Assessment of the Effectiveness of Human-Snow Leopard Conflict Mitigation Measures in Ghunsa and Yangma Valley of Kanchenjunga Conservation Area, Nepal

A Dissertation Submitted for the Partial Fulfillment of the Requirements of Master's Degree in Environmental Science

Submitted to

Central Department of Environmental Science

Tribhuvan University

Kirtipur, Kathmandu

Submitted By

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LETTER OF RECOMMENDATION

This is to certify that **Mr. Dinesh Bhandari** has prepared this Dissertation entitled **"Assessment of the Effectiveness of Human-Snow Leopard Conflict Mitigation Measures in Ghunsa and Yangma Valley of Kangchenjunga Conservation Area, Nepal"** for the partial fulfillment of the requirement for the completion of Master's Degree in Environmental Science under my Supervision and Guidance.

This Dissertation bears the candidate's own work, and has not submitted for other Academic purposes. I, therefore, recommend this work for approval and acceptance.

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<div align="center">**LETTER OF APPROVAL**</div>

The Dissertation entitled "**Assessment of the Effectiveness of Human-Snow Leopard Conflict Mitigation Measures in Ghunsa and Yangma Valley of Kangchenjunga Conservation Area, Nepal"** submitted by **Mr. Dinesh Bhandari** is accepted and duly approved as the partial fulfillment of the requirement for completion of Master's Degree in Environmental Science.

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ABSTRACT

The Human-Snow Leopard conflict has recently become one of the fundamental aspects of wildlife management as it represents the most widespread and complex challenge, currently livestock predation appears to be the single most important cause that has brought Snow leopards into direct conflict with human populations. This Dissertation was carried out to asses the effectiveness of adopted Human-Snow Leopard conflict mitigation measures and degree of tolerance towards the Snow Leopard considering livestock depredation in the Ghunsa and Yangma valley of Kangchenjunga Conservation Area (KCA).

Purposively, the study was carried out in two areas namely Ghunsa and Yangma of KCA. All together 34 household was taken for the study through a combination of social survey methods involving participatory techniques, structured questionnaire surveys of households and key informant interviews. The study assessment of the human-snow leopard conflict was the most serious issue in the high mountains of Nepal's Himalaya. Animal husbandry was one of the most important economic enterprises in Ghunsa and Yangma of KCA. But these livestock were depredated by Snow Leopard which results serious conflict between the community and the wild predators. Thus, guarding livestock was the best practice to minimize the depredation. For the effectiveness of adopted mitigation measures there should be the provision of predator proof corrals during the night time and herders should be monitored for their guarding practice during the grazing and day time. A community based livestock Insurance program was initiated in Kangchenjunga Conservation Area in 2005 by WWF-Nepal in collaboration with locals so as to reduce retaliatory killing and conflicts and create communal effort for Snow Leopard Conservation.

It is strongly recommended for the KCA to improve guarding system during day and night time in pastures and pens. Similarly, the number of predator proof corrals should be increased on required sites to reduce depredation rate of livestock.

Key Words: Snow Leopard, Kangchenjunga, Questionnaire survey, Conflict

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ACRONYMS AND ABBREVIATIONS

ACA: Annapurna Conservation Area

ACAP: Annapurna Conservation Area Project

CITES: Convention on International Trade in Endangered Species

CRAC: Community Resource Action Committee

DNPWC: Department of National Park and Wildlife Conservation

GIS: Geographic Information System

ISLT: International Snow Leopard Trust

KCA: Kangchenjunga Conservation Area

KCAP: Kangchenjunga Conservation Area Project

Km^2:   Square Kilometer (sq. km)

LIS: Livestock Insurance Scheme

mm: Millimeter

MUP: Minimum Viable Population

NML: Northern Mountain Landscape

NPWCA: National Parks and Wildlife Conservation Act

NRs: Nepali Rupees

NTFPs: Non-Timber Forest Products

NTNC: National Trust for Nature Conservation

PAs: Protected Areas

PRA:　　　　Participatory Rural Appraisal

SHL:　　　　Scared Himalayan Landscape

SLCC:　　　Snow Leopard Conservation Committee

SLCSC:　　Snow Leopard Conservation Sub-Committee

SLIMS:　　Snow Leopard Information Management System

SLSS:　　　Snow Leopard Survival Strategy

SPNP:　　　Shey-Phoksundo National Park

SPSS:　　　Statistical Package for Social Scientists

UMBCP:　　Upper Mustang Biodiversity Conservation Project

VDC:　　　Village Development Committee

WWF:　　　World Wide Fund for Nature

CHAPTER 1

INTRODUCTION

1.1 Background

The Snow Leopard *Uncia uncia* the "Mountain Queen" is a charismatic flagship species, rare and thinly populated through the Himalayas and mountains of the Central Asia (Kattel and Bajimaya 1995, Jackson 1996). This beautiful and shy species is a striking symbol of the world's highest places and top predator of the mountainous ecosystems (Shrestha 2003, Jackson 1996). It is also an environmental ambassador, encouraging the establishment of Transboundary national parks or protected areas (PAs), and an indicator of a healthy mountain ecosystem. This endangered wild cats remains one of the most mysterious cats in the world and is considered and ranked as a top level species of the food chain in the Himalayan range. The Snow leopard is also known as "Him Chituwa" in Nepali. It is a large carnivore of the Himalayan wilds. The high altitude cat lives cryptically hidden among the rocky terrain of this animal in the wild is scarcely rivaled by another cat. Due to its lithe grace and beauty of its coat, this cat is persistently sought by hunters. This activity has caused its steep decline in all high altitude areas of Asia.

The smoky-gray snow leopard weighs about 35-55kg (female; 35-40kg, male; 45-55kg), measures about 1.8-2.3 m in length from head to tail and stands 60cm at its shoulder. Snow leopards are characterized by a short broad muzzle, short forelimbs and long hind limbs that provide agility in steep and rugged terrain. Their body fur is tinged with yellow with prominent dark grayish-black rosettes and spots. The characteristic long tail aids in balancing on cliffs and rugged place. Also, snow leopards wrap their body and face with the tail for comfort and warmth against the cold. Large paws perhaps help them walk better on snow.

If the Lion is the 'King of the Beast' and the tiger the 'king of the Jungle; the snow leopard is surely 'Queen? Somehow that title seems more appropriate than 'king' when applied to the snow leopard. The Lion and tiger evoke power and ferocity. But the snow leopard's image is gentler the admiration of people from all over the world and around their interest in its homeland and varied cultures who live there (Jackson 1995).

1.1.1 Distribution and Status of Snow leopard

The snow leopard has a patchy distribution through the central Asian mountain ranges- over an area of 2.5-3.0 million squares kilometers. It is usually found at elevations 3,000-5,400m in the Himalaya; 900-3,000m in Mongolia and Russia. As the snow leopard lives above the timber line, the population has always been smaller than that of the common leopard (Panthera paradus) which for example in Nepal is distributed from the tree-lines to the sub-tropical valleys. This is not possible for the snow leopard as it has adapted itself to cold climate and rarefied atmosphere. Snow leopards occur in 12 countries Afghanistan, Bhutan, China, India, Kazakhstan, Kyrgyzstan, Mongolia, Nepal, Pakistan, Russia, Tajikistan and Uzbekistan; presence in Myanmar is unconfirmed (ISLT. and SLN, 2007). Large parts of the range have not been surveyed, or were surveyed 10-20 years ago. Much of the distribution is located along international boarders, adding to the difficulty of field work (Upadhyay, M; 2010). The distribution and status of Snow leopard is shown in the table (Annex 2).

1.1.2 Population density of snow leopards in Nepal

Snow leopards are found along Nepal's northern border with the Tibet Autonomous region, China, with the largest populations in Dolpo, Humla, Mugu, Manang, Mustang, and Myagdi districts. The snow leopard is associated with steep, broken mountainous habitat in the alpine and sub-alpine zones, where vegetation is sparse. It is usually found at elevations 3,000-5,400m in the Himalaya. Jackson estimated the number of snow

leopards in Nepal to be between 300-500. Recent studies of Department of National Parks and Wildlife Conservation (DNPWC) has also shown the presence of 300-500 Snow leopards in Nepal (DNPWC, 2009).

This Population estimate was based on the model describing the relationship between signs encounter rates, their numbers assessed through genetic analysis and the habitat suitability assessment. Jackson (1977) has arrived at his conclusion by estimating the average number of one snowleopard/110km^2. Formerly in the Namlung valley, Schaller (1973) has counted 3-5 animals within area of 250km^2, i.e., one animal/70km^2. Snow leopards in Nepal appear to live in the districts of Mugu and Dolpa where about 60 may exist. The Dolpa and Mugu districts are among a few selected places in Nepal where the snow leopard could survive. In the Dolpo district, an area of about 240km^2 has been proposed as a Sanctuary (the Shey-phoksundo area). In his recommendation to the government of Nepal, Jackson (1977) stressed the need of the establishment of the Shey-phoksundo national park as well as another Sanctuary at the suburb of Mugu district. Both of these areas have a large carrying capacity of snow leopards prey species, making survival more possible than in another area in Nepal. Green (1982) reported existence of snow leopards living within Langtang National Park near Gosainkund 3,900m and Langsisia 4,540m. Further more; Jackson also proposed the re-introduction of snow leopard in Khumbu national Park and Langtang National Park.

1.1.3 Protected Areas (PAs) Coverage in Nepal

Snow leopards are thought to occur in about 120 PAs located across their entire range in Central Asia. In Nepal, they reportedly occur in 8 PAs, but the actual number present in each PAs is unknown. Only 26.7% of the snow leopard's Potential range falls within these PAs. The total area within the PAs is about is about 22,000 sq.km. including forested and other non-habitat areas. Based on sightings, reports and anecdotal oral history, its presence has been suggested in eight mountain Protected areas (PAs) of Nepal. They are Annapurna Conservation Area, Shey-phoksundo National Park,

Kangchenjunga Conservation Area, Manaslu Conservation Area, Makalu Barun National Park, Dhorpatan Hunting Reserve, Sagarmatha National Park, and Langtang National Park (DNPWC, 2005).

Table 1.1.3 Density of Snow Leopard in different Regions of Nepal

Area	Density of Snow leopard/$100km^2$
Lungu valley (Mugu, SPNP)	10-12
Dolpo, SPNP	5-7
Manang, ACA	4.8-6.7
Phu valley, Manang ACA	4-5
Sagarmatha National Park	1-3
Kangchenjunga Conservation Area	3-4

(Source Thapa, 2007)

Its population density in Nepal is highly variable. It is denser in Lungu valley of Mugu, sparse in Sagarmatha site and generally estimated 1-5 animals per 1000 km^2 elsewhere. It seems that only five PAs Shey-phoksundo, Langtang and Annapurna, Manasalu, and Makalu Barun are predicted to be capable of meeting the "short-term survival" Minimum Viable Population (MVP) value of 50 individuals although Sagarmatha NP nearly achieves this number (Jackson and Ahlborn, 1990). But no protected area is expected to contain more than 180 animals even assuming mean densities as high as 5 individuals per100 km^2 as suggested by signs surveys (Jackson and Ahlborn, 1989).

Kangchenjunga Conservation Area (KCA) covers four VDCs of the Taplejung district; with 2,035 km^2. Mammal species symbolic of KCA include the Snow leopard, musk deer and red panda. Snow leopard's presence/absence survey has been carried out in KCA for quite some years. The GIS modeling using the revised criteria has predicted that about

63% land (1283.36 km^2) can be categorized as a potential habitat of these animals in KCA. Ghunsa and Yangma valley have been identified as the prime habitats of Snow leopard within KCA with an estimated population of 3-4 individuals/100 km^2 (WWF, 2008).

1.2 Human-Snow leopard Conflict

The snow leopard human conflict is one of the main threats to its survival because it is known to kill a large animal twice monthly on an average. Their diet consists of sheep, goats, horses and yak calves. Snow leopard conflicts with herders:-

1.2.1. Livestock Loss:- Loss of rates differ according to the kind of livestock involved, with sheep, goats, yak calves, sub adult yaks, colts, being most vulnerable because they are either small or are left up attended on the open range for extended period of time. Loss of livestock was of forage, cold or winter snow, accident and disease.

1.2.2. Costs of depredation (Economic Loss):- snow leopards attack on domestic livestock can make considerable economic loss for herding communities. Predation ultimately while affects local economy, it can lead to even negative attitudes towards wildlife conservation among herders.

1.2.3. Livestock depredation by predators: - Domestic animals commonly far out-numbered natural mainstay food item such as blue sheep, Himalayan tahrs or Ibex and they are Easter to kill. Snow leopards to prey on domestic livestock are which sets up a negative perception of the cat among herders, who then became motivated to kill snow leopard in retaliation for to prevention of attacks on livestock.

Historically herders suffering from excessive depredation solicited help from Shikari's and professional hunters, who were rewarded with gift, food, alcohol and livestock for trapping habitual stock predators (Jackson, Ahlborn, Gurung and Ale 1996, Jackson 2000). For examples, over grazing by domestic livestock may lead to competition with and eventually loss of wild ungulates, a major prey source for snow leopard. In turn, such reduction of wild prey often leads. Snow leopards to prey on domestic livestock's, which

sets up a negative perception of the cat among herders, who then become motivated to kill snow leopard in retaliation for or prevention of attacks on livestock (Theile 2003).

Snow leopards appear to attack livestock for four basic reasons:

1. Livestock are not well-guarded, especially during the daytime. At night, they may be housed in poorly constructed pens that a predator may easily enter.

2. The predator is old, incapacitated or injured and thus not able to pursue its normal prey.

3. There is not enough natural prey or habitat for it.

All of these factors may interact to worsen the cycle of depredation and retribution. Furthermore, females bringing their cubs to a livestock as prey, by teaching their offspring are what to hunt and eat. In addition, during their first 6-8 weeks of life, cubs are completely immobile and restricted to their natal den, thus forcing the female to secure all food, near by. As wild prey animals become increasingly wary or leave the immediate area, she may be more likely to go after livestock. As they mature and become independent snow leopard disperse from their natal areas, and may be forced to leave the confines of a PA, only to enter and attack livestock outside the park. The snow leopard's tendency to remain at its kill site and consume all available meat only increases their vulnerability to human retribution. Such conflict with herders dates back over 9,000 years to the time when animals were first domesticated by humans. So why is it such a problem today? Before possessing modern fire arms and traps, herders employed simple, but reasonably effective methods for minizing loss of livestock by;

- Using shepherds to maintain close watch over their livestock and keep predators away.
- Avoiding grazing their animals in predator-rich habitats.
- Using skilled livestock-guarding dogs.
- Keeping livestock in predator-proof night time corrals.
- Favored livestock breeds with well-developed anti-predator traits.

1.2.4 Threats

The snow leopard-human conflict is one of the main threats to its survival because they are known to kill sheep, goats, horses and yak calves. Depredation of snow leopard habitats continues due to year-round grazing pressure following the closure of the Tibetan border some 30 years back. Although livestock populations may not have necessarily increased in a few areas, their stocking rate had increased with the closure. Such large numbers of livestock out-compete free ranging ungulates like the blue-sheep, Himalayan Tahr and musk deer. A decline in prey population is inevitable. All mountain Pas have human enclaves in them and livestock far exceed wild ungulates. Being food deficit areas, village economy is largely dependent on animal husbandry trading. Each household keeps a considerable number of yaks, horses, sheep and goats. Since most of the land around the village is used for agriculture, livestock are sheltered in the temporary cattle shed (goth) in pastures. For example, poorer households are devastated when horses are killed which may cost nearly NRs 50,000. Depredation is compounded further by the Tibetan wolf, Jackel and wild dog.

It is argued that when snow leopard's free ranging prey are out-competed by grazing stock, livestock depredation is natural. As snow leopards are opportunistic predator, they often kill livestock because of high encounter rates and ineffective guarding by herders. A recent study in Manang suggests that blue sheep density is eight per km^2 but livestock is equally high, and the biomass of yaks is almost three times as high as that of blue sheep. In addition, the number of sheep and goats has increased with tourism for the consumption of meat. Also, unlike the free-ranging ungulates, livestock lack behavioral response for early detection of predators and subsequent evasive strategy. Reasons for livestock depredation are several and they all are important. Loss of livestock may occur through problem individual predator because of old age or injury, females with cubs, large no. of sheep in poorly-constructed pens, untended herds of sheep and other livestock, loss of active, villagers seek retribution through trapping, poisoning or

shooting. Recent data on livestock depredation indicate that since 1992 snow leopards in upper Mustang have been covertly killed in retaliation until now.

Poaching is primarily associated with the trade on snow leopard pelts, bones, and body parts are used in oriental medicine. As the illicit trans-border market exists between northern frontiers of Nepal and the Tibet Autonomous Region of clins, poaching has become too lucrative for a few. Also, these villages have become important for poachers/traders because they use villagers as conduit for their haul across the border where community vigilance and border surveillance are minimal.

1.3 Conservation of snow leopard in Nepal

The snow leopard is one of the least known and most threatened wild animals in Nepal. Limited information is available on this elusive animal as little detailed study has been conducted so far. Some of the early Himalayan studies include surveys conducted by Jackson (1979), Schaller (1977). Snow leopard populations have been seriously depleted by hunters in retaliation for livestock lifting. Many countries including Nepal have now ratified the 1973 convention on International Trade in Endangered species (CITES) in an attempt to check the fur trade. Establishment of 6 national parks and conservation areas in the high Himalayan region provide protection to animals like the snow leopard which has a restricted distributional range. The National Parks and wildlife conservation Act 2029 (1973) has listed 26 mammals (including snow leopard), 9 birds and 3 reptiles under the protected category. Hunting bans on these animals are imposed by this act. However, enraged elephants, man-eating tigers and diseased or injured animals which cannot survive can be killed or caught by the order of responsible authorities. Also, animals which damage the life and property of people outside forest areas can be killed, caught, or driven off by the continue to be killed by the local people because they lose their livestock to predation.

Nepal has taken a significant step in the conservation of snow leopards by establishing several National Parks in the Himalayan region. Langtang National Park, Shey-phoksundo National Park and Rara National Park are most famous among those with known snow leopard presence. The snow leopard is legally protected in all the Himalayan regions of Nepal by 1973 Act. These parks are protected by contingents of the Nepal Army and are regularly patrolled. The fur trade in Nepal is totally illegal and is punishable by law. The export of pelts is virtually non-existent. The snow leopard is listed as one of the most endangered species in Nepal. Moreover, Nepal has ratified the 1973 convention on International Trade in Endangered species (CITES). That prohibits trade in species like snow leopard. This has caused substantial reduction in snow leopard pelt values in Nepal (Jackson 1979). But crazy hunters often kill this elusive and shy predator just to show off. Most villagers will kill the leopard indefence of their livestock. The Department of National Parks and wildlife reserves is considering these events very seriously and is going to evaluate and compensate for the loss of the livestock of the villagers. Our wardens and game scouts are collecting information from the villagers and shepherds about the type of snow leopard/livestock interactions. We are going to find the ways and means to reduce this conflict between man the snow leopard in the near future.

Moreover, snow leopards outside the National Parks are also suffering due to reduced food sources from wild animals. Thus, they normally now tend to prey upon livestock. The snow leopard's tendency to continue although it is extremely difficult within the limited budget and manpower constraints to police the rugged habitat of the Himalayas outside the Park boundaries.

The snow leopard needs a large living space and its home range often overlaps with humans. It has low reproductive rate and is easily affected by hunting. These factors make the snow leopard extremely vulnerable and thus make its conservation and protection a difficult task. At landscape level, the 35,000 km^2 Qomolangma Nature preserve in Tibet (China) links Nepal's several Pas including Makalu-Barun, Sagarmatha,

Langtang, Manaslu and Annapurna. Also, Kangchenjunga Conservation Area of Nepal is also connected with Kangchendzonga National park (1,784 km^2) in Sikkim, India. Thus, important of trans-frontier Pas is high when conservation of snow leopard is considered. Recently, a joint study team from Nepal and china has recommended some measures to reduce transboundary poaching activities and their trade in both countries. Similar efforts and collective strength exist between India and Nepal.

Of all PAs in Nepal, Annapurna Conservation Area, Shey-phoksundo National Park and Kangchenjunga Conservation Area have initiated several grass-root measures in Conservation. The Annapurna Conservation Area project (ACAP) of the National Trust for Nature Conservation (NTNC) has instituted eight local snow leopard conservation committees since 1993. These committees own more than half a million rupees as an endowment fund for their welfare. As of now, these committees have hired communal herders for three different communities, developed two pastures with water-holes, and conducted on-going anti-poaching activities. ACAP has conducted several awareness camps and education programs including adult literacy classes. Many schools and health posts have been constructed to benefit community and biodiversity conservation. In ACAP, monitoring of livestock, blue-sheep and snow leopard populations to establish a database that helps in going since 1999. In addition, wildlife interactions, has benefited both ACAP field staff and herders.

Likewise, the Department of National Parks and Wildlife reserves and WWF Nepal programme have supported several workshops on survey methods and field techniques in Shey-phoksundo and Kangchenjunga since 1999. In addition, WWF has produced "Snow leopard Manual: Field study Techniques for the Kingdom of Nepal" which is comprehensive and a valuable field guide. In Shey-phoksundo, there are 5 snow leopard conservation committees comprising of herders, woman and villager leaders and elders. In November 2000, committee members rescued a female snow leopard nursing two cubs from being killed by retaliatory villagers. They had exhausted the animal by running it

down into the riverside. Usually, a fatigued animal is pelted with stones, sticks and tossed around by its tail until dead.

Similar efforts are being made in Kangchenjunga Conservation Area (KCA) through WWF programme. Last years, the KCA survey and monitoring team had destroyed 200 large mammal traps and snares, confiscated 2 muzzle-loading guns, and several musk deer skin. The team has a strong presence of natives of Taplejung, who can perform field surveys independently. Therefore, such activities not only gather much needed information on the snow leopard and its prey, but improve human resource development, and deter poaching activities.

The International Snow leopard Trust (ISLT) in Collaboration with experts from the snow leopard range countries has developed a standardized survey procedure known as SLIMS (Snow leopard Information Management System). The SLIMS detail methods for surveying the status and distribution of snow leopard and its prey, to facilitate information reporting and management. Using SLIMS, Shey-phoksundo field staff has established 6 snow leopards transect and monitoring has been on-going for the last 3 years. Several National and International Conservation Organizations and development agencies are now involved in the conservation of the snow leopard. They include Department of National Parks and Wildlife Conservation, Department of Forest, National Trust for Nature Conservation (NTNC), WWF Nepal programme, International snow leopard Trust, UNDP/GEF, USAID and many others.

1.4 Programs initiated to prevent snow leopard livestock conflict at the international level and national level

1.4.1 Snow leopard Enterprises

Snow leopard Enterprises was initiated with the objective to manage and ameliorate conflict between wildlife conservation and economic development. Snow leopard Enterprises offers herders and others an opportunity to increase their household's income in return for a commitment to protect the snow leopard and its natural prey. Herders, who have been known to kill snow leopards in response to their attacks on livestock, are one of the major threats to these endangered cats. Snow leopards Enterprises was established in response to persistent requests by rural Mongolian villagers to help them develop alternative sources of income. It offers the training and equipment necessary for the herders to produce hand-made, woolen handicrafts. Then the project markets these products both nationally and internationally. Participating herders sign contracts agreeing to perform specific wildlife-friendly herding practices that will not harm snow leopards or their native prey. These agreements are policed by snow leopard Enterprises supporters and National park staff. Herders receive a bonus equivalent to a month's salary on all sales if no poaching occurred, while entire communities lose this incentive if just one person has violated the contract. Financial benefits, as well as peer pressure, provide the herder to participate actively. Current the project is working with 300 participants from 200 households in Mongolia. It has increased awareness among herders and the local community of the value and benefits of wildlife, and reduced the threat to snow leopards and their natural prey. By preserving their natural prey, snow leopards are likely to attack domestic livestock (www.snowleopard.org).

1.4.2 Upper Mustang Biodiversity Project

To reduce widespread poverty in upper Mustang, the Upper Mustang Biodiversity project (UMBCP) has initiated income-generating activities for the local inhabitants, on the assumption that poverty and lack of viable alternative income generating opportunities are a cause to biodiversity loss (UMBCP 2001) and reducing poverty positively affects

biodiversity. This project has established community owned and operated micro-finance institutions to provide a financial delivery mechanism for the local people. Project has to date invested US $ 100,000 for the communities to start Community Trust Funds and community owned and operated Saving and Credit Groups in the region.

Such a group mobilizes local savings, provides financial outreach to the locals, assists in micro-enterprise development and mitigates rural financial market failures. UMBCP supports community-based fund from outside the system. The Community Resource Action Committee (CRAC) is the sole body authorized for managing the system. The committee operates the Community Trust Fund, in which US $ 25,000 has already been deposited, for coordination and supportive works, to sustain income generation schemes. Importantly, the CRAC is a local steering body for upper Mustang for overall biodiversity conservation endeavors. All together 19 groups in 18 settlements have been formed and each group covers over 90% of the population in its respective settlement. The UMBCP Savings and Credit Group formation to supplement income generation at grass-root levels is unique.

At the community level, the saving and Credit Group manages a "community owned micro-enterprise" which can also be rented out. The income generated from this will financially assist the saving and Credit Group. At individual household level, the saving and Credit Group will lend loans for productive investments, collect interest and at the same time it will mobilize community-level savings. The Savings and Credit group will also pay interest on the saving deposited. By introducing community-level and individual household-level transactions, the saving and Credit Group will be in a better position to reduce risk of its loan portfolios. The project not only seeks to reduce poverty for the conservation of biodiversity in the area, but more directly also develop a livestock insurance schemes targeted especially against livestock depredation from snow leopard. Livestock depredation by snow leopards and wolves persists in the region and snow leopards are killed in retribution. Records from 1992 to date indicate that snow leopards

have been covertly killed in retaliation in upper Mustang, in spite of the presence of ACAP (Ale, 2002). This scheme is, therefore, ultimately aiming to resolve the ailing snow leopard-people conflict and thereby help generate positive attitudes toward snow leopards. The whole idea is when farmers get compensation through insurance schemes; there would be no retaliatory killing of snow leopards after a year or so, when the group matures, and when they are capable of managing the saving and credit transactions independently through UMBCP trainings and when they start generating group funds, insurance scheme will be introduced by integrating it into the existing Saving and Credit Group. Premium rates and claims of the locals. The aim of the insurance scheme is to take the risk away (Sloman, 1999), and in this context the risk of livestock depredation from the predator, the snow leopard.

1.4.3 Corral Improvement Project

Reduce the for retribution killing of snow leopards by providing better protection of local herders livestock. In collaboration with the snow leopard Conservancy and the Mountain Institute, the International snow leopard Trust helped pilot a new program to better protect herder's livestock. In collaboration with the village of Markha, India, the Trust built predator-proof corrals that protect villager's livestock from snow leopards and wolves. The Trust provides materials such as rock, sand, and gravel. By providing better protection of livestock and reducing herder's losseses, the program helps find a way for herders and snow leopards to share their habitat. In exchange for the programs support, herders signed environmental agreements that ensure the protection of snow leopards and their wild prey. Since the completion of the corrals, no livestock have been lost to predators-a major accomplishment. During the construction phase, villagers did suffer losses from a snow leopard attack. But due to the participatory nature of the project and the high level of support from the village, the project was completed and no retaliatory actions were taken against snow leopards in the area (www.snowleopard.org).

1.5 Justification of the Study

Snow leopards are found in the Himalayas above 3,000m and below 5,400m and are associated with steep, broken mountainous habitat in the alpine and sub-alpine zones, where vegetation is sparse. In this region, local people mostly depend upon the livestock as a source of their income which then overlapped by snow leopards. This creates an environment where the opportunistic snow leopard preys on livestock. The snow leopards are then killed. Because of this reason the relationship between the local people and the snow leopard has not been harmonious and creates a conflict between them, which threatens the community economically and physically.

The human-snow leopard conflict has been widely acknowledged as one of the fundamental issues in Nepal and elsewhere. To combat this problem, various conflict mitigation measures have been implemented in the high mountains of Nepal's Himalaya including scared Himalaya Landscape (SHL), Northern Mountain Landscape (NML), Annapurna Conservation Area (ACA), and Kangchenjunga Conservation Area (KCA). These measures include the formation of snow leopard Conservation Committees (SLCC), regular financial and technical back up, the establishment of a community-based livestock insurance scheme, awareness campaigns, construction of predator-proof livestock corrals, strengthening of guard dog systems, initiating veterinary services, strengthening the rotational grazing system, instituting the community-managed livestock insurance schemes etc. Despite these efforts, we do not have clear picture of effectiveness of such mitigation measures towards the conservation of the snow leopard. Such information is, in turn, expected to greatly facilitate the development of sound guidelines for snow leopard conflict mitigation strategies in Himalaya of Nepal. Thus, this study was undertaken to highlight the effectiveness of existing adopted human-snow leopard conflict mitigation measures and degree of tolerance towards the snow leopard considering livestock depredation in the Kangchenjunga Conservation Area (KCA).

1.6 Objectives of the Study

1.6.1 General Objective:

The broad objective of the proposed study is Assessment of the effectiveness of human-snow leopard conflict mitigation measures in Ghunsa and Yangma valley of Kangchenjunga Conservation Area.

1.6.2 Specific Objectives:

- To acquire information on livestock holding patterns and intensity of livestock depredation by snow leopard.
- To document the existing mitigation measures and the prevailing conservation attitudes among respondents
- To explore effectiveness of mitigation measures and to minimize retaliatory killing of Snow Leopard.

1.7 Limitations of the Study

All the research works are bounded by some limitations. The main limitations of this study were as follows:

- The study was mainly based on questionnaire data and information's.
- This study was dependent on the response of the respondents, researcher's observation and survey tool of participatory rural appraisal (PRA).
- The findings of the data collected from the particular area were not being replicable to other regions.

CHAPTER 2

LITERATURE REVIEW

Jackson (1996) studied the home range, distribution and ecology of snow leopard in Langu valley in Dolphu in 1996. This was followed by another study in Manang in 1998. Both related some facts about the home range, movement pattern and ecology. Jackson (2002) reported a questionable inverse relationship between snow leopard density and blue sheep in Trans-Himalaya of Nepal. Snow leopards are found along Nepal's northern border with the Tibet autonomous Region, china, with the largest population in Dolpa, Humla, Mugu, Manang, Mustang and Myagdi districts (Bajimaya 2001). Because no protected areas in Nepal are large enough to contain viable populations of snow leopards and other large predators, the establishment of Tran frontier conservation areas at landscape level with neighboring countries may facilitate genetic exchange between individuals ensuring their long-term survival (Jackson and Ahlborn, 1990).

Snow leopards are solitary and territorial animal. Home range size is function of prey species availability and abundance, and habitat quality. It varies from 12-39 sq.km in prime habitat to over 1,000 sq.km in marginal habitat in Mongolia; this has lower prey densities (McCarthy, 2000). Oli (1991) analyzed total 213 (snow leopard) scats, the prey item included seven species of wild animals, five species of domestic mammals and birds. Jackson and Ahlborn (1990) concluded that 65% of this snow leopard population was located outside Nepal's protected area. Thus landscape conservation becomes an important strategy. WWF's Himalayan Region snow leopard Action strategy workshop, 2005 in Paro, Bhutan highly emphasized on landscape approaches to conservation within a regional context, rather than focusing on individual protected areas Thapa (2004) in a case study from Phu valley, Manang district, Annapurna Conservation Area concluded a positive correlation between the density of blue sheep, number of snow leopard and livestock depredation. Marks may be more than four times as abundant in areas where core home range overlaps among different individuals. From studies in Nepal, the

intensity of home range "Core areas" overlaps. These represent sites where sampling is most profitably under taken (Jackson and Hunter, 1996).

Depredation by snow leopard in Phoo is a natural phenomenon like in other parts in the snow leopard home range. The intensity, however, differs from pasture to pasture, from season to season and from livestock species to species. The depredation intensity is also affected by local herding system, other socio-economic factors and the bio-physical environment of individual pastures. Oli (1991) reported that the annual depredation in Manang area was 2.6%. Depredations have been found to be ranging from 7.6% for sheep and goat in western china (Schaller et.al. 1994). Sherpa and Oli (1988) reported that Phoo village, the current study area, looses 10 cattle and yaks, 25 sheep and goats and 3-4 horses from depredation each year. However there are needs to specifically indicate the bio-physical characteristics of the individual pastures that are responsible for livestock depredation. In most of the cases the depredation losses are cumulative including that of lynx, wolf and other predators associated with snow leopard. There are difficulties to extract the exact depredation by snow leopard. Snow leopard is often blamed when other predator kill the livestock. In addition to these the livestock guarding systems are also not adequately elaborated to address depredation phenomenon.

The livestock depredation in Phoo was never carried out in detail before. This study was therefore carried out in Phoo village to elaborate the depredation specificity in relation to site, site characteristics and herding practices. In the early 1980s Jackson and Ahlborn (1984) initiated a major study on the snow leopard in the prime habitats in Dolpo in Nepal. This was followed by another study in Manang (1988). Both studies, which revealed much about cat's home range, movement patterns and ecology, were concentrated in the western region. Fox and Jackson (1994) report a questionable inverse relationship between snow leopard density and blue sheep in trans-Himalayan Nepal (blue sheep 2-4/sq.km. and 2.8 snow leopard sign item/100m) of sign transect) and in Bhutan/blue sheep 4-6/sq.km and 1.2 snow leopard sign item/100m). The snow leopard has patchy distribution through the Central Asia mountain ranges over an area of 2.5-3.0 million square kilometers. It is usually found at elevations 3,000-5,400m in the

Himalaya; 900-3,000m in Mongolia and Russia. Snow leopards are found along Nepal's northern border with the Tibet autonomous Region, China, with the largest populations in Dolpo, Humla, Mugu, Manang, Mustang, and Myagdi districts (Bajimaya, 2001), computer-based modeling suggests that these areas are the only ones that can support a minimally viable population of 100 or more, therefore, whenever possible adjacent parks should be linked by corridors (Jackson and Ahlborn, 1990). Snow leopard is solitary and terrestrial animals. Home range size is function of prey species availability and abundance, and habitat quality. It varies from 12-39 sq.km in prime habitat in Mongolia; this has lower prey densities (McCarthy, 2000).

This is becoming the single most important conservation issue for large predators like the snow leopard. The number of domestic stock damage complaints is increasing in most areas, along with increasing number of livestock and decreasing number of herbivores snow leopard that attack livestock, especially those implicated in repeated or multiple killing, usually end up being killed themselves, for angry herders will try to trap, poison, or shoot predators that cause unacceptable economic loss. (WWF, 2001)

The high mountain of Nepal where snow leopards occur have long supported a variety of large mammals and livestock, which is a clear indication that wild animals and livestock can coexist as elsewhere in the Himalayan region. However, this balance between herbivores and plants is now increasingly threatened because of habitat degradation partly due to heavy grazing pressure following the closure of the Tibet border. Grazing and constant trampling by ever increasing numbers of livestock have led to widespread degradation of Fragile alpine meadows and shrubs land ecosystems, which has influenced the survival of the region's wildlife such as snow leopards (Fox, 1994). Because of the inter-linkage of rangeland, wildlife and animal husbandry, any conservation strategy to conserve large mammals such as snow leopards should be based on an integrated grass-roots approach with a strong focus on reducing poverty. Besides, protection measures confined only to protected areas are not sufficient for snow leopard conservation in

Nepal, because more than half of snow leopard territory falls outside of the protected areas (Jackson and Ahlborn, 1990), the management of which lies with the District Forest Office under the Forest Act 1993. Management and protection of snow leopards in protected as well as outside protected areas is the most preferable strategy to meet the long-term conservation of snow leopards in Nepal. This should be complemented by trans-boundary cooperation for linking protected areas in neighboring countries.

Lack of scientific database has always impeded proper management goals. Also, the old-age issue of snow leopard-livestock conflict still remains (Jackson, 1994). As Schaller 1998 states "Conservation is a social problem not scientific, issues such as population growth, habitat encroachment as a result of local, national and international economies play vital role, baseline information, monitoring and evaluation are fundamental to understand progress in resource management (Sinclair and Acres, 1995).

Jackson who is a leading figure in snow leopard conservation writes "livestock depredation has become a significant problem across the snow leopard range in central Asia, being most severe in and around protected areas. Such predation, especially incidents of "surplus killing" in which five to hundred or more goats are lost in a single night, almost inevitably leads herders to retaliate by killing endangered carnivores like snow leopard and thus continuing the age-long conflict (Jackson, 1994).

Peter Mathiessen's famous book " The snow leopard" (Mathiessen, 1978), in which George Schaller searches for the snow leopard Uncia uncia in remote alpine valleys in parts of Dolpo in west Nepal while Peter Mathiessen seeks spiritual tranquility, establishes Nepal as a haven for the elusive snow leopards. In the 1980's five snow leopards were radio-collared for the first time in the Langu valley in Dolpo by Rodney Jackson's team (Jackson and Ahlborn, 1989). The early nineties witnessed a Nepalese biologist Madan K. Oli, tracking three snow leopards in Manang valley in Annapurna region (Oli, 1994). Apparently, snow leopards of Nepal have caught the interest of academicians and biologists much earlier than elsewhere. With this came the realization that the population of snow leopards in the country was under threat and hence since the early 1970's, the government has taken the necessary steps to conserve them within its territory. The National Parks and Wildlife Conservation (NPWC) Act 2029 (1973) listed

the snow leopard as a fully protected species. The fourth Amendment of this Act increased the penalties for poaching snow leopards and buying and selling its pelt and bones up to Rs 100,000 (approx. US $ 1,300) or five to fifteen years in prison, or both (Kattel and Bajimaya, 1995). Killing in retribution for livestock depredation and poaching for pelts and bones are the main threats to snow leopard survival in Nepal.

Despite the strong religious and conservation legislation and practices snow leopards of Nepal to date continue to be threatened due to habitat loss and the retaliatory killings of snow leopards in retribution of livestock depredation (Jackson et al. 1994).

Madan Kumar Oli (1991) have been found total 213/snowleopards) scats were analyzed and the prey item identified includes 7 species of wild mammals, 5 species of domestic mammals and birds. Their interviews with Nar/Phu villages disclosed that at least 10 cow and yak calves, 25 domestic sheep and goats and 3 to 4 horses are killed annually by the snow leopard in each of the Nar/phu villages (Sherpa and Oli, 1988), Sherpa and Oli (1988) state that blue sheep doesn't seem to present any problems in both upper Manang and Nar but in Phu blue sheep often raid.

In Nepal, the number of yak and chauri (female yak) total 140, yet up to 25%/35 animals) are claimed to be killed by snow leopard every year and in Ghyaru 14% of all yak and chauri are killed every year by the snow leopard (Groves, 1998).

Thapa (2004) indicated altogether seventy animals were reportedly lost to snow leopard both Nar and Phu VDC's. Of this, Nar village losses 31 animals and Phu village losses 39 animals and 1.01%, 2.13% depredation rate respectively. The average number of livestock lost to snow leopard per household was 0.53 and 1.18 animals in the year 1999-2000 Nar and Phu respectively. Total economic lost of Rs3; 44,000/- was calculated for the period of 1999-2000. The average loss per household was estimates Rs 3510, 20/-

CHAPTER 3

METHODOLOGY

The study was carried out in the Ghunsa and Yangma of Kangchenjunga Conservation Area (KCA). Different methods like structured questionnaire, survey tools of participatory rural appraisal (PRA), interviews with local household members, KCAPs staff, and some herders.

3.1 Description of the Study Area

Kangchenjunga Conservation Area (KCA) (27° 24' and 27 ^{o} 57' N, 87 ^{o} 33' and 88 ^{o} 12' E) is situated in the far eastern and northern parts of Nepal as Transnational protected area between Sikkim, India, and bordered by Qomolongma Nature reserve (Tibet Autonomous Region of China) and Nepal. Kangchenjunga Conservation Area (KCA) is the only protected area of Nepal managed by local communities. This area covers more than 50% of the total area of Taplejung district with 2035 square kilometers.

This area was declared as conservation area in 1997 to protect and manage the biological and cultural resources of this area through the joint efforts of Government of Nepal, Department of National Parks and Wildlife Conservation (DNPWC) and WWF Nepal. The main important flora of this area; pure stands of Thingre salla, Dhupi salla, 48 types of Orchids, and 137 types of Non-Timber Forest Products (NTFPs). Among these, 13 plant species are endemic to this area while 24 are endangered species listed in IUCN, CITES, and National parks and wildlife Conservation Act 1973. Twenty two species of mammals (estimated existence of 58 mammals) and more than 253 species of birds are found in this area. Snow leopard *Unicia uncia*, Red panda (Ailurus Fulgers), Himalayan Black Bear (Ursus thibetanus), Musk Deer (Moschus Chrysogaster), Grey Wolf (Canis Lupus) and Macaque (Macaca assamensis) are the important endangered mammals found here. Other important mammals of this area are common Leopard (Panthera Pardus), Blue sheep (Pseudois nayaur) and common Langur (Semnopithecus entellus).

This area consists of four remotest village Development Committees (Lelep, Tapethok, Wolangchung Gola and Yamphudin) of Taplejung district. There are 35 villages and about 1000 households with a population of approximately 5,500. KCA accommodates culturally diverse ethnic groups including Sherpa, Limbu, Rai, Gurung, Tamang, Sarki, Damai, Kami, Bahun and Tibetan refugees. Although KCA is rich in natural resources, local people's socio-economic condition is below the satisfactory level.

About 66% of total population falls below the poverty line. The main occupation of the local communities is agriculture along with animal husbandry.

The proposed study was undertaken in Ghunsa and Yangma as a study area assessment of the effectiveness of human-snow leopard conflicts mitigation measures in Ghunsa and Yangma of Kangchenjunga Conservation Area. Ghunsa village is situated in Lelep VDC of KCA in the far eastern part of Nepal. It is covered by sub-alpine fir, juniper and larch forest up steep river valley. Ghunsa is a Sherpa village with intensive agro-pastoralism. This village consists of 30-45 households. Most of the people have yak as a livestock in Ghunsa village. There is an electricity, telephone facility, school, guest house for tourist because it is the main route for tourist to visit Mt. Kangchenjunga.

Yangma is another proposed study area. It lies in northeast part from Walangchung Gola VDC in KCA. It is located in between Yangma River and Syabok River at the altitude of 4200m.The floods in these two rivers gradually eroding the village every year. So many people from this village migrated too. There were 15-20 households in Yangma village. It is both a winter and summer settlement and a lot of firewood is necessary to survive the harsh and long winter. There is a primary school in Yangma where the student enrollment is very low or negligible. It is also a part of trading route to China.
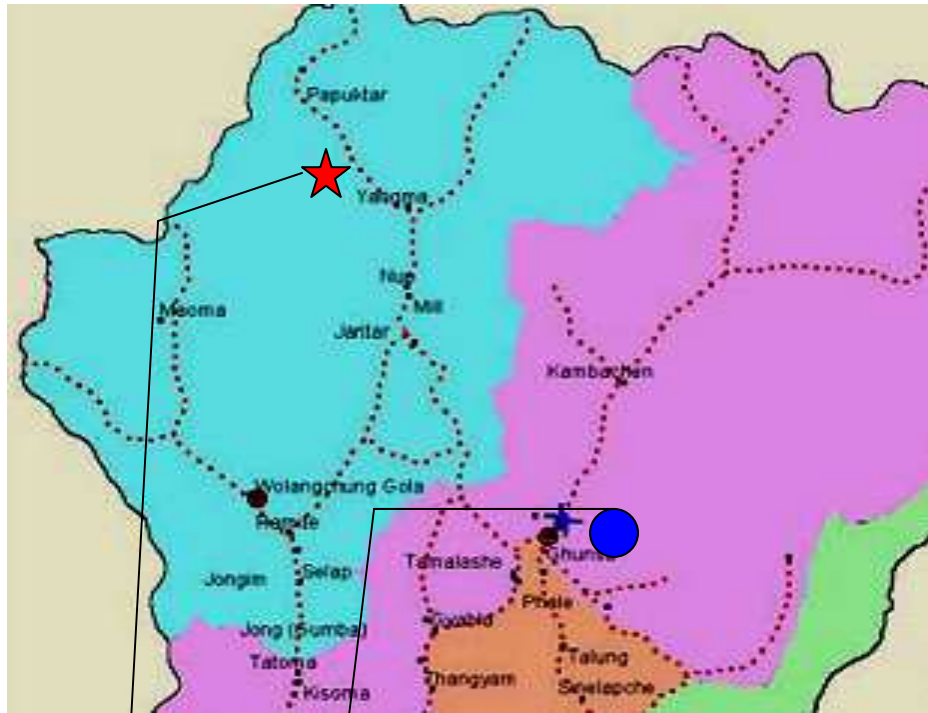
Fig. 3.1.1 Study area Ghunsa and Yangma

Legend

 Yangma

 Ghunsa

Fig. 3.1.3 Protected Areas of Nepal

Fig. 3.1.2 Kangchenjunga showing Ghunsa and Yangma

For this study namely Ghunsa and Yangma were selected and two levels of samples, households and respondents were determined for the primary data collection. There were all together 34 households carried at the time of this study in Ghunsa and Yangma because most of the people migrate to Tibet for business purpose. The study was conducted in last of the November 2008.

3.2 Data Collection Technique

3.2.1 Primary Data Collection

A set of questionnaire was developed to achieve the research objectives. The primary data was gathered using PRA tools like preference ranking of different pasture, problem ranking in relation to different predator, livestock depredation, key informants, interview and discussion with local people, and some herders. Household survey was focused on quantifying information that was measurable overtime in terms of conflict imparted by Snow leopard in the sampled area. In collecting data scheduled technique was employed. While collecting data respondents were asked question regarding Conservation attitude in relation to Snow leopard, predation pattern, and perception of Snow leopard attack on livestock, other conservation agencies, mitigation measures techniques, future conflict resolution plans and conservation activities initiated.

The discussion was carried out on herders and other local people dependent on livestock holding, KCAP's office staffs. Some of the things observed were livestock management pattern, attitudes towards Snow leopard. The attitude or perception of different level of respondents were measured in a "disagree" to "agree". The questionnaire was prepared in Nepali and then translates into English. The detail of the questionnaire is given in Annex 1.

3.2.2 Secondary data collection

Through desk study, secondary data were collected from related Project reports, various research papers, Library, Internet surfing, KCAP's office Taplejung, NTNC's Office, WWF Nepal, literatures etc. Information regarding livestock depredation by Snow

leopard, Snow leopard Conservation Sub-Committee LIS were collected from KCAP's office Taplejung.

3.2.3 Data Analysis

The data generated from different household survey and tools of PRA were analyzed using Statistical package for Social Scientists (SPSS 16.0) for windows. All the collected data were coded, entered and tabulated. The raw data were run to the Statistical analysis using Ms-Excel 2003, and SPSS 16.0 Statistical computer packages. Mostly descriptive Statistics were used as per the nature of data. To make findings more clear and conspicuous to the reader and present the data, graphs were calculated wherever necessary for the study. Information generated from PRA was also analyzed and presented in qualitative form. The results were then presented in descriptive, tabular or graphic forms. An attempt is made to present the data in conspicuous manner possible.

Data Collection

Data Analysis

Findings
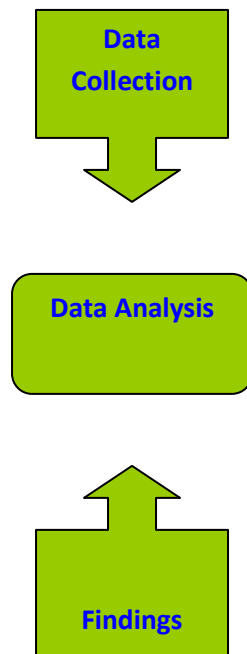
Fig.3.2.3 Conceptual model for the data collection and the Analysis

CHAPTER 4

RESULTS

4.1 Primary Sources of Livelihood

Livestock husbandry was a most important source of livelihood. 52.70% of people depend upon the livestock as shown by result. Besides this 23.97% of people depends on the agriculture as a income source for livelihood. Similarly 14.26% of the people depend on the tourism, and 8.82% of the people depend on the business which is the least percentages among the other sources of livelihood. Thus it indicates that most of the people, about half of the people heavily relied on livestock husbandry for their livelihood in KCA. The result shows that animal husbandry was one of the most important economic enterprises; it contributed over half of the total income of the inhabitants.

Fig 4.1 Primary sources of Livelihood
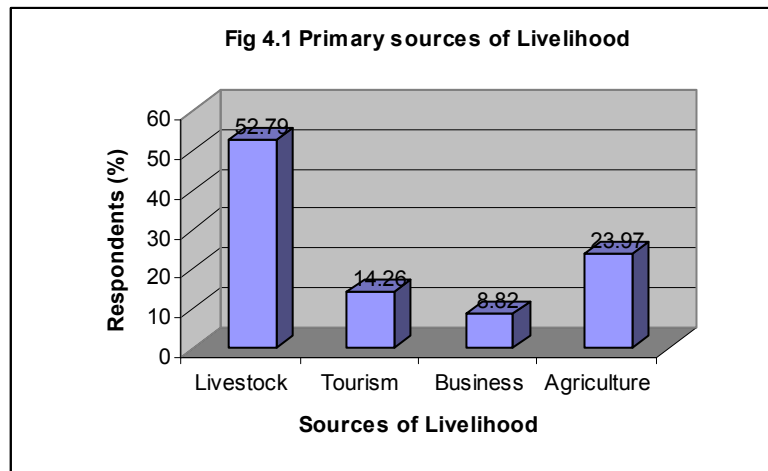
4.2 Livestock Husbandry

People of KCA mostly relied on livestock husbandry because it is important source of livelihood. Education level among the peoples in Kangchenjunga Conservation area moderate. More than 60% of the people had the lower secondary education, 2% had the secondary level and more than 37% of the people were illiterate. As there had not been any cheese factories to sell the milk directly, herders had to make income by making

'Chhurpi, a hard cheese like product and ghee. In spite of the good income, this occupation has been less prioritized by the new generation and there have been a trend of shifting occupation. There was significant variation in livestock holding size among the herders. More than 7% of the herders had the livestock holding size of more than 70, whereas about 35% had the livestock size of 20-45 and about 58% had the less than 20. The average number of livestock per household was found 25.2. The total number of livestock holding in KCA (Ghunsa and Yangma) was found to be 342 Yak, 498 Nak and 15 goat 40% of Yak, 58% of Nak, and 2% of goat was found as a livestock (Fig 4.2 (a,b). Among them total number of Nak and percentage of Nak was found to be higher than other livestock husbandry. In summary results indicate that most of the peoples in KCA depends on livestock husbandry. Depending upon livestock husbandry 65% of respondents agreed that income from livestock was higher during than previous year.

Fig 4.2 (a) Livestock holding pattern

Fig 4.2 (b) Livestock holding sizes and depredation rate

Fig 4.2 (c) Income from livestock during 5 years

12%   3%
12%
8%
65%

- Decreased
- Don't know
- Satisfactory
- As it is
- Increased
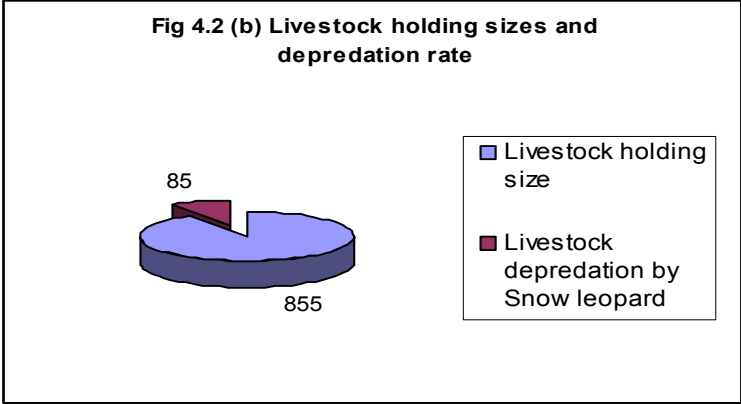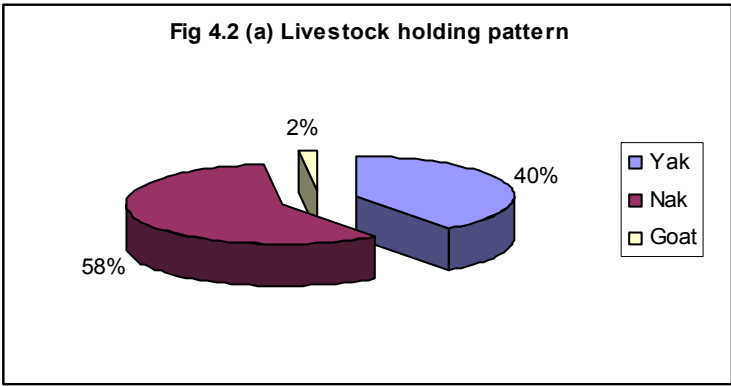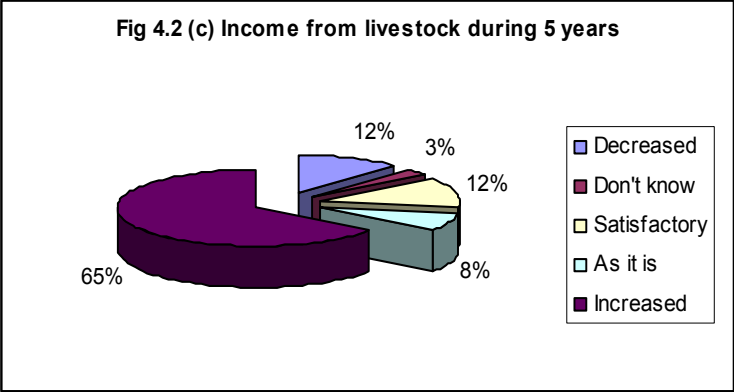
4.3 Supply of Forage during winter and summer season

One hundred percent of respondents agreed that supply of forage was insufficient in winter whereas 85% of respondents agreed that supply of forage was sufficient in summer in KCA.

Fig 4.3 Supply of forage during Winter and Summer season

Respondents (%)

100 — 100
80 —
60 —
40 —
20 — 3   12   85
0 —
Unsure   Insufficient   Sufficient

Supply of forage
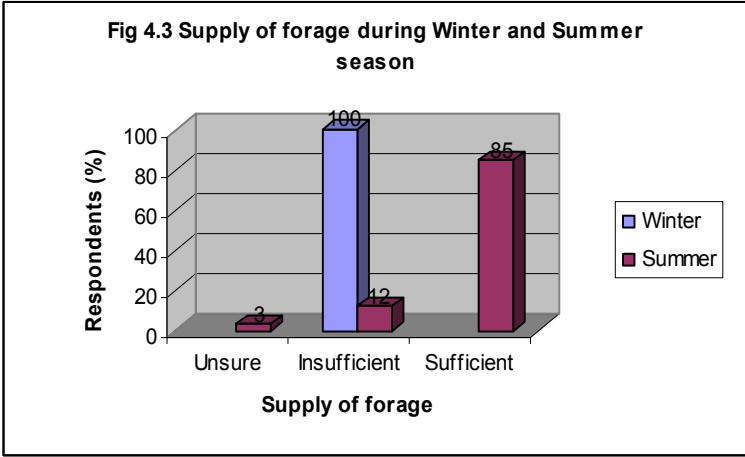
- Winter
- Summer

4.4 Causes of Livestock Mortality

The highest causes of livestock mortality in KCA were due to the predation and winter snow (Rank>5.0), where as diseases and accidents were ranked as moderate causes (Rank 2.0 to 4.0) and lack of forage was ranked as the lowest cause (Rank <2.0). Overall results show that livestock predation was ranked as main cause of livestock mortality

followed by diseases; accidents and lack of forage were moderate cause of livestock mortality.

Fig 4.4 Major causes of Livestock mortality

Causes	Rank in number
Lack of forage	2
Accident	3
Disease	4
Wintersnow	5
Predation	5
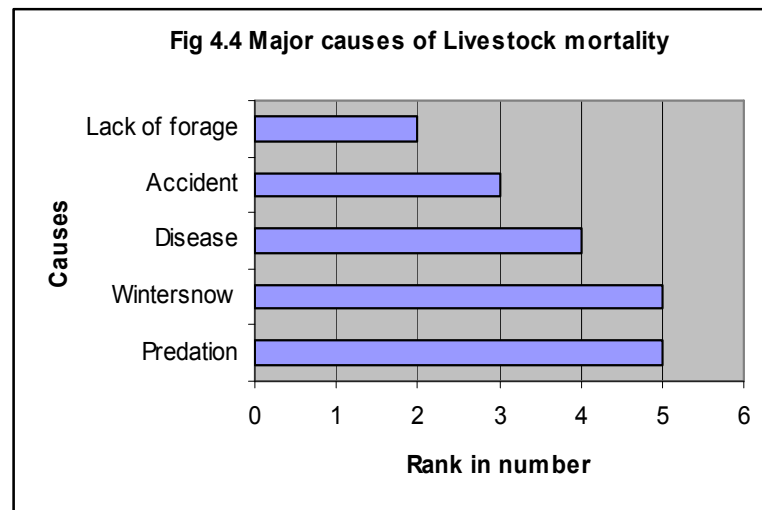
4.5 Preference Ranking for Predator prone pasture

Preference ranking for different predator prone pastures was carried out. This was done employing a PRA tool called preference ranking. The different pastures that were used by the villagers were listed down. These pastures were then rated to find its preference shows in figure (4.5) below. The different pastures were compared against each other and the more preferred one's name was putdown. The villager's preference among different pasture was based on pasture size and fodder available. Among different pastures Doodhpokhari which scored 8 was the most preferred predator prone pasture and then so on. Jimbubari which scored 1 was the least preferred predator prone pasture.

Fig 4.5 Preference Ranking for predator prone pasture
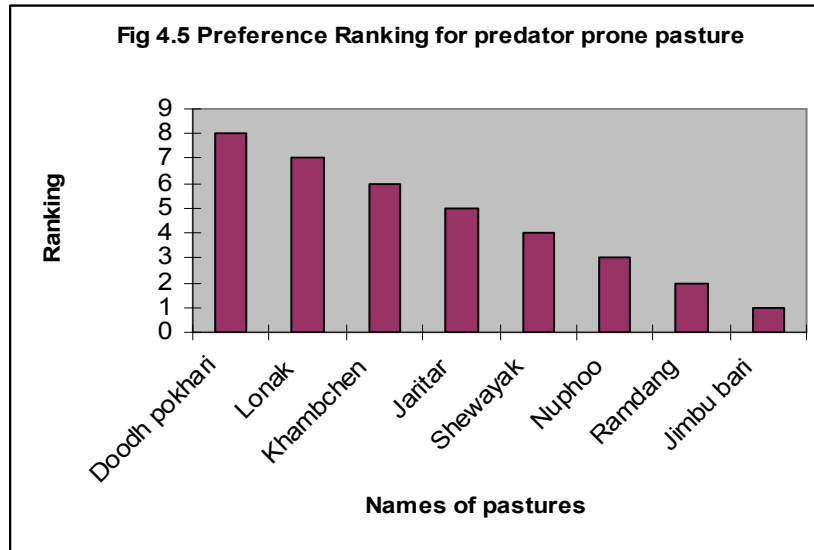
4.6 Month of Predation

According to the study it was found that the maximum percentage i.e. 63% of predation took place on winter season followed spring and summer. The winter pastures are limited in terms of number and area. Therefore, the animals are concentrated in limited pastures where the livestock density becomes high. This makes the animals weak and there was a high chance of encountering of livestock by Snow leopard at the pasture. The winter pastures at lower altitude are with shrub and forest coverage. They are also down in the valleys and gorges where the topography was with cliffs, broken surface and boulders. This provides Snow leopard a good hide.

Fig 4.6 Month of Predation
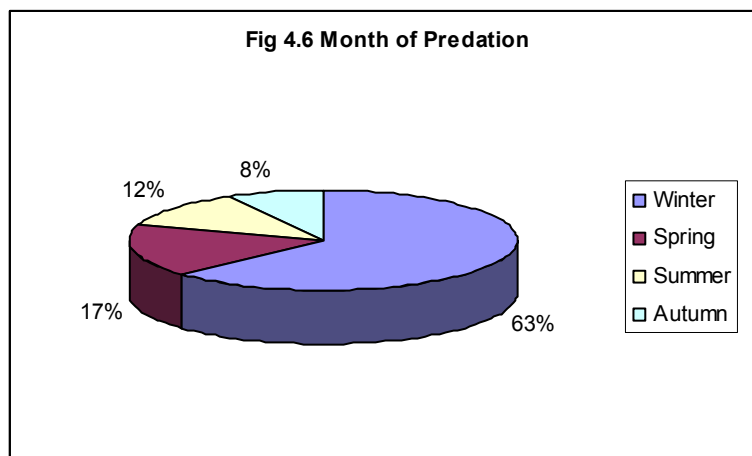
4.7 Problematic Wild animals

According to result, the snow leopard was categorized as the most problematic animal in Ghunsa and Yangma (Threat level > 4). Besides this Blue sheep was categorized as another problematic animal after Snow leopard in this area. Similarly Himalayan tahr and musk deer were absent in Ghunsa and Yangma (KCA). Likewise, wild boar and red fox were least (Threat level >1) problematic animals in this area.

Fig 4.7 Threat level of problematic wild animals as precieved by the respondents
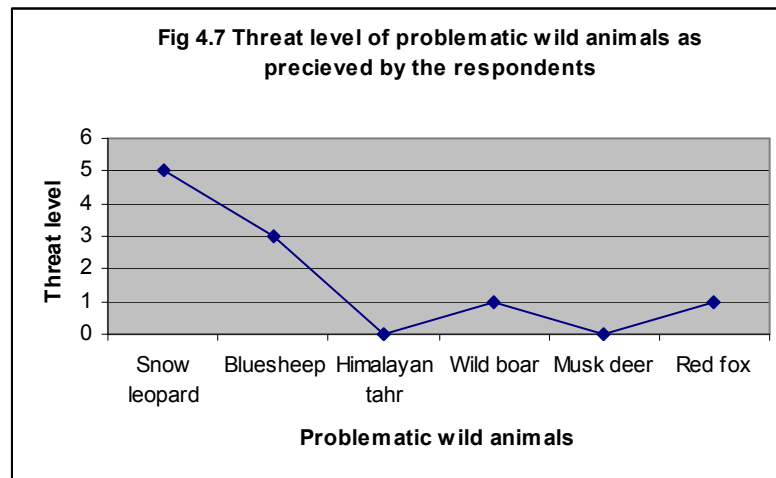
4.8 Human-Snow leopard Conflict

In Ghunsa and Yangma, 100% of the respondents agreed that there were no attacks on humans by Snow leopard. Similarly 62% of the people agreed that livestock was killed by Snow leopard. More than 90% of the respondents did not agreed on livestock injured by Snow leopard. This perception indicated that fewer than 10% of livestock could have chance to survive if attacked by Snow leopard. There were no results found in Ghunsa and Yangma of human being attacked by Snow leopard.

fig 4.8 Human-Snow leopard conflict in Ghunsa and Yangma

A bar chart titled "fig 4.8 Human-Snow leopard conflict in Ghunsa and Yangma" showing Respondents (%) on the y-axis and Problems on the x-axis.

- Livestock killed: No = 38, Yes = 62
- Livestock injured: No = 94, Yes = 6
- Human attack: No = 100
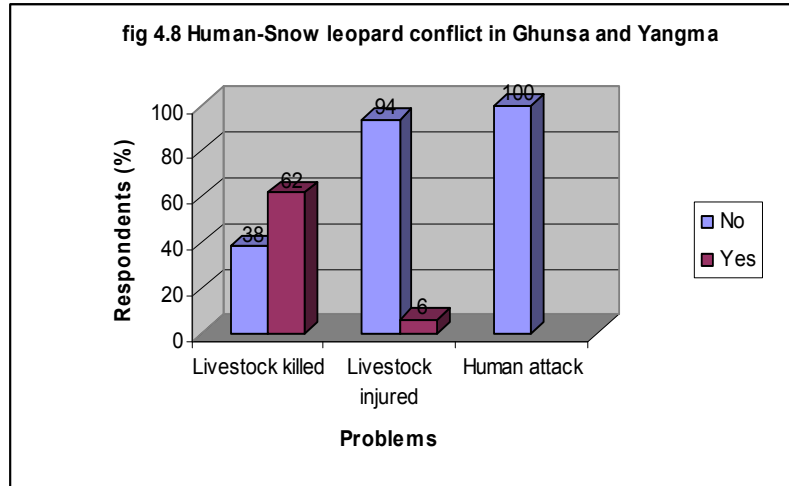
4.9 Perception of Livestock attack by Snow leopard in Pastures and Pens

The majority of the respondents (82%) in KCA noted that pasture was more vulnerable to livestock attack by Snow leopard than pens. Similarly 73% of the respondents did not agreed about the attack of Snow leopard in village pens. This response indicates that guarding of livestock is moderately good in KCA.

In contrast, livestock pens and night guarding was not a greater concern than livestock guarding problems in pasture lands.

Fig 4.9 Perception of Livestock attack by Snow leopard in pastures and pens

A bar chart titled "Fig 4.9 Perception of Livestock attack by Snow leopard in pastures and pens" showing Respondents (%) on the y-axis and Respondents perception on the x-axis.

- No: Village pens = 73
- Don't know: Village pens = 18, Pasturelands = 18
- Yes: Village pens = 9, Pasturelands = 82
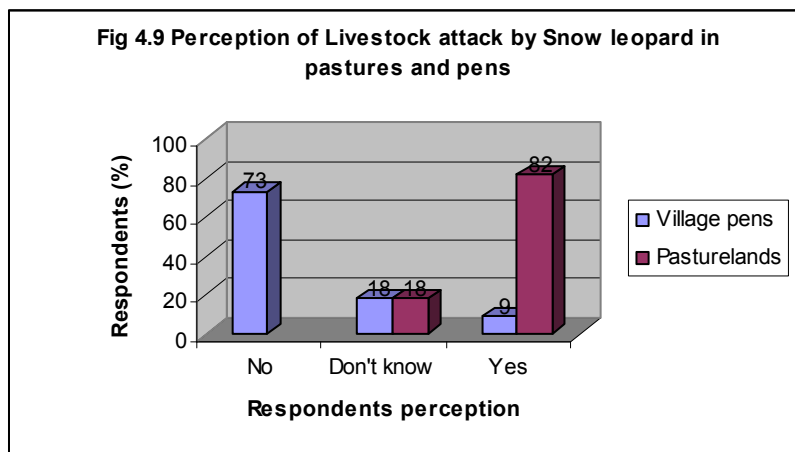
4.10 Peoples perception on Snow leopard

According to the result more than 60% of livestock was injured by Snow leopard. Similarly, 94% of the respondents agreed that killing of livestock by Snow leopard was serious problem in Ghunsa and Yangma. More than 90% of the respondents believed that the rate of retaliatory killing of Snow leopard was decreasing in this area. About 76% of respondents claimed that the effectiveness of mitigation measures was increasing signific

antly.

Fig 4.10 Peoples perception on Human-Snow leopard conflict during 5 years
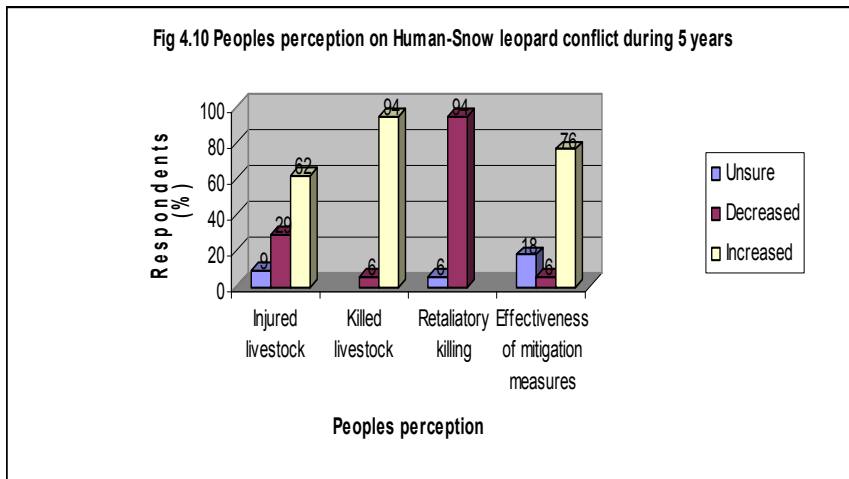
4.11 Problem caused by Snow leopard

In Ghunsa and Yangma of KCA, 70% of respondents disagreed that habitat degradation was main factor of snow leopard problem, however 24% of respondents agreed that habitat degradation was the key conflict factor with the Snow leopard (Fig 4.14 (a). Only 3% of the respondents were totally disagreed and 3% of the respondents were totally agreed about the habitat degradation.

Fig 4.11 (a) Habitat Degradation
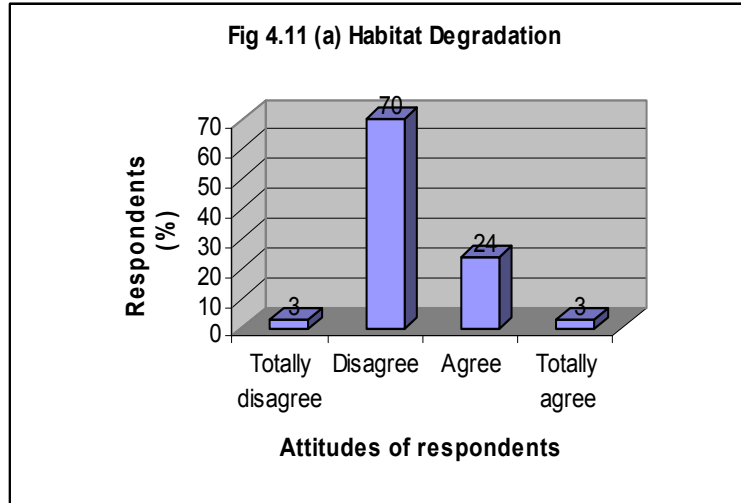
More than 60% of the respondents agreed that the increase in population of Snow leopard was major causing problem regarding depredation of livestock.

Fig 4.11 (b) Increase in population of Snow leopards
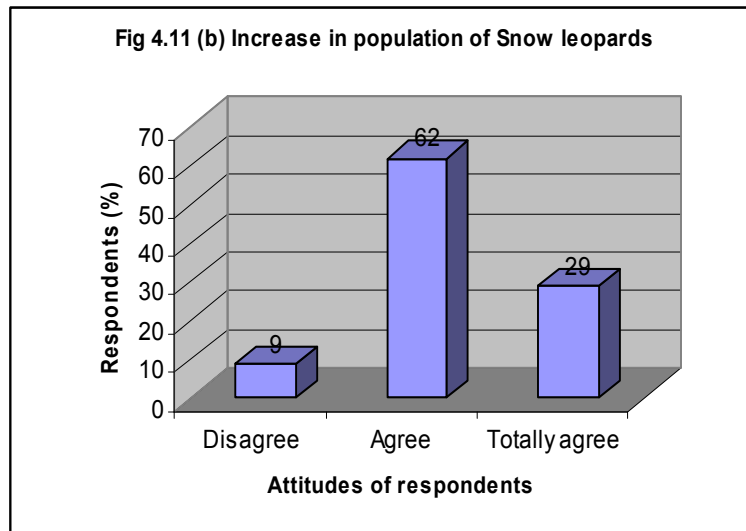
More than 55% of respondents disagreed that teasing of Snow leopard by human was a major causing problem. Most of the people in KCA (58%) supported the idea that the reduction of effective mitigation measures could be a major problem of Snow leopard. Similarly 50% of respondents were conscious that the lack of livestock guarding was one of the key factors associated with the Snow leopard conflict with human.

Fig 4.11 (c) Teasing of Snow Leopard by human

Respondents (%)

60
50
40 — 38
30
20
10
0

Totally disagree: 38
Disagree: 59
Agree: 3

Attutudes of respondents
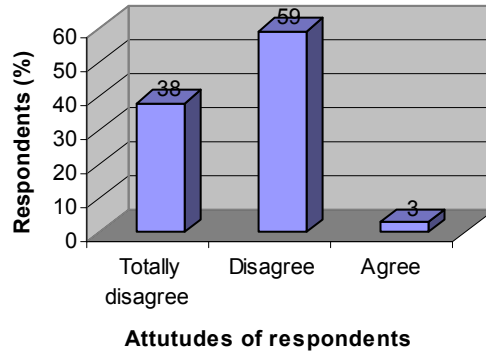
Fig 4.11 (d) Decrease in effectiveness of mitigation measures

Respondents (%)

60 — 58
50
40
30
20 — 24
10 — 9
0

Totally disagree: 9
Disagree: 24
Don't know: 3
Agree: 58
Totally agree: 6

Attitudes of respondents
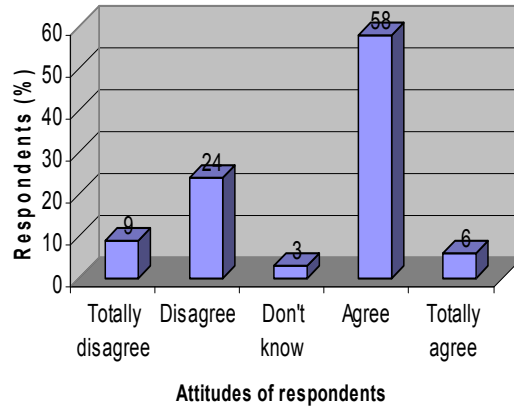
Fig 4.11 (e) Poor guarding of Livestock

Respondents (%)

50 — 50
40
30
20
10
0

Disagree: 3
Agree: 50
Totally agree: 47

Attitudes of respondents
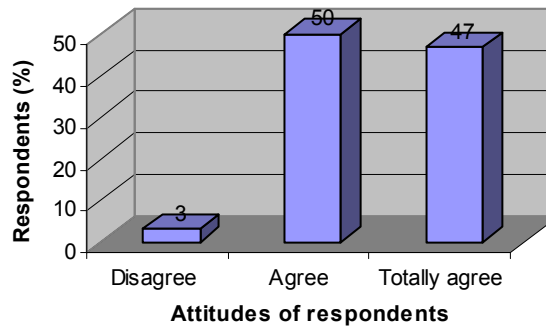
Nearly 60% of people in Ghunsa and Yangma agreed that Unconstructive livestock pens were creating conflict with the Snow leopard (Fig 4.14(h). Nearly 60% of respondents disagreed that increasing level of conflict with snow leopard could not be the result of lack of an appropriate guard dog (Fig 4.14(i)).

Fig 4.11 (f) Unconstructive Livestock Pens

Fig 4.11 (g) Inefficiency in Livestock guarding by dogs
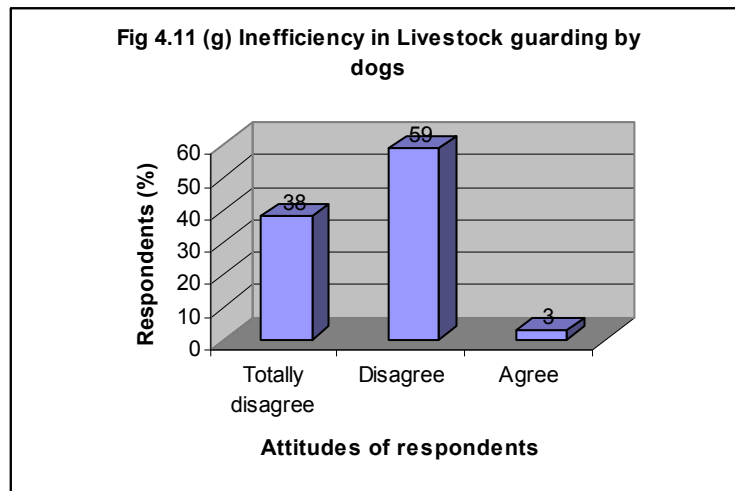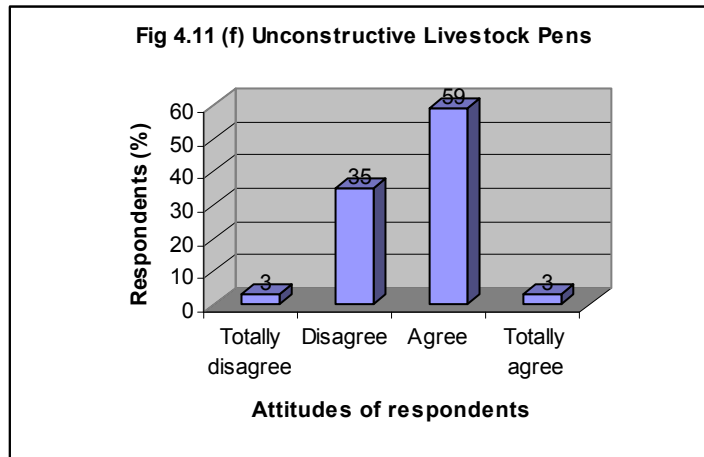
4.12 Existing mitigation measures undertaken to combat Human-Snow leopard Conflict

More than 60% of respondents agreed that they are satisfied by using traditional mitigation measures guarding by dog to combat Snow leopard attacks on Livestock (Fig 4.12 (a). More than 80% of the respondents satisfied by doing noise to combat Snow leopard attacks on Livestock (Fig 4.12 (b).

Fig 4.12 (a) Effectiveness by the use of dog to combat Snow leopard

9% 21% 15% 55%

Don't know
Poor
Satisfactory
Good

Fig 4.12 (b) Effectiveness by doing noises to combat Snow leopard

9% 12% 79%

Poor
Satisfactory
Good
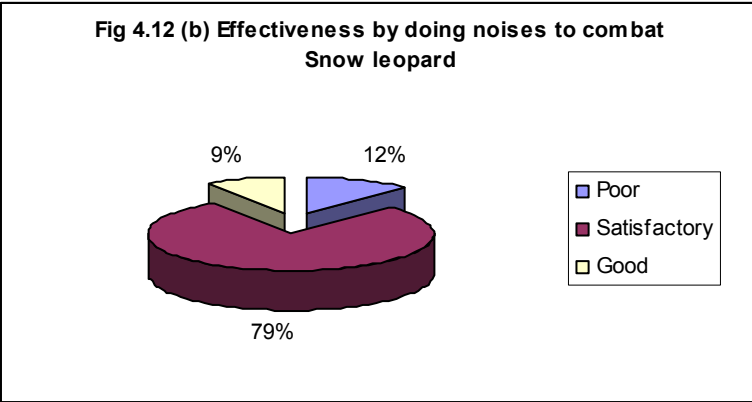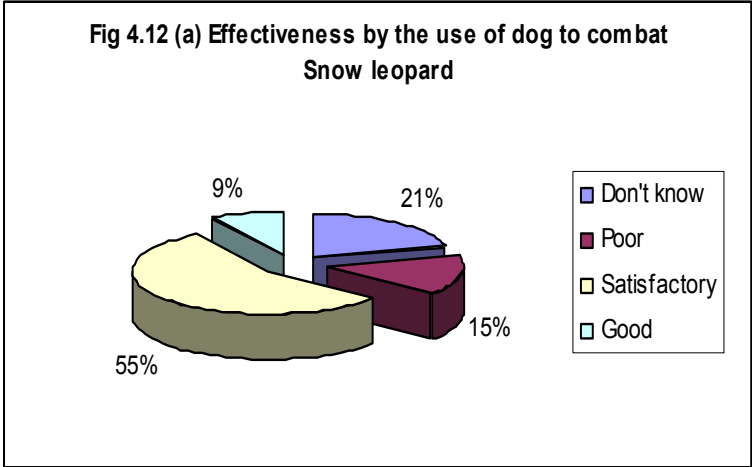
Likewise 64% of the respondents agreed by burning dungs in pens to combat Snow leopard attacks (Fig 4.12 (c). More than 80% of respondents (Fig 4.12 (d) satisfied about improving livestock pens to combat Snow leopard.

Fig 4.12 (c) Effectiveness by burning dung to combat Snow leopard

9% 15% 21% 55%

Don't know
Poor
Satisfactory
Good

Fig 4.12 (d) Effectiveness by improving pens to combat Snow leopards

12%

18%

□ Poor
■ Satisfactory
□ Good

70%
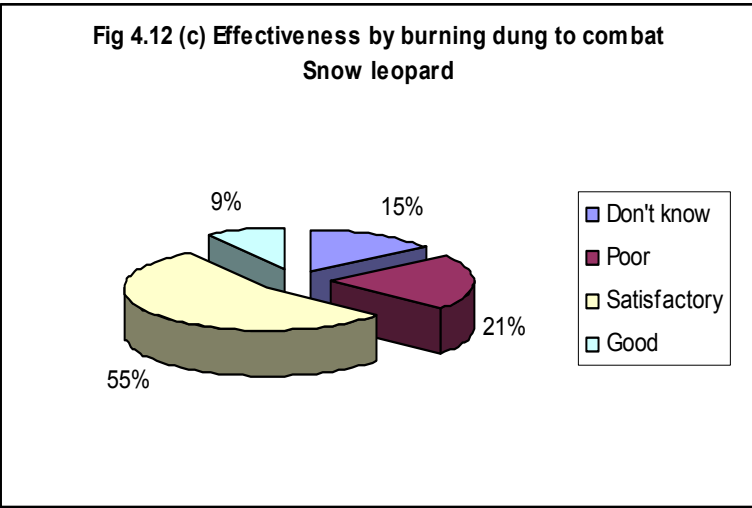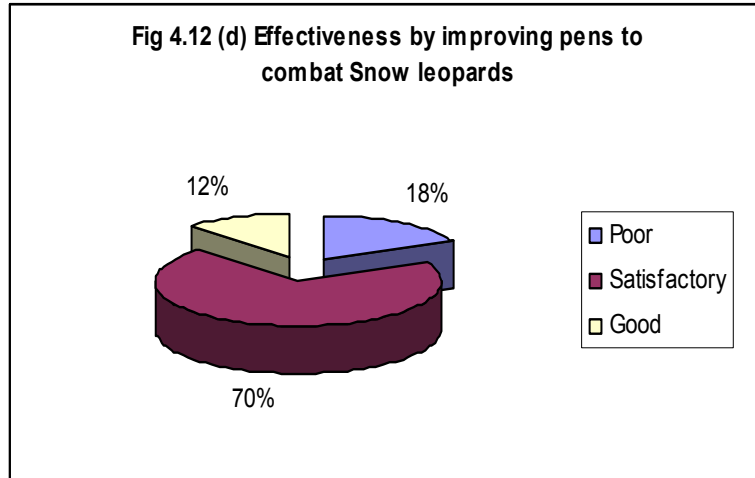
Similarly 100% respondents in pasture (Fig 4.12 (f) and 94% of respondents in pens (Fig 4.12 (e) agreed that guarding of livestock at night in pens was considered more effective in reducing the killing of livestock by Snow leopard than other existing mitigation measures.

Fig 4.12 (e) Effectiveness by night guard at pens to combat Snow leoaprd

6%

□ Poor
■ Satisfactory
□ Good

55%

39%

Fig 4.12 (f) Effectiveness by guard at day time in pasture to combat Snow leopard

18%

■ Satisfactory
■ Good

82%
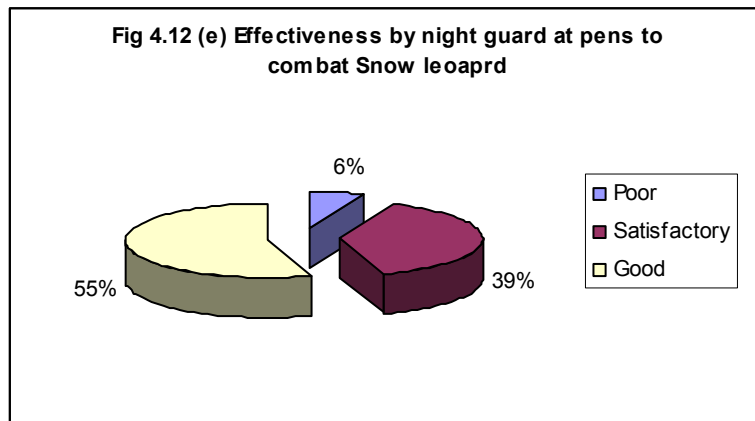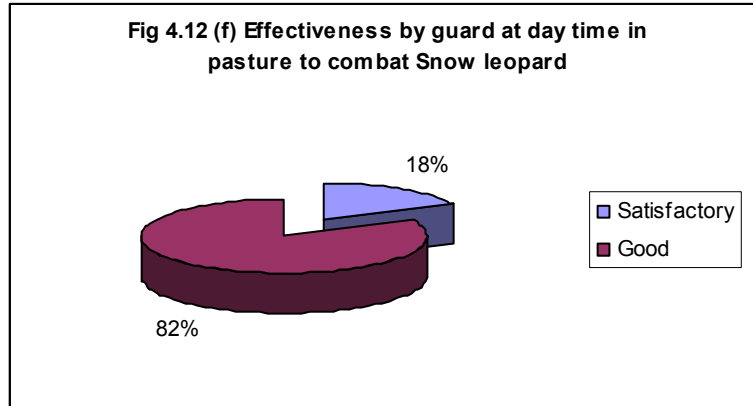
4.13 Perception on Livestock Insurance Scheme (LIS)

More than 80% of people in KCA responded that they knew about the livestock insurance scheme. The insurance scheme was functioning in KCA from December 2005 with the support of WWF Nepal.

Fig 4.13 (a) Do you know about Livestock Insurance Scheme?

18%

■ No
■ Yes

82%
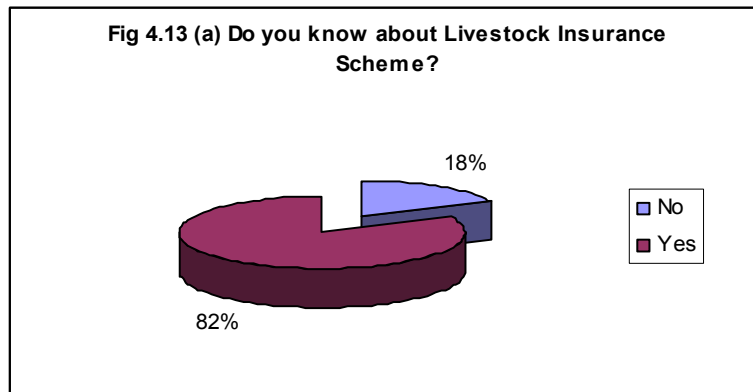
More than 55% of people involved in Insurance scheme. About 47% of respondents in Ghunsa and Yangma of KCA agreed that the insurance scheme was good and 15% of respondent were satisfied.

Fig 4.13 (b) Involvement in Insurance Scheme

41%

59%

- No
- Yes

Fig 4.13 (c) Level of Satisfaction with Livestock Insurance Scheme

47%

38%

15%

- Don't know
- Satisfactory
- Good
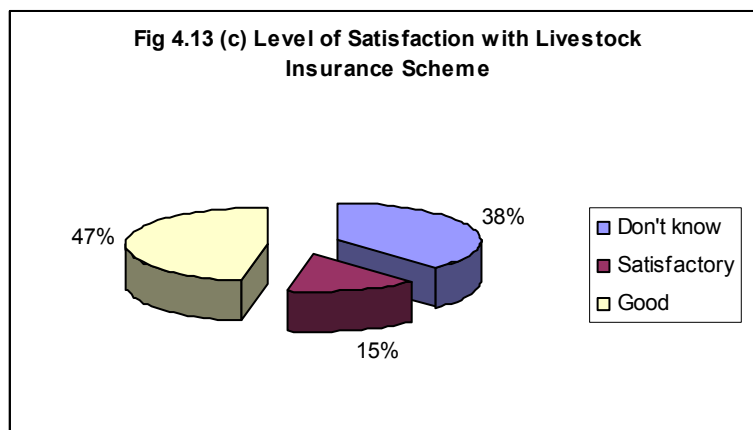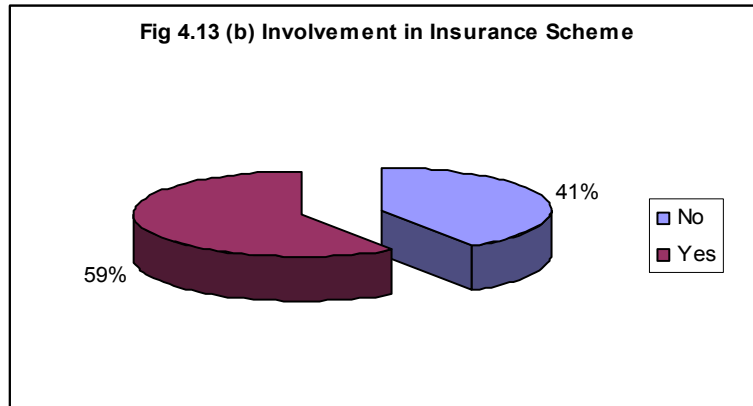
More than 70% of respondents were benefited by receiving the insurance Scheme they said Livestock Insurance Scheme is necessary in contrast to livestock depredation by Snow leopard. So, results shows that majority of people in Ghunsa and Yangma strongly demanded that compensation should be given, if there is loss of livestock by Snow leopards.

Fig 4.13 (d) Peoples perception on necessity of livestock Insurance Scheme

30%

70%

- Agree
- Totally agree
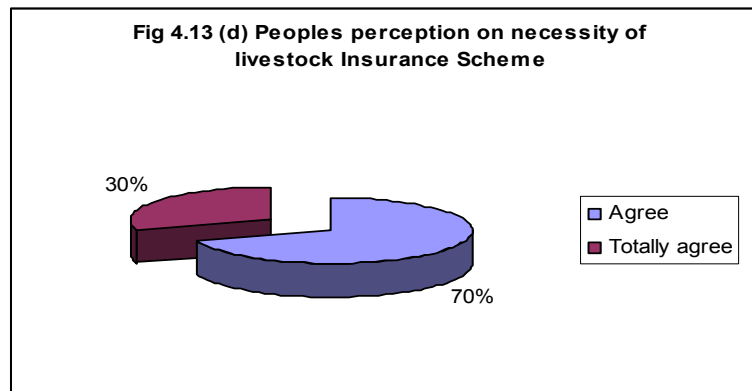
4.14 Attitudes towards Conservation Successful

More than 80% of respondents were more positive towards the involvement in Conservation activities. Likewise, the majority of respondents (32.35%) in KCA were more conscious of the successes of conservation activities. Nearly 42% of respondents agreed that such Conservation action was positive towards reducing retaliatory killing of Snow leopards. More than 30% of the respondents agreed about the successfulness of conservation activities were good, whereas more than 50% of the respondents don't know about the successfulness of conservation activities. This indicates that conservation activities were successful.

Fig 4.14 (a) Involvement in any Conservation activities

Fig 4.14 (b) Successful of Conservation activities
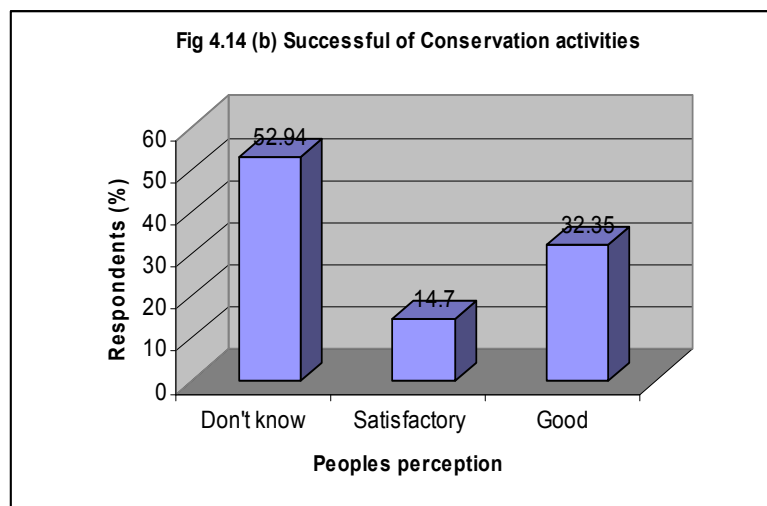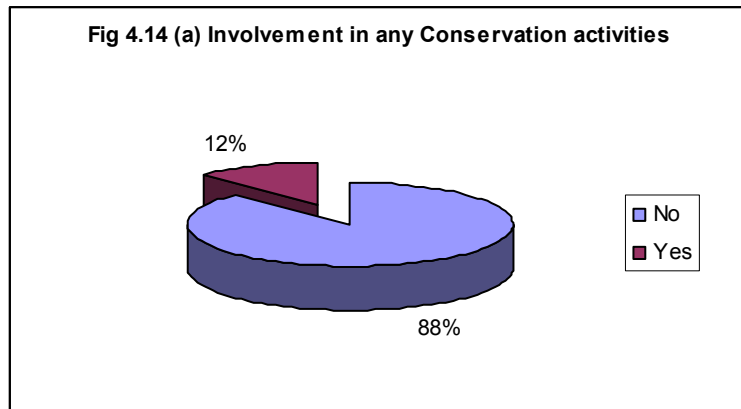
About 41% of the respondents were satisfied in the involvement of conservation action taken positive towards reducing retaliatory killing of Snow leopard, whereas 50% of the respondents don't know about the positiveness of reducing retaliatory killing of Snow leopard.

Fig 4.14 (c) Conservation action taken positive towards reducing retaliatory killing of Snow leopard
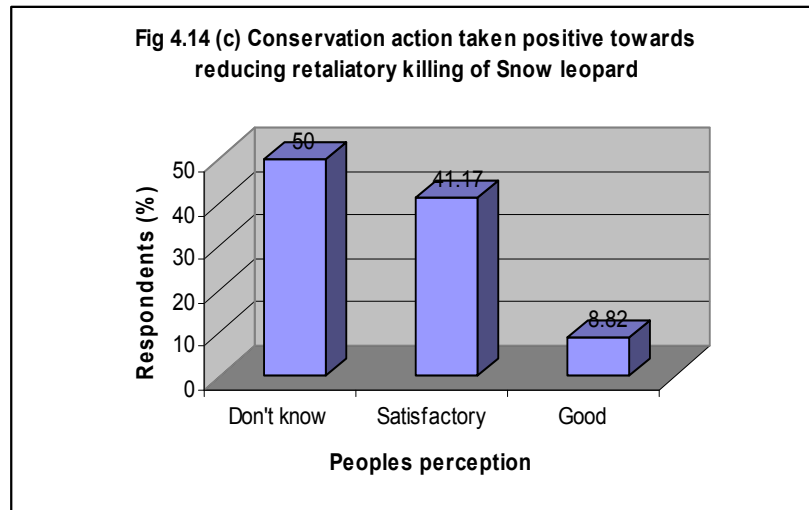
According to study, 56% of the respondents were agreed and 44% of the respondents were totally agreed about not to degrade the wildlife habitat this indicates that people were more positive towards the conservation of Snow leopard.

Fig 4.14 (d) Wildlife habitat should not be degraded
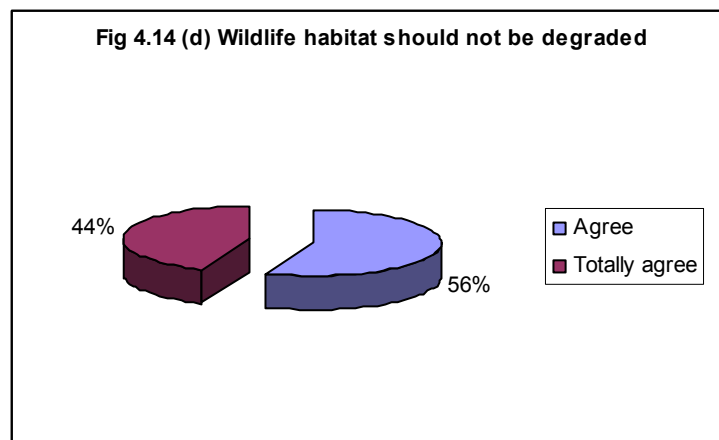
Higher percentage of the people i.e. 100% of the people agreed that compensation should be given to combat economic status of people due to livestock depredation by Snow leopard. More than 80% of the respondents totally agreed that killing of Snow leopard is against the religious belief.

Fig 4.14 (e) Compensation should be provided

30%

70%

- Agree
- Totally agree

Fig 4.14 (f) Killing of Snow leopards is sin as religious

12%

88%

- Agree
- Totally agree
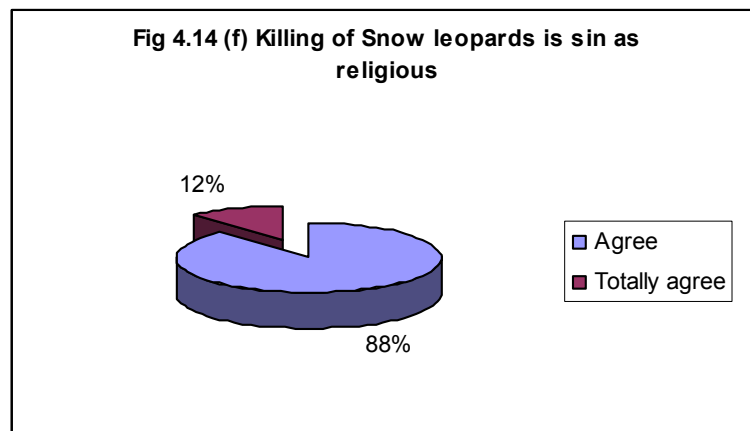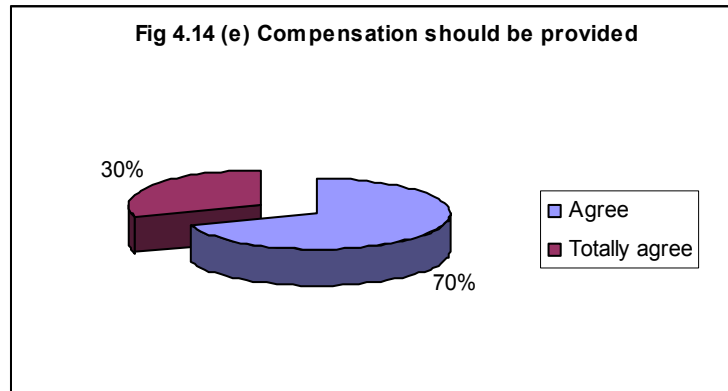
100% of the respondents agreed that snow leopard population should not be decreased. They believe that conservation of Snow leopard was a matter of pride in KCA and also promote tourism in this area. More than 65% of the people agreed that traditional mitigation measures i.e. guard dog, making noise, burning dung, improving pens, night guard at pens, day guard at pastures should be applied to combat Snow leopard attack.

Fig 4.14 (g) Snow leopard population should be decreased

32%

68%

- Disagree
- Totally disagree

Fig 4.14 (h) Traditional mitigation measures should be applied to combat Snow leoaprd attack

3%

26%

3%

68%

- Disagree
- Don't know
- Agree
- Totally agree
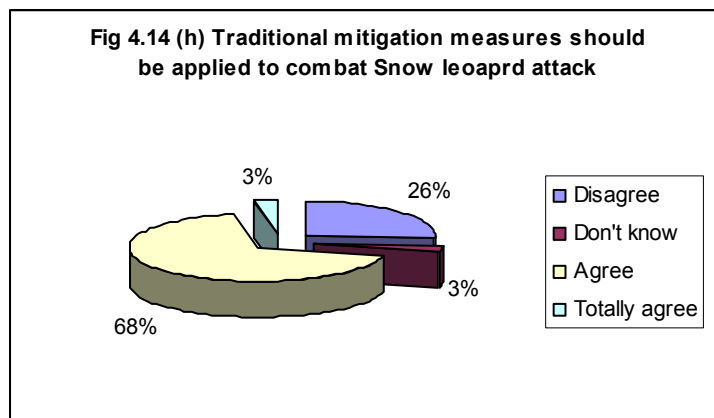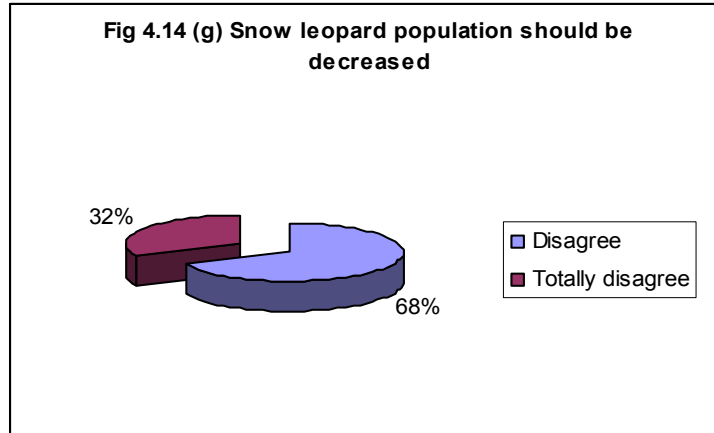
More than 95% of the respondents agreed that modern mitigation measures should be applied to combat Snow leopard attack. 97% of the respondents believed that presence of Snow leopard in the area was matter of pride. Approximately 100% of the people agreed about the conservation of Snow leopard, it shows that people are more positive and more conscious towards the conservation of Snow leopard.

Fig 4.14 (i) Modern mitigation measures should be applied to combat Snow leopard attack

2%

Legend:
- Don't know
- Agree

98%
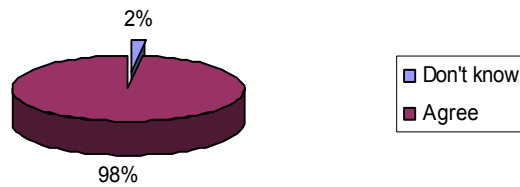
Fig 4.14 (j) Proud on presence of Snow leopard in the area

3%

38%

59%

Legend:
- Totally disagree
- Agree
- Totally agree
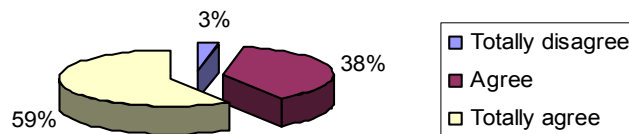
Fig 4.14 (k) Snow leopard Should be conserved

44%

56%

Legend:
- Agree
- Totally agree

More than 85% of the respondents believed that presence of Snow leopard promote tourism, and was also believed that tourism upgrade the lifestyle of people in KCA. More than 80% of the respondents agreed that if the population of Snow leopard decreases than the population of Blue sheep increases and there was a lack of forage for livestock. It shows that Blue sheep population overlaps the forage of livestock.

Fig 4.14 (l) Presence of Snow leopard promote tourism

12%   9%   6%

Disagree
Totally disagree
Agree
Totally agree

73%

Fig 4.14 (m) Decrease in Snow leopard population increase bluesheep and there is lack of forage for livestock

6%   18%

Disagree
Agree
Totally agree

76%
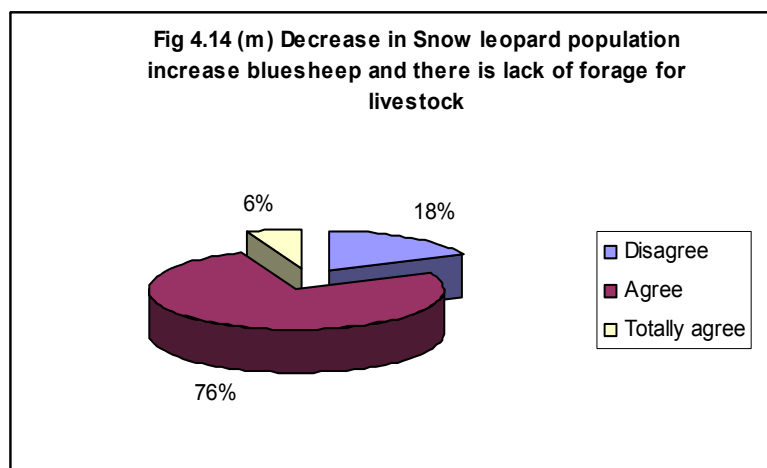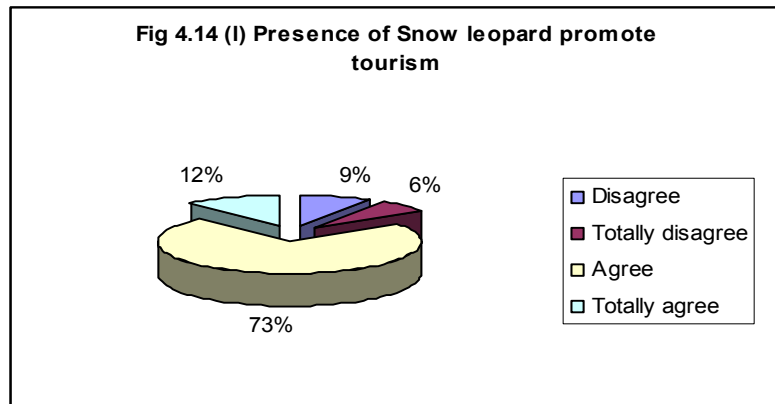
4.15 Conservation initiatives to make more effective of conservation

Higher percentages of the respondents in Ghunsa and Yangma of KCA agreed that more effective conservation could be done through improvement in the pasturelands, conservation awareness, Infrastructure development and income generated by tourism (Fig 4.15 (a, b, c, d).

Fig 4.15 (a) Improvement in pasturelands

Respondents (%)

Bad	Satisfactory	Good
12	3	85

Presence of Snow leopard
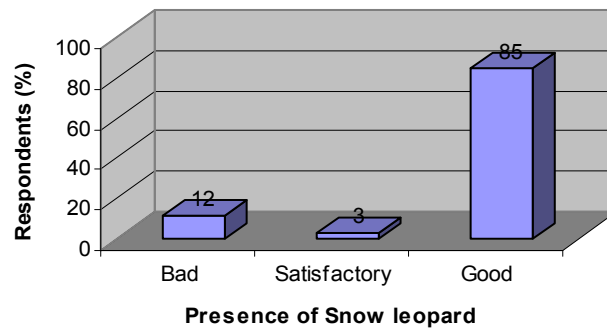
Fig 4.15 (b) Implementation awareness

Respondents (%)

Satisfactory	Good
3	97

Peoples perception

Fig 4.15 (c) Infrastructure developement

100%

Fig 4.15 (d) Increasement income by tourism

Respondenst (%) vs Peoples perception

- Don't know: 6
- Satisfactory: 12
- Good: 82
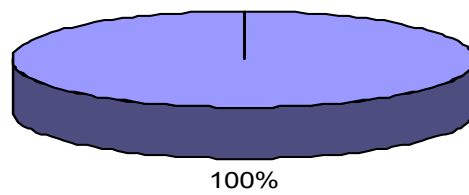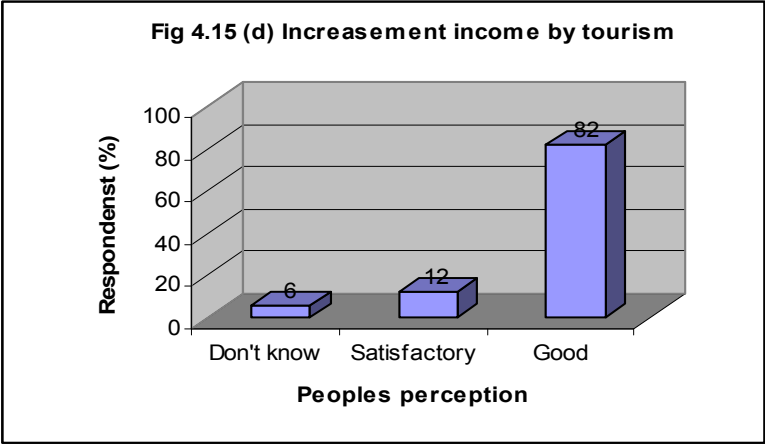
In contrast, more than 70% of respondents in KCA believed that increasing the natural prey population was a poor solution for effective conservation. Likewise, the majority of respondents i.e. 88% of respondents denied that the reduction in the livestock population.

Fig 4.15 (e) Increasement of natural prey population

Respondents (%) vs Peoples perception

- Bad: 74
- Satisfactory: 17
- Good: 9

Fig 4.15 (f) Decrease livestock population

Respondents (%)

100 — 88

Bad · Satisfactory 9 · Good 3

Peoples perception
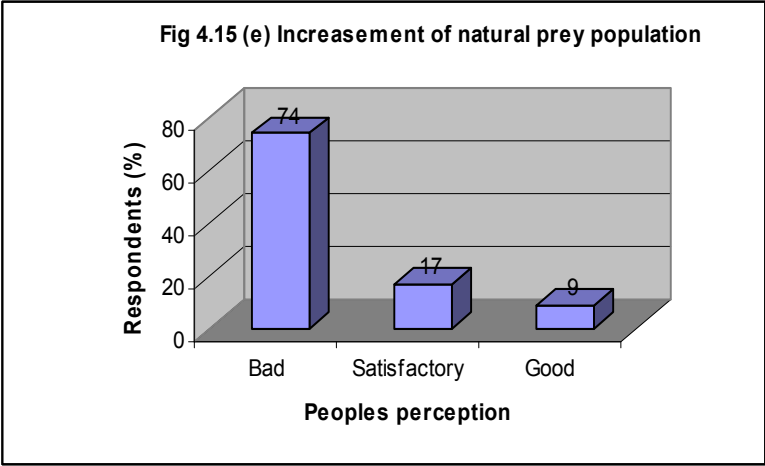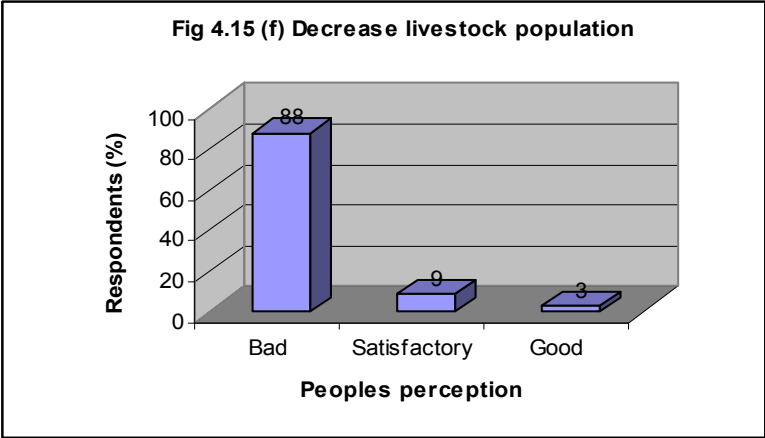
Similarly more than 60% of respondents demanded that the authority should be handed over to local people so that it could promote effective conservation in the future.

Fig 4.15 (g) Authority hand over to local people

Respondents (%)

50

Bad 38 · Satisfactory 12 · Good 50

Peoples perception
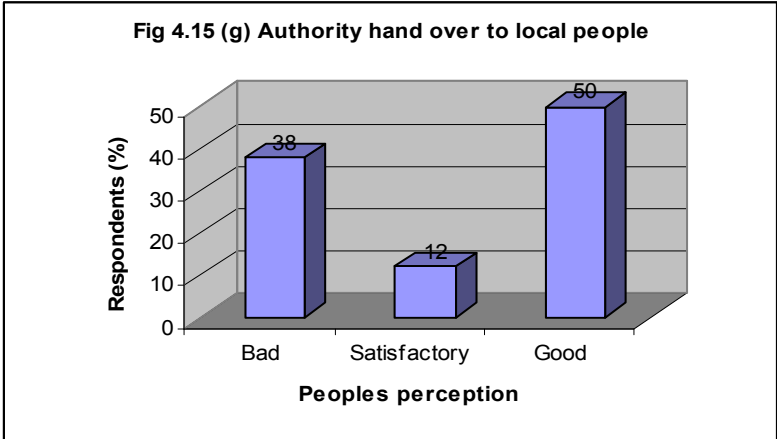
CHAPTER 5

DISCUSSION

Livestock rearing was one of the main livelihood strategies in the upland communities of the Ghunsa and Yangma of KCA. From the study it was found that nearly, 53% of the people depend upon the livestock for their livelihood followed by other sources as tourism, business and agriculture. From the study it was found that, 65% of the people in the KCA agreed that income from livestock was higher than previous year. So the livestock losses have a significant economic impact on the community.

Livestock husbandry was the prime important source of livelihood for the people of Ghunsa and Yangma of KCA. The total number of livestock found in the study area was 855 among which 85 numbers of livestock were depredated by Snow leopard. Worst scenario of livestock depredation causes unsustainable living condition or withdraw from yak pastoralism to the households with medium or small-sized herds (<40 cattle) due to their inability to repurchase the cattle. So, even a single livestock loss causes significant impact on the pastoralist's livelihood.

Livestock being the primary means of livelihood in the study area, depredation of livestock by the predators has generated serious conflict between the community and the wild predators. Though there was a lack of baseline to study the dynamic of these depredations, existing literatures suggests a rise in livestock depredation to large carnivores in the Himalayas in the recent years (Jackson et.al. 1996). Increase of population of the predators and decreasing prey population are believed to be a major cause behind the rising livestock depredation. However, a study on Snow leopard in the KCA suggests that livestock kill by Snow leopard was significant despite of availability of blue sheep in relatively high number (Oli 1991).

The highest causes of livestock mortality in Ghunsa and Yangma were due to the predation by wild animals and by winter now (Rank>5.0) in the month of winter season because the supply of forage in winter season was insufficient for livestock. The majority of the people (82%) in KCA suggest that pasture was more vulnerable to livestock attack

by Snow leopard than pens. In contrast livestock pens and night guarding was not a greater concern than livestock guarding problems in pasturelands. The area like Doodhpokhari, Lonak, Khambachen, Jaritar, Shewayak, Nuphoo, Ramdang, Jimbu Bari, were the major grazing area of the livestock. Among these areas Doodhpokhari was rated most predator prone, followed by others. These above mentioned areas also favored the habitat of bluesheep. High diet overlaps between livestock and blue sheep, together with density-dependent forage limitation, results in resource competition and a decline in blue sheep density (Mishra et.al. 2004).

According to the study human-snow leopard conflict was serious problem in Ghunsa and Yangma. It was found that 62% of the people agreed that livestock was killed by Snow leopard, but it doesn't harm or killed human. In turn 90% of the people believed that the rate of retaliatory killing of snow leopard was decreasing in this area and 76% of people claimed that the effectiveness of mitigation measures was increasing significantly. Owing perhaps to the Buddhist values of the local villagers, the persecution of animals seemed only occasional, but there remained a deep sense of resentment amongst the villagers against the predators.

Winter season (January) was found to be heavily depredated month in Ghunsa and Yangma of KCA which resulted heavy depredation in winter pastures. The peak depredation in Khangsar in Manang was however reported to be April-June (Jackson et.al 1996). But generally it was from winter to early summer, although the exact time could be different by few days place to place. Incase of KCA (Ghunsa and Yangma) both bio-physical and socio-economic factors are supporting to the depredation by Snow leopard. The winter pastures are limited in terms of number and area. So the animals are concentrated in limited pastures where the livestock density becomes high. This makes the animals weak and there was a high chance of encountering of livestock by Snow leopard at the pasture. The winter pastures at lower altitude are with shrub and forest coverage. They are also down in the valleys and gorges where the topography was with cliffs, broken surface and boulders. This provides Snow leopard a good hide.

This study also revealed that most of the animals were killed by Snow leopard at night in pastures. The high number of depredation by Snow leopard in pastures at night time was related to poor night guarding and physical characteristics of the pastures.59% of the respondents agreed that depredation by Snow leopard was due to the unconstructive livestock pens. Livestock depredation by the Snow leopard was one of the main issues in this area. People are showing their interest to know about the causes and mitigation measures. The natural features and the climate of this area are the factors for the livestock depredation. Besides this other several factors that are responsible for the depredation on by the predators may be due to (a) shortage of grasses pushes yak and other livestock to reach in dangerous rocky and cliff areas where Snow leopard easily attacks them, (b) poor condition of corrals and pens like unprotected open corral, (c) poor guarding and carelessness of herders especially in winter due to severe cold, (d) poor guarding in corrals especially at night time, (d) weak and unhealthy livestock, (f) lack of infrastructures, such as water hole in the pastures triggering the extra movement of livestock.

Livestock, due to their reduced escape capabilities compared to wild herbivores, become especially vulnerable for the predation (Nowell and Jackson 1996). My study revealed that the economic value of livestock loss/Hh/year in Ghunsa and Yangma was (NRs. 17,080/Hh/yr). Yak accounted for the highest economic loss in KCA among other types of domestic stock i.e. almost 100% of the total economic loss per household per year in Ghunsa and Yangma of KCA. Khatiwada (2004) reported the actual loss of livestock by predator (62%) in Langtang National Park, Nepal. Gurung and Thapa (2004) estimated the annual depredation of snow leopard about Rs 378,500 (US $ 185) or Rs 12,617.00 per household year in Ghunsa, Yangma, and Olangchungola which was relatively lower than present study. The average annual loss per household, which was approximately NRs 17,088 (US $ 237), was significant especially for the places in Nepalese Himalayas whereas there were very limited commercial activities due to harsh environmental conditions and difficult topography.

However, Snow leopard preyed on livestock despite of availability of blue sheep in relatively high number (Oli 1991). Therefore, improved herding practice and protective measures are also necessary to reduce the perceived conflict between Snow leopard and human. In this regard, construction and use of predator-proof corral could be effective in reducing livestock depredation. Since majority of the livestock casualties occurred in pasturelands and majority of the predation incidents are due to poor guarding, improved herding practice was needed to reduce depredation. Community should, therefore, encourage hiring skilled herders. In this regard, appropriate training should be provided to the herders. Using trained dogs to guard grazing herds can also help reduce livestock depredation by wild predators. However, management should be careful in using dogs as increase in number of dogs in the pasturelands could create negative effect as well. Their presence in the pasturelands could cause in depletion of natural prey for wild predators which in turn again can increase livestock depredation (Namgil, 2004).

From the study it was found that majority (100%)of respondents in Ghunsa and Yangma were using traditional mitigation measures to combat snow leopard attacks on livestock e.g. the use of a guard dog, making noise, burning dung, livestock guarding in pastures and pens. Most of the people (58%) supported the idea that the reduction of effective mitigation measures could be a major problem of Snow leopard. Half of the people were conscious that the lack of livestock guarding was one of the key factors associated with the Snow leopard conflict with human. The majority of respondents in Ghunsa and Yangma of KCA agreed that guarding of livestock in pastures and pens was considered more effective in reducing the killing of livestock by Snow leopard than other existing mitigation measures.

For the effectiveness of mitigation measures there should be the provision of predator proof corrals during the night time and herders should be monitored for their guarding practice during the grazing and daytime. Besides this use of guard dog as an informant of Snow leopard presence and potential of attack and taking assistance of guarding livestock was the best practice to minimize the depredation. Only few herders have reared guard dogs in their shed, and many of them are show dog rather than the guard dogs due to the lack of training to them. So there was the need of assessment of all the pasturelands,

management of water availability and grass, so that the herders would not have need to go to the Snow leopard habitation areas, and construction of predator proof corrals in the pasturelands of prime Snow leopard habitation areas, and construction of predator proof corrals in the pasturelands of prime Snow leopard habitation areas. Awareness levels among the herders were less and their attitudes towards Snow leopard were still negative as taken as a predator only. They were less aware about the importance of Snow leopard conservation. Awareness and informal education should be given to the herders regarding Snow leopard conservation and reporting of Snow leopard presence and depredation activity. So that the other herders would be alert and also the conservation committee would be supported for planning conservation management and compensation program. By educating and giving awareness to herders, the insurance program should be completely handed over to them for the management and implementation. Network should be well established for the effective verification and immediate compensation of the lost livestock. Whenever the herders do not realize their ownership over the capital fund and insurance program, the success in this program would never be achieved.

Currently, 85% of the respondents were facing the problem due to wild animal. As an effort to minimize human-Snow leopard conflict and promote Conservation of Snow leopard in Ghunsa and Yangma of KCA. Livestock Insurance Program (LIS) has been in operation since December, 2005. with an endowment Fund of NRs 1,200,000 (about US $ 16,900), supported by National Centre of Competence in Research (NCCR North-South) through the Department of Geography, University of Zurich, Switzerland in Collaboration with WWF-NP, the Livestock Insurance Program (LIS) was initiated (Gurung, 2006). To take part in this scheme, herders should have paid NRs 55 per Yak breed each year.

If any herder's livestock loss was verified to be caused by Snow leopard, then the project would provide NRs 2500 and the Verification was made by Snow leopard Conservation Sub-Committee (SLCSC). From the study it was found that more than 80% of the respondents in Ghunsa and Yangma of KCA knew about the Livestock Insurance Scheme and 59% of respondents involved in insurance program. However, 70% of respondents were benefited by receiving the insurance scheme and they said livestock insurance

scheme was necessary in contrast to livestock depredation by Snow leopard. Majority of respondent in Ghunsa and Yangma Strongly demanded that compensation should be given, if there is loss of livestock by Snow leopards.

Compensation and insurance program, if well managed in favor of communities, was the best practice for Snow leopard Conservation as community included Conservation practices have been in the progress of success. As an attempt to soothe herders frustration, minimize the retaliatory killings of Snow leopard and insure its conservation, insurance program was initiated in KCA. However still after passing of more than 4 years, the program has many circumstances, obstacles and weakness that all are hindering against objective of success achievement. The program has not been appreciable accepted by all the respondents. The premium (NRs 55/cattle yr) and compensation (NRs 2,500/cattle killed) for each size and breed of the cattle enforces "one size fits all" modality whereas cost of different cattle breed ranges from NPR 4,000-25,000. With the compensation received from the insurance program, the medium herd-sized farmers rarely become able to recover their loss by re-buying new cattle. This condition leads to decrease in number of cattle each year, and ultimately make the pastoralists with draw from this occupation.

Respondents of Ghunsa and Yangma of KCA were more positive concerning the involvement of conservation activities and they were conscious about the successes of conservation activities. Nearly 50% of respondents in my study area agreed that such conservation action was a positive step towards reducing retaliatory killing of Snow leopards while the remainders were uncertain. Higher percentages of respondents in Ghunsa and of KCA agreed that more effective conservation could be done if they initiated wildlife habitat management, conservation awareness, infrastructure development and income generation by tourism. Despite this more than 70% of respondents in KCA believed that increasing the natural prey population was not good. More, importantly, more than 60% of respondents demanded that the devolution of authority to local people for the over all management of the natural resources could be improving future conservation. This demand was logical in the high and remote

mountains of Nepal's. Himalayas, where a traditional system was in place and there was little accessibility by the staff of governmental and non-governmental organizations.

In Ghunsa and Yangma, where insurance program was in operation, the Snow leopard Conservation sub-committee has done nothing on pastureland management and other depredation minimization approaches, just correct premium and pay compensation if verification approved. The rate of retaliatory killing of Snow leopard has been decreased after the initiation of the insurance program but more was due to the fear of KCAP and penalties than due to the awareness and effectiveness and benefits from the insurance program. Due to the lack of well guarding practice and predator proof corals, livestock were let free on pasturelands even in the night time, when depredation was higher. A combination of lax guarding practices, favorable cover and habitat conditions, and high Snow leopard density are primarily responsible for the high depredation rates in Nepalese Himalaya (Jackson et.al., 1996). Well-off herders insure only half of their herds because of the fear of exposing wealth (cattle) outside. The trend was privileged during the period of Maoist insurgency and was still on the same scenario. Even the herders who were in the vital post of the insurance committee had taken the insurance of their half of the cattle only. The insurance process was very unsystematic as there was not the system of marking the cattle having insurance. Due to this, the insurance committees were not free from the potential fake claim of compensation.

There were no significant relationship among the livestock holding size and acceptance of insurance program. But the social and economic status had played vital role on taking membership on insurance program. Livestock holding size determines the economic status of the herders. The economic and social status determines their approach to conservation and development committees. In some Sherpa family there was a belief that their ancient god protects their livestock from the predators. So they did not feel the importance of insuring their livestock, and the committee was unable to make aware them to involve in the program. Due to the higher work input, tedious job and degraded quality of the grass, the young generation of the pastoralist communities were not interested to the traditional livestock herding occupation. So the numbers of herds have been decreasing on each year.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The study was carried out in the month of November and December, 2008 revealed that Ghunsa and Yangma of KCA were affected by the Human-Snow leopard conflict in terms of livestock loss. The majority of respondents in KCA strongly requested community-based livestock insurance. This program could be the most effective tool for minimizing the severity of conflict between humans and the Snow leopard. Replication of this type of livestock insurance in other locations with a similar geographical, socio-economic and cultural context should be one of the most effective tools for minimizing the human-Snow leopard conflict. However comprehensive planning and effective implementation of preventative mechanisms was required. In contrast, financing this kind of insurance scheme was a challenging issue for expanding the livestock insurance scheme in other place and locations.

The majority of respondents in Ghunsa and Yangma of KCA believed that a lack of livestock guarding was one of the most serious problems related to livestock depredation. Thus, traditional systems should be strongly encouraged to conserve the endangered snow leopard in association with local livelihoods, e.g. livestock guarding in pasture and pens, use of better guards, maintaining predator-proof corrals on a regular basis, implementing rotational grazing and conservation awareness campaigns along with religious value etc.

Most of the respondents in KCA agreed that guarding of livestock in pastures and pens was considered more effective for reducing the killing of livestock by Snow leopard compared to other existing mitigation measures. The greatest number of respondents in KCA agreed that they knew about the livestock insurance scheme and they were moderately benefited from this scheme. The respondents of Ghunsa and Yangma strongly believed compensation should be given if there was loss of livestock as a result of Snow leopards.

More importantly the demand of authority handed over to local people for the overall management of natural resources was high in KCA. This demand was logical in the high remote mountains of Nepal's Himalaya where traditional systems were functioning strongly and areas were largely inaccessible to extreme organizations. However. External support should be provided regular basis to benefit Snow leopard conservation as capacity building in the high altitude, remote Himalayan region.

6.2 Recommendations

Based on the study Assessment of the effectiveness of Human-Snow leopard conflict mitigation measures in Ghunsa and Yangma valley of Kangchenjunga Conservation Area, Nepal following recommendations were putdown.

- ➢ Guarding system should be properly improved.
- ➢ Guarding by watchdog should be taken especially during day and night in pastures and pens.
- ➢ Predator proof corals and pens should be constructed in the pasturelands of prime Snow leopard habitation areas.
- ➢ Slingshot should be used in the open pastures to keep the livestock together.
- ➢ Firing and smoking should be managed around the corrals at night.
- ➢ Better pasture management practices should be organized.
- ➢ Compensation should be provided to people for their livestock loss.
- ➢ Compensation should be increased.
- ➢ There should be the system of one premium and one compensation for each breed and size of livestock.
- ➢ Insurance Scheme for the livestock depredation should be managed.
- ➢ Conservation education should be provided to the local inhabitants for the sound Conservation of Snow leopard.
- ➢ Awareness should be raised for the infrastructure development and Conservation.

REFERENCES

Ale, S.B. 2002. Observation on Conservation of Snow leopard in Nepal. Mountain research and development.

Bajimaya, S. 2001. Snow leopard Manual: Field techniques for the Kingdom of Nepal.

Brower, B. 1997. Sherpa of Khumbu: People livestock, and landscape. Oxford: Oxford University press.

DNPWC, 2005. The Snow leopard Conservation Action Plan for the Kingdom of Nepal, Department of National Park and Wildlife Conservation, Babarmahal Nepal.

DNPWC, 2006. Brochure of Kangchenjunga Conservation Area, Kathmandu, Nepal.

DNPWC, 2009. Press Release: Updated information of Snow leopard and Tiger in Nepal. http.\\ www.dnpwc.gov.np/news. asp on December 7, 2009.

Fox, J.L. 1994. Snow leopard Conservation in the wild: a comprehensive perspective on a low density and highly fragmented population. ISLT, Seattle.

Fox, J.L., and Jackson, R. 1994. Wildlife Conservation and land use changes in the Trans-Himalayan region of Nepal. Mountain Research and Development 14: 39-60.

Green, M.J.B 1982. Status, distribution and conservation of the Snow leopard in Northern India. Pp-6-10 in Blomqusit, L. (Ed). 1982.

Groves, N. 1998. Snow leopard Depredation in Upper Mustang, Pokhara, Nepal: Annapurna Conservation Area Project.

Gurung, G. and Thapa. 2004. Snow leopard (Uncia uncia) and Human Interaction in Phoo village in the Annapurna Conservation Area, Nepal. Report submitted to International Snow leopard Trust, USA.

Gurung, A. B., 2006. Mammal's species: Snow leopard. In Chhetri M. Chapagain N.R. and Pandey M.R. (Eds). Some Important Wildlife and Plants of Upper Mustang. NTNC, ACAP, Upper Mustang Biodiversity Conservation Project, Kathmandu, Nepal.

HMG, 1973. National Parks and Wildlife Conservation Act 2029. Nepal Gazette BS 2029-11-28.

ISLT, 1996. Snow leopard Survey and Conservation Hand book. 154 pages. ISLT, Seattle, WA, USA.

ISLT, and SLN, 2007. Snow leopard Survival strategy. ISLT and SLN, Seattle, USA

Jackson, R. 1977; Snow leopard Wildlife.

Jackson, R.M., 1979. Snow leopards in Nepal. Oryx 15:191-195.

Jackson, R.M., and Ahlhorn, G. 1984. A preliminary Habitat suitability Model for the Snow leopard, Panthera uncia in west Nepal. Intl. ped. Book of Snow leopard 4:43-52.

Jackson, R. and Ahlborn, G. 1989. Snow leopards in Nepal-Home range and movements. Nat. Geog. Res. 5: 161-175.

Jackson, R. and G, Ahlborn. 1990. The role of protected areas in Nepal maintaining viable populations of Snow leopards. Intl. ped. Book of Snow leopard 6:51-69.

Jackson, R. 1994. Reducing Livestock depredation in the Nepalese Himalaya: Case if the Annapurna Conservation Area. Unpub. Report prepared for U.S. Agency of International Development by Biosystem Analysis, Inc., Tiburon California.

Jackson, R. 1995. Snow leopard survey and Conservation Handbook (2nd Edition): ISLT and National Biological survey, 1995.

Jackson, R.M. 1996. Home Range movements and Habitat Utilization of Snow leopard (Uncia uncia) in Nepal. Ph.D. Dissertation University of London (external programme), London United Kingdom 233 pages.

Jackson, R.M., Ahlborn, M. Gurung, and S. Ale. 1996. Reducing Livestock depredation losses in the Nepalese Himalaya. Proceedings Vertebrate pest Conference 17:241-247.

Jackson, R. 1998. Depredation management handbook: environmentally and socially responsible livestock-predator damage control measures for Qomolangma Nature preserve, Tibet. Pp. 18 International Snow leopard Trust, Seattle.

Jackson, R. 2000. Report on the second Bhutan SLIMS training workshop. Unpub. Report, International Snow leopard Trust, Seattle.

Jackson, R. 2001. Managing people-wildlife conflict in Tibet's Qomolangma National Nature Preserve. Pages 188-191.

Kattle, B. and Bajimaya, S.S. 1995 Status and Conservation of Snow leopard in Nepal.

Katwal, S. 2005. Study of Human-Snow leopard Conflict in Dolphu region of Shey Phoksundo National Park. A thesis submitted to Kathmandu University, Nepal.

Khatiwada, J.R. 2004. The status of Snow leopard and relation with principal prey species in Langtang National Park, Nepal. M.sc. dissertation submitted to Central Department of Zoology, Tribhuvan University, and Kathmandu, Nepal.

Mathiessen, P. 1978. The snow leopard. The Viking Press.

Mc Carthy, T. M. 2000. Ecology and Conservation of Snow leopards, Gobi Brown bears and wild Bactrian Camels in Mongolia. Ph. D. Dissertation. University of Massachusetts, USA.

Mishra, C. 2004. Competition between domestic livestock and wild bharal Pseudois nayaur in the Indian Trans-Himalaya, Journal of Applied Ecology 73: 344-354.

Namgil, T. 2004. Interactions between argali and livestock in Gya-Miru wildlife Sanctuary, Ladakh, India. Final Project Report. The International Snow leopard Trust.

Nowell, K. and R. Jackson. 1996. Wild Cats status survey and Conservation Action Plan. IUCN, Glands, Switzerland.

Oli, M. K. (1991). The Ecology and Conservation of Snow leopard (Panthera Uncia) in the Annapurna Conservation, Nepal. M. Phil. Thesis, University of Edinburgh. 155 pages.

Oli, M. K. 1994. Snow leopards and Blue sheep in Nepal: densities and predator-prey ratio. J. Mammal. 75 (4): 998-1004.

Schaller, G.B. 1973; Observation on the Himalayan tahr (Hemitragus Jem lahias) J. Bombay Nat. Hist. SOC. 70 (1): 1-23.

Schaller, G. B. 1977. Mountain Monarches wild sheep and goats of the Himalayan. University of Chicago, Press 425 Pp.

Schaller, G.B. 1994. Observations on Snow leopards in Mongolia. Proc. Int. Snow leopard Symp. 7: 33-42.

Sherpa, M. N. and Oli, M. K. 1988. Report on Nar phu valley wildlife fund, US and King Mahendra Trust for Nature Conservation Nepal. 33 Pp.

Shrestha, J. K. 2003. Wildlife of Nepal.

Sinclair, S. K. and E. Arces. 1995. Serengeti II: Dynamics, Management and Conservation of an Eco-system. The University of Chicago Presses. Chicago, USA.

Thapa, K. 2004. Study on Correlation between populations of blue sheep and Snow leopard in the light of livestock depredation. A case study from Phoo valley, Manang District, Annapurna Conservation Area. A thesis on Bachelor of Science in Environmental Management. Kathmandu, Nepal.

Thapa, K. 2007. Snow leopard: Monitoring Guideline. Edited by Shah, K. B. and Bajimaya, S. published by WWF-Nepal. Pp. 60.

Theile, S. 2003. Fading Footsteps: The killing and Trade of Snow leopards. A Traffic Report, published by TRAFFIC International, Cambridge, UK.

UMBCP, 2001. Annual report. Upper Mustang Bio-diversity Conservation Project. KMTNC/ACAP. Pokhara.

Upadhaya, M. 2010, Relative Abundance, Habitat preference and threats of Snow leopard (Uncia uncia) in Upper Mustang, Nepal. Thesis Tribhuvan University, Institute of Forestry, Pokhara.

WWF-NP (World Widelife Fund Nepal Program). 1998. Kangchenjunga Conservation Area Project: Annual Technical Project Progress Report- July 01, 1997- June 30, 1998. WWF-NP, Kathmandu.

WWF-Nepal, 1999. Snow leopard in Nepal. DNPWC, ISLT and WWF-Nepal Program, Kathmanu, Nepal.

WWF-Nepal, 2001. Snow leopard Manual: Field stud Techniques for the Kingdom of Nepal. WWF-Nepal Program, Kathmandu, Nepal.

WWF, 2008. WWF Nepal Annual Report 2007-08. WWF, Nepal, Kathmandu.

Yonzon, P. 2001. The inseparable Tibetan landscape of Nepal. A Resource Himalaya Factfile. VIII (II).

www.google.com/about ghunsa

www.google.com/about yangma

www.snow leopard conservancy.org

Annex 1. QUESTIONNAIRE FORM

Central Department of Environmental Science

Tribhuvan University, Kathmandu

Questionnaire No: ……   Date: …………………..

Name of Respondents: ………………………………   Age: …………………..

Sex: Male/Female   Village: ……………….

Ward No.: ………………   District: ………………

Education: …………………   Name of the interviewer: ………………………………

1. What are the Primary Sources of Livelihood?

Occupation	Rank (1-5)	Annual %
Livestock		
Tourism		
Business		
Agriculture		
Others		

2. Do you have livestock? Yes ( ) NO ( ) If yes How many do you have?

Livestock	Yak	Nak	Djo	Horse	Sheep	Goat	Cattle	Others

Number								

3. Are you able to obtain sufficient supply of fodder for Livestock in winter and summer

Month	Yes	No
Winter		
Summer		

4. Has income from Livestock increased or decreased in last 5 years? Yes ( ) No ( )

5. What are the major causes of livestock mortality?

Causes of mortality	Rank (1-5)	Yak	Nak	Djo	Horse	Sheep	Goat	Cattle	Others
Predation									
Winter Snow									
Disease									
Accidents									
Lack of forage									
Others									

6. Do you have faced any problem due to wild animals? Yes ( )/ No ( ). If yes, please

Specify?

Problems	Sometimes	Never
Killed livestock		
Injured livestock		
Encountered with wild animals		
Killed any family member		
Injured any family member		
Others		

7. Which are the most problematic wild animals in your area? Rank them in order

Wild Animals	Rank (1-10)	Sighting no.
Snow leopard		
Blue sheep		
Himalayan tahr		
Monkey		
Bear		
Wild boar		

Common leopard		
Fox		
Others		

8. What is the current status of wild animals in recent 5 years? Please specify.

Wild animals	Increased	As it is	Decreased	Don't Know
Snow leopard				
Blue sheep				
Himalayan tahr				
Monkey				
Bear				
Wild boar				
Common leopard				
Musk deer				
Wolf				
Others				

9. Please indicate the pastures name, a month which was used, types of livestock using in

Pasture and, distance (hours walked) of each measure pasture from your home village

in the following table.

Name of pasture	Months used	Distance (hour)	Types of livestock used in pasture	Status of pastures	
				Good	Bad

10. Which one of the pasture is more depredated by wild animals?

11. Do you have faced any problems by Snow leopard in last 12 months? Yes ( )/NO ( ).

   If yes what type of problem do you have faced?

   a) Killed livestock
   b) Injured livestock
   c) Injured any family member
   d) Others

12. In which place do you found more predations by Snow leopard?

   a) Village pens
   b) Pasture

13. What types Livestock is predated by Snow leopard in last 12 months? And which is

   the month predated by Snow Leopard

S.No.	Livestock	Predation (yes/no)	Number	Month
1.	Yak			

S.No.				
2.	Nak			
3.	Djo			
4.	Horse			
5.	Sheep			
6.	Goat			
7.	Cattle			
8.	Others			

14. Has there been an increase/decrease in Snow leopard problems in recent 5 years?

S.No.	Problem	Yes	No	Don't Know
1.	Injuring of livestock			
2.	Killing of livestock			
3.	Retaliatory Killings			
4.	Decrease in effectiveness of mitigation measures			

15. Why do you think Snow Leopard is creating Problems?

Description	Totally agree	Agree	Don't know	Disagree	Totally disagree
Habitat					

degradation					
Increase in population of Snow leopard					
Decrease in natural prey population					
Livestock as easy prey					
Teasing of snow leopard by human					
Decrease in effectiveness of mitigation measures					
Poor guarding of livestock					
Unconstructive livestock pens					
Inefficiency in livestock guarding by dogs					

16. How much loss due to Snow leopard has been created during a year in your home?

Rs……………………………..

17. What mitigation measure do you have applied to combat Human-Snow leopard

conflict? And what is the effectiveness of applied mitigation measures

S.No.	Mitigation measures	Effectiveness
1.	Guarding by dog	
2.	Making noise	
3.	Burning dungs	
4.	Improving pens	
5.	Guarding at night	
6.	Guarding pasture at day	
7.	Others	
8.	Nothing	

Good-1   Satisfactory-2   Bad-3

18. Do you have requested for help to Concern Institutions/Organization for problem

Solution created by Snow Leopard yes / no / don't know? If yes, please specify.

a) Community Development
b) Relief or Compensation
c) Physical infrastructure for mitigation

19. Did you get any help from concern institution/organization? If yes, please

Specify.

a) Good   b) Satisfactory   c) Don't Know   d) did no get anything

20. Have you get compensation or relief for the loss of Livestock due to the Snow

Leopard? From Whom? How? How much?

Organization	How	Amount (Rs.)

21. Do you know about Life insurance Scheme yes/ no? Are you involved in it yes/no

Are you satisfied with the Scheme?

a) Good   b) Satisfactory   c) Bad

22. Are you involved in any Conservation activities yes/no?

23. How successful are such conservation program?

a) Good   b) Satisfactory   c) Bad

24. Was the program effective in reducing the retaliatory killing of Snow leopard?

a) Good   b) Satisfactory   c) Bad

25. Do you agree with the following?

Information	Totally disagree	Disagree	Don't know	Agree	Totally agree
Wildlife habitats should not be degrade					
Compensation should be provided					
Killing of Snow leopard is sin as religious					
Snow leopard population should be decreased					
Traditional mitigation measures should be applied to combat Snow leopard attack					
Modern mitigation measures should be applied to combat Snow leopard attack					
Proud on presence of Snow leopards in area					
Snow leopard should be conserved					

Presence of Snow leopard promote tourism					
Decrease in Snow leopard population increases blue sheep and there is a lack of forage for livestock					

26. How can conservation be made more effective?

S.No.	Conservation work	Good	Satisfactory	Bad
1	Improvement in Pasturelands			
2	Implementation awareness			
3	Infrastructure development			
4	Increasement income by tourism			
5	Increasement of natural prey population			
6	Decrease Livestock population			
7	Authority hand over to local people			
8	Others			

Annex 2.   Distribution and Status of Snow leopard throughout the world

Range State	Area of Habitat (km^2)	Estimated Population	Sources of data
Afghanistan	50,000	? (100-200)	Area-based estimates, low density
Bhutan	15,000	? (100-200)	Area-based estimates, medium density
China	1,100,000	2000-2500	Schaller, 1990; Jackson, 1992
India	75,000	200-600	Chundwat et al. 1988; Fox et al. 1991
Kazakhstan	50,000	180-200	Annenkov,1990; Zhirjakov, 1990
Kyrgyzstan	105,000	150-500	Koshkarev 1989, Koshkarev, 2000
Mongolia	101,000	500-1000	Green, 1988; Schaller et al. 1994; Mc Carthy 2000a
Nepal	30,000	300-500	Jackson and Ahlborn, 1990
Pakistan	80,000	200-420	Schaller, 1976 and 1977; Hussain, 2003
Russia	130,000	150-200	Poyarkov and Subbotin, 2002
Tajikistan	100,000	180-220	Bykova et al; in litt 2002
Uzbekistan	10,000	20-50	Kreuzberg-Mukhina et al, 2002

Source (Upadhyay, M; 2010)

Annex 3. PHOTOPLATES

Plate1. Ghunsa Village

Plate 2. Interviewing to president of SLCC of Ghunsa

Plate 3. Yak in Ghunsa

Plate 4. Calves of Chauri resting during

Mid day, ward no.8 of Lelep VDC

Plate 5. Abandoned Shed
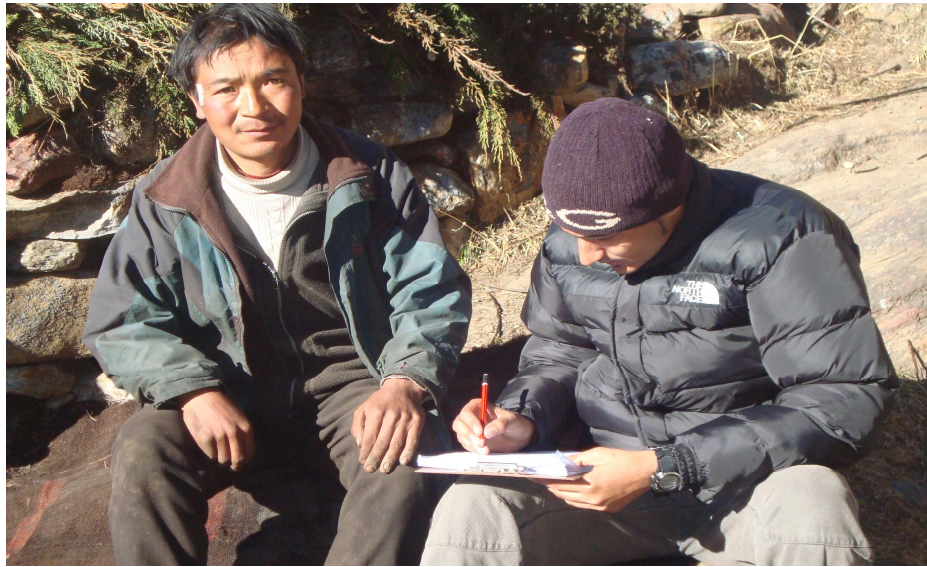

Plate 6. Interviewing to respondents of Ghunsa

Plate 6. Yangma Village

Plate 7. Interviewing to respondents of Yangma Village