Hours
	Winter	5 hours	2 Hours

Grazing Time

It was investigated that during summer the animals were started to move for grazing or open protected area at 6.00 AM to 11.00 AM. Then the animals were provided rest and protection from the sun till 4.30 PM as presented in the Table 4.8. After which the animals were again started to move and graze till 6.30 PM when they were stopped for the night rest at their home. In this way the grazing hours during summer were 7 hours in total; 5 hours in morning and 2 hours in the second spell of the day. During summers in pasture the grazing hours were much longer i.e., 11 hours a day. Ad lib grazing and browsing was allowed in summer by the respondents. During winter all the respondents took their animals for grazing around 9.00 AM in the morning and brought them back near their Shed around 5.00 PM in the evening and thus allowing a grazing time of about 7 hours.

4.1.15 DISTRIBUTION OF RESPONDENT BASED ON PRODUCTION AND DISPOSAL PATTERN OF MILK

The results in Table-4.9 revealed that majority (49.00 %) of the farmer produces less than 5 litre milk per day. While 42.50 and 8.50 per cent of the respondents comes under medium and high category of milk production respectively. The average milk production of the respondents was 6.89 litre/day. The finding of the present study are in line with finding of Verma (2012**)** observed that 41.33 per cent of the farmers fell in medium category of milk production, (producing 6.11 to 10.07 litres milk per day) followed by 32.67 per cent and 26.00 per cent of the farmers belonged to low and high categories of milk production , respectively. It was also observed that some farmers were able to produce milk up to 24 litres/day from their dairy animals.

Table–4.9: Distribution of respondents according to milk Production and Its disposal pattern of milk

(n=200)

S. N.	Variables	Categories	Frequency	%
1.	Milk production (litre/day) (Mean : 6.89) (Range : 2-24)	Low (<5 lit/ day)	98	49.00
		Medium (5-9 lit/ day)	85	42.50
		High (>9 lit/ day)	17	8.50
2.	Milk consumption (litre/day) (Mean : 3.42) (Range : 3-14)	Low (<2.30)	102	51.00
		Medium (2.30-5.20)	53	26.50
		High (>5.20)	45	22.50
3.	Milk sale (litre/day) (Mean : 4.98) (Range : 0-15)	No sale	86	43.00
		Low (<3.50)	48	24.00
		Medium (3.50-8.20)	29	14.50
		High (>8.20)	37	18.50

Milk consumption data, depicted in Table-4.9 showed that 51.00 per cent of the respondents were retaining less than 2.30 litre of milk/days for their home consumption. It was also seen that 26.50 and 22.50 per cent of the respondents had 2.30 to 5.20 litre and more than 5.20 litre of household consumption of milk per day respectively. The findings of the present study are in accordance with results of Meena (2015) who reported that majority of the respondents 68.75 per cent fell in medium category of milk production producing 4-13 liters milk per day, 16.68 belongs to the low category producing less than 4 liters milk per day, 14.57 per cent comes under high category producing more than 13 liters milk per day. The surplus milk was sold to the local milk vendors in the village. The milk sale data presented in Table-4.9. Indicated that 43.00 per cent of the respondents were not selling milk. Whereas 24.00 and 14.50 per cent of respondents had low (<3.50 litre) and medium (3.50-8.20 litres) sale. During the survey it was observed that 11.88 per cent respondent have more than 8 members in their family and hence, they required more milk for home consumption rather than to sale.

4.1.16 MARKETING CHANNEL FOR MILK AND MILK PRODUCTS

The results presented in the Table 4.10 indicated that two marketing channels were reported among the respondents for the sale of milk and milk products. It was observed that 75.44 per cent of the respondents were sold their milk directly to the consumer and 24.56 per cent respondents sell milk to vendor. It is surprise to note that dairy cooperative societies were not existing in study area.

Table-4.10: Distribution of farmers as per milk and milk products marketing channel (n=200)

Category	Frequency	Per centage
Producer- consumer	86	75.44
Producer- milk vendor-consumer	28	24.56
Total	114	100.00

4.1.17 CHANGE IN FARMING AFTER CREATION OF NATIONAL PARK

The Table 4.11 revealed that 90.00 per cent respondents reported that the crops damage has increased due to wild animals and 5.50 per cent farmers reported that there was no change in farming after creation of National Park. In case of level of ground water table 88.00 per cent of farmers told that there were decreases of ground water table whereas 88.50 per cent farmers revealed that after creation of KNP insect/pest infestation were increased. Table 4.11 also showed that 74.00 per cent farmers described in the study area that crop insect/pest were increase in the farm field vis-a-vis 82.50 per cent respondents reported there were increase in number of bird population. The increase in the number of birds in the study area was good for nature and for the national park but for the farmers point of view birds damage the food grains of crops results into loss of food grains production. Same Table also revealed that more than 50.00 per cent respondents reported that the rate of agriculture land were decreased and only 20.50 per cent farmers told that the rate of agricultural land were increased only in connected roadside.

Table-4.11: Distribution of farmers as per change in farming after creation of National Park in case of Agriculture (n=200)

Agriculture	Increase	No change	Decrease	Can't say	Total
Crop damage by wildlife	181 (90.50)	11 (05.50)	3 (1.50)	4 (2.00)	200 (100)
Level of water table	5 (2.50)	11 (5.50)	176 (88.00)	8 (4.00)	200 (100)
Insect/ pest infestation	177 (88.50)	14 (07.00)	4 (2.00)	5 (2.50)	200 (100)
Crop insect/ pest	148 (74.00)	17 (8.50)	17 (8.50)	18 (9.00)	200 (100)
Increase bird population	165 (82.50)	14 (7.00)	11 (5.50)	10 (5.00)	200 (100)
Rate of Agrl. land	41 (20.50)	38 (19.00)	112 (56.00)	9 (4.50)	200 (100)

4.1.18 EFFECT OF NATIONAL PARK ON ANIMAL HUSBANDRY

The Table 4.12 explained, majority (73.50%) of the respondents reported that livestock population in the study area were decreasing after establishment of national park whereas 15.50 per cent respondents told that there was no change in livestock population in the study area. The reason behind decrease in the livestock population in the vicinity of national park was the increase in animal's depredation by forest animals and unavailability of pasture land around the surrounding area. However, 84.50 per cent of the respondents reported that there were increases in livestock depredation by wild animals while only few (14.00 %) told there were no changes in livestock depredation by wild animals after establishment of national park in the study area.

Table-4.12: Distribution of respondents as per effects of National Park on Animal Husbandry (n=200)

Animal Husbandry	Increase	No change	Decrease	Can't say	Total
Livestock population	10 (5.00)	31 (15.50)	147 (73.50)	12 (6.00)	200 (100)
Livestock depredation by wild animals	169 (84.50)	28 (14.00)	1 (0.50)	2 (1.00)	200 (100)
Fodder availability	26 (13.00)	66 (33.00)	55 (27.50)	53 (26.50)	200 (100)
Land for grazing	9 (4.50)	16 (8.00)	170 (85.00)	5 (2.50)	200 (100)
Livestock diseases	150 (75.00)	22 (22.00)	17 (8.50)	11 (5.50)	200 (100)
Rate of livestock	46 (23.00)	131 (65.50)	4 (2.00)	19 (9.50)	200 (100)

4.1.18 CHANGE IN SOURCES OF INCOME AFTER CREATION OF NATIONAL PARK

The integration of different enterprises give sustained cash flow to farmers in order to manage farm and family activities throughout the year. The results presented in Table 4.13 showed that 71.00 per cent of the respondents told that there was no change in source of income and employment after creation of park because of tourist visit while 27.50 per cent told that the income was increases because of visit of tourist after establishment of park. Shops play important role as a source of income after establishment of national park as per opinion of 76.00 per cent of respondents of the study area. The finding were bring into line with Meena (2015) reported that majority 72.91 per cent of respondent are come under medium income category followed by 15.42 per cent in high income group 11.67 per cent in low income group.

Table-4.13: Distribution of farmers as per change in sources of income after establishment of National Park (n=200)

Sources of income/ employment	Increase	No change	Decrease	Can't say
Tourist	55 (27.50)	142 (71.00)	0 (0.00)	3 (1.50)
Shops	152 (76.00)	34 (17.00)	0 (0.00)	14 (7.00)

4.1.19 EFFECT ON FARMERS AFTER CREATION OF NATIONAL PARK

The results presented in the Table 4.14 explain 78.50 per cent of respondents experienced that injuries of human life were increase after creation of national park while 13.00 per cent of the respondent reported that there was no loss or injury of human life after being establishment of park. Similarly, 94.50 per cent respondents of the study area reported that destruction of crop was increased after establishment of national park. It was also reported from same Table 4.14 that 74.00 per cent of the respondents experienced destruction of farm infrastructure and 11.00 per cent respondents experienced no change in farm infrastructure after establishment of park. Injury among respondents increases in the study area because there are increasing in the number of monkey in the study area.

Table-4.14: Distribution of farmers as per effect on farmers after creation of National Park (n=200)

Effect on Farmer	Increase	No change	Decrease	Can't say
Loss/ injury of human life	157 (78.50)	26 (13.00)	17 (8.50)	0 (0.00)
Destruction of crop	189 (94.50)	11 (5.50)	0 (0.00)	0 (0.00)
Destruction of farm infrastructure	148 (74.00)	22 (11.00)	15 (7.50)	15 (7.50)

4.1.20 TRAINING RECEIVED

The results in Table 4.15 revealed that cent per cent farmers were attended training programme related to forestry and more than three forth of the respondents (83.87 %) attended training programmes on agriculture while only 51.61 per cent of the respondents attended training programmes related to dairying as well as agriculture. Similarly, 46.24 per cent and 37.63 per cent farmers got training separately in dairying and agro-forestry,

respectively. The training provided opportunities to them to improve their knowledge about agricultural innovations, dairy management practices and in adoption of innovations much earlier than others.

Table-4.15: Distribution of farmers as per training received on dairying, agriculture, agro-forestry and forestry (n=200)

Training	Training Organisation	Frequency	Per centage
Dairying	State Govt., Yamunanagar	43	46.24
Agriculture	KVK, Yamunanagar	78	83.87
Dairying + Agriculture	State Govt., Yamunanagar and KVK, Yamunanagar	48	51.61
Agro-forestry	State Govt., Yamunanagar	35	37.63
Forestry	Kalesar	93	100

4.1.21 SOCIAL PARTICIPATION

It could be perusal from Table 4.16 that distribution of respondents in social participation. Out of total respondents, 52.50 per cent, 31.00 per cent and 16.50 per cent of respondents were under low, medium and high category of social participation, respectively. This finding of the study are in conformity with Murai (2009) who reported that majority of the 20.00 per cent respondents had no any kind of social participation, followed by 20.00 per cent in one organisation, 25.00 per cent in more than one organisation, whereas 35.00 per cent were office bearer in one organisation. The proportion of respondents for social participation was greater in low category. This might be due to majority of farmers were young and not participated in social event and illeteracy which force them not to participate in various extension and social activities.

Table-4.16: Distribution of respondents as per social participation (n=200)

Category	Frequency	Per centage
Low (<3.70)	105	52.50
Medium (3.70-6.10)	62	31.00
High (>6.10)	33	16.50

Observations clearly concluded that the participation in the social institutions of the respondents was low.

4.1.22 EXTENSION CONTACT

Table 4.17 showed that 42.00 per cent farmers were under medium category of extension contact followed by 31.50 per cent with low category of extension contact and rests of the farmers were fall in high category of extension contact. The finding of the above study aligned with Garai (2007) who revealed that majority (72.22%) of the respondents had

medium level of extension contact followed by high and low extension contact who constituted 15.56 and 12.22 per cent, respectively. It was found that large farmers were having high level (more frequency) of extension contact as compared to the small farmers.

Table-4.17: Distribution of respondents as per Extension contact (n=200)

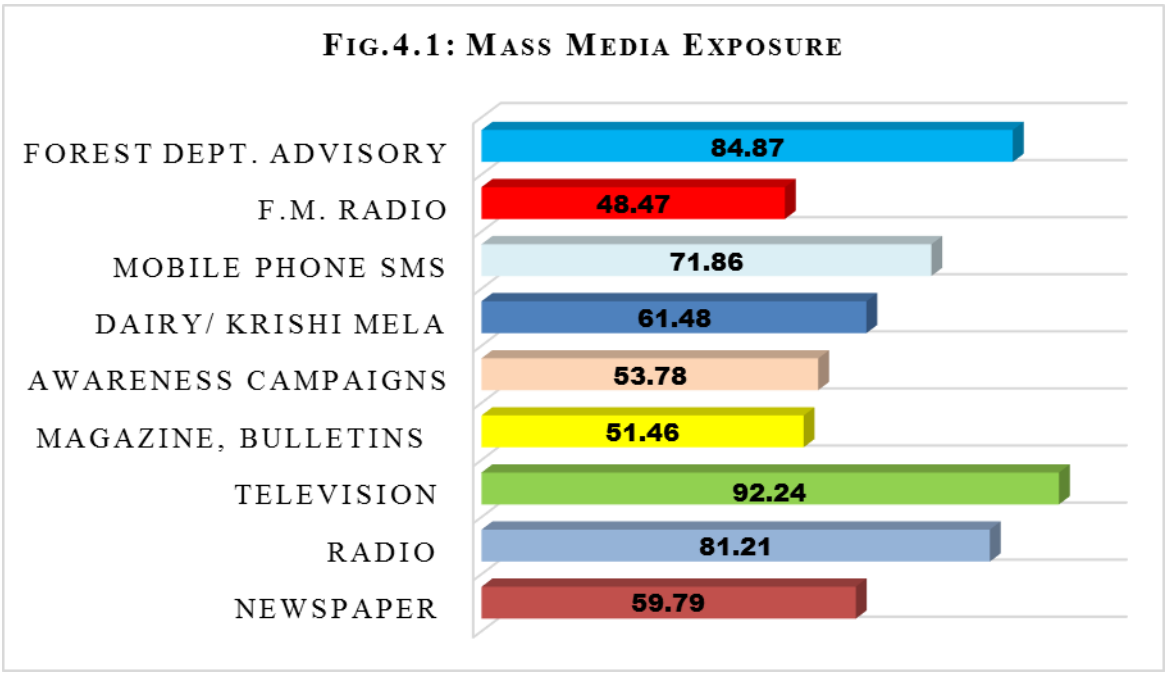
Category	Frequency	Per centage
Low (<7)	63	31.50
Medium (7-12)	84	42.00
High (>12)	53	26.50

4.1.23 MASS MEDIA EXPOSURE

A bird's eye view of mass media exposure in Table- 4.18 showed that more than three fifth of the overall respondents (62.50 %) had high mass media exposure, more than one fourth (26.00 %) had medium mass media exposure and rest (11.50 %) had low mass media exposure. The results aligned with finding of Subash (2011) who found that majority (38.00 %) of the farmers had low exposure to mass media, 34.67 per cent were in medium category of mass media exposure and 27.33 per cent were in high category of mass media exposure. Result explains that they were very much dependent on mass media not only for source of news and information, but also as a source of entertainment and leisure (enjoyment).

Table-4.18: Distribution of respondents according to mass media exposure (n=200)

Category	Frequency	Per centage
Low (<5)	23	11.50
Medium (5-8)	125	62.50
High (>8)	52	26.00



4.1.24 RESOURCE COLLECTION

Table 4.19 indicated that about 63.00 per cent of respondents collected wood from the buffer zone whereas only 14.50 per cent respondents collect wood from their own land. Wood collected from nearby location were used for fencing, making furniture, cooking energy and other household purpose. More than one third respondents collected wood for fuel purpose from national park (25.00 %) and only 23.50 per cent respondents collect wood (for fuel purpose) from their own land. Almost 29.50 per cent of the respondents collected fodder for their livestock from their own farm and 27.50 per cent collect fodder from community forest and rest of them from buffer zone (25.00 %) followed by national park (18.00 %). In case of Minor forest products, (MFP) or medicinal plant 76.50 per cent respondent collected from national park and 16.00 per cent were collected from buffer zone and only 7.50 per cent respondents collected from community forest. These collected medicinal plant were mostly used for treatment of livestock as well as human like fever, wound curing and consumption purpose. The majority of respondents used MFP for livestock and human treatment due to their close contact with nature and abundant availability in the locality. Kalesar National Park has much significance in terms of bio-diversity and ecological stability in this part of the country. In terms of bio-diversity, it is storehouse of numerous medicinal plants.

Table-4.19: Distribution of respondents according to various resource collection in different season of year (n=200)

Area/ Resources	Wood	Fuel wood	Fodder	MFP/medicines
National park	11 (5.50)	50 (25.00)	36 (18.00)	153 (76.50)
Buffer zone	126 (63.00)	67 (33.50)	50 (25.00)	32 (16.00)
Community forest	34 (17.00)	36 (18.00)	55 (27.50)	15 (7.50)
From own land	29 (14.50)	47 (23.50)	59 (29.50)	0 (0.00)

4.1.25 WILDLIFE DISPERSAL FROM NATIONAL PARK

Finding regarding dispersal of wild animals from the protected area to the vicinity of national park or surrounding village presented in table 4.20. The most wild animal dispersed in the vicinity of park were primates, blue bull, barking deer, sambar, chital reported by almost all of the respondents. The dispersal of the wild animal from park was because of absence of boundary or fencing of the national park and other reasons of the dispersal of animals was scarcity of the food and water in the national park in summer. The same Table also showed that 84.50 per cent reported they watched leopard in the vicinity of national park. Similarly, in case of elephant, 97.00 per cent respondent reported that elephant were roaming near field for food and water. The stated animals in the table were most frequent shown by respondents and among these animal primates (monkey) and blue bull were mainly responsible for damaging of crops.

Table-4.20: Distribution of respondents according to wildlife dispersal from National Park in different season of year (n=200)

Wild animal	Frequency	Per centage
Primates(Monkey)	200	100
Blue bull (Rojh)	200	100
Barking deer	200	100
Sambar	200	100
Chital	200	100
Leopard	169	84.50
Elephants	194	97.00

4.1.26 WILDLIFE DISEASE RISK PERCEPTION

FAO (2009) stated that properly designed, constructed and maintained fences can be almost completely effective in preventing Human Wildlife Conflict (HWC) and, apart from mitigating HWC fences also help prevent the transmission of certain endemic diseases such as foot and mouth diseases. Table 4.21 shows that weighted mean with (70.38 %) respondents near the protected area were fear from rabies and T.B. and thought that it causes serious consequences on human and livestock health. While (69.00%) were worried or panic about rabies, T.B. and Brucellosis especially from monkey which roam everywhere near park. Domesticated animals such as dog, cattle, buffalo and goat may transmit diseases to wildlife, including protected species, causing illness and death. In order to prevent this insidious form of conflict, we need policies that will ensure that domesticated animals such as dogs and cattle should be vaccinated properly against contagious diseases. People and wildlife were kept a healthy distance to avoid harm to humans. Disease transmission between humans or domesticated animals and wildlife was frequent and can present a serious challenge to human-wildlife coexistence. Threats to livestock, pets and humans from transmission of disease impose costs on local people and create fear of wildlife. The finding are in line with Musimbi (2013) and Waithaka (2012) who reported that human wildlife conflict manifests itself as crop damage, livestock injury or death, human injury or even death, competition for pasture or infection of livestock with zoonotic diseases.

Table-4.21: Distribution of respondents according to wildlife Disease risk perception (n=200)

S.N.	Wildlife Disease Risk Perception	Not Serious	Somewhat serious	serious	Very serious	Weighted Mean (%)
1	If [you personally, people in your community, pets, domestic livestock, wildlife] were to contract [rabies, T.B., Brucellosis virus disease], how serious do you think the consequences would be…?	13.50	21.00	36.00	29.50	70.38
2	In your opinion, how likely to contract (or catch) [rabies, T.B., Brucellosis] are…?	30.50	26.50	27.00	16.00	57.13
3	Do you worry about or feel fearful of [rabies, T.B., Brucellosis virus disease] affecting…?	14.50	24.50	31.50	29.50	69.00
4	Have you, or do you know someone who has, contracted or otherwise been affected by [rabies, T.B., Brucellosis virus disease]?	33.00	31.50	22.00	13.50	54.00
5	How concerned are you that rabies, T.B., Brucellosis virus disease] could affect the health of [humans, pets, domestic livestock, wildlife, the overall ecosystem]?	22.50	24.50	25.50	27.50	64.50
6	In general, how concerned are you about protecting the health of [humans, domestic animals, wildlife and the overall ecosystem]?	20.50	21.50	29.50	28.50	66.50
7	Do you agree or disagree that: most environmental problems are caused by humans interfering with nature; the occurrence of disease (in general) has been made worse by humans and their activities?	22.50	27.00	27.00	23.50	62.88
8	Perceived risk severity, susceptibility, and dread for zoonotic diseases	25.00	24.50	30.00	20.50	61.50

Table 4.22 clearly indicates that the 66.00 per cent respondents perceived they had risk of disease from the wild animals in their locality especially from the primates and dogs followed by 32.50 per cent respondents had having low level of risk perception of disease. Similarly, only very few respondents (1.50 %) perceived risk of diseases from the wildlife.

Table-4.22: Distribution of respondents according to various Wildlife Disease Risk Perception (n=200)

Category	Frequency	Per centage
Low (<2.29)	65	32.50
Medium (2.29-3.47)	132	66.00
High (>3.47)	3	1.50

4.2 LOSSES OF CROPS AND LIVESTOCK DUE TO CONFLICT

Livestock owners wildlife conflict (LOWC) has become one of the primary factor of wildlife management as it represents the most extensive and complex challenge currently being faced by the conservationist (Woodroffe *et al*., 2005). Table 4.23 clearly indicated that the 99.10 area were damaged reported by wild animals from 710.67 cropped area (Acre). The total cropped area damaged (13.94 %) mostly by monkey, blue bull, wild boar and sometime by elephant.

.

Table-4.23: Crop wise area raided and per cent loss due to wildlife

(n=200)

Crop	Total cropped Area (Acre)	Total area damage(Acre)	% Loss
Wheat	211.33	24.40	11.55
Paddy	180.67	23.75	13.15
Maize	149.00	28.24	18.95
Sugarcane	88.67	14.07	15.87
Poplar	44.33	4.85	10.95
Eucalyptus	36.67	3.78	10.32
Total	710.67	99.10	13.94

In respondents that population of wild animals (i.e. Monkey, wild pig, ungulates etc.) has increased in last few years in the vicinity of national park. This has created competition

for livestock and human and also threat for local economy. The results revealed that conflict between wildlife and livestock owners caused economic loss.

Table-4.24: Crop wise area raided and monetary loss due to wildlife

(n=200)

Crop	Average area Raided (Acre)	Average monetary loss (RS)
Wheat	0.12	2668.82
Paddy	0.17	2295.60
Maize	0.12	1715.72
Sugarcane	0.14	3824.25
Poplar	0.07	7522.80
Eucalyptus	0.05	8213.75
Average	**0.11**	**4373.49**

The table 4.24 revealed on crop wise area raided and monetary loss due to wildlife. The average land holding for surveyed household was found to be 3.0 acre while average land raided was calculated as 0.11 acre per household. The crop raiding caused economic loss of INR 4373.49 /hh. Questions related to crop raiding focused on the incidences occurred in last three years. In the study area, people grow wheat, paddy, sugarcane and maize while in agro-forestry poplar and eucalyptus were cultivated.

Wheat (*Triticum aestivum)*

Table 4.24 revealed that out of 200 households sampled, 82.00 per cent reported that their wheat fields were raided by wild animals. A total of 0.12 acre/hh land under wheat crop was raided which caused monetary loss of INR 2668.82 /hh at prevailing market price by Goral, blue bull (Rojh), Rhesus monkey and wild boar were found responsible for major loss of the wheat crop in the study area.

Paddy (*Oryza sativa)*

Table 4.24 showed that respondents have lost their Dhaan (Paddy) yield to crop raiding incidences by wild animals and observed that majority of the raiding occurred in the night time. The loss of paddy crop was attributed to wild boar and blue bull which had raided 0.17 acre of crop field and resulted in the loss of INR 2295.60 /hh.

Maize (*Zea mays*)

Four wild species, *i.e.* Blue bull, monkey, wild boar and Goral were reported to be involved in cases of raiding of maize (Makka) fields. 135 (67.50 %) households reported that they have damage in their *maize* crop due to these wild species. Table 4.24 revealed that total of 0.12 acre/hh land under maize crop was raided which caused loss INR 1715.72.

Sugarcane *(Saccharum officinarum*)

A total of 113 households (56.50%) reported that their sugarcane crop was raided by blue bull, Rhesus macaque and elephant. Table 4.25 revealed that a total of 0.14 acre /hh land under sugarcane was raided which caused loss of INR 3824.25/hh. Majority of respondents reported that the above mention animals raided the field in afternoon and night. Respondent also reported that from last three year the raiding of sugarcane were increased due to increasing the population of monkey in the area.

Poplar *(*Populus)

A total of 79 households (39.50) reported that they have damage their poplar plant due to raiding by wild animals and said that all the raiding occurred in the day time. Table 4.24 revealed that all the loss of poplar crop was attributed to monkey which had raided 0.07 acre/hh and in economic term Rs. 7522.80/hh were loss. Most of the poplar plant were damaged at initial stage of the plant growth. In majority of poplar damage, monkey plug the top part of the plant, which caused determinant growth of the plant and the economic value of the plant, was reduce due to the thickness and height of the plant is affected by damaging top portion of the plant.

Eucalyptus (*Eucalyptus oblique*)

Table 4.24 showed total of 0.05 acre /hh land under Eucalyptus (Eucalyptus obliqua) crop was raided which caused monetary loss of INR 8213.75/hh. Langur and Rhesus macaque were attributed to the raiding of eucalyptus plant.

Table-4.25: Distribution of respondents according to monetary loss in crop due to Wildlife (n=200)

S.N.	Category(Rs)	Frequency	Per centage
1.	Less than 13042	18	9.00
2.	13043-48942	57	28.50
3.	More than 48943	125	62.50

It could be perused from Table 4.25 that majority of 62.50 per cent of respondents experienced that they bear monetary loss of Rs. 48943 while 28.50 per cent of respondents reported that they were loss Rs 13043 to 48942 money in crop due to wildlife and rest 9.00 per cent respondents loss approx. Rs 13042 from crop damage. The wild animal damaged cultivated crops like wheat, paddy, maize and sugarcane were the most severely damaged crops in the study area. All respondents faced the crop damage problem by the wild animals. Property damaged by the wild animals is the second major problem. Destruction of animal house was damaged by the wild boar. The crop raiding by the wild animals was continued almost throughout the year.

4.2.1 Perceived economic loss due to livestock depredation/lifting by wild animals:

Table 4.26 showed that out of 200 respondents, 5 (2.50 %) families reported loss of goats in night to (Rs. 28500 in last three years) by unknown wild animals while 1 (0.50 %) reported loss of cattle (Rs.34000 in last three years) and 1 respondents reported loss of buffalo of Rs. 42000 while 2 calf were also depredated by wild animals and cause loss of Rs. 24000. The killed livestock were reported to belong to different age categories, which is more than 3 years old. This is because livestock of this age group are generally send for grazing and left unsupervised in the forest while younger ones are stall-fed. Total monetary losses due to livestock depredation in the study area perceived by farmers were calculated as Rs. 128500/hh. It was also reported that more incidences of cattle lifting occurred in winter season than in summer season.

Table-4.26: Perceived Economic loss due livestock depredation by the wild animals (n=200)

Animal	Frequency	Monetary loss (Rs)
Cattle	1	34000
Buffalo	1	42000
Calf	2	24000
Goat	5	28500
Total loss	**9**	**128500**

4.2.2 Monetary loss due to attack on human

Most of the respondents encountered with wild animals like monkey, blue bull and wild Boar. Majority of the respondents encountered with more than one wild animal. But there was no such official record of human casualties. Table 4.27 revealed that out of 200

families, only 48 persons reported an attack by monkey. In this case, monkey attacked the victim near the agriculture field. Injury among the human causes loss of Rs. 9500.19/person. This loss include loss of working days, expenditure of treatment, expenditure of travel to hospital and number of working days loss of one care taker (as one member of the family has to stay at home to take care of the injured person mainly affecting agricultural and livestock related work).

Table-4.27 Estimated economic loss due to wild animal attack on human

(n=200)

Human injury	Working day loss	Expenditure of treatment (Rs.)	Travel to hospital (Rs.)	Care taker day loss	Loss due to attack (Rs.)
48 Persons	291 @465* =135315	218300	26600	163 @465* =75795	456010
Per Person	2819.06	4547.91	554.16	1579.06	9500.19
* DC rate in Haryana state for 2016-17					

4.3 LIVELIHOOD VULNERABILITY INDEX

Vulnerability is conceptualized in diverse ways by academics from different knowledge domains, and even within the same domain. It is a dynamic phenomenon often in a continuous state of flux like biophysical, social and institutional processes that shape local conditions and the ability to cope are themselves dynamic (O'Brien *et al*., 2007). While some scholar define vulnerability as a systems potential for loss in response to exposure to hazard (Cutter *et al*., 2003) and the ability to recover or adapt to losses (Schmidtlein *et al*., 2008). Though methods of vulnerability assessment have been developed over the past several decades in natural hazards, food security, poverty analysis, sustainable livelihoods and related fields. Livelihoods are the mechanisms through which livestock owners translate natural resources into the things they need to survive, thrive and mitigate. Livelihoods are the means that enable people to earn a living. This includes the capabilities, assets, income and activities people require in order ensuring that their basic needs are covered. For assessing the livelihood vulnerability of livestock owners in the vicinity of National Park, Livelihood Vulnerability Index (LVI) was developed by considering following Dimensions.

4.3.1 BIOPHYSICAL VULNERABILITY:

Biophysical vulnerability described the human assets and natural assets. Human assets represented the health, nutrition, education, knowledge and skills, information and the ability to work (Majale, 2001) that together enable people to pursue livelihood strategies and achieve livelihood objectives (DFID, 1999). The Table 4.28 showed that the mean value for natural assets was 6.39 and mean value of human assets was 6.39, showed that the vulnerability were found to be maximum in human assets as compared to natural assets. Human assets were more vulnerable because age of head of household, Diverse conflict mitigation skill, Training received and injury to human by wild animals get maximum relevancy weight in the LVI on 0 to 1 point continuum. Thus posing a serious threat if the vulnerability of the human assets could not be relaxed at any cost and on priority basis, the natural asset was found to be flexible in terms of attempts required to freeze the vulnerability. However, this dimension was found to be efficient, if biophysical vulnerability was considered and remedial measures to be taken.

Human assets required in order to make use of other four types of resources like natural, physical, social and financial, and hence it was considered quite important.

Natural assets such as land, forests, water, wildlife, biodiversity and environmental service (Krantz, 2001) are particularly important as people derive some or most of their livelihood from these sources. But the importance of natural assets goes beyond only livelihood, as we cannot even survive without these resources (DFID, 1999). Also, these capitals often define the adaptive capacity and resilience of the communities depending upon these resources. Hence, it became important to document these resources. Natural assets in the research includes crop cultivated area, land holding, crop yield, herd size, natural water source, crop diversification, water availability for crop, ground water level, farm diversification, natural hazards, firewood etc.

4.3.2 SOCIAL VULNERABILITY:

Social vulnerability denotes inability of Farmers, organizations and societies to withstand adverse impacts from multiple stressors to which they are exposed. Social vulnerability represents an attempt to understand the social conditions that transform a natural hazard. These impacts are due in part to characteristics inherent in social interactions, institutions and systems of cultural values. Social vulnerability integrate social assets; social assets are the social resources upon which people draw on in pursuit of their livelihood

objectives (Gaire, 2012) and are developed through relationships of trust, formal and informal groups, membership of groups, networks, access to wider institutions and participation in decision making (Majale, 2001). Social assets may not always be positive (Schuit, 2011) but can be particularly important for the poor and vulnerable as being the "resource of last resort" (DFID, 1999). Information that was collected for this study includes number of persons in family, participation of respondents in different social, festivals and religious activities. Social migration was due to conflict among the villagers as well as culture and taboo of study area. Participation in SHGs, forest rules and regulation and legal penalties by Government was observed during investigation. In addition, questions were asked if there is any improvement of general awareness and capacity after involvement in these types or groups. As far as social vulnerability was concerned, Table 4.28 expresses that it ought to be as the second most critical indicator in terms of the vulnerability among livestock dependents. It was evident from them mean value of sub dimension (6.58). Livestock Owners wildlife conflicts (LOWC) in the conservancy posed a continuous burden on society, particularly women who work in farm and/or collect natural resources. For many women, the threat of LOWC translated into ongoing fears about livelihood security, concerns about feeding family members, worries about physical safety, and frustrations over lost investments. For livestock owners who sustained crop damage or lose family members, impacts and recovery could be long term. But even women who were not directly impacted by LOWC may pay a high emotional toll because of fear, anxiety, and uncertainty.

4.3.3 INSTITUTIONAL VULNERABILITY:

Institutional vulnerability marked the threat posed by the two indicators namely financial and physical assets. This sub dimension was found to be least efficient among all dimensions, if Institutional vulnerability were considered and remedial measures to be taken to find the livelihood vulnerability. Physical assets is comprised of basic infrastructure (water, sanitation, energy, transport, communications, housing), and tools and technology (tools and equipment for production) Emmanue *et al*. (2002). The opportunity costs associated with poor infrastructure can have negative impacts on levels of education, access to income generation activities, health services and market places (DFID, 1999). The components of infrastructure that are considered for this study include

livestock, shelter, access to information (communication) and food loss and tools and equipment in farming. Physical assets mean value was 6.23.

Financial assets are the financial resources people use to achieve their livelihood objectives. It includes two types of resources, available stocks and regular inflow of money (Venkateswarlu, 2014). Saving cash, bank deposits or liquid assets represents available stocks whereas remittances, pension or other government support represents the regular inflow of money. Credit is also considered a type of financial capital (Majale, 2001). Financial assets is considered one of the most important types of assets but it is also the asset that tends to be the least available to the poor (DFID, 1999). Information collected in this study to analyze the financial capital were saving, average family income, occupation, employment opportunities, crop loss due to wild animals, remittances received, compensation for loss/ damage of crops and livestock, credit facilities etc. It was found that financial asset was less vulnerable (6.23) as compared to physical asset (6.32).

Table-4.28: Livelihood Vulnerability Index (LVI) for Livestock Owners

ri	**Ri**	Biophysical vulnerability		Social vulnerability	Institutional vulnerability		∑	**P**	**C**
		Human Assets	Natural Assets	Social Assets	Financial Assets	Physical Assets			
1	1	6	5	8	6	4	31	90.00	8
2	2	7	5	7	4	8	31	70.00	7
3	3	8	7	4	7	7	31	50.00	6
4	4	3	4	7	5	6	31	30.00	6
5	5	7	10	5	9	6	31	10.00	5
∑f		31	31	31	31	31	155	250	32
∑fC		198	191	204	193	196	982		
Mc or Rj or Rc		6.39	6.16	6.58	6.23	6.32	31.68	M= 6.34 σ= 0.15 Standard error for Mc=0.03	

ri = Correct rank order, Ri = Reverse rank order, ∑ = Sum, *p*= Proportion, C = C values of respective ranks, Mc = Mean value, Rj = Response value, Rc = Scale Value, σ = Standard Deviation, Standard Error=σ/√N=0.15/31=0.15/5.57=0.03

Table: 4.29 Relevancy Weightage and Mean Relevancy Score of Selected statements with Respective Indicators of Livelihood Vulnerability Index for livestock owners.

Dimensions	Sub dimension	Indicators	R weightage	MRS
Biophysical Vulnerability	Human Assets	Age of head of household	0.90	2.71
		Diverse conflict mitigation skill	0.89	2.68
		Awareness regarding conflict mitigation	0.87	2.61
		Traditional knowledge	0.91	2.74
		Training received	0.80	2.39
		Working manpower in family	0.76	2.29
		Hired man force	0.88	2.65
		Injury to human by wild animals	0.78	2.35
	Natural resources Assets	Crop cultivated area	0.84	2.52
		Land holding	0.80	2.39
		Crop yield	0.87	2.61
		Herd size	0.86	2.58
		Per cent of households that utilize natural water source	0.77	2.32
		Crop diversification	0.88	2.65
		Water availability for crop	0.89	2.68
		Average ground water level	0.76	2.29
		Farm diversification	0.91	2.74
		Natural hazards	0.88	2.65
		Firewood	0.87	2.61
Social Vulnerability	Social Assets	Family size	0.80	2.39
		Membership of SHGs	0.77	2.32
		Legal penalties by Government	0.81	2.42
		Culture and taboo	0.85	2.55
		Social migration due to conflict	0.86	2.58
		Membership of Cooperatives	0.77	2.32
		Forest rules and regulation	0.87	2.61
		Role of social leader in conflict management	0.82	2.45
		Socio-political participation	0.86	2.58
		Festivals and religious activity	0.77	2.32
Institutional Vulnerability	Financial Assets	Saving form Agricultural activity	0.81	2.42
		Average Family Income	0.85	2.55
		Occupation	0.84	2.52
		Off-farm employment opportunities	0.86	2.58
		Crop loss due to wild animals (Area)	0.89	2.68
		Crop loss due to wild animals (INR)	0.94	2.81
		Remittances	0.88	2.65
		Compensation for loss/ damage	0.89	2.68
		Government supported mitigation	0.86	2.58
		Per cent of household access credit facilities	0.83	2.48
		Major source of family income	0.88	2.65
		Livestock	0.91	2.74

	Physical Assets	Household that experience damage to infrastructure	0.90	2.71
		Shelter	0.87	2.61
		Access to information	0.83	2.61
		Tools and equipment in farming	0.83	2.48
		Food loss or shortage causes hunger	0.89	2.68

4.3.4 Livelihood Vulnerability Index value with Index value

Table 4.30 revealed that among biophysical vulnerability; human assets were more vulnerable to livelihood with index value (0.34) followed by natural assets. Human assets were more vulnerable in the study area because low literacy, low level of training among the respondents, lack of training institution in the research area while natural assets were less vulnerable because most of area were notified and protected by government to conserved and less interference by local communities. The same table also showed that social assets were more vulnerable with index value 0.39. Social vulnerability was high because small family size, very few farmers were members of SHGs, high and complicated culture and taboo, social migration due to conflict, very few respondents were members of cooperatives, low leadership quality among the respondents in conflict management. For improving the livelihood and reducing the social vulnerability government and state agency must focus to increase the SHGs and Cooperative as well membership in these social institutions. In institutional vulnerability, financial assets were more vulnerable with index value (0.31) followed by physical assets (0.27). Financial assets were more vulnerable due to raiding of crop and livestock depredation by wild animals, more dependents on agricultural, less or no compensation for loss/ damage by government. For improving the livelihood status in the study area government must provide remunerative price of compensation and government support mitigation strategies must be improve or implement.

Table-4.30: Livelihood Vulnerability Index value of livestock owners (n=200)

Livelihood Vulnerability Index for Livestock Owners		
Dimensions	Sub dimensions	Index Value
Biophysical Vulnerability (32.00 %)	Human Assets	0.34
	Natural Assets	0.25
Social Vulnerability (39.00 %)	Social Assets	0.39
Institutional Vulnerability (29.00%)	Financial Assets	0.31
	Physical Assets	0.27
Livelihood Vulnerability Index for Livestock Owners by Forest official		
Dimensions	Sub dimensions	Index Value
Biophysical Vulnerability (41.00%)	Human Assets	0.44
	Natural Assets	0.38
Social Vulnerability (31.00%)	Social Assets	0.31
Institutional Vulnerability (28.00%	Financial Assets	0.33
	Physical Assets	0.23

4.3.5 Livelihood Vulnerability Index (LVI) regarding vulnerability of livestock owner's livelihood

The Table 4.31 showed that 7.00 per cent respondents had very low level of livelihood vulnerability scale continuum (< 0.32 score) followed by low level livelihood vulnerability scale continuum with level of LVI score of 0.32 – 0.53 with 14.00 per cent respondents. However, 24 per cent respondents had medium livelihood vulnerability with LVI score value (0.54 – 0.69). Most of the respondents (43.00 %) had high level vulnerability with vulnerability score range from 0.70 to 0.82 and 12 per cent respondents were very high vulnerable towards their livelihood with LVI value (>0.82). In the research area, farmers were mostly generating income from their farm and livestock. For improving livelihood of farmers, they must focus on multiple resources such as land, farm, forest, water, crops, livestock and knowledge for sustaining as well as improving their livelihoods. A livelihood include not only the income generating activities but also a combination of non-income activities (e.g. social institutions, intra house relation) as well that help to diversify income and meet household needs.

Table-4.31: Distribution of respondents on continuum of Livelihood Vulnerability Index (LVI) regarding vulnerability of livestock owner's livelihood (n=200)

Categories	Frequency	Per cent
Very low (<0.32)	14	7.00
Low (0.32-0.53)	28	14.00
Medium (0.54-0.69)	48	24.00
High (0.70-0.82)	86	43.00
Very high (>0.82)	24	12.00

(Continuum: 0 to 1)

4.3.6 Livelihood Vulnerability Index (LVI) regarding vulnerability of livestock owner's livelihood by forest official The Table 4.32 shows that 10.00 per cent livestock owners were very low level livelihood vulnerability with index value (<0.23) and 23.33 per cent household were low vulnerability with index value (0.23-0.45) of LVI in 0 to 1 continuum. Only 13.33 per cent respondents were very high vulnerable towards wildlife conflict with livelihood vulnerability index value (>0.78) in 0 to 1 continuum as perceived by forest official. In the research area, farmers were mostly generating income from their farm and livestock. For improving livelihood of farmers, they must focus on multiple resources such as land, farm, forest, water, crops, livestock and knowledge for sustaining as well as improving their livelihoods.

Table-4.32: Distribution of respondents on continuum of Livelihood Vulnerability Index (LVI) regarding vulnerability of livestock owner's livelihood by forest official (n=30)

Categories	Frequency	Per centage
Very low (<0.23)	3	10.00
Low (0.23-0.45)	7	23.33
Medium (0.46-0.68)	6	20.00
High (0.68-0.78)	10	33.33
Very high (>0.78)	4	13.33

(Continuum: 0 to 1)

4.3.7 Livelihood assets, strategies and Livelihood Vulnerability

The five major livelihood assets human, natural, social, financial and physical assets as described by DFID (1999) were analyzed for livelihood vulnerability index. In the study areas, it was found that 17.50 per cent of the respondents were marginal and regarding landholding based on caste/ religion, no clear distinction was found. Therefore, it can be

concluded that there was a fair and equal distribution of land size among the different caste/religion. Fairly good access to services such as clinic for human health and infrastructures as roads were found in study area while education, market place for family members and health service for animals was found very poorly and dissatisfactory. Overall, it can be concluded that availability and access to the physical capitals was bound to have a positive influence on the sustainability of livelihood but for long term must focus on education, health service and market facilities. Lack of these often leads to opportunity costs or trade-offs precluding education, access to health services and income generation activities (Upadhyay, 2013). At the same time, financial service such as loans were found to be widespread. The inhabitants in the surrounding of KNP used different sources for credit activities. A large number of the households still depended on the informal sources of loan such as villagers and moneylenders. Only very few respondents reported that they got loan from formal financial sources such as bank and cooperatives societies. Nevertheless, these types of credit or loan facilities represent one of the diverse livelihoods among the people. Education and training not only helped people with diversifying their income and livelihood but also in disseminating innovative technique and build capacity to increase public understanding concerning LOWC and untimely resolve or prevent such conflicts (Ahuja *et al*., 2008). Lack of education and training in farmers in general and among women in particular implies vulnerability in terms of both achieving sustainable livelihood and mitigating wildlife damages. Cash crops and cereals were the most common type of crop grown in the vicinity of parks. Some of the common crops that grown in these areas were paddy, maize, wheat (food crops), sugarcane, vegetables, oilseeds (cash crops) and poplar plants. The average livestock units (LSU) were found to be 5.03. Cow, buffalo and goat were the main animals reared by the respondents as important source of income and nutritional supplements to the respondents. The average household income per year were found to be Rs.148660/annum. Assets, activity and income diversification lie at the heart of livelihood strategies. Lack of alternative to these may intensify the potential consequences of resources destruction by wildlife (Dickman, 2010). Hence these alternatives were key part of coping strategies in reducing vulnerability (Naughton-Treves and Treves, 2005). Agriculture was the main source of livelihood in the study areas. Some other main occupation in the study areas were services, business and daily wages labor. Business, livestock products and remittance were found to be the three major sources of incomes. High level of income from business and remittance and the proximity to urban areas and engagement in off-

farm activities can create opportunities for income diversification (Barrett *et al.*, 2001). The diversified household incomes not only changes and improves the livelihood conditions but also plays a positive role in dealing with vulnerability from wildlife damages. But the inequality in income and wealth distribution poses a great challenge in achieving equality and justice that are often integral part of conservation goals. Additionally, the dependence of majority of respondents on agriculture for income and food is a source of vulnerability in obtaining a sustainable livelihood. This is particularly true for poor as the impacts of wildlife damages are two folds for them. Damage to crops reduces the food supply and also the option for earning cash by selling surplus harvest. Loss of livestock to wildlife also represents the same situation. Alternative livelihood strategies, as a shift away from agriculture based livelihood towards wildlife tourism, can be a solution in dealing with conflicts related to wildlife damages (Sitati *et al*., 2005). However, these alternative livelihoods may not always be available particularly in developing countries (Parker and Osborn, 2006). Hence it was important to explore feasibility of these alternative livelihood strategies in dealing with conflict mitigation and this study recommends future research.

4.4 THE PERCEPTION OF LIVESTOCK OWNERS TOWARDS WILDLIFE CONFLICT.

To a great extent, the ultimate decision to adopt particular mitigation methods depends on the farmer's perception towards the wildlife conflict. Rahman (2003) and Wei *et al.* (2007) opined that farmers' perception was important as a guide to farmers' decision making and was a good reflection of the basis for farmer's adoption behavior. Table 4.33 shows 43.00 per cent respondents were strongly perceived that crop raiding, livestock depredation, killing of pet animals, household items destroyed by wildlife were the reasons for livestock owners-wildlife conflict whereas 24.00 per cent respondents were only agree with above condition while only 10.00 per cent respondents were perceived strongly disagree.

Nearly half (46.00%) of the respondents strongly perceived that carnivore animals were threat to livestock and people near national park while 12.50 per cent respondents strongly disagree with above statement. There may be chance of spreading zoonotic diseases due to Wild animals in the vicinity of park were perceived by 48.00 per cent respondents and 35.00 per cent respondents perceived that wildlife have as much right to exist on protected areas land as human.

Table 4.33 Mean score of perception of respondents towards wildlife

(n=200)

S.N.	Statement	SA	A	UD	D	SD
1	Crop raiding, livestock depredation, killing of pet animals, household items destroyed by wildlife are the reasons for Livestock Owners-Wildlife Conflict	43.00	24.00	10.50	12.50	10.00
2	Carnivore animals are threat to livestock and people near National Park	46.00	23.50	04.00	14.00	12.50
3	The protection of wild animal is important for ecological balance	41.50	38.00	16.00	04.50	0.00
4	In the vicinity of National Park farmers fear to work in their field during odd hours due to wild animal.	33.00	28.50	07.50	19.50	11.50
5*	There may be chance of spreading zoonotic diseases due to Wild animals	48.00	29.50	10.00	12.00	0.50
6*	Wildlife have as much right to exist on protected areas land as we have	35.00	16.00	22.50	23.00	3.50
7	Restriction of farming in the vicinity of the National park can reduce Livestock Owners- Wildlife Conflict	17.00	08.00	13.00	34.50	27.50
8	Livestock owners felt more risk from wildlife than non-livestock owners	19.50	12.50	15.00	36.00	17.00
9	Current laws are sufficient to protect wildlife and fauna of NP	30.00	27.50	10.50	30.00	02.00
10	Fuel woods from National Park is important source of energy for local communities	12.00	15.50	19.50	36.00	17.00
11	Promotion of Livestock insurance scheme may reduce the Livestock Owners- Wildlife conflict	34.50	25.50	18.00	21.00	01.00
12	Proper Fencing around the National Park may reduce the Livestock Owners- Wildlife conflict	38.00	24.00	16.00	22.00	0.00
	Overall mean score	33.17	22.67	13.54	22.08	8.54

*Negative Statement,
SA= Strongly Agree A= Agree UD=Undecided D=Disagree SDA=Strongly Disagree

The overall mean score of perception of respondents is presented in figure 4.2, and revealed that mean score value (33.17) of respondents were strongly agree that they were risk of wild animals conflict in the vicinity of park and the score value (8.54) perceived that they are strongly disagree that livestock owners wildlife conflict exists in the vicinity of park.

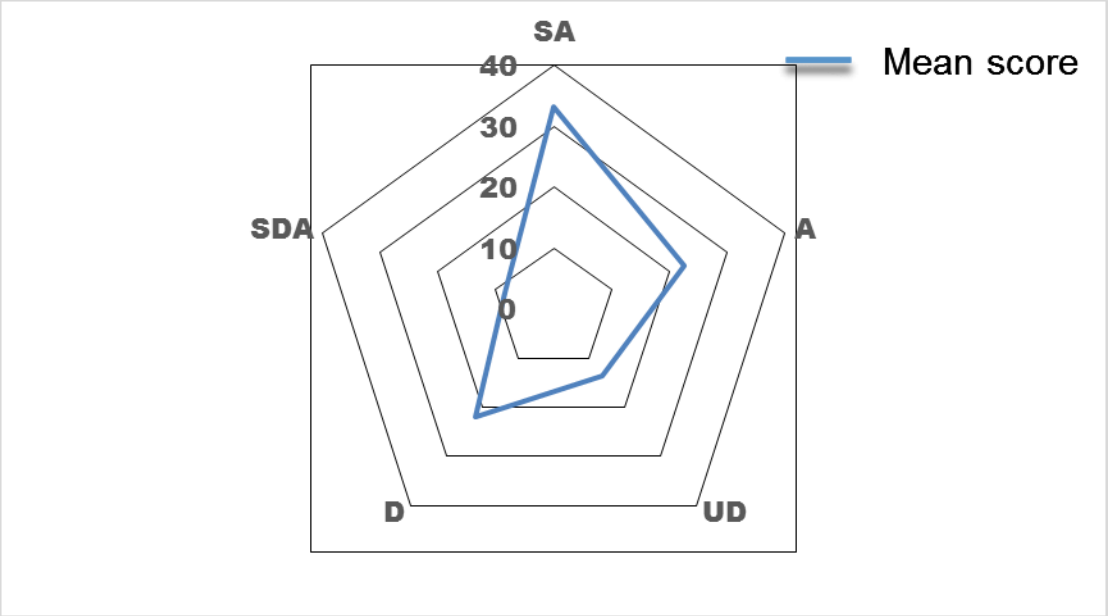


Fig. 4.2 Overall mean score of respondents' perception towards wildlife conflict

Table 4.34 indicates that approximately half (48.00 %) of the respondents had perceived medium level of conflict with wild animals in the vicinity of national park whereas more than one- third (33.50) respondents perceived that low level of conflict with wild animals near the locality of protected area followed by high level conflict (18.50 %) in the study area. It was concluded that more than half (66.50 %) of the respondents had perceived medium to high level of conflict with wild animal.

Table- 4.34: Distribution of farmers according to perception towards wildlife (n=200)

Perception	Frequency	Per centage
Low (<3.37)	67	33.50
Medium (3.37-3.78)	96	48.00
High (>3.78)	37	18.50
Total	200	100

4.4.1 Livestock owners' Overall level of perception towards wildlife conflict

The finding depicted in Table 4.35 indicates that 83.13 per cent of respondents perceived that the protection of wild animal was important for ecological balance followed by 82.70 per cent farmers perceived that there may be chance of spreading zoonotic diseases due to Wild animals in the vicinity of national park. Whereas 50.00 per cent of respondents perceived that restriction of farming in the vicinity of the National park can reduce Livestock Owners-Wildlife Conflict (LOWC). Other statements about perceptions indicated in table 4.35.

Table-4.35: Overall level of perception towards Livestock owners' wildlife conflict

S.N.	Statement	Overall level of perception
1	Crop raiding, livestock depredation, killing of pet animals, household items destroyed by wildlife are the reasons for Livestock Owners- Wildlife Conflict	75.22
2	Carnivore animals are threat to livestock and people near National Park	75.12
3	The protection of wild animal is important for ecological balance	83.13
4	In the vicinity of National Park farmers fear to work in their field during odd hours due to wild animal.	70.45
5	There may be chance of spreading zoonotic diseases due to Wild animals	82.70
6	Wildlife have as much right to exist on protected areas land as we have	71.44
7	Restriction of farming in the vicinity of the National park can reduce Livestock Owners- Wildlife Conflict	50.95
8	Livestock owners felt more risk from wildlife than non-livestock owners	56.82
9	Current laws are sufficient to protect wildlife and fauna of NP	71.24
10	Fuel woods from National Park is important source of energy for local communities	54.63
11	Promotion of Livestock insurance scheme may reduce the Livestock Owners- Wildlife conflict	75.02
12	Proper Fencing around the National Park may reduce the Livestock Owners- Wildlife conflict	76.42
Overall mean score		70.26

4.5 THE TOLERANCE LEVEL OF LIVESTOCK OWNERS TOWARDS WILDLIFE CONFLICT

The concept of "tolerance" for a species or population has been explored in several studies focused on people's attitudes toward carnivore populations and preferences regarding carnivore management (Naughton-Treves, Grossberg, and Treves, 2003; Naughton Treves L, 1998).

Large animal depredation losses may create such levels of anger towards leopards, wolves and other large predators that local communities lose any tolerance and view predator extermination as the only solution to the conflict (Dickman, 2009).

Table-4.36: Mean score level of tolerance of respondents

(n=200)

S.N.	Statements	HT	MT	UD	Lo T	LeT
1	I believe that farmers having more land have high tolerance towards wildlife	27.00	20.50	21.50	30.50	0.50
2	I feel that farmers who have adopted crop insurance have more tolerance to wild animals	43.50	24.00	22.50	10.00	0.00
3	I feel that farmers who have adopted livestock insurance have more tolerance to wild animals harm	48.50	23.50	17.50	9.50	1.00
4	The farmers having alternate sources of income are more tolerant than other farmers	36.00	26.00	21.00	16.50	0.50
5*	Livestock depredation by wild animals create high intolerance among farmers	0.00	2.00	20.00	43.00	35.00
6*	Farmers feel intolerable especially to large, highly symbolic animals	0.00	1.50	10.00	51.50	37.00
7	Farmer tolerate the ordinary safety hazards associated with some wildlife	20.50	12.00	22.50	40.50	4.50
8	I believe that surety of compensation increase the tolerance towards wildlife menace	36.00	22.00	20.50	21.50	0.00
9	Social benefits/beliefs about the value of wildlife and appreciation of its existence improve the tolerance among farmers	4.50	21.00	23.00	39.00	12.50
10	In my view tolerance was linked to guarding and watching services	30.50	15.00	20.50	27.50	6.50
Overall mean score		24.65	16.75	19.90	28.95	9.75

*Negative Statement,
HT- High Tolerance; MT= Mild Tolerance-UD- Undecided; LoT- Low Tolerance ; LeT= Least Tolerance

Table 4.36 revealed that the farmers who had adopted crop insurance (43.50 %) were more tolerance than other farmers whereas 48.50 per cent farmers who adopted livestock insurance were more tolerable. 30.50 per cent respondents view tolerance were linked to guarding and watching the crop field and livestock while Farmers feel intolerable especially to large, highly symbolic animals reported by 51.50 per cent respondent causes fear and low tolerance against wild animals especially carnivores. Table 4.36 also showed that overall tolerance among respondents were low tolerance towards wild animals conflict.

The overall mean score of tolerance among respondents is presented in figure 4.3 revealed that mean score value with (24.65) of respondents were strongly agree that they are tolerable to wild animals conflict in the vicinity of park and the score value with (9.75) belief that they were strongly disagree that livestock owners wildlife conflict exists in the vicinity of park.

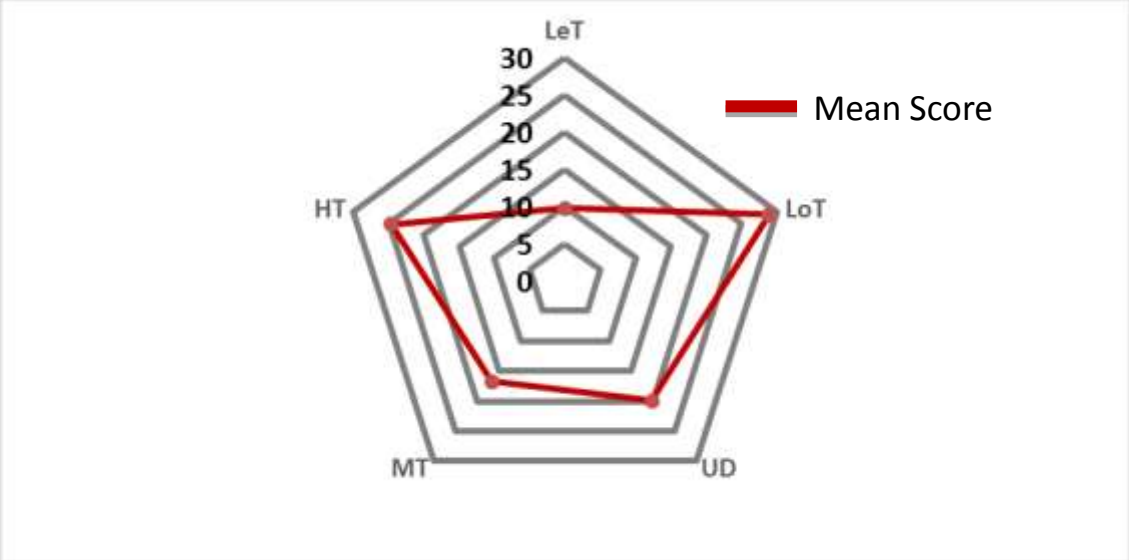


Fig. 4.3 Mean score level of tolerance of respondents towards wildlife

The result presented in Table 4.37 indicated that majority (65.00%) of the respondents fall in medium level (2.97-3.65) of tolerance towards livestock owners' wildlife conflict (LOWC). Whereas, only 10 per cent respondents had high level of tolerance and 25 per cent possess low level of tolerance towards wildlife conflict. The finding was supported by the study of Senthilkumar *et al.* (2016) from buffer zone of Tamil Nadu as the majority (61.70%) of the farmers had medium level of tolerance towards human-wildlife conflict (HWC). It can be interpreted from the findings that majority of the farmers fall in medium categories of tolerance which need to be more awareness about importance of

wildlife, surety of compensation and it was easy process and agriculture/ livestock insurance scheme. The developmental agencies should make plan for awareness campaigns and capacity building of farming community for their active participation in wildlife conservation.

Table-4.37: Distribution of livestock owners according to level of tolerance toward wildlife conflict (n=200)

Categories	Frequency	Per centage
Low(<2.97)	50	25.00
Medium(2.97-3.65)	130	65.00
High(>3.65)	20	10.00
Total	200	100

4.5.1 Livestock owners' Overall level of tolerance towards wildlife conflict

According to Dublin and Hoare (2004), conflict causes due to combination of crop damage and complex social dimension while conflicts can be mitigated by educating the local people, with special reference to marginal farmers. Wildlife laws, attitude of local people, habitat recovery and conservation efforts are the main factors to reduce the human-wildlife conflict in many areas (Mech, 1995; Breitenmoser, 1998 and Naughton-Treves *et al.,* 2003). The obtained results depicted in Table 4.38 indicated that respondents have high level of tolerance who have adopted livestock insurance with overall level of tolerance (81.7) and those respondents who adopted crop insurance whose overall level of tolerance was (80.0) and highly tolerable to wildlife conflicts followed by the farmers having alternate sources of income are more tolerant than other farmers who had no alternative source of income. Livestock depredations by wild animals created high intolerance among farmers with rise in overall level of tolerance (38.1). Second most intolerable condition among the respondents of study area was social benefits/beliefs about the value of wildlife and appreciations of its existence to improve the tolerance among farmers.

Table-4.38: Overall level of tolerance towards Livestock owners' wildlife conflict

S.N.	Statements	Overall level of tolerance
1	I believe that farmers having more land have high tolerance towards wildlife	68.40
2	I feel that farmers who have adopted crop insurance have more tolerance to wild animals	80.00
3	I feel that farmers who have adopted livestock insurance have more tolerance to wild animals harm	81.70
4	The farmers having alternate sources of income are more tolerant than other farmers	76.10
5	Livestock depredation by wild animals create high intolerance among farmers	38.10
6	Farmers feel intolerable especially to large, highly symbolic animals	60.00
7	Farmer tolerate the ordinary safety hazards associated with some wildlife	61.10
8	I believe that surety of compensation increase the tolerance towards wildlife menace	74.90
9	Social benefits/beliefs about the value of wildlife and appreciation of its existence improve the tolerance among farmers	53.80
10	In my view tolerance was linked to guarding and watching services	67.80
Overall mean score		66.19

4.6 PERCEIVED FEEDBACK OF RESPONDENTS ABOUT THE MITIGATION STRATEGIES

For the purpose of prioritizing the mitigation strategies, Garret ranking had been used. After calculating the per cent position of ranks of the already identified mitigation strategies, transmutation of orders of merit was done following Garret (1926). The final ranking of the feedback in order to fix their relative priority was done on the basis of their mean scores. Mitigation strategies adopted by the respondents ranging from simple, traditional to modern, expensive technologies implemented by state agencies related to wildlife conflict were assessed and discussed in details and the result have been concluded in the Table 4.39.

Table-4.39: Prospects of Mitigation Strategies as perceived by the respondents. (n=200)

S.N.	Mitigation strategies	Mean score	Rank
1.	Guarding of crop field and livestock	93.12	I
2.	Physical barriers (Fences, Walls and Ditches)	82.29	II
3.	Use of Crackers	74.79	III
4.	Making Noise (Acoustic) or Sound	66.23	IV
5.	Burning of chilli powder	65.51	V
6.	Changing crops to those less palatable	56.18	VI
7.	Compensation by government	51.23	VII
8.	Insurance	49.38	VIII

As par Table 4.39, guarding of livestock at the time of grazing and farm field when cropped/planted were most important mitigation strategies adopted by the farmers with mean score value of 93.12 followed by physical barriers like fencing of farm field as well as livestock yard, uses of brick or mud wall for protecting livestock or ditches with 82.29 mean score value. Some farmer in the study area also uses horny plants (e.g. cactus, agave) and trees planted in a close (sometimes triangular) pattern as fence to protect crop fields and livestock. Compensation by government and insurance of crop and livestock were also important mitigation strategies followed by respondents in the study area with mean score value 51.23 and 49.38, respectively. Same table also revealed that (mean score 66.23) making noise (mean score 66.23) like banging on metal, thunder-flashes, fire-arms, cracking whips, trip-wire alarms, recorded sounds (e.g. African honey-bees, elephant distress calls, infrasound) were used by some of the respondents in the study area. The above findings were aligned with (Upadhyay, 2013). So there is an urgent need to reduce the negative economic impacts of livestock predation through livestock management procedures by following different mitigation strategies that reduce depredation and to offset losses through insurance, compensation or other incentive schemes.

Table-4.40: Prospects of Mitigation Strategies as perceived by the forest official (n=30)

S.N.	Mitigation strategies	Mean score	Rank
1.	Guarding of crop field and livestock	86.29	I
2.	Park Boundary	80.52	II
3.	Electric fencing	79.81	III
4.	Compensation	65.22	IV
5.	Community based livestock and crop insurance Scheme	64.52	V
6.	Livestock shed improvement	62.00	VI
7.	Conservation education programs	59.80	VII
8.	Avoid illegal grazing in the Protected Areas	58.66	VIII
9.	Resettle farmers from conflicts hotspots to new areas	55.46	IX
10.	Generate information or to educate to lessen LOWC	53.74	X
11.	Alternative Unpalatable crops	49.83	XI

The finding in Table 4.40 revealed that guarding of livestock and crop field were most important mitigation strategies suggested by the forest official with mean score value of 86.29 followed by park boundary with 80.52 mean score value reported by the forest official. Electric fencing and compensation of crop and livestock were also important mitigation strategies suggested by forest official in the study area with mean score value 79.81 and 65.22, respectively. Community based livestock and crop insurance scheme were alternative mitigation strategies perceived by official. This finding of the present study are aligned with the earlier studies (Hussain 2003, Mishra *et al*. 2003, Jackson and Wangchuk 2004; Jackson *et al.,* 1996). Observed community based conservation/incentive schemes had been relatively successful in a few places in establishing a locally managed system for monetary compensation and insurance for those herders losing livestock. Unpalatable crops like chilies, sesame, tobacco, citrus, neem, and poplar were found to impede or discourage the passage of blue bull (Rojh) and monkey.

4.6.1 The Effective Mitigation Method Applied to Alleviate Damage or Repel Animals as perceived by the farmers

Despite the widespread application of measures namely making noise, chasing with fire, dog releasing, stone and dust throwing, they were not considered to be effective in mitigating HWC by the people in long run. But the effectiveness of all these methods was found to be good during initial application as wild animals were unaware of new methods

in the field. But after certain time of application, they were common to escape such despite the use of these methods. The Table 4.41 revealed that making noise (Acoustic) or sound was most effective mitigation method applied by respondents to alleviate damage or repel animals with weighted mean 60.80 per cent.

Table-4.41: The Effective Mitigation Method Applied to Alleviate Damage or Repel Animals perceived by farmers

Mitigation method	Very good	Good	Fair	Low	Very low	Weighted mean (%)
Guarding of livestock and crop fields	15.50	20.00	21.50	23.00	20.00	57.60
Park boundary	19.50	21.00	18.50	19.00	22.00	59.40
Physical barriers	20.00	16.50	18.50	22.50	22.50	57.80
Use of Crackers	18.00	24.00	18.50	19.00	20.50	60.00
Making Noise (Acoustic) or Sound	19.00	19.50	26.00	17.50	18.00	60.80

The Table 4.42 revealed that Community based livestock and crop insurance Scheme were most effective mitigation method suggested by forest official to the farmers with weighted mean 68.87 per cent followed by guarding of livestock at the time of grazing and crop field (weighted mean 63.23). Park boundary was third most important effective mitigation method applied to alleviate damage or repel animals perceived by forest official with weighted mean value 60.65.

Table-4.42: The Effective Mitigation Method Applied to Alleviate Damage or Repel Animals perceived by forest official

Mitigation Method	Very good	Good	Fair	Low	Very low	weighted mean
Guarding of livestock and crop field	23.33	26.67	13.33	23.33	13.33	63.23
Park boundary	26.67	10.00	20.00	30.00	13.33	60.65
Electric fencing	13.33	23.33	16.67	33.33	13.33	58.06
Compensation	16.67	16.67	26.67	13.33	26.67	57.42
Community based livestock and crop insurance Scheme	20.00	30.00	13.33	16.67	88.89	68.87

4.6.2 Effective Mechanisms in curbing encroachment in the Park

Encroachment defined as the unlawful, unauthorized, or unpermitted use of the property of another. An encroachment was often thought of as a structure, such as a fence or part of a building, but an unauthorized use, such as parking, a storage area or garden, may also be considered an encroachment. The table 4.43 shows that boundary of park was very

effective method (39.50 %) to control encroachment with highest weighted mean (71.62 %) by farmers while forest official give more emphasis on arrest by law (90.00 %) to control encroachment with overall weighted mean 98.33 per cent in the table 4.43 whereas farmers consider enforcement of forest law was fairly effective (32.50 %).

Table-4.43: Effective mechanisms in curbing encroachment in the park as suggested by the farmers (n=200)

Effective mechanisms	Very effective	Effective	Fairly effective	Not effective	Weighted mean (%)
Park boundary	39.50	19.50	27.00	13.50	71.62
Enforcement of forest law	23.00	26.50	32.50	16.50	65.12
Fines	10.50	13.00	36.00	40.50	48.37
fences	17.50	14.00	31.00	37.00	53.38
Awareness campaign	17.50	19.50	30.50	32.50	55.51

Not all of the respondents complained to any agency on crop loss or animals' loss by the wildlife. They did not get any sort of compensation and support (Monetary and Physical) from any governmental authority's body. They were unknown about who should provide the compensation on crop loss, livestock loss and human injury.

Table-4.44: Effective mechanisms in curbing encroachment in the park as suggested by the forest officials (n=200)

Effective Mechanisms	Very effective	Effective	Fairly effective	Not effective	Weighted mean (%)
Park boundary	90.00	10.00	0.00	0.00	97.50
Enforcement of forest law	93.33	6.67	0.00	0.00	98.33
Fines	0.00	3.33	96.67	0.00	50.83
fences	20.00	80.00	0.00	0.00	80.00
Awareness campaign	83.33	13.33	0.00	0.00	94.17

The above finding in Table 4.44 revealed that enforcement of forest law was most Effective mechanisms in curbing encroachment in the park as suggested by the forest officials with weighted mean 98.33 per cent whereas park boundary was second most important effective mechanisms(weighted mean 97.50 %)

SUMMARY

&

CONCLUSION

"The end justifies the meaning…"

5. SUMMARY AND CONCLUSION

The Indian economy is predominantly rural and agrarian in nature. Indian agriculture has responsibility of providing food security to millions of people. Among agricultural sectors, livestock sector contribute to the livelihoods with an estimation of 70 per cent of the rural poor by providing a small but steady stream of food and income, raising whole farm productivity, increasing assets and diversifying risks. Rearing different species of livestock like Cattle, Buffalo, Goat, Sheep and Horse in different agro climatic conditions. Livestock provides local people in isolated areas with milk, meat and wool. Marginal and small farmers constitute more than 84 per cent of the 115 million operational holdings, which are cultivating only 29.00 per cent of the arable land. The livelihood of the small and marginal household families are the major concern. The small landholders are better contributors to the total production (78.00%) but generally are weak in terms of generating adequate income and sustaining their own livelihood. The declining trend in size of land holding poses a serious challenge to the sustainability and profitability of farming. In country like India, human–wildlife conflict is a contentious and a common issue among conservation initiatives, authorities, personnel, and local communities. Human-Wildlife Conflict (HWC) is defined as any interaction between wildlife and humans which causes harm, whether it is to the human, the wild animal, or property. These conflicts may result when wildlife damage crops, injure or kill domestic animals, threaten or kill people" (Distefano, 2005). Human-wildlife conflict is fast becoming a critical threat for the survival of many endangered species, like wild buffalo, deer, elephants, tiger, lion, leopard etc. and such conflicts affect not only its own population but also has broadened the environmental impacts on the ecosystem equilibrium and conservation of biodiversity. Wildlife-human conflicts are a serious obstacle to wildlife conservation and the livelihoods of people worldwide and are becoming more prevalent as human population increases, development expands, and global climate changes and other human and environmental factors put people and wildlife in greater direct competition for a shrinking resource base. Conflicts between wildlife and humans cost many lives, both human and wildlife, apart from threatening livelihoods through loss of crops and livestock depredation which jeopardize long-term conservation goals such as securing protected areas and building constituencies in support of biodiversity conservation. Keeping these issues in mind the present study "**Assessment**

of Livestock Owners - Wildlife Conflict in the Vicinity of National Park" was planned to estimate the losses of crops and livestock, assess the vulnerability of livestock owners livelihood, the perception and tolerance of livestock owners and diverse mitigation strategies adopted by farmers to reduce the impact of wildlife conflict on the livelihood. The present study was formulated with the following specific objectives:

1. To estimate the losses of crops and livestock due to livestock owners - wildlife conflict.
2. To assess the vulnerability of livestock owners livelihood due to wildlife.
3. To measure the perception and tolerance of livestock owners towards wildlife.
4. To identify and study the effectiveness of existing strategies to mitigate the livestock owners-wildlife conflict.

5.1. RESEARCH METHODOLOGY

The present study was undertaken in the state of Haryana. There are two national parks in the state of Haryana, namely Kalesar National Park and Sultanpur National Park. From these two National Parks, Kalesar National Park was selected purposively, which is located in Yamunanangar district of Haryana. As per the forest department of Haryana, 15 villages of Yamunanagar district have boundary with Kalesar National Park. Out of these 15 Villages, ten surrounding villages within 5 Kilometres vicinity of Kalesar National Park was selected randomly by lottery method and data were collected with the help of interview schedule for the research. A list of farmers were prepared for every selected villages who were rearing the dairy animals. From the list, 20 livestock owners were selected by applying suitable random sampling. Thus, 200 livestock owners (20 from each selected village) were interviewed to get first-hand information on livestock owners' wildlife conflict. Apart from livestock owners from the surrounding villages of Kalesar National Park, 30 forest officials were also selected randomly. Thus total 230 respondents were interviewed for present study. The data was collected through using PRA techniques such as Village Resources Map, Transect Walks, Seasonal calendars and semi- structured interview schedule. The collected data were scored, compiled, tabulated and subjected to the appropriate statistical tools to draw meaningful conclusions.

5.2. SALIENT FINDINGS OF THE STUDY

5.2.1 The socio-personal and socio-economic profile

1) The study revealed that majority (54.00 %) of the respondents belonged to middle age group, and 80.00 per cent of the respondents were male, about 76 per cent had nuclear family type while 44.50 per cent respondents were having small family size (less than 5).
2) Education among respondents were found to be low with the majority (58.50 %) of respondents were educated up to primary level whereas 43.00 per cent respondents had low level family education status.
3) It was seen that 44.50 per cent farmers engaged in agriculture along with dairy as a main occupation and cent per cent of the respondents had their own land out of which 45.50 per cent of the respondents were in small land holding. About 49.00 per cent of the respondents, have medium annual income with average income Rs.148660/annum.
4) The average herd size in the study area was 5.00 (standard livestock unit) animals per household, buffalo was the preferred dairy animal, and 42.50 per cent of the farmers were found under medium category (18-28 years) of experience in dairying.
5) It was seen that 43.00 per cent of respondents were having more than 200 per cent cropping intensity that was good sign for the farmer's economy and prosperity vis-à-vis majority (81.00%) of respondents uses herder/ Gwala for grazing the livestock.
6) The average milk production were found to be 6.89 litre/day and 49.00 per cent of the household produces less than 5 litre milk per day whereas the 43.00 per cent household not selling their milk in the market.
7) The majority (73.50%) of the respondents reported that livestock population in the study area were decreasing after creation of national park as well as 71.00 per cent of the respondents told that there was no change in source of income and employment after creation of park.
8) The study of social participation revealed that 52.50 per cent respondents having low social participation and 42.00 per cent were under medium category of extension contact while in case of mass media exposure more than three fifth of the overall respondents (62.50 %) had greater mass media exposure.
9) It was seen that about 29.50 per cent of the respondents collected fodder for their livestock from their own farm.

5.2.2 Status of Crops Losses, Livestock depredation and Human Causalities due Conflict

1) The study revealed that 82.00 per cent respondents reported that their wheat fields were raided by wild animals and loss causes mainly by wild boar and blue bull to an area of 0.17 acre of crop field and resulted in the loss of INR 2295.60 /hh. Further, the study also revealed that 67.50 per cent households have lost their maize crop due to wild species like monkey and blue bull (Rojh) and resulted in the loss of INR 1715.72.
2) In case of cash crop majority (56.50%) respondent reported that their sugarcane crop was raided by blue bull, Rhesus macaque and elephant whereas poplar plantation was attributed to monkey who had raided 0.07 acre/hh and destroyed an estimated INR 7522.80/hh and further Eucalyptus (Eucalyptus obliqua) crop caused monetary loss of INR 8213.75/hh.
3) The results showed that only, 5 (2.50 %) families reported loss of goats in night to (INR 28500 in last three years) by unknown wild animals while just 1 (0.50 %) family reported loss of cows (INR 34000 in last three years) and 1 respondents reported loss of buffalo of INR 42000. The killed livestock were reported to belong to different age group that is more than 5 years old.
4) Most of the respondents encountered with wild animals like monkey, blue bull and wild boar. Majority of the respondents encountered with more than one wild animal. But, there were no such official record of human casualties.

   It was also revealed that in last 3 years only 48 persons were injured by wild animals.In that particular case, monkey attacked the victim near the agriculture field. Injury among the human causes loss of INR 9500.19/person.

5.2.3 Livelihood Vulnerability of livestock owners

1) Biophysical vulnerability describe the both the human assets and natural assets. The index value of human assets was found to be 0.34 and the index value for natural assets of the respondents 0.25. The results revealed that the vulnerability was found to be maximum in case of human assets (0.34) as compared to natural assets (0.25) which was based on the different dimensions on 0 to 1 point continuum. Thus posing a serious threat if the vulnerability of the human assets could not be relaxed at any

cost and on priority basis. The natural asset was found to be flexible in terms of attempts required to freeze the vulnerability.

2) Social vulnerability represents an attempt to understand the social conditions that transform a natural hazard. It was evident from the value of indicator (0.39) which expresses that it ought to be as the most critical indicator in terms of the vulnerability among livestock dependents.
3) Institutional vulnerability marked the threat posed by the two indicators namely financial and physical assets. It was found that financial asset were more vulnerable (0.31) as compared to physical assets (0.27) while keeping them on the 0 to 1 point continuum of the livelihood vulnerability index.
4) Most of the respondents (43.00 %) had high level vulnerability with vulnerability score range from 0.70 to 0.82 and 12 per cent respondents were very high vulnerable towards their livelihood with LVI value (>0.82) as assessed by forest official.

5.2.4 The Perception and tolerance of farmers towards wildlife conflict

1) The results revealed that 43.00 per cent of respondents strongly perceived that crop raiding, livestock depredation, killing of pet animals, household items destroyed by wildlife were the main reasons for livestock owners-wildlife conflict and nearly half (46.00%) of the respondents strongly perceived that carnivore animals were posing threat to livestock and human adjoining national park.
2) The overall mean score of perception of respondents revealed that majority were strongly agree that they were risk of wild animals' conflict in the vicinity of park with the mean score value (33.17).
3) It was seen from the results that majority (65.00%) of the respondents fall in medium level (2.97 to 3.65) of tolerance towards Livestock Owners' Wildlife Conflict (LOWC).
4) The results revealed that respondents have high level of tolerance who have adopted livestock insurance and were found to have with overall level of tolerance value (81.7) while those respondents who adopted crop insurance whose overall level of tolerance was (80.0).

5.2.5 Perceived feedback of respondents about the mitigation strategies

1) It was seen that guarding of livestock at the time of grazing were most important mitigation strategies adopted by the farmers (mean score value of 93.12).

2) The study revealed that making noise (acoustic) or sound were most effective mitigation method as perceived by the farmers to alleviate damage or repel animals (weighted mean 60.80 per cent) while most important effective mitigation method applied to alleviate damage or repel animals as perceived by forest officials were the community based livestock and crop insurance scheme (weighted mean 68.87 %).
3) The results shows that boundary of park was very effective mechanism in curbing encroachment in the park as suggested by the farmers (39.50 %) to control encroachment with highest weighted mean (71.62 %) while forest official give more emphasis on enforcement of forest law (90.00 %) to control encroachment with overall weighted mean 98.33 per cent.

5.3. CONCLUSION

Findings of the present research establish that the National Park contribute significantly to the farmers well-being near park. Governments and societies faced with the development versus conservation dilemma need to consider in such benefits while taking decisions that influence natural resources and ecosystems. The study revealed that most of the respondents had medium socio-economic status and crop and dairy was the main occupation. The research also indicates that monkey, blue bull, wild pigs and wild birds were ranked the most destructive crop raiders in the surrounding village. They cause heavy crop loss while tiger, elephant and wild boar were ranked least followed by livestock owners. Cereal crops are the most raided crops within Kalesar National Park (KNP) compared to cash crops. Rice, wheat, maize and sugarcane were mostly liked by blue bull, monkey and avian species. Among crops which were not vulnerable to crop raiding were found to be onions, chilies and egg plants. There were a high incidence of crop raiding attributed mostly to neighboring the forest. Furthermore increased habitat destruction, high population, poor guarding methods and lack of grazing have also contributed to increased crop raiding. Crop raiding is the main cause of poverty in vicinity of National Park, as farmers' loss a large share of income per season to crop raiders. Nonetheless, food shortages and loss of income caused by crop raiders were not the only factors affecting people's livelihoods other factors like high population growth, over dependence on subsistence farming were also contributed. Livelihood was directly associated with food security, income of household, leisure time of individuals and social relationship among neighbors'.

Livelihood vulnerability index value indicated that due to wild animals social vulnerability (Social assets- 0.39) of respondents have maximum affected as compared to other sub dimension. About 41 per cent of the livestock owners had high vulnerability level (>0.70-0.82). It was also notice that 48 per cent of respondents were strongly agreed with statement that there may be chance of zoonotic disease due to wildlife and 36 per cent respondents disagreed with the statement livestock owners felt more risk compare to non-livestock owners towards wild animals. Large number of the respondents perceived huge economic loss due to wild animals in their agricultural field. The crops raided by wild animal such as wild boar, blue bull, elephant and monkey. Respondents perceived that park boundary, awareness campaign, guarding, use of crackers and making noise were the effective mitigation method for alleviate the damage due to wildlife. It is also important to note that crop raiding cannot be easily be eradicated given the population pressure and the kind of human activities within and along the periphery of Kalesar National Park.

5.4. IMPLICATIONS OF THE STUDY

Based on the findings of the present investigation and conclusion made there upon the following implications could be recommended:

1. The present investigation ascertained the existing reasons of conflict with wild animals in the study area. The study envisaging the degree of conflict in the National Park would help to understand the supplementary and complementary mitigation strategies and further adoption of suitable mitigation strategies to reduce the loss due to crop raiding and livestock depredation.
2. The ICTs tools possess high capability for information dissemination on wild animal's dispersal, crop raiding and livestock depredation, mitigation strategies and warning from dangerous animals. So such information would be helpful and can be disseminated to a large number of vulnerable people with one time efforts economically.
3. The livelihood vulnerability has multidimensional aspects and by using three-dimensional approach, the Livelihood Vulnerability Index (LVI) was developed for the study and it would be a useful tool for the researchers and policy makers to assess and compare the status of livelihood and vulnerability of farmers in the country.
4. Farmer's perception about any developmental activity is priceless resource to policy makers for designing policies in order to reduce vulnerabilities. Hence, the perception

scale developed for the study would be a useful tool for the researchers and policy makers to measure the perception of farmers towards wildlife conflict.

5. The majority of selected respondents were found middle age group. The middle age group farmers were adopting viable mitigation strategies enthusiastically and with positive mindset. Hence, the implementation of viable mitigation approach in protected adjoining areas could reduce the crop loss, livestock depredation and human injury to great extent.
6. The perceived feedback of the respondent indicates that the all the aspect of mitigation strategies were satisfactory in their content and found to be enhancing the tolerance ability of the farmers.
7. The variables such as farmer's education, annual income, experience, ICTs utilization were found to be important variables would effectively influence the implementation of ICT based services. So these variables should be taken into consideration before preparing an ICT based project.
8. Forest department, state department, research institute and other developmental agencies can make the use of information module in educating farmers on wild animal's dispersal, crop raiding and livestock depredation, mitigation strategies and warning system from dangerous animals.
9. The findings of this study would be helpful for formulating policies by forest department, policy makers, scientists, extension workers, private agencies and NGOs engaged in managing the human wildlife conflict.

5.5 Recommendations for reducing the vulnerability of local communities

On the basis of the results of the present study following specific recommendations are made:

1) Though at the scale of governance, the officials in the policy making, scientific community are well informed about conservation of nature and natural resources, but at grass root level stakeholders like farmers and the visitors (non-locals) did not know the significance of protecting the region as National Park. So became important to target each stakeholder at grass root level, to educate about conservation and importance of wild animals through the use of assuasive instruments, such as education, extension, outreach, research, and visiting people should be informed about the links between them.

2) Nature based tourism in and around Protected Area (PA) has potential to augment equitable livelihood opportunities for forest dependent communities, thereby eliciting local participation in biodiversity conservation around PA. Forest resources have significant contribution to the local economy of Kalesar National Park. This play important role in the livelihood of the respondents thus policy and management sector have to recognize this.

3) The social and economic vulnerabilities were found to result from lack of better education. Educational facilities, especially vocational training, should be provided to diversify livelihoods.

4) Institutions should be identified to develop integrated plan to ensure the conservation of natural resources and should recommend different mitigation method among farmers.

5) Firewood was found to be the main source of energy for cooking among the farmers. They bring firewood from the nearby forest. So their dependency over the forest was high which may imbalances the coexistence of Human and Wildlife. Hence alternative sources of energy, mainly biogas should be promoted, as most of the households were reported to have the livestock.

6) Open grazing in forest should be discouraged. Stall feeding system should be promoted with proper fodder plantation in private land.

7) Literacy rate among the villagers were found to be low, so formal and informal education should be promoted.

8) Awareness campaign on environmental protection, wildlife conservation and management should be done among the local people.

9) Plantation of Multiple uses tree species should promoted.

10) State Government must be empowered to undertake necessary relief measures regarding compensation mechanism for crop damage and livestock depredation.

5.6 SUGGESTION FOR FUTURE RESEARCH

Based on the findings and experiences of the present study, following areas were identified where further research could be contemplated.

1. An experimental or comparative study with different National Parks or Biosphere reserve may be taken up to measure crop and livestock loss.

2. The impact of conflict on farmer's livelihood and socio-economic aspects may be studied after introducing certain need-based enterprises with the selected farmers/villages through participatory research.
3. The study on sustainable livelihood of farmers based on different herd size of livestock can highlight the precise contribution of livestock in the livelihood of farmers.
4. Information module on various other aspects of mitigation strategies, livestock farming can be developed for quick dissemination of information to the farmers.
5. The similar study can be conducted in other areas of country with inclusion of more variables on human wildlife conflicts for an in-depth study.
6. A study could be formulated to assess the belief and attitude of farmers and forest officers towards human wildlife conflicts.
7. The present study was conducted with limited sample size. In order to derive wider generalizations a study could be conducted with large sample size covering more area in the different National Park of India.
8. The extension personnel working in the KVKs, SAUs, Research institute and functional staff must provide a platform to discuss the current scenario of agricultural production and livestock rearing and conflict with wild animals and finally suggest the appropriate mitigation strategies to the farming community.

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Annexure

ANNEXURE-I

Dairy Extension Division
ICAR-National Dairy Research Institute
(Deemed University)
Karnal-132001 (Haryana), India

Dr. H. R. Meena
Senior Scientist

Dear Sir/Madam,

I am glad to inform that **Mr. Mukesh Kumar,** Ph.D. Scholar of Dairy Extension Division is undertaken a research study entitled **"Assessment of Livestock Owners - Wildlife Conflict in the Vicinity of National Parks"** under my guidance. As a part of the study, Scholar develops an index on vulnerability of farmer's livelihood due to wildlife conflict. For the present investigation, Vulnerability is operationalized as the degree to which farmers are at risk of crop damage, livestock depredation combined with individual ability to cope with damage and recover from the impact of hazard caused by wild animals.

In this connection, some dimensions of **Livelihood Vulnerability** of farmers have been enlisted based on review of literature and discussion with experts. Considering your high academic qualification and rich experience, we are pleased to seek your valuable judgment on the relevancy of these dimensions.

Please make specific judgment on the relevancy of these dimensions on three point continuum, by ticking (√) in the appropriate column. You are also requested to suggest any other pertinent dimension that you consider as relevant to Livelihood Vulnerability of farmers and assign the ranks to the dimensions based on their importance as perceived by you.

Further, the procedure for measurement of these dimensions is also indicated. You can suggest modification(s) if any for further improvement.

I, therefore request you to kindly spare some of your valuable time and help in the student research.

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Fax: +91 184-2250042 e-mail: drhrms@gmail.com

ANNEXURE-II

Dairy Extension Division
ICAR-National Dairy Research Institute
(Deemed University)
Karnal-132001 (Haryana), India

Dr. H.R. Meena
Senior Scientist

Dear Sir/Madam,

I am glad to inform that **Mr. Mukesh Kumar**, one of the Ph.D. Scholar of Dairy Extension Division is working under the guidance of me on the topic of **"Assessment of Livestock Owners - Wildlife Conflict in the Vicinity of National Park"**. In this context he needs to develop a scale to measure **the tolerance of livestock owners towards wildlife**. Hence, it is requested, that kindly devote some of your precious time and energy to scrutinize the statements for inclusion in the Tolerance scale. Listed below are statements about tolerance. Please read each statement carefully. Then tick on the column that show how much you agree or disagree with the statement. Please check which of the following best describes your feelings towards wildlife and add or delete the statement, which is more suitable for the study.

Thank you, in advance for sparing your valuable time for this purpose.
With regards,

Yours sincerely,

H. R. Meena
(Senior Scientist, Dairy Extension Division)

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ANNEXURE-III

Dairy Extension Division
ICAR-National Dairy Research Institute
(Deemed University)
Karnal-132001 (Haryana), India

Dr. H.R. Meena
Senior Scientist

Dear Sir/Madam,

I am glad to inform that Mr. Mukesh Kumar, one of the Ph.D. scholar of Dairy Extension Division is working under the guidance of me on the topic of **"Assessment of Livestock Owners - Wildlife Conflict in the Vicinity of National Park"**. In this context he need to develop a scale to measure **the perception of livestock owners towards wildlife**. Hence, it is requested, that kindly devote some of your precious time and energy to scrutinize the statements for inclusion in the perception scale. Listed below are statements about perception. Please read each statement carefully. Then tick on the column that show how much you agree or disagree with the statement. Please check which of the following best describes your feelings towards wildlife and add or delete the statement which is more suitable for the study.

Thank you, in advance for sparing your valuable time for this purpose.
With regards,

Yours sincerely,

H. R. Meena
(Senior Scientist, Dairy Extension Division)

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ANNEXURE-IV

ICAR-NATIONAL DAIRY RESEARCH INSTITUTE
(Deemed University)
Karnal-132001 , Haryana

"Assessment of Livestock Owners - Wildlife Conflict in the Vicinity of National Park"
"राष्ट्रीय पार्क क्षेत्र में रहने वाले वन्य जीव व पशुपालकों के बीच में बिरोधाभास/ संघर्स का अवलोकन"

To,

…….

Dear Sir/Madam

I wish to inform you that one of my Ph.D. Scholar **Mr. Mukesh Kumar** has undertaken a research project entitled "**Assessment of Livestock Owners - Wildlife Conflict in the Vicinity of National Parks"**. I request you to provide necessary information to him for smooth conduct of research study. I assure that the information provided by you will be kept confidential and used only for his academic research purpose. It is also clarify that permission for conducting this study nearby national park already taken from the forest department of Haryana with vide letter number **4857** dated **16/10/2015**

I look forward for your esteemed cooperation

With kind regards

Yours sincerely,

H. R. Meena
(Senior Scientist, Dairy Extension Division)

ANNEXURE-V

FOREST DEPARTMENT, GOVT. OF HARYANA

O/o Additional Principal Chief Conservator of Forests, Wildlife

cum- Chief Wildlife Warden, Haryana

Van Bhawan, Sector – 6, Panchkula – 134109 Phone/Fax – 0172-2561224 email. : apccfwl@gmail.com

No : 4857 Dated : 16-10-15

To

Dr. Khazan Singh
Head, Division of Dairy Extension,
National Dairy Research Institute,
Karnal.

Sub : Request for permission to conduct research study in vicinity of Kalesar National Park.

Ref: Your Letter dated 30.09.2015

After careful consideration and perusal of your research proposal, the necessary permission under section 12 of Wildlife Protection Act, 1972 is granted subject to the following conditions:-

1. The research scholar will share the research finding with Forest Department Haryana.
2. The research scholar will not violate any provisions of Wildlife Protection Act, 1972 and will take all necessary permissions from the Chief Wildlife Warden, Haryana as required under the Act.

Chief Wildlife Warden,
Haryana, Panchkula.

Endst No : 4858-59 Dated : 16-10-15

A copy is forwarded to :-

1. CF, Wildlife Panchkula.
2. DWLO, Panchkula for information.

Chief Wildlife Warden,
Haryana, Panchkula.

ANNEXURE-VI

The selected indicators of respective dimensions of livelihood vulnerability index with their relevancy weightage and mean relevancy score

Dimensions	Sub dimension	Indicators	R weightage	MRS
Biophysical Vulnerability	Human Assets	Age of head of household	0.90	2.71
		Diverse conflict mitigation skill	0.89	2.68
		Awareness regarding conflict mitigation	0.87	2.61
		Traditional knowledge	0.91	2.74
		Training received	0.80	2.39
		Working manpower in family	0.76	2.29
		Hired man force	0.88	2.65
		Injury to human by wild animals	0.78	2.35
	Natural resources Assets	Crop cultivated area	0.84	2.52
		Land holding	0.80	2.39
		Crop yield	0.87	2.61
		Herd size	0.86	2.58
		Percent of households that utilize natural water source	0.77	2.32
		Crop diversification	0.88	2.65
		Water availability for crop	0.89	2.68
		Average ground water level	0.76	2.29
		Farm diversification	0.91	2.74
		Natural hazards	0.88	2.65
		Firewood	0.87	2.61
Social Vulnerability	Social Assets	Family size	0.80	2.39
		Membership of SHGs	0.77	2.32
		Legal penalties by Government	0.81	2.42
		Culture and taboo	0.85	2.55
		Social migration due to conflict	0.86	2.58
		Membership of Cooperatives	0.77	2.32
		Forest rules and regulation	0.87	2.61
		Role of social leader in conflict management	0.82	2.45
		Socio-political participation	0.86	2.58
		Festivals and religious activity	0.77	2.32
Institutional Vulnerability		Saving form Agricultural activity	0.81	2.42
		Average Family Income	0.85	2.55
		Occupation	0.84	2.52
		Off-farm employment opportunities	0.86	2.58
		Crop loss due to wild animals (Area)	0.89	2.68
		Crop loss due to wild animals (INR)	0.94	2.81

	Financial Assets	Remittances	0.88	2.65
		Compensation for loss/ damage	0.89	2.68
		Government supported mitigation	0.86	2.58
		Percent of household access credit facilities	0.83	2.48
		Major source of family income	0.88	2.65
	Physical Assets	Livestock	0.91	2.74
		Household that experience damage to infrastructure	0.90	2.71
		Shelter	0.87	2.61
		Access to information	0.83	2.61
		Tools and equipment in farming	0.83	2.48
		Food loss or shortage causes hunger	0.89	2.68

ANNEXURE-VII

A list of selected statements of perception for final scale construction with their respective 't' values

Perception Scale		
S.N.	**Statement**	**t-value**
1*	Crop raiding, livestock depredation, killing of pet animals, household items destroyed by wildlife are the reasons for Livestock Owners- Wildlife Conflict	2.10
2*	Carnivore animals are threat to livestock and people near National Park	1.93
3	The protection of wild animal is important for ecological balance	1.94
4*	In the vicinity of National park farmers fear to work in their field during odd hours due to wild animal.	2.22
5	There may be chance of spreading zoonotic diseases due to Wild animals	2.36
6	Wildlife have as much right to exist on protected areas land as we have	1.94
7*	Restriction of farming in the vicinity of the National park can reduce Livestock Owners- Wildlife Conflict	2.30
8	Livestock owners felt more risk from wildlife than non-livestock owners	2.13
9	Current laws are sufficient to protect wildlife and fauna of the National Park	2.21
10	Fuel woods from National Park is important source of energy for local communities	1.85
11	Promotion of Livestock insurance scheme may reduce the Livestock Owners- Wildlife conflict	1.90
12	Proper Fencing around the National Park may reduce the Livestock Owners-Wildlife conflict	1.79
* Negative Statement		

ANNEXURE-VIII

A list of selected statements of tolerance for final scale construction with their respective 't' values.

Tolerance Scale		
S.N.	**Statement**	**t-value**
1	I believe that farmers having more land have high tolerance towards wildlife	1.78
2	I feel that farmers who have adopted crop insurance have more tolerance to wild animals	1.94
3	I feel that farmers who have adopted livestock insurance have more tolerance to wild animals harm	2.47
4	The farmers having alternate sources of income are more tolerant than other farmers	3.06
5*	Livestock depredation by wild animals create high intolerance among farmers	2.07
6*	Farmers feel intolerable especially to large, highly symbolic animals	1.85
7	Farmer tolerate the ordinary safety hazards associated with some wildlife	3.31
8	I believe that surety of compensation increase the tolerance towards wildlife menace	2.15
9	Social benefits/beliefs about the value of wildlife and appreciation of its existence improve the tolerance among farmers	4.08
10	In my view tolerance was linked to guarding and watching services	1.86
*Negative Statement		

ANNEXURE-IX

ICAR-NATIONAL DAIRY RESEARCH INSTITUTE
(Deemed University)
Karnal, Haryana

"Assessment of Livestock Owners - Wildlife Conflict in the Vicinity of National Park"

"राष्ट्रीय पार्क क्षेत्र में रहने वाले वन्य जीव व पशुपालकों के बीच में बिरोधाभास /संघर्स का अवलोकन"

INTERVIEW SCHEDULE

साक्षात्कार अनुसूची

Serial No:…… Date: ……

Name of the respondent (नाम): …… Mobile No……

Father's / Husband Name (पिता/पति का नाम) ……..

Name of the Village (गांव)……. Block (खंड)……

Tehsil (तहसील(…… District (जिला)……

A. SOCIO-ECONOMIC VARIABLES

S.N.	Particulars	Response	S.N.	Particulars	Response
1.	**Age**		**2.**	**Gender (लिंग)**	
3.	**Family type**	Joint /Nuclear	**4.**	**Family Size:**	
5.	**Education (शिक्षा):**	Illiterate(अनपढ़) (0)	Functionally literate (कार्यात्मक साक्षर) (1)	Primary (प्राथमिक) (2)	Middle (मिडिल) (3)
		Secondary(माध्यमिक) (4)	Higher Secondary(उच्च माध्यमिक) (5)	Graduate and above (स्नातक और इससे आगे (6)	
6.	**Family Education Status**	Name of Family Member	Relation with Respondent	Age	Education
	1				

	2				
	3				
	4				
	5				
7.	**Land holding(Acre)**		**Owned Land**	**Leased out land**	**Leased in land**
		Agricultural Land			
		Area (if any)			
		Other purpose			

8. Herd composition and size

Animal type (पशु प्रकार)	**In Milk** दूध देने वाली	**Dry** दूध न देने वाली	**Heifer** बछिया	**Calves** बछड़े	**Bull/Bullock** सांड / बैल	**Total** कुल
Indigenous cow (देशी गाय)						
Crossbred cow (संकर गाय)						
Buffalo(भैंस)						
Goat						
Sheep						
Poultry						
Horse/ponies						
Total (कुल)						

9-12 Occupation, annual income and expenditure

9. Occupation (व्यवसाय)	Main (मुख्य)	Secondary(माध्य म क)	10. **Source of income** (आय स्रोत)		**11.Expenditure on**		**12.Loan**	
	(2)	(1)		**Rs/annum**		Exp. Rs.	Sources of loan	Rs.
Mixed farming (कृ ष)			Mixed farming (कृ ष)		Mixed farming			
Crop (फसल)			Crop (फसल)		Crop			

Dairy (डेरी)			Dairy (डेरी)		Dairy			
Service & (नौकरी)Business (व्यापार)			Service & (नौकरी)Business (व्यापार)		School			
Labour (श्रम)			Labour (श्रम)		Living Food			
Other (अन्य)			Any other (कोई अन्य)		Any other			
			Total					

13. Cropping Pattern

S .N.	Crop	Season	Area under cultivation	Yield	
				Main products	By-products
1.					
2.					
3.					

14. Grazing system

Season (मौसम)	**Grazing without herder**	**Hours**	**Timing Mor./ Aft./Eve.**	**Grazing with herder**	**Hours**	**Timing Mor./ Af./Ev.**
Rabi (रबी(						
Zaid (जैद)						
Kharif (खरीफ)						

15. Milk production & Disposal Pattern

S.N.	Type of animal	Total milk production (In liters)	Consumption of milk at home		Milk sold (In liters)	@Rs.
			Fresh milk(Lt)	Milk Product		
1.	Crossbred cow (संकर गाय)					
2.	Indigenous cow (देशी गाय)					

3.	Buffalo (भैंस)					
4.	Goat/Sheep (बकरी/ भेड़)					

16. The milk marketing channel (as perceived by the farmers)

S.N.	Milk Marketing Channels			
1	Producer-consumer			
2	Producer-milk hawker-consumer			
3	Producer-processor-consumer			
4	Producer-processor- retailer-consumer			
5	Producer-dairy co-operative -processor- retailer consumer			
6	Producer-milk transporter-processor - retailer-consumer			
7	Producer-milk trader-processor-retailer-consumer			
8	Producer-dairy coop - milk transporter-processor-retailer-consumer			
9				

17. Change in farming after establishment of National Park

17.1Agriculture	**Crop damage by wildlife**	**Level of water table**	**Insect/ pest infestation**	**Crop insect/ pest**	**Increase bird population**	**Rate of Agril land**
Increase						
No change						
Decrease						
Can't say						
17.2Animal Husbandry	**Livestock population**	**Livestock depredation by wild**	**Fodder availability**	**Land for grazing**	**Livestock diseases**	**Rate of livestock**

		animals				
Increase						
No change						
Decrease						
can't say						
17.3Sources of income/ employment	Tourist	Shops	**17.4Effect on farmer**	Loss/Injury of human life	Destruction of crop	Destruction of farm infrastructure
Increase			Increase			
No change			No change			
Decrease			Decrease			
can't say			can't say			

18. **Have you attained any kind of training related to dairying, agril, forest, etc**

If yes, mention the following information हाँ ,तो निम्नलिखित जानकारी का उल्लेख करे।

S.N.	**Subject on which training was given** (किस विषय पर प्रशिक्षण दिया गया था)	**Organised by**	**Place of training** प्रशिक्षण की जगह	**Duration** (अवधि)
1.				
2.				
3.				
4.				
5.				

19. **If an opportunity provide for training related to dairying, agril, forest etc. what kind of topic/ subject would you like?**

S.N.	**Subject on which training was given** (किस विषय पर प्रशिक्षण दिया गया था)	**Duration** (अवधि)	**Place of training** प्रशिक्षण की जगह On/ off campus	
1.				
2.				
3.				
4				
5				

20. **Social participation** (सामाजिक सहभागिता)

S. N.	Organization (संगठन)	Member (सदस्य) (1)	Office bearer (नौकरशाह) (2)	Extent of participation (भागीदारी की सीमा)		
				Always (सदैव) (2)	Sometimes (कभी कभी) (1)	Never (कभी नहीं) (0)
1	Gram panchayat;ग्राम पंचायत					
2	Panchayat samiti (पंचायत स मति)					
3	Milk co-operative society (दुग्ध सहकारी स मति)					
4	Farmers forum(कसान मंच)					
5	SHG(स्वयं सहायता समूह)					
6	Youth Club(युवा क्लब)					
7	Religious organization (धा र्मक संगठन)					
8	Political organization (राजनीतिक संगठन)					
9.	Others (अन्य)					

21. **Extension contact (** वस्तार संपर्क)

S. N.	Extension personnel/ agency वस्तार कार्यकर्ता/ संस्था	Degree of frequency (आवृत्ति की डग्री)		
		Always (सदैव) (2)	Sometimes (कभी कभी) (1)	Never (कभी नहीं) (0)
1.	Agriculture officer (AO) कृ ष अ धकारी			
2.	Veterinary officer (VO) पशु च कत्सा अ धकारी			
3.	Block development officer (BDO) खंड वकास अ धकारी			
4.	KVK (SMS)(के.वी.के)			
5.	University/College Extension Staff वश्व वद्यालय के वस्तार कर्मचारी			
6.	Forest officer / wildlife inspector (वन पदा धकारी)			
7.	Private agency / NGO निजी एजेंसी / गैर सरकारी संगठन			
8.	Input dealers इनपुट आपूर्ति एजेंसी			
9.	Progressive farmer प्रगतिशील कसान			

10.	Paravet (परभेट)			
11.	Agriculture supervisor			
12.	Any other (please specify) कोई अन्य			

22. Mass media exposure,(मास मी डया संपर्क**)**

How often have you been exposed to following media in obtaining relevant information about dairy farming and forest rules?

कतनी बार आप डेयरी फा र्मंग के बारे में प्रासं गक जानकारी प्राप्त करने में निम्न मी डया का उपयोग कये हो **?**

S. N.	**Mass media** मास मी डया	**Regularly** निय मत रूप **(3)**	**Occasionally** कभी कभी **(2)**	**Rarely** शायद ही कभी **(1)**	**Never** कभी नहीं **(0)**
1.	Newspaper अखबार				
2.	Radio रे डयो				
3.	Television टेली वज़न				
4.	Magazine, bulletins पत्रिका ,बुलेटिन				
5.	Awareness campaigns जागरूकता अ भयान				
6.	Dairy/Krishi mela डेयरी / कृ ष मेला				
7.	Mobile phone SMS				
8.	F.M. Radio				
9.	Forest dept. advisory वन) वभाग(				
10	Others कोई अन्य				

23. Enlist various resource collected by you in different season of year (in %)

S.N	**Area/ Resources**	Wood	Fuel wood	Fodder	MFP/medicines	Others
1.	National park					
2.	Buffer zone					
3.	Community forest					
4.	From own land					

24. Wildlife dispersal from National Park

Do wild animals come into your farm? Yes…. No……..

Enlist the types of wild animals that mostly found in your localities in different season?

S.N	**Wild animal**	**Season**
1.		
2.		
3.		
4.		

5.		
6.		
7.		

25. Do you benefit from wildlife? Yes…… No……

If yes, what benefits do you receive from Wildlife/ National Park?

S.N.	Benefits
1.	
2.	
3.	
4.	

If you are not receiving any benefits from wildlife/ National Park , what type of benefits would you like to see?

S.N.	
1.	
2.	
3.	
4.	

26. Wildlife Disease Risk Perception

S.N.	Statements	1	2	3	4
1	If [you personally, people in your community, pets, domestic livestock, wildlife] were to contract [plague, rabies, T.B., Brucellosis virus disease], how serious do you think the consequences would be…?	Not serious	Somewhat serious	Serious	Very serious
2	In your opinion, how likely to contract (or catch) [plague, rabies, T.B., Brucellosis] are…?	Very unlikely	Unlikely	Likely	Very unlikely
3	Do you worry about or feel fearful of [plague, rabies, T.B., Brucellosis virus disease] affecting…?	Not at all	Rarely	from time to time	a great deal
4	Have you, or do you know someone who has, contracted or otherwise been affected by [plague, rabies, T.B., Brucellosis virus disease]?	Don't know	Little bit	Awareness	Knowledge
5	How concerned are you that plague, rabies, T.B., Brucellosis virus disease] could affect the health of [humans, pets, domestic livestock, wildlife, the overall ecosystem]?	Not at all concerned	Somewhat concerned	Serious concerned	Extremely concerned
6	In general, how concerned are you about protecting the health of [humans, domestic animals, wildlife and the overall ecosystem]?	Not at all concerned	Somewhat concerned	Serious concerned	Extremely concerned
7	Do you agree or disagree that: most environmental problems are caused by humans interfering with nature;	Strongly disagree	Disagree	Neither agree nor disagree	Strongly agree

	the occurrence of disease (in general) has been made worse by humans and their activities?				
8	Perceived risk severity, susceptibility, and dread for zoonotic diseases	Not serious	Somewhat serious	Serious	Very serious
	Self				
	Other				
	Pets				
	Livestock				
	Wildlife				

1. To estimate the losses of crops and livestock due to livestock Owners - wildlife conflict

1.1. Which wild animals reach your house or agriculture field?

S.N.	**Wild animal**	**Season**	**Livestock Loss in a year**		
			Livestock	**Market Value of Livestock**	**Loss (In Rs)**
1.					
2.					
3.					
4.					
5.					

1.2 What is the amount of crop damage by wild animals?

Wild animal	Major Crops	Area raided	Total production if not damaged (per year/Ha) (A)	Total production at Present per Ha. (B)	Total damage A-B

1.3 Loss/ Injury due to wildlife attack on human

S.N.	**Wild animal**	**Season**	**Human Loss / Injury due to attack**					
			No. of person	Loss of working days	Expenditure of treatment	Expenditure of travel to hospital	Care taker working days loss	Loss
1.								

2.								
3.								
4.								

1.4 Injury due to wildlife attack on dairy animal

S.N.	Wild animal	Season	Injury due to attack					
			No. of animal	Loss of milk	Expenditure of treatment	Expenditure of feed/ fodder	Care taker working days loss	Loss
1.								
2.								
3.								
4.								

1.5 Loss/ Injury due to wildlife attack on pets

S.N.	Wild animal	Season	Pets loss / Injury due to attack				
			No. of animal	Expenditure of treatment	Expenditure of feed/ fodder	Care taker working days loss	Loss
1.							
2.							
3.							

2. To assess the vulnerability of livestock owners' livelihood due to wildlife

Livelihood Vulnerability Index

Dimensions	Indicators	Sub-Indicators	SA	ND	SD
Biophysical Vulnerability	**Human Assets**	Age of the household is related to vulnerability			
		Diverse conflict mitigation skill			
		Awareness regarding conflict mitigation			
		Traditional knowledge			
		Training received			
		Working manpower in family			
		Hired man force			
		Injury to human by wild animals			
		Crop cultivated area			
		Land holding			
		Crop yield			
		Herd size			

	Natural Assets	Percent of households that utilize natural water source			
		Crop diversification			
		Water availability for crop			
		Average ground water level			
		Farm diversification			
		Natural hazards			
		Firewood			
Social Vulnerability	**Social Assets**	Family size			
		Membership of SHGs			
		Legal penalties by Government			
		Culture and taboo			
		Social migration due to conflict			
		Membership of Cooperatives			
		Forest rules and regulation			
		Role of social leader in conflict management			
		Socio-political participation			
		Festivals and religious activity			
Institutional Vulnerability	**Financial Assets**	Saving form Agricultural activity			
		Average Family Income			
		Occupation			
		Off-farm employment opportunities			
		Crop loss due to wild animals (Area)			
		Crop loss due to wild animals (In Rupees)			
		Remittances			
		Compensation for loss/ damage			
		Government supported mitigation			
		Household access credit facilities			
		Major source of family income			
	Physical Assets	Livestock			
		Household that experience damage to infrastructure			
		Shelter			
		Access to information			
		Tools and equipment in farming			
		Food loss or shortage causes hunger			
SA: Strongly Agree, ND: Not Decided, SD: Strongly Disagree					

3. To measure the perception and tolerance of livestock owners towards wildlife

S.N.	**Perception Scale Statement**	**Response (प्रति क्रया)**				
		SA 5	A 4	UD 3	D 2	SD 1
1*	Crop raiding, livestock depredation, killing of pet animals, household items destroyed by wildlife are the reasons for Livestock Owners- Wildlife Conflict					
2*	Carnivore animals are threat to livestock and people near National Park					

3	The protection of wild animal is important for ecological balance					
4*	In the vicinity of National Park farmers fear to work in their field during odd hours due to wild animal.					
5	There may be chance of spreading zoonotic diseases due to Wild animals					
6	Wildlife have as much right to exist on protected areas land as we have					
7*	Restriction of farming in the vicinity of the National park can reduce Livestock Owners- Wildlife Conflict					
8	Livestock owners felt more risk from wildlife than non-livestock owners					
9	Current laws are sufficient to protect wildlife and fauna of NP					
10	Fuel woods from National Park is important source of energy for local communities					
11	Promotion of Livestock insurance scheme may reduce the Livestock Owners- Wildlife conflict					
12	Proper Fencing around the National Park may reduce the Livestock Owners- Wildlife conflict					
*= Indicate Negative Statement						

S.N.	**Tolerance Scale Statement**	**Response (प्रति क्रया)**				
		SA 5	**A 4**	**UD 3**	**D 2**	**SD 1**
1	I believe that farmers having more land have high tolerance towards wildlife					
2	I feel that farmers who have adopted crop insurance have more tolerance to wild animals					
3	I feel that farmers who have adopted livestock insurance have more tolerance to wild animals harm					
4	The farmers having alternate sources of income are more tolerant than other farmers					
5*	Livestock depredation by wild animals create high intolerance among farmers					
6*	Farmers feel intolerable especially to large, highly symbolic animals					
7	Farmer tolerate the ordinary safety hazards associated with some wildlife					
8	I believe that surety of compensation increase the tolerance towards wildlife menace					
9	Social benefits/beliefs about the value of wildlife and appreciation of its existence improve the tolerance among farmers					
10	In my view tolerance was linked to guarding and watching services					

*= Indicate Negative Statement
SA-Strongly Agree-5; A-Agree-4; UD-Undecided-3; D-Disagree-2; SD-Strongly Disagree-1
ज्यादा सहमत-5, सहमत-4, अनिश्चित-3, असहमत-2, ज्यादा असहमत -1

4.To study the effectiveness of existing strategies to mitigate the livestock owners-wildlife conflict.

4.1. Enlist the Mitigation strategy to alleviate damage or protect livestock and crops.

S. N.	Mitigation methods/ strategies	Rank
1.		
2.		
3.		
4.		

1.2. Which is the effective method applied to alleviate damage or repel animals?

S.N.	Mitigation Method/ strategies	Very Good	Good	Fair	Low	Very Low
1.						
2.						
3.						
4.						

#Very good has highest number having 5 and very low has the lowest number 1.

4.3 How effective are the following mechanisms in curbing livestock incursion in the park?

S.N.	Items	Very effective	Effective	Fairly effective	Not effective
1.	Park boundary				
2.	Arrests by Law enforcing				
3.	Fines/sentencing by courts				
4.	Fences				
5.	Education & Awareness				
6.	Other, specify				

4.4 How effective are the following mechanisms in curbing encroachment in the park?

S.N.	Items	Very effective	Effective	Fairly effective	Not effective
1.	Park boundary				
2.	Arrests by Law enforcing				
3.	Fines/sentencing by courts				
4.	Fences				
5.	Education & Awareness				
6.	Other, specify				

4.5 Compensation given by the government against losses due to wild animals

S.N.	Statement	Yes	No	Don't
1.	Whether there is any provision of compensation by the government against losses by wild animals?			
2.	If Yes, are people satisfied from this compensation			
3.	If people not satisfied what are the reasons	Less compensation	Long process	Lack of awareness

ANNEXURE-X

ICAR-NATIONAL DAIRY RESEARCH INSTITUTE
(Deemed University)
Karnal, Haryana

"Assessment of Livestock Owners - Wildlife Conflict in the Vicinity of National Park"

"राष्ट्रीय पार्क क्षेत्र में रहने वाले वन्य जीव व पशुपालकों के बीच में बिरोधाभास /संघर्स का अवलोकन"

INTERVIEW SCHEDULE FOR FOREST OFFICIAL

साक्षात्कार अनुसूची

Serial No:…… Date: ……

2. Name: …… Mobile No……

3. Working Experience:…… Education/ Degree……

Livestock depredation and crop damaged caused by wild animals in last five years?

S.N.	**Wild animal**	**Season**	**Livestock Loss in a year**			**Crop damaged**		
			Livestock	**Market Value of Livestock**	**Loss (In Rs)**	**Year**	**Major Crops**	**Area raided**
1.								
2.								
3.								
4.								
5.								

Human and pet animals attacked by wild animals in last five years

S.N.	**Wild animals**	**Year / Season**	**No. of person**		**Pet animals**	
1.			Injured	Killed	Injured	Killed
2.						
3.						
4.						
5						

Compensation given by the government against losses due to wild animals

S.N.	Statement	Yes	No	Don't
1.	Whether there is any provision of compensation by the government against losses by wild animals?			
2.	If Yes, are people satisfied from this compensation			
3.	If people not satisfied what are the reasons	Less compensation	Long process	Lack of awareness
4.				

To assess the vulnerability of livestock owners' livelihood due to wildlife

Livelihood Vulnerability Index

Dimensions	licators	Sub-Indicators	SA	ND	SD
Biophysical Vulnerability	**Human Assets**	Age of household is related to vulnerability			
		Diverse conflict mitigation skill			
		Awareness regarding conflict mitigation			
		Traditional knowledge			
		Training received			
		Working manpower in family			
		Hired man force			
		Injury to human by wild animals			
	Natural Assets	Crop cultivated area			
		Land holding			
		Crop yield			
		Herd size			
		Percent of households that utilize natural water source			
		Crop diversification			
		Water availability for crop			
		Average ground water level			
		Farm diversification			
		Natural hazards			
		Firewood			
Social Vulnerability	**Social Assets**	Family size			
		Membership of SHGs			
		Legal penalties by Government			
		Culture and taboo			
		Social migration due to conflict			
		Membership of Cooperatives			
		Forest rules and regulation			
		Role of social leader in conflict management			
		Socio-political participation			
		Festivals and religious activity			
Institutional Vulne		Saving form Agricultural activity			
		Average Family Income			
		Occupation			

	Financial Assets	Off-farm employment opportunities			
		Crop loss due to wild animals (Area)			
		Crop loss due to wild animals (In Rupees)			
		Remittances			
		Compensation for loss/ damage			
		Government supported mitigation			
		Household access credit facilities			
		Major source of family income			
	Physical Assets	Livestock			
		Household that experience damage to infrastructure			
		Shelter			
		Access to information			
		Tools and equipment in farming			
		Food loss or shortage causes hunger			
SA: Strongly Agree, ND: Not Decided, SD: Strongly Disagree					

To measure the perception and tolerance of livestock owners towards wildlife

S.N.	**Perception Scale Statement**	**Response (**प्रतिक्रिया)				
		SA 5	A 4	UD 3	D 2	SD 1
1*	Crop raiding, livestock depredation, killing of pet animals, household items destroyed by wildlife are the reasons for Livestock Owners- Wildlife Conflict					
2*	Carnivore are threat to livestock and people near National Park					
3	The protection of wild animal is important for ecological balance					
4*	In the vicinity of National Park farmers fear to work in their field during odd hours due to wild animal.					
5	Chance of spreading zoonotic diseases due to Wild animals					
6	Wildlife have as much right to exist on protected areas as we have					
7*	Restriction of farming in the vicinity of the National park can reduce Livestock Owners- Wildlife Conflict					
8	Livestock owners felt more risk from wildlife than others					
9	Current laws are sufficient to protect wildlife and fauna of NP					
10	Fuel woods from National Park is important source of energy for local communities					
11	Livestock insurance may reduce the Livestock Owners-Wildlife conflict					
12	Fencing around the National Park may reduce the Livestock Owners- Wildlife conflict					
*= Indicate Negative Statement						

S.N	**Tolerance Scale Statement**	**Response** (प्रतिक्रिया)				
		SA 5	**A 4**	**UD 3**	**D 2**	**SD 1**
1	Farmers having more land have high tolerance towards wildlife					
2	Farmers who have adopted crop insurance have more tolerance to wild animals					

3	Farmers who have adopted livestock insurance have more tolerance to wild animals harm					
4	Farmers having alternate sources of income are more tolerant than other farmers					
5*	Livestock depredation by wild animals create high intolerance among farmers					
6*	Farmers feel intolerable to large, highly symbolic animals					
7	Farmer tolerate the ordinary safety hazards associated with wildlife					
8	Compensation increase the tolerance towards wildlife menace					
9	Social benefits/beliefs about the value of wildlife and appreciation of its existence improve the tolerance among farmers					
10	Tolerance is linked to guarding and watching services					
*= Indicate Negative Statement						
SA-Strongly Agree-5; A-Agree-4; UD-Undecided-3; D-Disagree-2; SD-Strongly Disagree-1 ज्यादा सहमत-5, सहमत-4, अनिश्चित-3, असहमत-2, ज्यादा असहमत -1						

4. Enlist the Mitigation strategy followed by farmers for livestock owners-wildlife conflict

S. N.	Mitigation methods/ strategies	Rank
1.		
2.		
3.		
4.		
5.		

4.1 Which is the effective method applied to alleviate damage or repel animals?

S.N.	Mitigation Method/ strategies	Very Good	Good	Fair	Low	Very Low
1.						
2.						
3.						
4.						
5.						

#Very good has highest number having 5 and very low has the lowest number 1.

4.2 How effective are the following mechanisms in curbing livestock incursion in the park?

S.N.	Items	Very effective	Effective	Fairly effective	Not effective
1.	Park boundary				

2.	Arrests by Law enforcing				
3.	Fines/sentencing by courts				
4.	Fences				
5.	Education & Awareness				
6.	Other, specify				

4.3 How effective are the following mechanisms in curbing encroachment in the park?

S.N.	Items	Very effective	Effective	Fairly effective	Not effective
1.	Park boundary				
2.	Arrests by Law enforcing				
3.	Fines/sentencing by courts				
4.	Fences				
5.	Education & Awareness				
6.	Other, specify				

ANNEXURE-XI

FORMULAS USED TO ANALYSE THE DATA

Mean:

$$\text{Mean} = \Sigma X / N$$

Where, Σ X = sum of all observation of a variable

N = Number of observation

Percentage:

$$\text{Percentage} = \frac{\text{Total obtained score}}{\text{Total obtainable score}} \times 100$$

Cumulative Square Root Frequency (CSRF):

There are various methods available to determine stratum boundaries, cumulative square root of frequency (CSRF) method allows greater efficiency for setting stratum boundaries. CSRF methodology breaks down the population into intervals, which can be of equal or unequal width. The steps involved in its calculation are given below:

1. Evaluate the data and determine the units that can be reviewed on an actual basis.
2. Stratify the remaining data into ranges or classes. Number of classes and class interval are determined using the formulas given as below :

   No. of classes = 2.5 x (number of samples) ¼

   Class interval $= \frac{(\text{Largest figure} - \text{smallest figure})}{\text{No. of classes}}$

3. Determine the frequency for each range. This is the number of units within the range.
4. Calculate the square root of the frequency for the first range. Then calculate the square root of the next range. Continue this process for each of the ranges.

5. Sum of the square root of the first and second range gives cumulative square root of the second range; sum of first, second and third gives the third range and so on for all the ranges.

6. The cumulative square root frequency value of the last class is divided by the number of sample strata desired (can vary 3-9) to get the cumulative square root value for each item.

7. Suppose, we desire to have 3 strata, then the upper limit of the first strata is determined using the formula as given below:

$$Li = Yi\text{-}1 + \frac{(Yi - Yi\text{-}1)\{(Sk/L) - Si\text{-}1\}}{\sqrt{f}} \quad \ldots\ldots\ldots\ldots \text{Value 1}$$

Where Li = Upper limit of the ith strata (In this case first strata)

L = Number of strata

Yi = Upper limit of the class in which Li lies

Yi-1 = Lower limit of the class in which Li lies

Sk = Cumulative square root frequency value

$\sqrt{f}$ = Square root of the frequency of the ith class in which Li (Sk/L) lies

Si-1 = Cumulative square root frequency of the preceding class in which Li (Sk/L) lies

Yi – Yi-1= Width of the class in which in which Li (Sk/L) lies

For the upper limit of second strata, the formula is:

$$Li = Yi\text{-}1 + \frac{(Yi - Yi\text{-}1)\{(Sk/L) \times 2 - Si\text{-}1\}}{\sqrt{f}} \quad \ldots\ldots\ldots \text{Value 2}$$

For the upper limit of third strata, the formula is:

$$Li = Yi\text{-}1 + \frac{(Yi - Yi\text{-}1)\{(Sk/L) \times 3 - Si\text{-}1\}}{\sqrt{f}} \quad \ldots\ldots\ldots \text{Value 3}$$

In this way, three strata are formed i.e., below value 1, between value 1 and value 2 and above value 2 up to value.

Garret Ranking

The formula for percent position as suggested by Garret (1981)

Garret ranking formula = **100 (R - 0.5) ÷ N**

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INTERVIEW SCHEDULE

साक्षात्कार अनुसूची

Serial No:…… Date: ……

Name of the respondent (नाम): …… Mobile No……

Father's / Husband Name (पिता/पति का नाम) ……..

Name of the Village (गांव)……. Block (खंड)……

Tehsil (तहसील)…… District (जिला)……

A. SOCIO-ECONOMIC VARIABLES

S.N.	Particulars	Response	S.N.	Particulars	Response
1.	**Age**		2.	**Gender** (लिंग)	
3.	**Family type**	Joint /Nuclear	4.	**Family Size:**	
5.	**Education (**शिक्षा**):**	Illiterate(अनपढ़) (0)	Functionally literate (कार्यात्मक साक्षर) (1)	Primary (प्राथमिक) (2)	Middle (मिडिल) (3)
		Secondary(माध्यमिक) (4)	Higher Secondary(उच्च माध्यमिक) (5)	Graduate and above (स्नातक और इससे आगे (6)	
6.	**Family Education Status**	Name of Family Member	Relation with Respondent	Age	Education
	1				
	2				
	3				
	4				
	5				

7.	**Land holding(Acre)**		**Owned Land**	**Leased out land**	**Leased in land**
		Agricultural Land			
		Area (if any)			
		Other purpose			

8. Herd composition and size

Animal type (पशु प्रकार)	**In Milk** दूध देने वाली	**Dry** दूध न देने वाली	**Heifer** बछिया	**Calves** बछड़े	**Bull/Bullock** सांड / बैल	**Total** कुल
Indigenous cow (देशी गाय)						
Crossbred cow (संकर गाय)						
Buffalo(भैंस)						
Goat (बकरी)						
Sheep(भेड़)						
Poultry(पौल्ट्री)						
Horse/ponies(घोड़ा /पोनी)						
Total (कुल)						

9-12 Occupation, annual income and expenditure

9. Occupation (व्यवसाय)	Main(मुख्य)	Secondary(माध्यमक)	10. **Source of income** (आय स्रोत)		**11.Expenditure on**		**12.Loan**	
	(2)	(1)		**Rs/annum**		Exp. Rs.	Sources of loan	Rs.
Mixed farming (कृष)			Mixed farming (कृष)		Mixed farming			
Crop (फसल)			Crop (फसल)		Crop			
Dairy (डेरी)			Dairy (डेरी)		Dairy			

Service & (नौकरी)Business (व्यापार)			Service & (नौकरी)Business (व्यापार)		School			
Labour (श्रम)			Labour (श्रम)		Living Food			
Other (अन्य)			Any other (कोई अन्य)		Any other			
			Total					

13. Cropping Pattern

S .N.	Crop	Season	Area under cultivation	Yield	
				Main products	By-products
1.					
2.					
3.					

14. Grazing system

Season (मौसम)	**Grazing without herder**	**Hours**	**Timing Mor./ Aft./Eve.**	**Grazing with herder**	**Hours**	**Timing Mor./ Af./Ev.**
Rabi (रबी)						
Zaid (जैद)						
Kharif (खरीफ)						

15. Milk production & Disposal Pattern

S.N.	Type of animal	Total milk production (In liters)	Consumption of milk at home		Milk sold (In liters)	@Rs.
			Fresh milk(Lt)	Milk Product		
1.	Crossbred cow (संकर गाय)					
2.	Indigenous cow (देशी गाय)					

3.	Buffalo (भैंस)					
4.	Goat/Sheep (बकरी/ भेड़)					

16. The milk marketing channel (as perceived by the farmers)

S.N.	Milk Marketing Channels			
1	Producer-consumer			
2	Producer-milk hawker-consumer			
3	Producer-processor-consumer			
4	Producer-processor- retailer-consumer			
5	Producer-dairy co-operative -processor- retailer consumer			
6	Producer-milk transporter-processor - retailer-consumer			
7	Producer-milk trader-processor-retailer-consumer			
8	Producer-dairy coop - milk transporter-processor-retailer-consumer			
9				

17. Change in farming after establishment of National Park

17.1Agriculture	**Crop damage by wildlife**	**Level of water table**	**Insect/ pest infestation**	**Crop insect/ pest**	**Increase bird population**	**Rate of Agril land**
Increase						
No change						
Decrease						
Can't say						
17.2Animal Husbandry	**Livestock population**	**Livestock depredation by wild animals**	**Fodder availability**	**Land for grazing**	**Livestock diseases**	**Rate of livestock**
Increase						
No change						
Decrease						
can't say						
17.3Sources of income/ employment	Tourist	Shops	**17.4Effect on farmer**	Loss/Injury of human life	Destruction of crop	Destruction of farm infrastructure

Increase			Increase			
No change			No change			
Decrease			Decrease			
can't say			can't say			

18. **Have you attained any kind of training related to dairying, agril, forest, etc**

S.N.	**Subject on which training was given** (किस विषय पर प्रशिक्षण दिया गया था)	**Organised by**	**Place of training** प्रशिक्षण की जगह	**Duration** (अवधि)
1.				
2.				
3.				
4.				
5.				

19. **If an opportunity provide for training related to dairying, agril, forest etc. what kind of topic/ subject would you like?**

S.N.	**Subject on which training was given** (किस विषय पर प्रशिक्षण दिया गया था)	**Duration** (अवधि)	**Place of training** प्रशिक्षण की जगह On/ off campus	
1.				
2.				
3.				
4				
5				

20. Social participation (सामाजिक सहभागिता)

S. N.	**Organization** (संगठन)	**Member** (सदस्य) **(1)**	**Office bearer** (नौकरशाह) **(2)**	**Extent of participation** (भागीदारी की सीमा)		
				Always (सदैव) **(2)**	**Sometimes** (कभी कभी) **(1)**	**Never** (कभी नहीं) **(0)**
1	Gram panchayat;ग्राम पंचायत					
2	Panchayat samiti					

	(पंचायत समति)					
3	Milk co-operative society (दुग्ध सहकारी समति)					
4	Farmers forum(कसान मंच)					
5	SHG(स्वयं सहायता समूह)					
6	Youth Club(युवा क्लब)					
7	Religious organization (धार्मक संगठन)					
8	Political organization (राजनीतिक संगठन)					
9.	Others (अन्य)					

21. **Extension contact (** वस्तार संपर्क)

S. N.	**Extension personnel/ agency** वस्तार कार्यकर्ता**/** संस्था	**Degree of frequency** (आवृत्ति की डग्री)		
		Always (सदैव**) (2)**	**Sometimes** (कभी कभी**) (1)**	**Never** (कभी नहीं**) (0)**
1.	Agriculture officer (AO) कृष अधकारी			
2.	Veterinary officer (VO) पशु चकत्सा अधकारी			
3.	Block development officer (BDO) खंड वकास अधकारी			
4.	KVK (SMS)(के.वी.के **)**			
5.	University/College Extension Staff वश्ववद्यालय के वस्तार कर्मचारी			
6.	Forest officer / wildlife inspector (वन पदा धकारी)			

7.	Private agency / NGO निजी एजेंसी / गैर सरकारी संगठन			
8.	Input dealers इनपुट आपूर्ति एजेंसी			
9.	Progressive farmer प्रगतिशील कसान			
10.	Paravet (परभेट)			
11.	Agriculture supervisor			
12.	Any other (please specify) कोई अन्य			

22. Mass media exposure,(मास मीडया संपर्क**)**

How often have you been exposed to following media in obtaining relevant information about dairy farming and forest rules?

कतनी बार आप डेयरी फार्मंग के बारे में प्रासंगक जानकारी प्राप्त करने में निम्न मीडया का उपयोग कयेहो **?**

हो **?**

S. N.	**Mass media** मास मीडया	**Regularly** नियमत रूप **(3)**	**Occasionally** कभी कभी **(2)**	**Rarely** शायद ही कभी **(1)**	**Never** कभी नहीं **(0)**
1.	Newspaper अखबार				
2.	Radio रेडयो				
3.	Television टेलीवज़न				
4.	Magazine, bulletins				
5.	Awareness campaigns जागरूकता अभयान				
6.	Dairy/Krishi mela डेयरी / कृष मेला				
7.	Mobile phone SMS				
8.	F.M. Radio				
9.	Forest dept. advisory(वन				

	वभाग)				
10	Others कोई अन्य				

23. Enlist various resource collected by you in different season of year (in %)

S.N	Area/ Resources	Wood	Fuel wood	Fodder	MFP/medicines	Others
1.	National park					
2.	Buffer zone					
3.	Community forest					
4.	From own land					

24. Wildlife dispersal from National Park

Do wild animals come into your farm? Yes…. No……..

Enlist the types of wild animals that mostly found in your localities in different season?

S.N	Wild animal	Season
1.		
2.		
3.		
4.		
5.		
6.		
7.		

25. Do you benefit from wildlife? Yes…… No……

If yes, what benefits do you receive from Wildlife/ National Park?

S.N.	Benefits
1.	
2.	
3.	
4.	

If you are not receiving any benefits from wildlife/ National Park , what type of benefits would you like to see?

S.N.	
1.	
2.	
3.	
4.	

26. Wildlife Disease Risk Perception

S.N.	Statements	1	2	3	4
1	If [you personally, people in your community, pets, domestic livestock, wildlife] were to contract [plague, rabies, T.B., Brucellosis virus disease], how serious do you think the consequences would be…?	Not serious	Somewhat serious	Serious	Very serious
2	In your opinion, how likely to contract (or catch) [plague, rabies, T.B., Brucellosis] are…?	Very unlikely	Unlikely	Likely	Very unlikely
3	Do you worry about or feel fearful of [plague, rabies, T.B., Brucellosis virus disease] affecting…?	Not at all	Rarely	from time to time	a great deal
4	Have you, or do you know someone who has, contracted or otherwise been affected by [plague, rabies, T.B., Brucellosis virus disease]?	Don't know	Little bit	Awareness	Knowledge
5	How concerned are you that plague, rabies, T.B., Brucellosis virus disease] could affect the health of [humans, pets, domestic livestock, wildlife, the overall ecosystem]?	Not at all concerned	Somewhat concerned	Serious concerned	Extremely concerned
6	In general, how concerned are you about protecting the health of [humans, domestic animals, wildlife and the overall ecosystem]?	Not at all concerned	Somewhat concerned	Serious concerned	Extremely concerned
7	Do you agree or disagree that: most environmental problems are caused by humans interfering with nature;	Strongly disagree	Disagree	Neither agree nor disagree	Strongly agree

	the occurrence of disease (in general) has been made worse by humans and their activities?				
8	Perceived risk severity, susceptibility, and dread for zoonotic diseases	Not serious	Somewhat serious	Serious	Very serious
	Self				
	Other				
	Pets				
	Livestock				
	Wildlife				

1. To estimate the losses of crops and livestock due to livestock Owners - wildlife conflict

1.1. Which wild animals reach your house or agriculture field?

S.N.	**Wild animal**	**Season**	**Livestock Loss in a year**		
			Livestock	**Market Value of Livestock**	**Loss (In Rs)**
1.					
2.					
3.					
4.					
5.					

1.2 What is the amount of crop damage by wild animals?

Wild animal	Major Crops	Area raided	Total production if not damaged (per year/Ha) (A)	Total production at Present per Ha. (B)	Total damage A-B

1.3 Loss/ Injury due to wildlife attack on human

S.N.	**Wild animal**	**Season**	**Human Loss / Injury due to attack**					
			No. of person	Loss of working days	Expenditure of treatment	Expenditure of travel to hospital	Care taker working days loss	Loss

1.								
2.								
3.								
4.								

1.4 Injury due to wildlife attack on dairy animal

S.N.	Wild animal	Season	Injury due to attack					
			No. of animal	Loss of milk	Expenditure of treatment	Expenditure of feed/ fodder	Care taker working days loss	Loss
1.								
2.								
3.								
4.								

1.5 Loss/ Injury due to wildlife attack on pets

S.N.	Wild animal	Season	Pets loss / Injury due to attack				
			No. of animal	Expenditure of treatment	Expenditure of feed/ fodder	Care taker working days loss	Loss
1.							
2.							
3.							

2. To assess the vulnerability of livestock owners' livelihood due to wildlife

Livelihood Vulnerability Index

Dimensions	Indicators	Sub-Indicators	SA	ND	SD
Biophysical Vulnerability	**Human Assets**	Age of the household is related to vulnerability			
		Diverse conflict mitigation skill			
		Awareness regarding conflict mitigation			
		Traditional knowledge			
		Training received			
		Working manpower in family			
		Hired man force			
		Injury to human by wild animals			
		Crop cultivated area			

	Natural Assets	Land holding			
		Crop yield			
		Herd size			
		Percent of households that utilize natural water source			
		Crop diversification			
		Water availability for crop			
		Average ground water level			
		Farm diversification			
		Natural hazards			
		Firewood			
Social Vulnerability	**Social Assets**	Family size			
		Membership of SHGs			
		Legal penalties by Government			
		Culture and taboo			
		Social migration due to conflict			
		Membership of Cooperatives			
		Forest rules and regulation			
		Role of social leader in conflict management			
		Socio-political participation			
		Festivals and religious activity			
Institutional Vulnerability	**Financial Assets**	Saving form Agricultural activity			
		Average Family Income			
		Occupation			
		Off-farm employment opportunities			
		Crop loss due to wild animals (Area)			
		Crop loss due to wild animals (In Rupees)			
		Remittances			
		Compensation for loss/ damage			
		Government supported mitigation			
		Household access credit facilities			
		Major source of family income			
		Livestock			

	Physical Assets	Household that experience damage to infrastructure			
		Shelter			
		Access to information			
		Tools and equipment in farming			
		Food loss or shortage causes hunger			
SA: Strongly Agree, ND: Not Decided, SD: Strongly Disagree					

3. To measure the perception and tolerance of livestock owners towards wildlife

S.N.	**Perception Scale Statement**	**Response (प्रति क्रया)**				
		SA 5	A 4	UD 3	D 2	SD 1
1*	Crop raiding, livestock depredation, killing of pet animals, household items destroyed by wildlife are the reasons for Livestock Owners- Wildlife Conflict					
2*	Carnivore animals are threat to livestock and people near National Park					
3	The protection of wild animal is important for ecological balance					
4*	In the vicinity of National Park farmers fear to work in their field during odd hours due to wild animal.					
5	There may be chance of spreading zoonotic diseases due to Wild animals					
6	Wildlife have as much right to exist on protected areas land as we have					
7*	Restriction of farming in the vicinity of the National park can reduce Livestock Owners- Wildlife Conflict					
8	Livestock owners felt more risk from wildlife than non-livestock owners					
9	Current laws are sufficient to protect wildlife and fauna of NP					
10	Fuel woods from National Park is important source of energy for local communities					
11	Promotion of Livestock insurance scheme may reduce the Livestock Owners- Wildlife conflict					
12	Proper Fencing around the National Park may reduce the Livestock Owners- Wildlife conflict					
*= Indicate Negative Statement						

S.N.	Tolerance Scale Statement	Response (प्रतिक्रया)				
		SA 5	A 4	UD 3	D 2	SD 1
1	I believe that farmers having more land have high tolerance towards wildlife					
2	I feel that farmers who have adopted crop insurance have more tolerance to wild animals					
3	I feel that farmers who have adopted livestock insurance have more tolerance to wild animals harm					
4	The farmers having alternate sources of income are more tolerant than other farmers					
5*	Livestock depredation by wild animals create high intolerance among farmers					
6*	Farmers feel intolerable especially to large, highly symbolic animals					
7	Farmer tolerate the ordinary safety hazards associated with some wildlife					
8	I believe that surety of compensation increase the tolerance towards wildlife menace					
9	Social benefits/beliefs about the value of wildlife and appreciation of its existence improve the tolerance among farmers					
10	In my view tolerance was linked to guarding and watching services					

*= Indicate Negative Statement

SA-Strongly Agree-5; A-Agree-4; UD-Undecided-3; D-Disagree-2; SD-Strongly Disagree-1

ज्यादा सहमत-5, सहमत-4, अनिश्चित-3, असहमत-2, ज्यादा असहमत -1

4.To study the effectiveness of existing strategies to mitigate the livestock owners-wildlife conflict.

4.1. Enlist the Mitigation strategy to alleviate damage or protect livestock and crops.

S. N.	Mitigation methods/ strategies	Rank
1.		
2.		
3.		
4.		

1.2. Which is the effective method applied to alleviate damage or repel animals?

S.N.	Mitigation Method/ strategies	Very Good	Good	Fair	Low	Very Low
1.						
2.						
3.						
4.						

#Very good has highest number having 5 and very low has the lowest number 1.

4.3 How effective are the following mechanisms in curbing livestock incursion in the park?

S.N.	Items	Very effective	Effective	Fairly effective	Not effective
1.	Park boundary				
2.	Arrests by Law enforcing				
3.	Fines/sentencing by courts				
4.	Fences				
5.	Education & Awareness				
6.	Other, specify				

4.4 How effective are the following mechanisms in curbing encroachment in the park?

S.N.	Items	Very effective	Effective	Fairly effective	Not effective
1.	Park boundary				
2.	Arrests by Law enforcing				
3.	Fines/sentencing by courts				
4.	Fences				
5.	Education & Awareness				
6.	Other, specify				

4.5 Compensation given by the government against losses due to wild animals

S.N.	Statement	Yes	No	Don't
1.	Whether there is any provision of compensation by the government against losses by wild animals?			
2.	If Yes, are people satisfied from this compensation			
3.	If people not satisfied what are the reasons	Less compensation	Long process	Lack of awareness

ICAR-NATIONAL DAIRY RESEARCH INSTITUTE
(Deemed University)
Karnal, Haryana

"Assessment of Livestock Owners - Wildlife Conflict in the Vicinity of National Park"

"राष्ट्रीय पार्क क्षेत्र में रहने वाले वन्य जीव व पशुपालकों के बीच में बिरोधाभास/ संघर्स का अवलोकन"

INTERVIEW SCHEDULE

साक्षात्कार अनुसूची

Serial No:…… Date: ……

1. Name: …… Mobile No……
2. Working Experience:…… Education/ Degree……

Livestock depredation and crop damaged caused by wild animals in last five years?

S.N.	Wild animal	Season	Livestock Loss in a year			Crop damaged		
			Livestock	Market Value of Livestock	Loss (In Rs)	Year	Major Crops	Area raided
1.								
2.								
3.								
4.								
5.								

Human and pet animals attacked by wild animals in last five years

S.N.	Wild animals	Year / Season	No. of person		Pet animals	
1.			Injured	Killed	Injured	Killed
2.						
3.						
4.						
5						

Compensation given by the government against losses due to wild animals

S.N.	Statement	Yes	No	Don't
1.	Whether there is any provision of compensation by the government against losses by wild animals?			
2.	If Yes, are people satisfied from this compensation			
3.	If people not satisfied what are the reasons	Less compensation	Long process	Lack of awareness
4.				

To assess the vulnerability of livestock owners' livelihood due to wildlife

Livelihood Vulnerability Index

Dimensions	licators	Sub-Indicators	SA	ND	SD
Biophysical Vulnerability	Human Assets	Age of household is related to vulnerability			
		Diverse conflict mitigation skill			
		Awareness regarding conflict mitigation			
		Traditional knowledge			
		Training received			
		Working manpower in family			
		Hired man force			
		Injury to human by wild animals			
	Natural Assets	Crop cultivated area			
		Land holding			
		Crop yield			
		Herd size			
		Percent of households that utilize natural water source			
		Crop diversification			
		Water availability for crop			
		Average ground water level			
		Farm diversification			
		Natural hazards			
		Firewood			
Social Vulnerability	Social Assets	Family size			
		Membership of SHGs			
		Legal penalties by Government			
		Culture and taboo			
		Social migration due to conflict			
		Membership of Cooperatives			
		Forest rules and regulation			
		Role of social leader in conflict management			
		Socio-political participation			
		Festivals and religious activity			
Institutional Vulnerability		Saving form Agricultural activity			
		Average Family Income			
		Occupation			
		Off-farm employment opportunities			

	Financial Assets	Crop loss due to wild animals (Area)			
		Crop loss due to wild animals (In Rupees)			
		Remittances			
		Compensation for loss/ damage			
		Government supported mitigation			
		Household access credit facilities			
		Major source of family income			
	Physical Assets	Livestock			
		Household that experience damage to infrastructure			
		Shelter			
		Access to information			
		Tools and equipment in farming			
		Food loss or shortage causes hunger			
SA: Strongly Agree, ND: Not Decided, SD: Strongly Disagree					

To measure the perception and tolerance of livestock owners towards wildlife

S.N.	**Perception Scale Statement**	**Response (**प्रतिक्रिया)				
		SA 5	A 4	UD 3	D 2	SD 1
1*	Crop raiding, livestock depredation, killing of pet animals, household items destroyed by wildlife are the reasons for Livestock Owners- Wildlife Conflict					
2*	Carnivore are threat to livestock and people near National Park					
3	The protection of wild animal is important for ecological balance					
4*	In the vicinity of National Park farmers fear to work in their field during odd hours due to wild animal.					
5	Chance of spreading zoonotic diseases due to Wild animals					
6	Wildlife have as much right to exist on protected areas as we have					
7*	Restriction of farming in the vicinity of the National park can reduce Livestock Owners- Wildlife Conflict					
8	Livestock owners felt more risk from wildlife than others					
9	Current laws are sufficient to protect wildlife and fauna of NP					
10	Fuel woods from National Park is important source of energy for local communities					
11	Livestock insurance may reduce the Livestock Owners-Wildlife conflict					

12	Fencing around the National Park may reduce the Livestock Owners- Wildlife conflict					
*= Indicate Negative Statement						

S.N	**Tolerance Scale Statement**	**Response** (प्रतिक्रिया)				
		SA 5	**A 4**	**UD 3**	**D 2**	**SD 1**
1	Farmers having more land have high tolerance towards wildlife					
2	Farmers who have adopted crop insurance have more tolerance to wild animals					
3	Farmers who have adopted livestock insurance have more tolerance to wild animals harm					
4	Farmers having alternate sources of income are more tolerant than other farmers					
5*	Livestock depredation by wild animals create high intolerance among farmers					
6*	Farmers feel intolerable to large, highly symbolic animals					
7	Farmer tolerate the ordinary safety hazards associated with wildlife					
8	Compensation increase the tolerance towards wildlife menace					
9	Social benefits/beliefs about the value of wildlife and appreciation of its existence improve the tolerance among farmers					
10	Tolerance is linked to guarding and watching services					
*= Indicate Negative Statement						
SA-Strongly Agree-5; A-Agree-4; UD-Undecided-3; D-Disagree-2; SD-Strongly Disagree-1 ज्यादा सहमत-5, सहमत-4, अनिश्चित-3, असहमत-2, ज्यादा असहमत -1						

3. Enlist the Mitigation strategy followed by farmers for livestock owners-wildlife conflict

S. N.	**Mitigation methods/ strategies**	**Rank**
1.		
2.		
3.		
4.		
5.		

4.1 Which is the effective method applied to alleviate damage or repel animals?

S.N.	Mitigation Method/ strategies	Very Good	Good	Fair	Low	Very Low
1.						
2.						
3.						
4.						
5.						

#Very good has highest number having 5 and very low has the lowest number 1.

4.2 How effective are the following mechanisms in curbing livestock incursion in the park?

S.N.	Items	Very effective	Effective	Fairly effective	Not effective
1.	Park boundary				
2.	Arrests by Law enforcing				
3.	Fines/sentencing by courts				
4.	Fences				
5.	Education & Awareness				
6.	Other, specify				

4.3 How effective are the following mechanisms in curbing encroachment in the park?

S.N.	Items	Very effective	Effective	Fairly effective	Not effective
1.	Park boundary				
2.	Arrests by Law enforcing				
3.	Fines/sentencing by courts				
4.	Fences				
5.	Education & Awareness				
6.	Other, specify				