HABITAT PREFERENCES AND ILLEGAL TRADE OF CHINESE PANGOLIN *Manis pentadactyla (*Linnaeus 1758*)* IN KAVREPALANCHOWK DISTRICT, NEPAL

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RECOMMENDATION

This is to certify that Ms Anju K.C. has completed this thesis entitled "Habitat Preference and Illegal Trade of Chinese Pangolin in Kavrepalanchowk District, Nepal." as a partial fulfillment of the requirement of M Sc. in Environmental Science under our supervision and guidance. This is her original work and to the best of our knowledge, this thesis work has not been submitted for any degree in any institutions.

We therefore, recommend the dissertation for acceptance and approval.

…….	……...
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Supervisor	Co-supervisor
Professor of Zoology Natural History Museum,	Faculty Member
Tribhuwan University	Khwopa College

CERTIFICATE OF ACCEPTANCE

This dissertation entitled "Habitat Preference and Illegal Trade of Chinese pangolin (*Manis pentadactyla Linnaeus 1758)* in Kavrepalanchowk district*"* submitted by Anju K.C. is examined and accepted as a partial fulfillment of the requirements of Master in Environmental Science.

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DECLARATION

I hereby declare that the work presented in the thesis has been done by myself and has not been submitted elsewhere for the award of any degree. All sources of information have been specifically acknowledged by reference to the authors or institutions.

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Date……..

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ABSTRACT

Conservation of biodiversity and sustainable management strategies must be based on an understanding of the structural and functional ecological traits of utilized species. Such basic information are still lacking for even the endangered species in Nepal .This study was conducted from the month of March 2015 to August 2015 in Kushadevi and Rayale VDCs, Kavrepalanchowk district with the main objective of investigating on preferred habitat and illegal trade of Chinese pangolin (*Manis pentadactyla*). Transect with zigzag walking method and questionnaire surveys were done to explore the habitat preference and illegal trade of the species at local scales. The study of the pangolin was based on the distribution of the burrows, types (new and old) occurrence and their distribution in terms of aspect, soil, altitude, vegetation and food availability. Altogether 199 respondents were interviewed around Kushadevi and Rayale VDCs. The questionnaire survey, group discussion, field observation, key informants interview and records from District Forest Office were achieved to fulfill gap information about pangolin, its trade and conservation threats and secondary information were also used to know different aspects of pangolins. GIS tool was used to find out area of different categories.

As many as 361((279 old and 82 new) burrows were found in the study site. Among the three habitats more burrows were found in Scrubland (170) followed by cropland (140) and least burrows were found in Forest (61).It was found that burrows were not uniformly distributed in all habitats. Out of 361 burrows 45% were found in south east aspect and least 11% in north east aspect. A total 230 burrows were found in red soil and 131 were in brown soil. The burrows were mostly distributed within the range of 1750-1850m and above 2000 m burrows were null. Fresh burrow density were maximum in Scrubland (3.27/Km²),least in Forest (0.14/Km²) and moderate at cropland (1.14Km²).The dominant plant species found within the habitats were Uttis(*Alnus nepalensis*), Hatti paila(*Eulphobia dabia*), Chilaune (Schima *wallichii*), Dhale katus (*Castonopsis indica*) and Painyu (*Prunus cerasoides*), Dryopteris sp., Siru ghans (*Imperata cylindrica*), Paniamla (*Nephrolepis auriculata*), Bamboo (*Bambus vulgare*),Narkat(*Phragmites karka*), aainselu (*Rubus ellipticus*), Banmar(*Peracarpa carnosa),*Amriso(*Thysanolaena maxima).*Chi-Square test revealed that there were significant difference in distribution of burrows according to habitat, soil, altitude and aspect.

A total of 191 people residing in the study area were interviewed using the questionnaires. Out of these total respondents, 54%% were male and 46% were female. As many as 79% respondents were surveyed from the non-ethnic group and 21% surveyed from that of the ethnic. High majority of people (95%) were involved in agriculture for their livelihood. Remaining 5% people were running their livelihood in other ways. Most of the people were unknown about medicinal use of the species but 16% at Kushadevi and 13.6% at Rayale admitted that they had eaten its meat. The meat is used for the treatment of gastro intestinal problem, as pain killer to treat cardiac and bone problems. Scale are used for making finger ring, necklace etc. The scales are rubbed on stone with water and used to treat skin diseases, burn

wound, and teeth problem. They are kept on the roof of the houses to prevent from insect infestation. Among the respondents 53% have seen pangolin and 47% had not seen in their life period. As many as 84.6% of them opined that pangolin's population was decreasing, 9.6% believed stable population and 5.8% were unknown about the population. Among the respondents 87.6% believed hunting by human as the main threat for pangolin, 10.5% believed habitat degradation, 1.9% believed use of pesticides as the main threat. As many as 60% respondents were eager to pay Rs.100-500, 20% eager to pay Rs. 100-500, 15%eager to pay below Rs. 100, 5% eager to pay above Rs.1000 and 5% were not interested to pay for conservation of species.

Illegal trade, habitat destruction and lack conservation awareness among locals found to be major threats to the species in the area. So it is concluded that strong law should be enforced to stop poaching of the species and conservation awareness program should be launched in the area to save the species.

Keywords: *Pangolin, Burrow, Habitat preference, Illegal trade, Conservation, Awareness, Respondents*

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ABBREVIATIONS AND ACRONYMS

FGD	Focus Group Discussion
GIS	Geographic Information system
GPS	Global Positioning System
Hhs	Households
IUCN	International Union for Conservation of Nature
NGOs	Non-Governmental Organizations
NPWC	National Parks and Wildlife Conservation
PCP	Participatory Conservation Program
VDC	Village Development Committee
CITIES	Convention on International Trade in Endangered species of wild Flora and Fauna
DFO	District Forest Office.
DPO	District Forest office
CIB	Central Investigation Bureau

CHAPTER I: INTRODUCTION

1.1 General Background

The characteristics of the ecological belts of any country determine the kind of biodiversity. About 75% of Nepal is covered by mountains, making it one of the most rugged mountainous countries in the world. It can be divided in its east-west axis into four geographical regions. In the south, along its border with India, lies the Terai, a low, flat and fertile landscapes that is the northern extension of the Gangetic plain, and which varies in width from about 25 to more than 32 kilometer. The southern part is a rich agricultural area, while the remaining northern area consists of forests and marshy river bottom rich in wildlife. Immediately, north of the Terai are the steep, forested Churia ranges that rise in almost perpendicular escarpments to an elevation of nearly 2000 m. Next, midland region, a densely populated area with Complex Mountain ranges up to 3000 meters. This region includes the Kathmandu and Pokhara valleys, and covers roughly 33% of the country. Finally along the northern border with Tibet, lays the Himalayan Mountain itself.

It is difficult to appreciate current rates of species loss unless we have some estimate of both the number of species alive today and of their decline. Unfortunately, only a small proportion of taxonomic diversity has been documented (May, 1988, 1995).So indirect methods of estimating the number of extent species have been devised. These include the use of environmental variables, indicators groups, or higher taxa as measures of species diversity (Gaston, 1996). Environmental factors are viewed as a key to population persistence because they effect large and small population alike and nowadays many are human in origin. Such anthropogenic factors include habitat fragmentation (Harris, 1984), competition or predation by exotic species (Atkinson, 1989). Anthropogenically caused habitat loss and fragmentation are key problems affecting current populations and Meta population theory has been used to model population persistence in small, remnant pieces of habitat. As human population growth and resources are driving forces behind the biodiversity crisis, understanding the strategies by which people produce and limit offspring and the circumstances under which they overexploit resources is critical to the conservation agenda.(Kaspal,2008).

Trade in wildlife and wildlife products is one of the greatest drains on biological diversity (Fitzgerald, 1989; Dobson, 1996). However, international convention such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITIES) are in place to be regulated to control its trade (Kaspal, 2008).

The conservation of endangered fauna and flora species is an important and controversial issue at national and international level. Despite the concerted efforts of the independent organizations, government agencies and private individuals , many species still face the prospect of extinction due to environmental degradation and the threat of illegal trade of wildlife and its related products (Song,2003).

PANGOLIN

The name Pangolin is derived from Malayan phrase 'Pen Gulling' meaning 'rolling ball', while the term Pholidota came from a Greek word meaning 'scaled animals'. They are also known as Scaly Anteaters because of their structure and food habits. The generic name of Pangolin in Nepal is "Salak" although it has some locals' names that are popular in particular areas. For instance, it is called "Kaynaya" (Newari language), "Gose",(Tamang language) and "Hilemaccha" in hill by the virtue of its bronze like overlapping scales.

The Chinese Pangolin *Manis pendactyla* is one of two species of Pangolin found in Nepal. It is an endangered species protected by National Parks and Wildlife Conservation Act, 1973. Internationally it is enlisted in Appendix II of CITES as Lower Risk/Near Threatened in IUCN Red Data Book. Animals are listed as Lower Risk when they are not critically endangered or vulnerable. Taxa included in the Lower Risk category can be separated into three sub-categories Conservation Dependent (CD), Near Threatened (NT) and Least Concern (LC). Near Threatened are those taxa which do not qualify for conservation dependent but which are close to qualifying for vulnerable (Taylor, 2000).

Pangolins are fantastic small mammal whose body is covered with scales. Their hard scale act as protection cover and they curl themselves in a ball. They are toothless nocturnal animals. They are peace loving creature with extremely shy and non-aggressive behaviors. Pangolin has long, stout claw for digging its hole, lives in burrows (Shrestha, 1981). Two types of Pangolins are found in Nepal. Dark brown scale with pink-beige face is Chinese Pangolins (*Manis pentadactyla)* and yellowish brown scale with light around the face is Indian Pangolins (*Manis crassicaudata).* The Chinese pangolin is usually found in Terai and Hilly area below 2000m. It is found in different types of tropical and sub tropical forest bushes and grassland, cultivated land and near human settlements. It is mostly found in red and brown soil. Usually reproduce in the month April and May. The diets of pangolin are ants, termites and other types of insects (Gurung, 1996). They help to control ants, termites and other insects which cause different diseases and agricultural loss. In a year a pangolin eats 70 million insects. Illegal trade of Pangolin for flesh and scale is high due to its high traditional medicinal value (Kaspal, 2009).

Trade

Poaching and illegal wildlife trades are major threats for the existence of many species. Despite the best efforts of controlling illegal trade worldwide, it is estimated to be the world's third largest black market with a transaction often of billions of dollars a year after narcotics and illegal arms deals. Several seizures, arrests, stockpiles and actions taken against wildlife perpetrators in different time shows how serious and challenging are wildlife crime in conservation field. Major factors in influencing the wildlife related crime are poverty, greed, corruption and lack of awareness, political protection and lapse in law enforcement, geographical and political situation

of the country. The other threats are habitat fragmentation, poaching and the illegal trade of wild animal's parts (MoFSC/ DNPWC,1999).
Poaching is found both opportunistic and organized and vacillates depending upon the area, season of the year, demands and political situation of the country which largely influence the law enforcement creating security lapse. Major species in poaching and illegal trade are Rhinoceros, Tiger, Snow leopard, Musk deer, Himalayan black bear, Sloth bear, Pangolin etc.

Illegal trade of Pangolin's flesh and scale is due to its high traditional medicinal value. It is one of the primary causes of declining pangolin in global context. The encroachment of human settlements into the preferred habitat of pangolin believed to be a major contributing factor for declining this species in Nepal.

1.2 Statement of Problem

Pangolin has received least scientific attention in Nepal (Kaspal, 2009). The regional decline in most of the species has occurred largely within the last 50 years, because of hunting for subsistence has been increasingly outweighed by hunting for the market due to weak law enforcement (Corlett, 2007). Since these species are rarely observed due to their secretive, solitary, and nocturnal habits, there is not enough research on population densities or global population (CITES 2000). There have been few documented records, and therefore there is very little information available on its population status. It can be further justified by survey of Gurung (1996), in the Royal Nagarjun Forest in Kathmandu, from where healthy population dramatically declined due to increase access to hunting and habitat loss. The current threats due to habitat destruction and trade in national and international market, is depleting the population of pangolin rapidly. A complex chain of supply, partnered with diversifying consumer demand, makes effective conservation and management of wild species in the region extremely challenging (Kaspal, 2009). The trade of this species has been openly blooming in Kathmandu (www.wcn.org) and different national and local newspapers have been focusing the news of pangolin trade in eastern and central Nepal.

It is heard that the pangolins meat is eaten by ethnic communities and their scales have medicinal values even in Nepal. Through the Nepal-Tibet border the scales of pangolin reaches Chinese and Hong Kong markets from eastern and central Nepal. Ethnic importance of pangolins has not been well documented. Local trade markets and involvement of people in pangolin trades has to be identified. People of Nepal have null knowledge on importance of pangolins in agro-pest control as well as its importance in the ecosystem maintenance. A huge gap occurs in pangolin related information in the country (Katuwal, 2013).

This study will help to know the habitat preferences of pangolin and their population density. The study will focus on the illegal trade of Pangolin which is the major problem for its population decline. This study will help in minimizing illegal trade by creating attention of the public, government and related stakeholders.

1.3 Research Questions

i. What are the habitat types preferred by pangolin?
ii. What is the burrow density of pangolin?
iii. What is the level of illegal trade of Pangolin?

1.4 Objectives

1.4.1 General Objectives

The general objective of study is to know habitat preferences and extent of illegal trade of pangolin.

1.4.2 Specific Objectives

The specific objectives of study will be as follows:

i. To know habitat preferences of pangolin
ii. To estimate burrow density
iii. To assess the status of illegal trade of pangolin.

1.5 Limitation of the Study:

i) This study was carried out in two VDCs in the Kavrepalanchowk District, Nepal.

ii) The study was been carried out for one season only.

CHAPTER II: LITERATURE REVIEW

Acharya (1993) conducted survey to study about the status of pangolin in the Royal protected forest of Nagarjun in 23rd December to 1st January. They had found six freshly dug burrows below Jamachok peak at south facing slopes. Pangolin visited farmland during the flowering season of maize, bean, yam and bamboo species in search of ants and termites. They pointed the display of pangolin's skin in local bazaars by traditional medicine men and mentioned the sale of pangolin scales at NRs. five/scale

Gurung (1996) conducted pangolin survey in Royal Nagarjun Forest in Kathmandu. He found 50 burrows along a four kilometer stretch of roadside at Raniban. He found the burrows in the grasslands. He noted the similarities of pangolin's habitat in Nagarjun with the reports from Tumlingtar of Sankhuwasabha in eastern Nepal, Chainpur of Dhadhing and Belephi of Sindhupalchok district. He found close relationship between the red soil and the burrow's distribution.

Shrestha (1997) studied the behavior of pangolin in Panauti-Beber area. He found the pangolin wriggling out at the dead of night for stalking termites and ants. It remained active until the dawn. He found it walking about for food over a long or short distance from its burrow. He recorded the home range of Pangolin in the Panauti-Beber area, which was about two square miles. He also reported that it was able to swim and climb on the tress and rock to stir up tree trunks, soil and moulds of termites and ants, which are its principal foods and were broken with the help of their powerful claws. While climbing, their prehensile tail served as a supporting aid.

CITES (2000) listed all species of the genus *Manis* (pangolins) in Appendix II in 1975. In 2000 a zero annual export quota was established for specimens of Asian species removed from the wild and traded for primarily commercial purposes.

Yong (2000) reported that 2000 live pangolins and 500 ~ 800kg of pangolin scales were smuggled to China through border of Yunnan every year. The species of pangolin smuggled are those of Asia three species, the main species smuggled in early 90's is mostly Chinese pangolins**,** Malayan pangolins as the main species smuggled in late 90's and into 2000 era, which mainly for the scales as medicine and live pangolin as food, but there's still no discovery of 4 Africa species smuggled into China. Now, the pangolins used for medicine and food are mostly smuggled, and till now the smuggling activities could not be controlled effectively. The main reasons are the laws related to illegal trading are not perfect, the enforcement of laws are not strict, and these add the level of difficulty to the effort of china to curb this problem.

DFO (2002) reported the occurrence of Chinese pangolin in its different blocks of community forest in Bhaktapur district.

EIA (2004) identified that Nepal is source as well as transit of illegal trade of pangolin between India and China. Kathmandu is believed to be one of the transit points for the underground illegal

trade centers in the region and described as "Staging Point" for illegal skins brought in from India to be sent to Tibet.

Shrestha (2005) conducted survey on pangolin in Shivapuri National Park. He found the burrows in the open forest with less coverage on south, southeast, southwest facing slopes. He observed the burrows in red soil. He also found that burrows were distributed by fodder collection, cutting trees and livestock grazing. He concluded that the population of pangolin was decline state in Shivapuri National Park and suggested further research on its conservation.

The Himalayan Times (English Daily) (2007) published about an incidence of Pangolin in Kathmandu entitled 'Local help rescue injured Pangolin'. One female Chinese pangolin was rescued from Taudaha of Kathmandu with the help of local volunteers. It was kept in the central Zoo but died on the seventh day despite the treatment and food.

Akpona (2008) studied ecological method with ethnographic approaches to investigate the ecology and ethno zoology of three- cusped pangolin in lama forest reserve, Benin. They interviewed 79 people from various socio-professionals groups to assess how important is three cusped pangolin to indigenous people.

Duckworth (2008) assessed the conservation status of the species due to high levels of hunting and other factors, such as habitat degradation, in recent years and the species was worse-evaluated as Endangered and the population considered being in decline.

Kaspal (2008) recorded the occurrence of Chinese pangolin in different blocks of community forest in Bhaktapur district. She found 51 burrows in the community forest of Suryabinayak Range Post of which more number of burrows were in brown soil and southeast aspect. She found scaly body cover of Pangolin keep for scales. She found the price of single pieces of scale was only NRs. 50.

Suwal (2009) conducted pangolin survey April 2008 to August 2009 in community and private forests of Balthali, Kavre with the main objective of investigating status, distribution, behavior, and threats of the species. The highest number of burrows was recorded from 1500-1550m with Pinus, Alnus and Betula dominating habitats. Poaching, grazing, deforestation, mining, fire and developmental activities were the major threats to pangolins.

Bhandari(2013) conducted survey on pangolins in Nagarjun Forest of Shivapuri Nagarjun National Park during April 2013.She had found 235 burrows of which more number of burrows were in northwest aspect. Fresh burrow density was found to be 0.833 burrows per hectare.

Katuwal (2013) studied pangolin in Eastern Nepal. They used questionnaire survey and recorded from District Forest Office (DFO) and analyzed pangolin trade flow, ethnic use and created awareness Program in four districts (Tapeljung, Illam, Dhankuta and Sankhuwasaba) of eastern Nepal.

Khatiwada (2014) conducted a study to find out the distribution, habitat utilization, social belief and conservation status of Chinese pangolins in Nangkholyang VDC of Taplejung district, eastern Nepal. The study found the presence of indirect signs of Chinese pangolin such as 211 burrows (including 16 new and 195 old), scats, footprints and traces of trails. Highest numbers of burrows were found in Southwest aspect. The habitat utilized by pangolin was maximum in agricultural land and forest. Hunting for illegal trade was found to be main threats for Pangolin in the area.

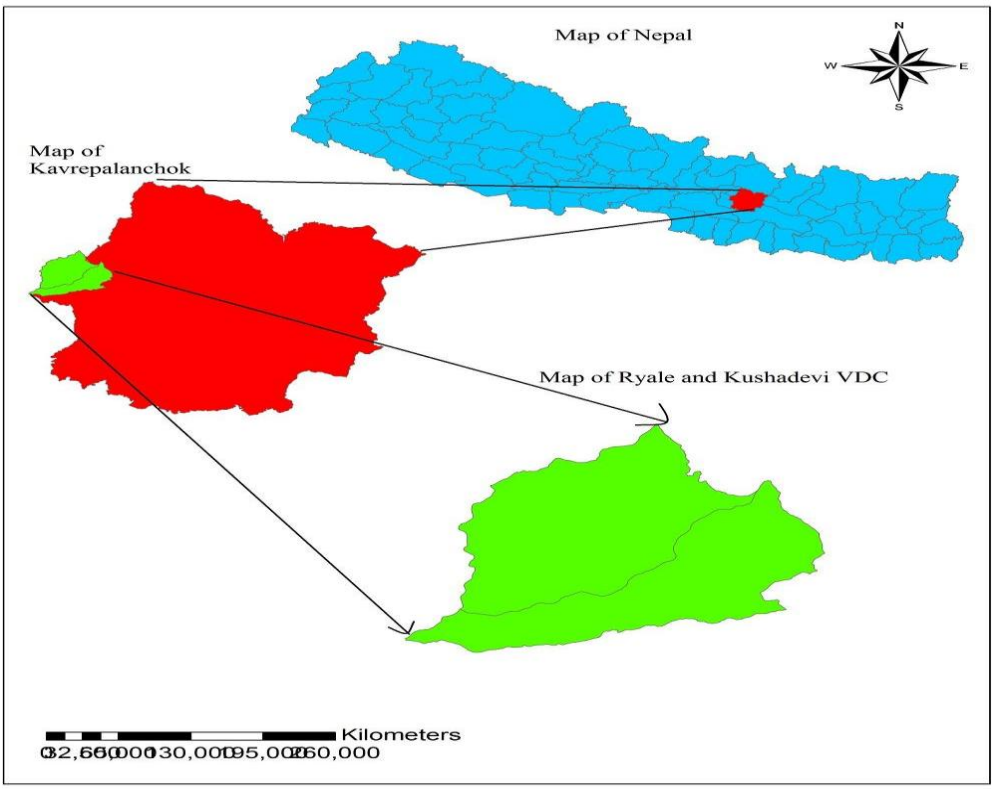
CHAPTER III: METHODOLOGY

3.1 Description of the study area

The study was carried out in two VDCs of Kavrepalanchowk district which is situated in Bagmati zone, at heart of the central region around 20 Km southeast of Kathmandu. The study area is positioned at 27°34"37'N and 85°26'57" E. The elevation is about 1900 m above sea level. The study area covers about 125.43 squares Km (Koirala, 2008).

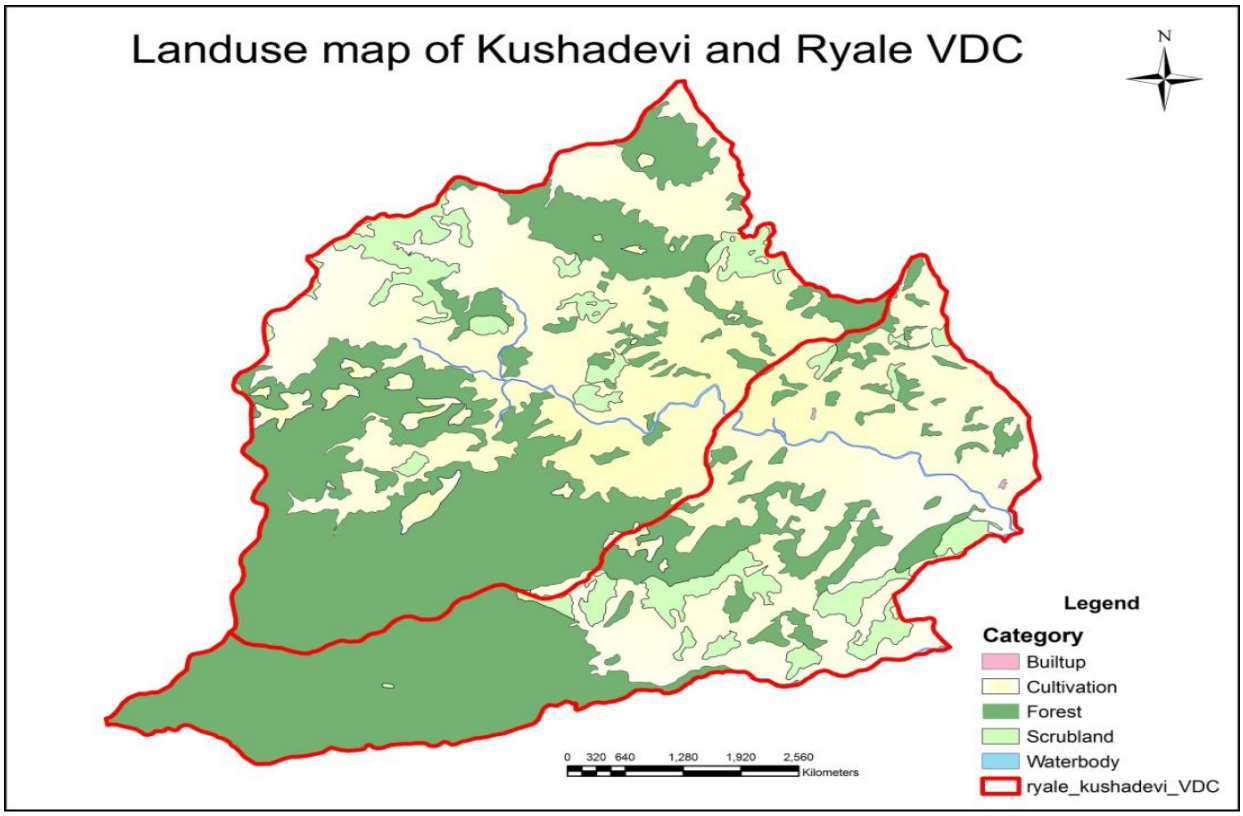
This is region of the middle hills of Mahabharat range. The district has monsoon climate with maximum average temperature 31° c, minimum average temperature 10° c and the minimum falls down to 0 °c in winter. The average annual rainfall is 1581 mm. The vegetation is mostly of tropical and subtropical forest (Koirala, 2008).

Study site is densely populated. Settlements of the VDCs are scattered, there are around 2526 households with 11516 total populations (Census 2011). Mostly dominated castes are Tamang, Brahmin, Chhetri, Newar, and Dalit. Over 70% are from indigenous groups, i.e. Tamang, and 25% are other castes, such as Brahmin, Chhetri and there are also a few Dalits (such as Kami and Sarki). The main occupation of the people is agriculture. Paddy, cereal- based crops, potato are the main crops of the study area. (Koirala, 2008).



Map 1: Map showing Study area

The total area of study area was 125.43km ².The study area was divided into three categories based habitat occupied by the species i.e. Cropland (26.36 Km²), Scrubland (12.55Km²) and Forest (86.01 Km²).



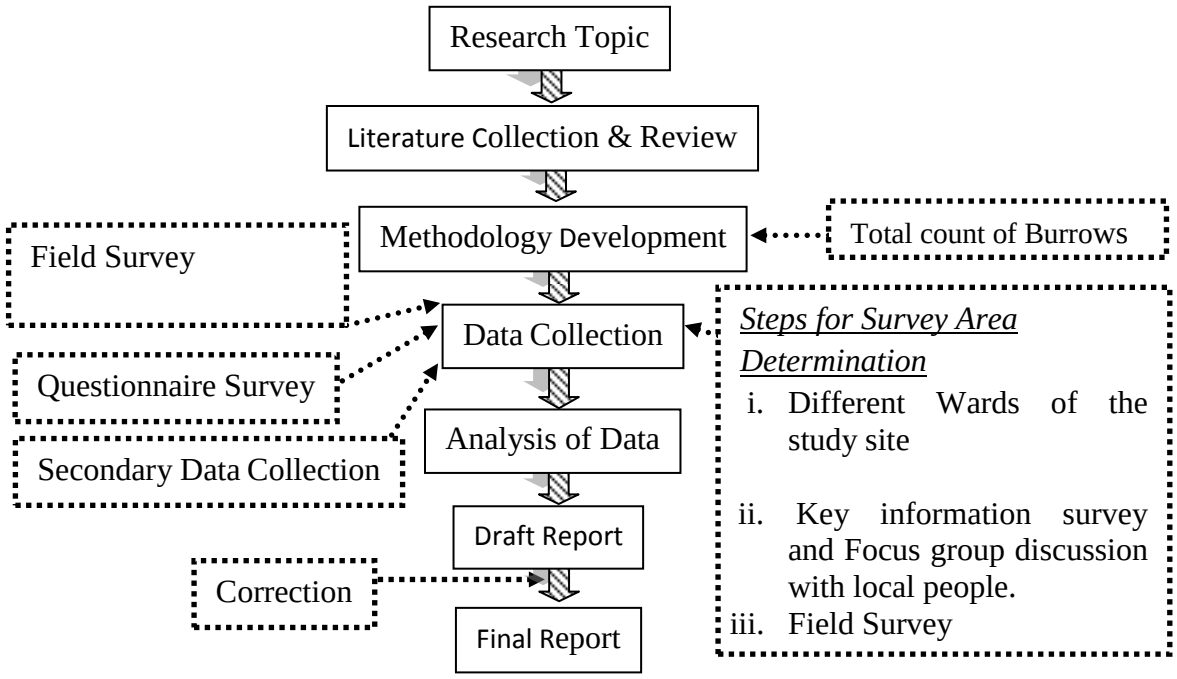
Map 2: Map showing Land use map of Kushadevi and Rayale VDC

Table 1: Available habitats in the study area

S.N.	Category	Kushadevi	Ryale
		Area km2	
1	Forest	41.49	44.52
2	Cultivation	13.79	13.57
3	Scrubland	1.25	10.66
4	Built up	0.01	0.59
5	Water body	0.25	0.25
	Total	56.79	69.59

3.2 Research Design

Research Design for study is as following chart:



3 .3 Data Collection

3.3.1 Primary data collection

3.3.1.1 Preliminary survey

Preliminary survey (both literature review and field visit) was conducted prior to initiation of the detailed field survey to identify potential habitats of pangolins in the study area. The preliminary survey was then followed by detailed field survey.

Burrow Density

The number of active burrows counted within sampling plot divided by total area of the plot. Walking transect were developed in the study area for counting the number of burrows of the species and for direct observation of animal's sign in the field.

Burrows count

The burrow density of Chinese pangolin was estimated by applying burrow count method. Methodology used for burrow counting consisted of walking predetermined transects lines in a zigzag way during the survey period and counting the number of occupied burrows by the pangolin. Occupancy of burrows was determined using combination of scat deposition and noting recent tracks as described by Blaum (2007).

The burrows were categorized as new and old.

New burrow: If the burrow contained fresh, loose soil devoid of vegetation but having scratches, it was classified as a new burrow.

Old burrow: If the burrow contained compacted soil with vegetation and no specific marking, it was classified as old burrow.

3.3.1.2 Detailed field survey

Transect with zigzag walking method was conducted in the habitats of pangolin and information like vegetation, soil types, aspect, altitude and availability of food were collected.

3.3.1.3 Questionnaire survey

A set of semi-structured questionnaire was used as a tool to collect primary data in order to achieve the research objectives. The questionnaire contains socio-economic condition of the respondents, conservation threats, trade and perception of local people. Different categories of the respondents (i.e. by gender and caste) were selected for the conservation threats analysis and perception of local people. The questionnaire was prepared in English first and then translated into Nepali before the respondents were asked in the study area. All together 199 respondents from different categories were taken for questionnaire survey. Out of 199 respondent 30 were local hunters.

3.3.1.4 Key informants interview

Informal interview was made with different key respondents like District forest officer of Kavrepalanchowk, VDC chairman, local healers, old people, local leaders, etc in order to get information on potential habitat of pangolins, its conservation threats and illegal trade at the local level.

3.3.1.5 Group discussion

Informal group discussions were conducted. Altogether three informal group discussions were done in three different places i.e. Bolakhe gaun of Kushadevi VDC and, Parkhalchaur and Lapsitar of Rayale VDC

3.3.1.6 Direct observation

Direct observation was also done in the study area in order to know people pressure on that area. People involved in activities like cutting grasses, closing burrows, cultivate agricultural products were observed in the study area.

3.3.1.7 Concerned authorities

Information regarding illegal trade and other related information were collected from District Forest Office, District Police Office and Central Investigation Bureau,

3.3.2 Secondary data:

Secondary data were collected from District Forest office Kavrepalanchowk and Kathmandu District Police office Kavrepalanchowk district, Central investigation Bureau, related articles, libraries (Khwopa college,) web-sites etc.

3.4 Data Analysis

The collected primary data and secondary data had been processed by using Statistical tools. Microsoft excel, GIS (Geographical Information System) and Chi- Square test were used to analyze the data. The results were presented in table and chart wherever possible.

Chi-square Test

To examine the significance of data, chi square test was employed. The 0.05 level of significance was used to accept or reject the null hypothesis.

$X^2 = \sum(O - E)^2/E$

Where, O= Observed Value,

E= Expected Value

For each test, relevant null hypothesis (Ho) and respective alternative hypothesis (H1) were set according to Pandit (1999).

CHAPTER IV: RESULTS

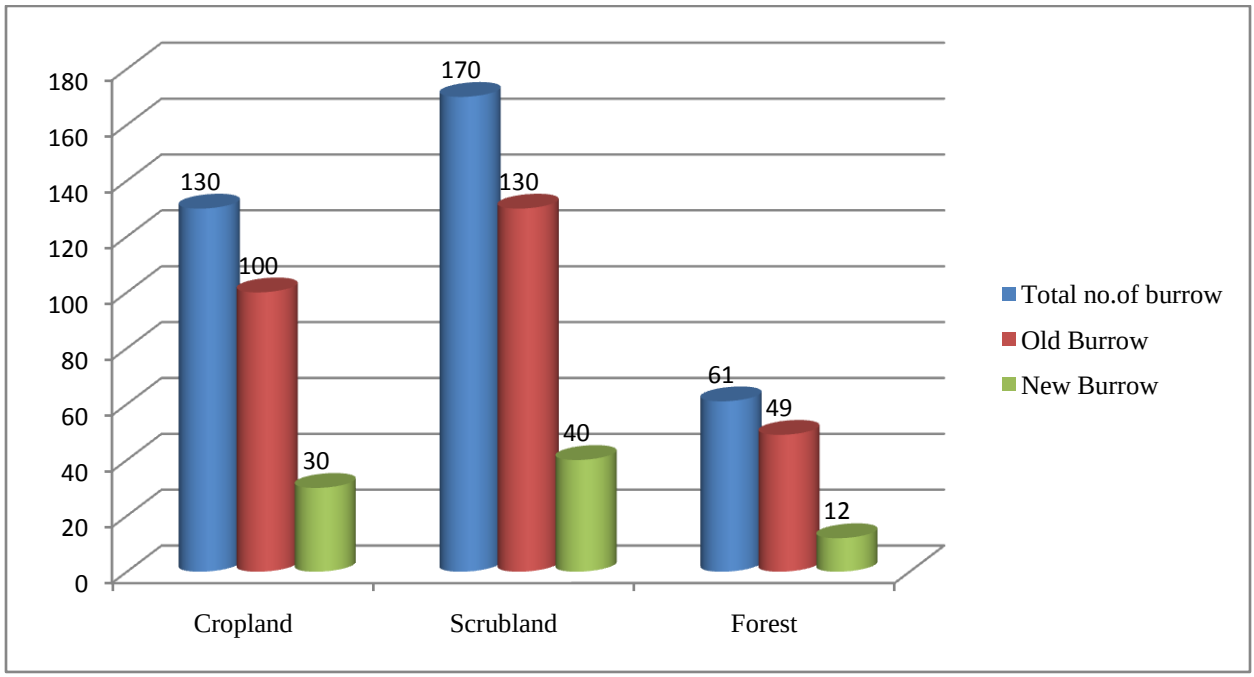
4. RESULTS

4.1 Burrow distribution according to Habitat

361 burrows were found in cropland, scrubland and forest.

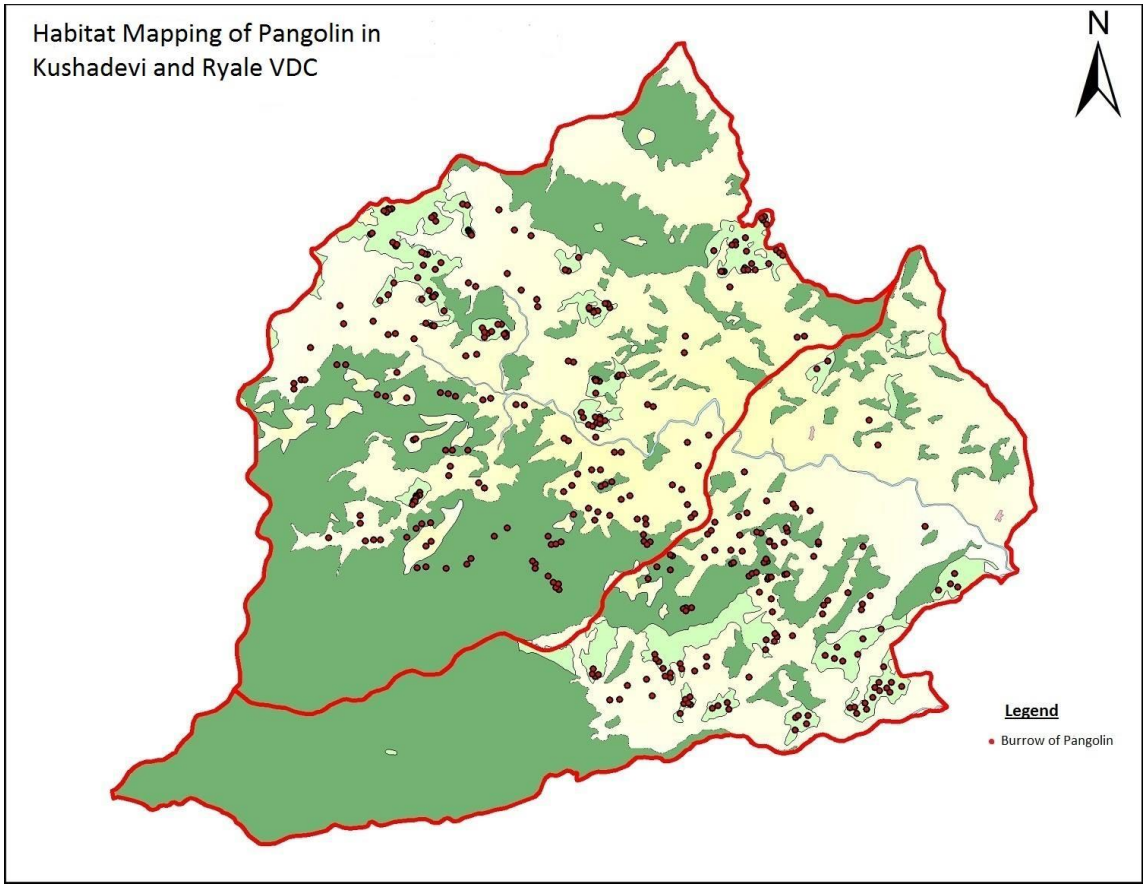
Table 2: Distribution of Burrows in different habitat

Category	Number of Burrows	Area(Km²)	Burrow Density
Cropland	130 (100 old, 30new)	26.36	1.14
Scrubland	170 (130old, 40new)	12.55	3.27
Forest	61 (49 old, 12new)	86.01	0.14
Total	**361 (279old, 82new)**	**124.92**	



Source: Field Survey-2015

Figure 1: Distribution of Burrow in Different Habitat



Map 3: Habitat mapping of Pangolin in Kushadevi and Rayale VDC

Burrow Density

In Cropland

The total numbers of burrows was to be 130 among them 100 were old and 30 were new ones. The fresh burrow density was 1.14/Km² and old burrow density was 3.78/Km².

In Scrubland

The total numbers of burrows was to be 170 among them 130 were old and 40 were new ones. The fresh burrow density of was 3.27/ Km² and old burrow density was 10.40/Km².

In Forest

The total number of burrows was to be 61 among them 49 were old and 12 were new ones. The fresh burrow density was 0.14 /Km² and old burrow density was 0.57/ Km².

On applying Chi square test to above data by taking the critical region at 0.05 level of significance was 5.99 for the degree of freedom 2, it was found that burrows were not evenly distributed in all habitats. Since computed value was 50.54 lie in critical region the test has accepted the null hypothesis. This might be due to favorable types of habitat and availability of the food.

4.2 Distribution of Burrow according to soil type

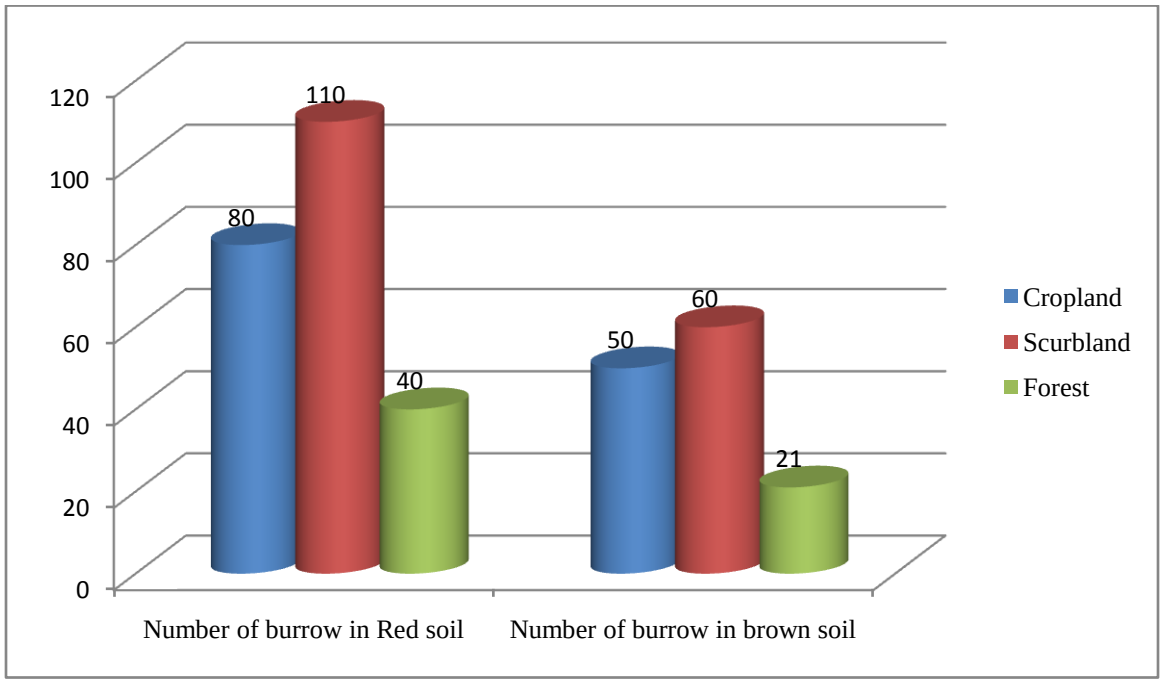


Figure 2: Frequency of Distribution of Burrow

Source: Field Survey-2015

Most of the burrows were found in red soil than brown (loamy) soil. In general, there were 230 burrows in red soil and 131 burrows in the brown soil.

On applying Chi-square test to the above data by taking the critical region at 0.05 level of significance was 3.84 for the degree of freedom 1, it was found that the distribution of burrow in red and brown soil differed. It means, there was direct relationship between the occurrence of burrows and nature of soil. Since computed value was 27.14 the burrows were found related to the soil characteristics.

4.3 Burrows Distribution According to Aspect

In terms of Aspect, it was found that there was high frequency of occurrence of pangolin burrows in south facing slope. Out of 361 burrows the highest 45% were found in south east aspect, followed by 26% in south. 18% in north and the rest 11% were found in north east aspect.

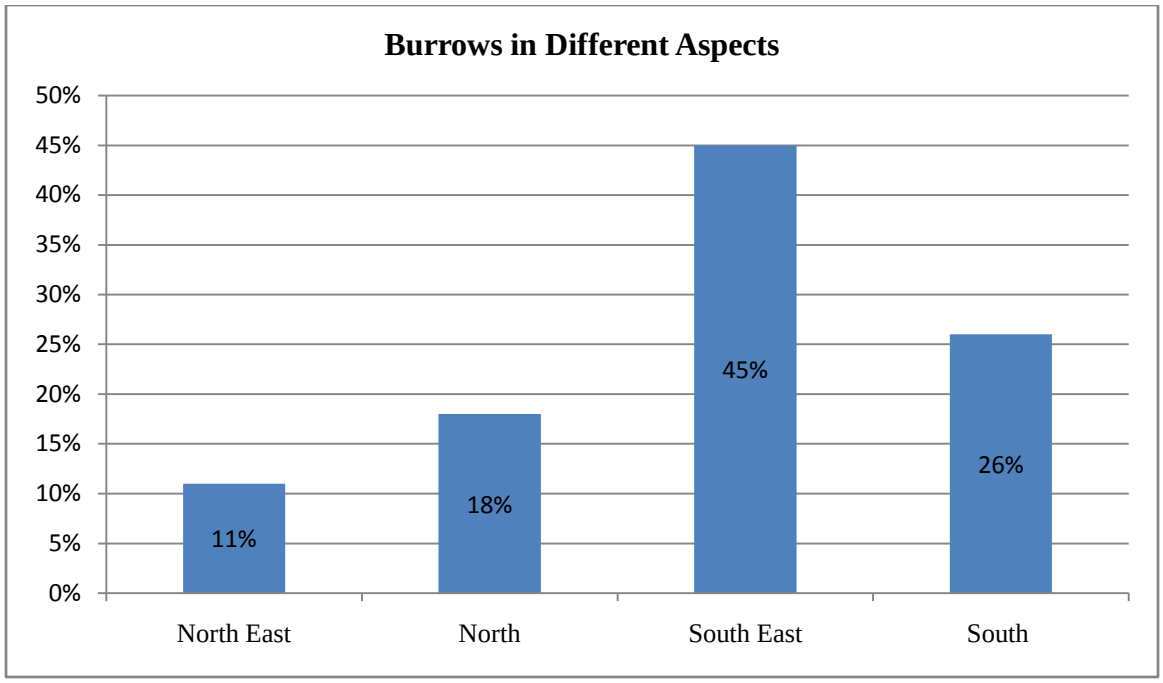


Figure 3: Burrows Distribution according to Aspects

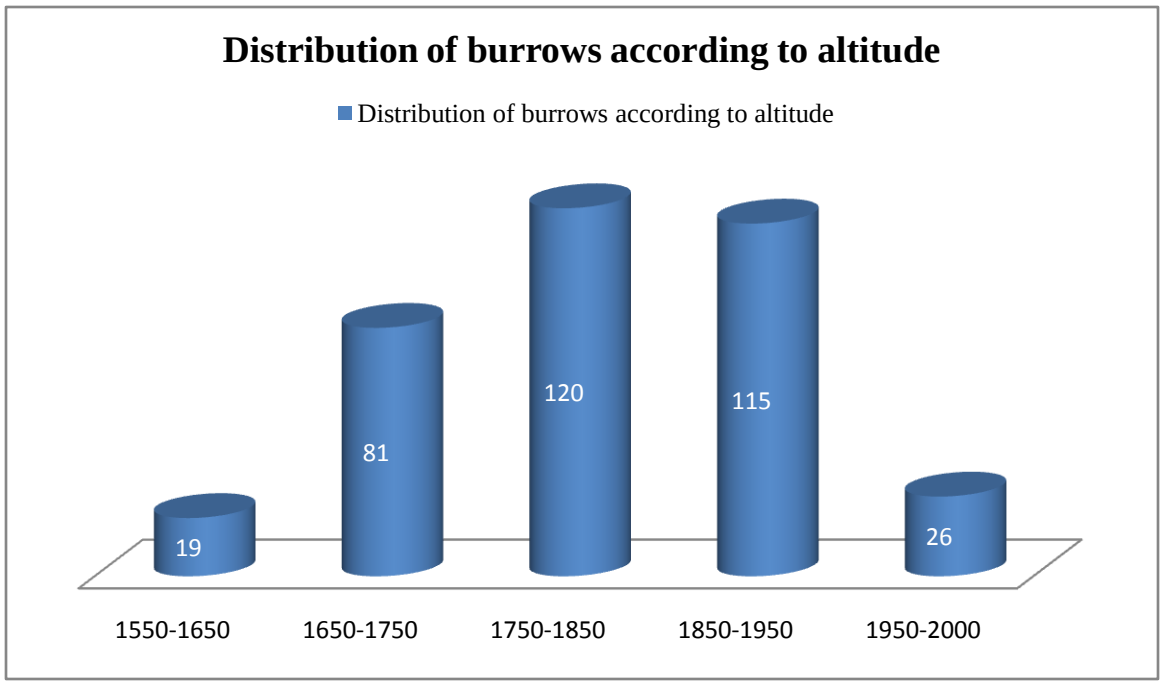
Source: Field Survey-2015

On applying Chi- Square test to the above data by taking the critical region at 0.05 level of significance was 7.815 for the degree of freedom 3, it was found that the burrows were not uniformly distributed in all aspect. High occurrence was due to the open forest, abundance of ant and termite mounds and due to high sunlight in south east aspect.

4.4 Distribution of burrows according to altitude

Table 3: Distribution of burrows according to altitude

S.N.	Altitude	Number of burrows
1	1550-1650	19
2	1651-1750	81
3	1751-1850	120
4	1851-1950	115
5	1951-2000	26



Source: Field Survey-2015

Figure 4: Distribution of burrows according to altitude

The highest numbers of burrows were record from 1750-1850 m i.e. 120 and least from 1550-1650 m i.e. 19. According to field survey, the minimum altitude for occurrence of burrow was 1596 m and maximum was 1989 m .Above 2000 m the presence of burrow is null.

On applying Chi- Square test to the above data by taking the critical region at 0.05 level of significance was 9.488 for the degree of freedom 3, it was found that the burrows were not uniformly distributed in all altitude.

4.5 Respondents by Gender

Altogether 199 respondents were interviewed. All the respondents were divided into male and female for the study. Out of total respondents, 54%% were male and 46% were female.

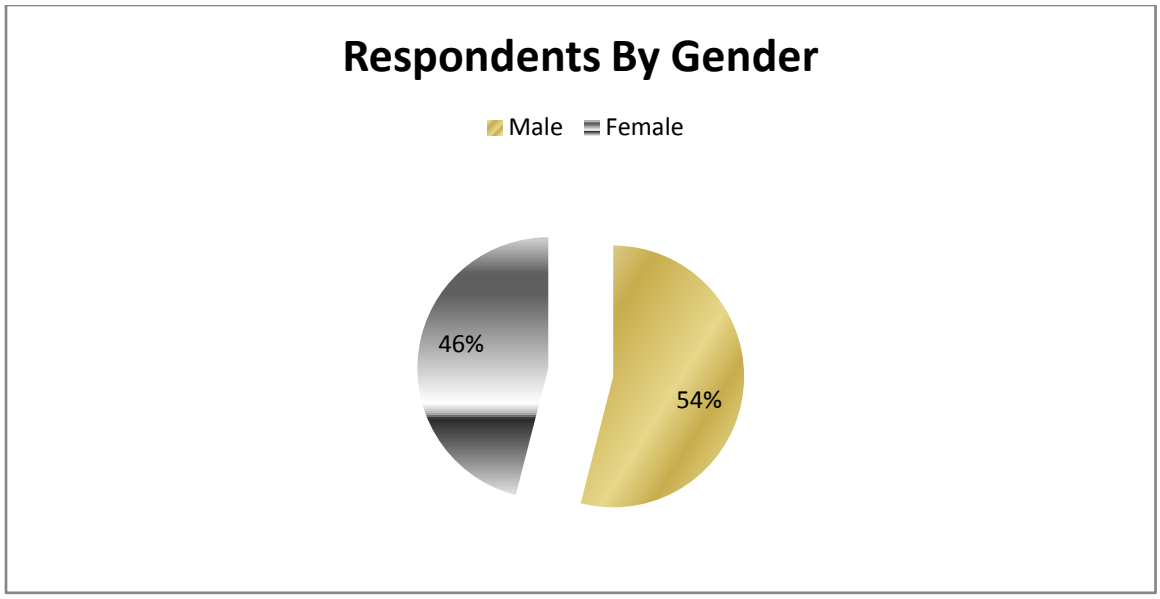


Figure 5: Respondent by Gender Source: Field Survey-2015

4.6 Respondents by Caste

All castes have been categorized into two main categories for the study. One is ethnic (it includes Newar, Magar , Tamang etc) and other is non-ethnic (it includes Brahmin, Chettri, Thakuri etc). Majority of the respondents were from non-ethnic group. Mainly, people from "Brahmin" caste have high majority among all with 56% respondent. Altogether, 79% respondents were surveyed from the non-ethnic group and 21% surveyed from that of ethnic group.

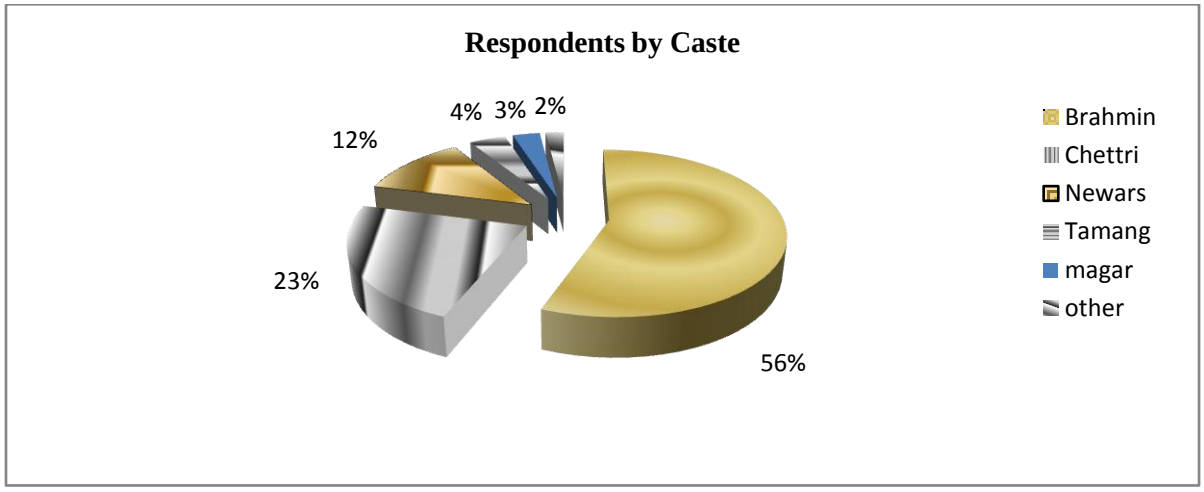


Figure 6: Composition of respondent by caste Source: Field Survey-2015

4.7 Occupation of the Respondents

The occupation of the people was mainly divided into two categories i.e. Agriculture and non-agriculture. High majority of people (95%) were involved in agriculture for their livelihood. Remaining 5% people were running their livelihood in other ways.Dependency on agriculture is very high in the study area.

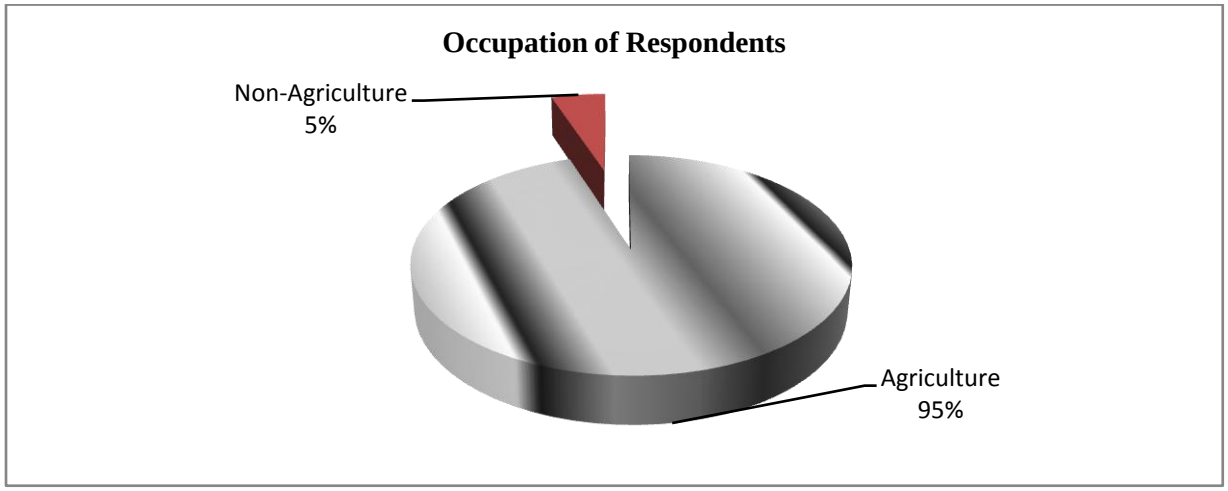


Figure 7: Occupation of respondents

Source: Field Survey-2015

4.8 Age of the respondents

The age of the respondents was categorized into three groups i.e. Children (14-18 yrs.), middle aged (18-60yrs.) and old aged (Above 60 yrs.). Of the total respondents, majority of the respondents (50.25%) were from the middle aged in the study area and was followed by old aged and Children with 27.13%and 7.5% respectively.

4.9 Ethno-biology of pangolin

Most of the people did not know about the use of medicinal value of pangolin However, about 16% of respondent at Kushadevi VDC and 13.6% at Rayale VDC had eaten the meat of pangolin. People had different perceptions towards the medicinal value of pangolins meat and scale. The meat is used for the treatment of gastro intestinal problem, used as pain killer during pregnancy, cardiac problem, back pain relief, medicine for bone problem where as the scales are used as a symbol of good luck and used to make finger ring and necklace to avoid danger, scales were rubbed and used to cure skin diseases, burn wound, also used for teeth problem, and even pneumonia. The scales are kept on the house roof to prevent from insect attack. It is also used to make garland.

4.10 Conservation Status

A total of 199 respondents were interviewed for finding the conservation status, trade issues and possible threats. Of these respondents interviewed, 105respondents (53%) had seen Chinese

pangolin in their life whereas 94 respondent (47.2%) had not seen the species. However, all the respondents were aware of pangolin signs i.e. burrows 107 respondents (53.7%) were male and 92 respondents (46.2%) were female.

4.11 Population trend within last five years

168 (84.6%) respondents opined that the population of pangolin was decreasing, 19 respondents (9.6%) opined that population was stable, 12 respondents (5.8%) were unknown about the population trend.

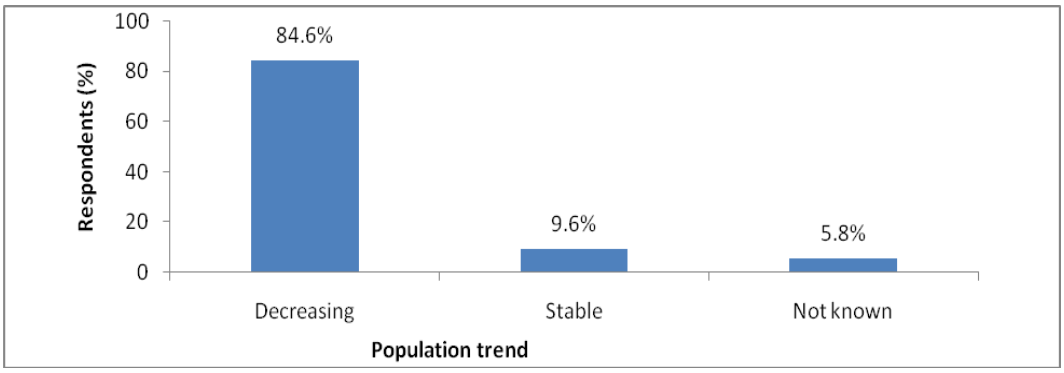
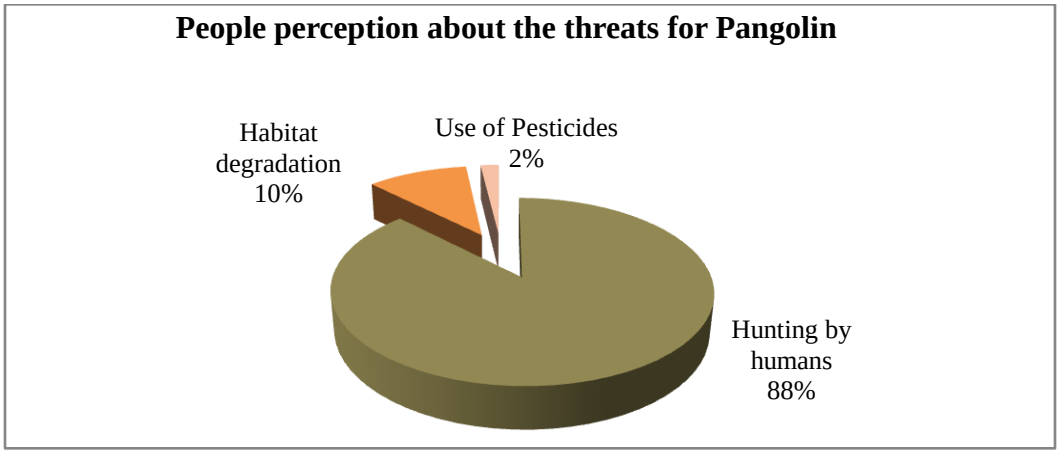


Figure 8: Population trend of Pangolin in last five years

Source: Field Survey-2015

4.12 Threats for Pangolin

Among the 199 respondents (87.6%) believed hunting by human as the main threat for pangolin. 20 respondents (10.5%) believed habitat degradation as the main threat. Only 4 of the respondent (1.9%) believed use of pesticides as the main threat to the species.



Source: Field Survey-2015

Figure 9: People's perception about the threats for pangolins

4.13 Human causes of habitat degradation

Regarding the causes of habitat degradation, 72 respondents (36.5%) opined forest fire as the main cause of habitat degradation. 45 respondents (23.1%) opined deforestation. 42 respondents (21.2%) opined road construction. 22 respondents (11.5%) opined fodder or grass collection and 18 respondents (7.7%) opined grazing for the main cause.

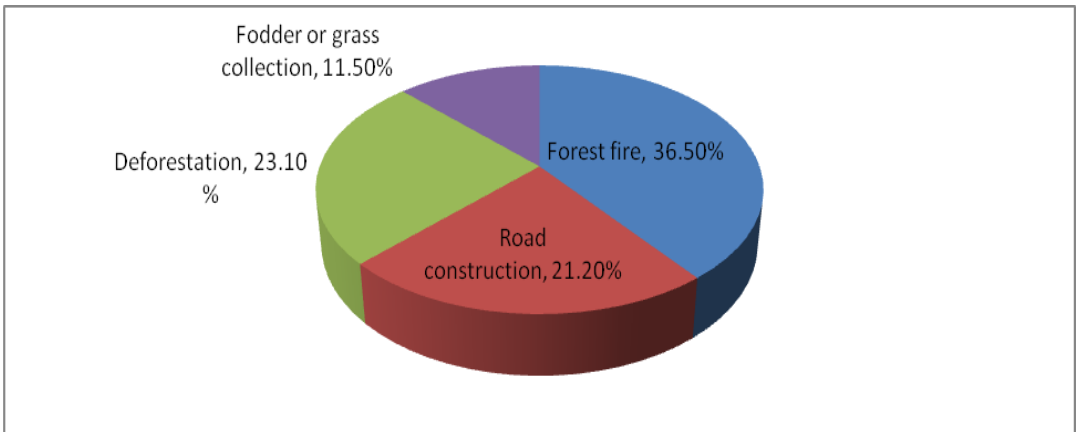


Figure 10: Human causes of habitat degradation

Source: Field Survey-2015

4.14 Occurrence of hunting pangolins in the village

Among 30 local hunters about 13 of the respondents (46%) said that the frequency of hunting was occasional, 6 of the respondents (18%) said that it was rare, 11 of the respondents (36%) were unknown about the frequency of hunting of the species in the village.

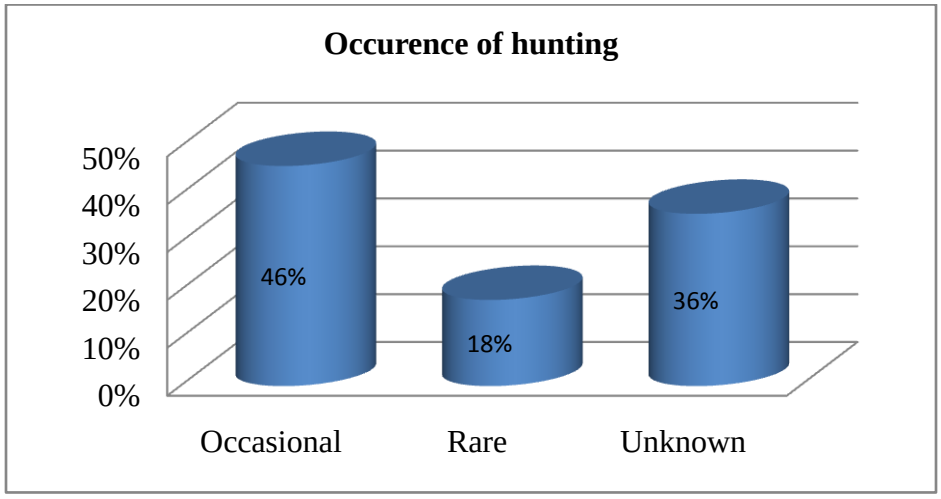
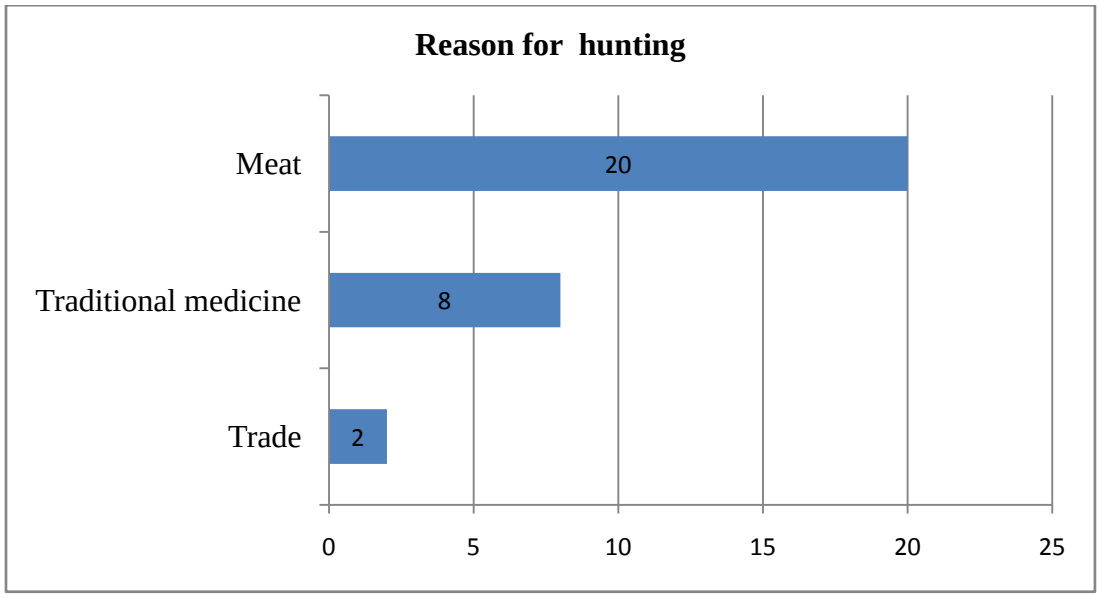


Figure 11: Occurrence of hunting in village

Source: Field Survey-2015

4.15 Reason for hunting

According to the respondents, 20 (66.67%) were hunted for meat, 8 (26.67%) for traditional medicine and only 2 respondents (6.7%) mentioned that it was for trade.



Source: Field Survey-2015

Figure 12: Reason for hunting

4.16 Frequency of hunting

Among 30 local hunter respondents, frequency of their illegal hunting of pangolin is shown in the following bar diagram:

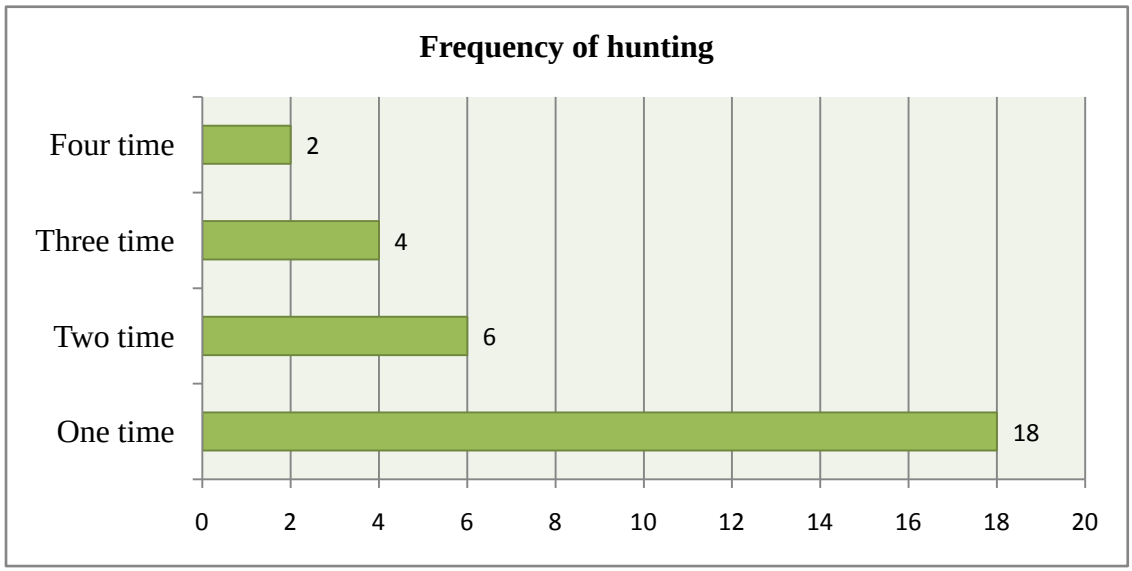


Figure 13: Frequency of hunting

Source: Field Survey-2015

4.17 Methods used to catch pangolin

18 respondents (61.3%) said that they caught pangolins by tracking their burrows, five respondents (16.67%) said that they caught pangolins by sending smoke into their burrows, 3 respondents (10%) said that dogs were used for catching pangolins, 2 respondents (6.7%) said that pangolin were caught by putting water into the burrows and two respondents were unknown about the methods used to caught pangolins.

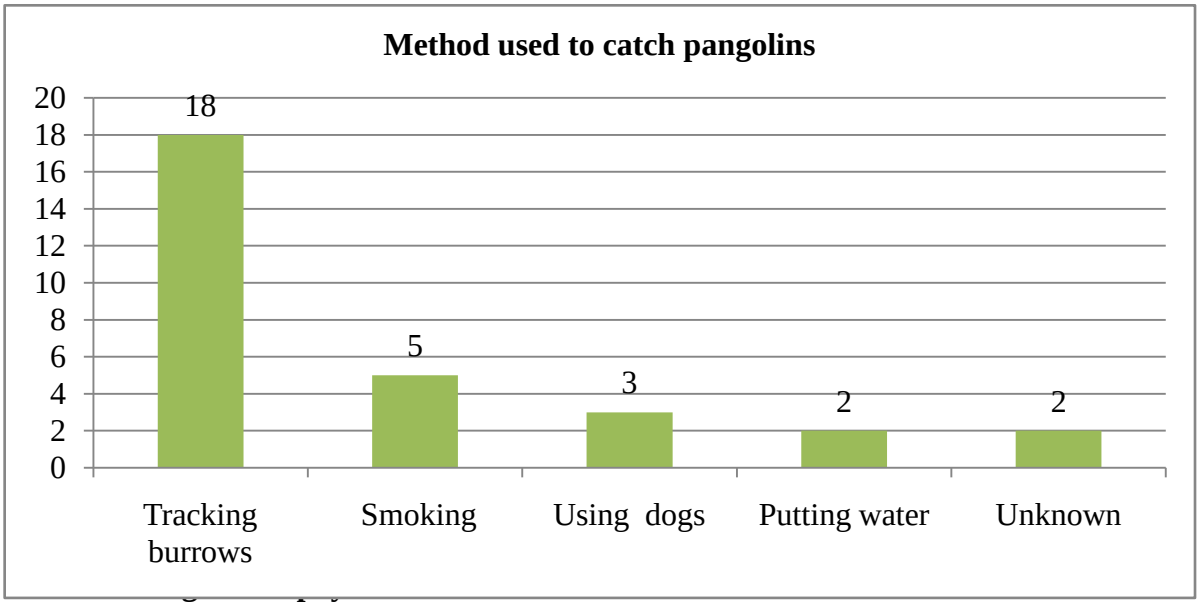


Figure 14: Method used to catch pangolin

Source: Field Survey-2015

4.18 Willingness to pay for Conservation

60% eager to pay Rs.100-500, 20% eager to pay Rs. 100-500, 15% eager to pay below Rs.100, 5% eager to pay above Rs.1000 and 5% were not interested to pay for conserving the pangolins.

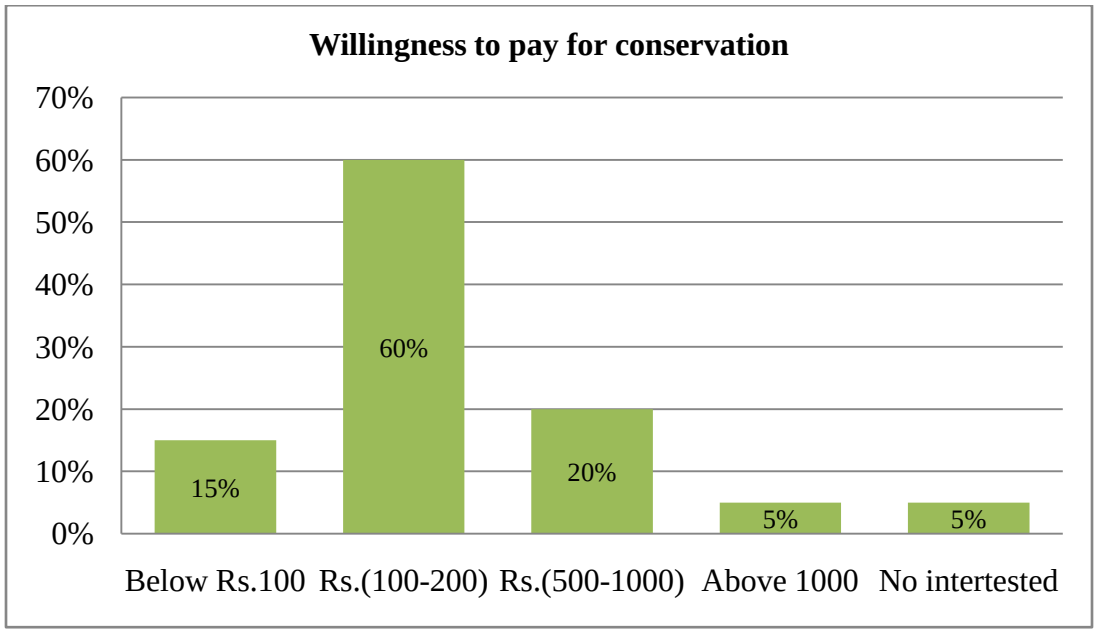


Figure 15: Willingness to pay for conservation Source: Field Survey-2015

4.9 Records of illegal trade from the DFO Office

Records from District Forest Office of Kavrepalanchowk

One case was recorded in District Forest office (DFO) of Kavrepalanchowk, where Mr Kamal Bahadur Parkhin (42yrs), Bishnu Bahadur Lama (35yrs) and Kanchaman Yonjan (38yrs) were arrested from Karunmai mandir Ugarchandi Nala VDC with 13Kg of Chinese pangolin scales in 9/19/2070. They were going to sell the scales at NRs. 25000 per Kg to a trader of Sindhupalanchowk district. They were freed by paying a fine of NRs. 100000.

Rescued Pangolin

One pangolin was rescued from Kushadevi VDC in 6/2/2072 and another on 27/2/2072 from Panchakhal-9.

Table 4: Records from District Forest Office of Kathmandu and Central Investigation Bureau Kathmandu

SN	Date	Part	Quantity	Arrested Person				Arrested From	Material Brought From	Material receiving Place
				Full Name	Address	sex	Age			
1	4/15/2069	Live Pangolin	1 pcs	Subash Kapali, Hirachan Gamal	Sindhupalchowk Makwanpur	m m	23 28	Kalimati, Kathmandu	Unknown	Unknown
2	5/17/2069	Scale	4.9 Kg	Jumik Bhote	Sankhuwasabha	m	35	Nagdhunga, Kathamdu	Unknown	Unknown
3	11/10/2069	Scale	1.8 Kg	Santi Lama Tamang	Makwanpur	m	53	Naikap, Kathmandu	Makwanpur	Kathamandu
4	11/11/2070	Scale with skin	1 Pcs	Dipendra Rana Magar Nirajan Rana	Kathmandu Kathmandu	m m	30 22	Bagbazar, Kathamdu	Shivapuri NP	Budhanilkantha
5	12/6/2070	Live Pangolin	1 pcs	Pramila Pandey Naran Prasad Paudel	Nuwakot Sindhupalchowk	f m	40 37	Bhatkekopul, Kathmandu	Nuwakot	Kathamandu
6	6/16/2070	Scale	13.8	Dhan Bahdur Ale	Makwanpur	m	25	Kalanki,	Unknown	Unknown

SN	Date	Part	Quantity	Arrested Person				Arrested From	Material Brought From	Material receiving Place
				Full Name	Address	sex	Age			
			Kg	Sukulal Ghalan	Makwanpur	m	40	Kathmandu		
				Padam Bahadur Lungwa	Makwanpur	m	30			
				Prem Bahadur Moktan	Makwanpur	m	34			
				Rajendra Ale	Kavrepalanchowk	m	28			
				Laxman Bahadur Thapa	Makwanpur	m				
7	3/22/2070	Scale	0.8 Kg	Durga Bahadur Thapa	Sindhuli	m	25	Kathmadnu-6	Sindhuli	Unknown
8	6/29/2071	Scale	1.9 Kg	Jaman sing Blone	Makwanpur	m	50	Podetole, Kathmandu	Hetauda	Kathamandu
9	4/27/2072	Scale	4.15 Kg	Bir Bahadur Tamang	Dolakha	m	30	Imadole Lalitpur	Unknown	Unknown
				Lal Kaji Tamang	Dolakha	m	52			
				Surya Shrestha	Ramechhap	m	21			
				Chandra Nepali	Ramechhap	m	31			
				Bimala Nepali	Ramechhap	m	21			
10	6/9/2072	Scale	4 Kg	Jayaman Loh	Sindhuli	m	56	Kotesohr, Kathmandu	Unknown	Unknown
				Hari Bahdur Rokaya	Jumla	m	42			
11	6/15/2072	scale	484 gm	Sita Shiwakoti	Dolakha	f	40	Guheshori	Unknown	Unknown

(Source: CBI-Environmental crime investigation pillar record list)

Chapter V: DISCUSSION

5.1 Habitat Preference

The total number of burrows found in the study area was 361.Among them 279 were old and 82 were new. The study conducted by Kaspal (2008) in community forests of SuryaBinayak Range post, Bhaktapur 51 pangolin burrows. Suwal (2011) conducted research on status, distribution, behavior and conservation of Pangolins in private and community forests of Balthali in Kavre. She found a total of 180 new burrows and 220 old burrows. Similarly Bhandari(2014) found 235 burrows in Nagarjun forest of Shivapuri Nagarjun National Park. Khatiwada(2014) found presence of indirect signs of Chinese pangolin such as 16 new and 195 old burrows, scats, footprints and traces of trails in Nangkholyang VDC of Tapeljung district.

The highest numbers of new burrows of the species were located in the scrubland, this kind of habitat supported high burrow density. The forest habitats supported minimum burrow density of species 0.14/Km², whereas cropland habitat harbored moderate burrow density of the species.

The fresh burrow density of cropland, scrubland and forest were found to be 1.14/Km², 3.27/Km and 0.14/km² respectively. The total burrow density recorded by Kaspal (2008) was 10.2/km² and burrow density recorded by Suwal (2011) was 8 burrows per hectare. Less burrow density found in this study as compared to those two researches; the reason is the use of only fresh burrows in calculating density in this study. In contrast to this, Kaspal (2008) and Suwal (2011) had used total number of burrows in calculating the densities. Similarly Bhandari (2014) used similarly process fresh burrow density like this study, found 0.833 burrows per hectare.

Kaspal (2008) found that the burrows were mostly dug in such places where ant hills and termite mounds occurred. Being an inoffensive creature, pangolin digs its burrows in sloppy areas so as to defend itself from enemies this is also found in my study. Similar trend was observed by Gurung (1996) in Nagarjun forest. According to Shrestha (1997) Panauti- Beber area is one of major habitat of pangolin. Kushadevi and Rayale VDC are parts of Panauti-Beber area which are one of the prime habitats of Chinese pangolin.

Burrows were mostly distributed at the range of 1750-1850 m and above 2000 m no any burrows were recorded, South facing slope, in the habitats are dominant with Uttis(*Alnus nepalensis*), Hatti paila(*Eulphobia dabia*), Chilaune (*Schima wallichii*), Dhale katus (*Castonopsis indica*) and Painyu (*Prunus cerasoides*) in the canopy cover between 25-50 % in brown soil. Burrows were distributed in the vegetation of herbs and shrubs species as well: Dryopteris sp., Siru ghans (*Imperata cylindrica*), Paniamla (*Nephrolepis auriculata*), Bamboo (*Bambus vulgare*),Narkat(*Phragmites karka*), aainselu (*Rubus ellipticus*), Banmar*(Peracarpa carnosa),*Amriso(*Thysanolaena maxima*). Heath (1992) and Wu et al. (2003) indicated the animal preference up to 1550 m while Chao (2001) and Chakraborty et al. (2002) recorded up to 2000 m. Gurung (1996) and Acharya (2001) stated the pangolins' preference to south facing

slopes and in red (laterite soil) in Nagarjun which is similar to findings of this study. The reason might be presence of termite mounds and anthills in the scrubland.

Heath (1992) reported burrows distribution in northern parts of Fujian and Jiangxi provinces with the acidic or yellowish red soil .Acharya (2001) mentioned that pangolin prefers to south facing slopes with red soil same preference also found in this study. This may be due to area's direct and longest exposure to the sun. Suwal (2011) recorded more burrows in east facing slopes with brown soil whereas Bhandari (2014) mentioned more number of burrows were in northwest and Khatiwda (2014) more burrows in southwest. Preference to the certain aspect in different areas might be influenced by the climatic condition, availabilities of food and degree of human interference.

Akpona (2008) mentioned that pangolin preferred closed forest habitat which is not found in this study. Haltenorth and Diller (1980), Ansell (1982), Sodeinde and Adedipe (1994) and Kingdon (1997) mentioned that they pangolins also survive in cultivated areas and forest which similar to finding of this study.

Shrestha (1997) mentioned that pangolin wriggling out at the dead night for stalking termites and ants. It remained active until the dawn. In present study 65% of the respondent opined that they usually seen at early evening, 25% respondents said at early morning, 7% at night and 3% at day.

5.2 Trade Flow

Pangolins are protected in Nepal (Baral and Shah, 2008; Jnawali et al., 2011). Inspite of this fact, its hunting is increasing. Poachers were inducing local youth of villages for trapping pangolins. Most of the people in the villages knew about the pangolins trade, but do not express their views nor report to the police about the poaching. From 2069-4-15 to 2072-6-15, 11 cases were recorded from DFO and CIB of Kathmandu.24 Smugglers were arrested among them 2 were women. 8 were inhabitant of Makwanpur district. Most of them were from ethnic group.2 live pangolins were rescued. 31.834 kg scales of pangolin were seized. Only few records were obtained from the DFO and police station of Kavrepalanchowk about pangolin trade. However, based on discussion with different conservation persons, security offices, and with the people, the extent of illegal trade was very high.

Chinese pangolin population has been dramatically reduced due to poaching (Jiang et al. 1988) Most of the respondents believed that the population of pangolin was decreasing rapidly in their areas. Illegal activities of human were major cause for its decline. Akpona(2008) mentioned majority of pangolin hunter are farmers who hunted both for subsistence, medicinal and commercial purposes. The major reasons behind the poaching of the animal in the study area for meat, medicine and scales for ornaments.

5.3 Ethno biology of pangolin

Most of the respondents are not actually aware about the importance of pangolin products in their livelihood. People think that meat is used for curing different types of chronic diseases. Cardiac, gastro-intestinal and bone problem patients eat its meat. The scales were rubbed in skin diseases and even the back pain problem. Scales were used in preparing the different types of ornaments. People even make the ring and garland of scale and wear them. CITIES (2000) and Duckworth et al., (2008) reported that scales were mostly used in preparing the Chinese medicine The scales of pangolins has even cultural significance in Africa, where it is used in ethno medical purposes (Challender et al., 2012) and has a aphrodisiac properties (Molur, 2008).

5.4 Conservation threats

At present habitat loss and poaching are the main threats to most of the animal in Nepal (Jnawali , 2011). According to Khatiwada (2014) hunting for illegal trade was found to be main threats for pangolin. Similarly Katuwal (2013) illegal trade, habitat destruction and lack of awareness were speculated to be the major threats. The problem is found to be worst in low educated and weak economic condition villagers. Almost all the respondents agreed that human were the prime cause to decline in the population of pangolins. The increasing settlements were destroying the habitat of pangolins. People were unknown about the importance of pangolins in their field, People caught during the trade were not punished hardly which is boosting up the traders. CITES (2000), Duckworth (2008) and Suwal (2011) discussed that poaching and habitat destruction as important factor for the decline of pangolin population.

CHAPTER V: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Kushadevi and Rayale VDCs seem one of the prime habitats for Pangolins. Therefore area should be provided special attention for conservation and research activities. The distribution of the species seems highly influenced by altitude, aspect, soil and vegetation as well as availability of food and human interferences. Scrubland is more preferred habitat by pangolin than forest and cropland. More pangolin burrows were found in red soil.

Kathmandu district is the more vulnerable district for the illegal trade of pangolins than Kavrepalanchowk district. Though people know the current status of pangolins, its trade is increasing. Based on the respondents views Pangolins are exported to China.

Most of the people do not know about the medicinal value of pangolin however they think it is used for gastro intestinal problem, pain killer during pregnancy, cardiac problem, back pain relief, bone problem etc. Illegal trade and hunting for food and medicinal value found to be major threats for the survival of the pangolins.

5.2 Recommendations

Chinese Pangolin is listed in DNPWC Act 2029, CITES Appendix I and IUCN Red Data Book as Lower Risk/Near Threatened. Therefore to conserve the species in the study area following recommendations are suggested.

- Stop local people from destroying burrows of Pangolin.
- Discourage local people eating the meat of Pangolin.
- Stop illegal hunting and trade of the species.
- Awareness campaigns should be launched to protect the Pangolin
- Strengthen enforcement of law to control pangolin's trade.

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PHOTOGRAPHS

Photo 1: Pangolin's new burrow in scrubland. Note: Pangolin's dropping also visible

Photo 2: Hunting tunnel dug by poacher in the cropland

Photo 3: Pangolin in its habitat

Photo 4: Old burrows of Pangolin

Photo 5: Anthill near a pangolin burrow

Photo 6: Local lady showing pangolin's burrow

Photo 7: Scats of Pangolin

Photo 8: Rescued Pangolin

Photo 9: Rescued Pangolin

Photo 10: Questionnaire survey in Kushadevi VDC

Photo 11: Questionnaire survey in Rayale VDC

Photo 12: Focal group discussion in Rayale VDC

Photo 13: Rescued Pangolin by DFO Kavrepalanchowk

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८० किलो सालकको खवटा बरामद

सय केजी सुनाबरी पनि फेला

अमेरिकी डलर, यूआन

सालको खपडासहित ५

Photo 14: Articles about Pangolin smuggling on national newspaper

Photo 15: Articles about Pangolin smuggling on national newspaper

ANNEXES

Annex-1

Questionnaire Survey

Date: ……

Name of Respondent: …… Sex: ……..

Address: …… Ward No: ……VDC: ……

Occupation: …….. Age: …….

1. Have you seen any pangolins in the area? If yes how many times? Yes……..… No…… Number…….

2. Are there any burrows in the area? Yes…… No……..

3. Are population decreasing or increasing during last five years? Increasing…….. stable……. Not known……

4. Have you ever eaten Pangolins meat? Yes…….. No……..Frequently……..

5. For what purposes, do you eat Pangolins meat? Medicinal…… For taste…….

6. Do you know the traditional medicinal value? Which part is used? ……

7. How many times have you used the Pangolins meat for medicine? If yes, for which diseases? Sometimes…….. Frequently…… Never……. Diseases…..……..

8. Do you know Pangolins are protected in Nepal? Hunting is illegal? Yes…….. No……

9. Have you ever seen somebody selling Pangolins product in the market? Sometimes…… Never…….....

10. What are reasons for illegal hunting?

i. Meat ii. Trade iii. Traditional medicine

11. What are the methods used to catch pangolin?

i. Putting water ii. Using dog iii. Smoking iv. Tracking burrows

12. What are the causes of habitat degradation?

i. Forest fire ii. Deforestation iii. Road construction iv. Fodder or grass collection

v. Grazing

13. Do you have idea, how much a Pangolin scale cost? Yes……. No…….

14. Where Pangolin's scales are sold, any idea? India…….. China……..Other

15. What are threats of pangolin?

i. Habitat degradation ii. Hunting by human iii. Use of pesticides

16. How much you able to willingness to pay for conservation?

i. Not interested ii. Below NRs.100 iii. NRs.100-500 iv. NRs.500-1000 v. Above NRs.1000

Annex-2

Location of Burrow

SN	x	y	Altitude	Area
1	644562	3052860	1704	Forest
2	644322	3052838	1701	Forest
3	644628	3052543	1880	Forest
4	644428	3052381	1944	Forest
5	644461	3052409	1894	Forest
6	644595	3052532	1879	Forest
7	644617	3052571	1846	Forest
8	644506	3052420	1916	Forest
9	644511	3052877	1685	Forest
10	644228	3052520	1814	Forest
11	644250	3052532	1808	Forest
12	643721	3052025	1949	Forest
13	643688	3052014	1947	Forest
14	643782	3052025	1976	Forest
15	643721	3051992	1977	Forest
16	643298	3052353	1921	Forest
17	643321	3052765	1937	Forest
18	643248	3052771	1933	Forest
19	643287	3052737	1958	Forest
20	643243	3052843	1881	Forest
21	642297	3052231	1923	Forest
22	642263	3052253	1912	Forest
23	642291	3052292	1905	Forest
24	642235	3052309	1927	Forest
25	642180	3052381	1940	Forest
26	642035	3052520	1959	Forest
27	642002	3052548	1957	Forest
28	642035	3052470	1944	Forest
29	643568	3052607	1857	Forest
30	643547	3052621	1873	Forest
31	643397	3052483	1902	Forest
32	643547	3052450	1837	Forest
33	642213	3052732	1914	Forest
34	642263	3052743	1886	Forest
35	642324	3052765	1852	Forest
36	642180	3052826	1947	Forest

SN	x	y	Altitude	Area
37	642464	3053071	1918	Forest
38	642770	3053383	1802	Forest
39	642814	3053405	1763	Forest
40	642892	3053439	1765	Forest
41	641572	3052825	1865	Forest
42	641721	3052921	1919	Forest
43	641313	3052580	1957	Forest
44	641268	3052513	1963	Forest
45	641038	3052468	1954	Forest
46	640808	3052483	1802	Forest
47	640712	3052476	1795	Forest
48	640762	3052966	1942	Forest
49	640861	3052976	1941	Forest
50	640703	3052916	1946	Forest
51	640594	3052817	1947	Forest
52	641277	3053787	1873	Forest
53	641109	3053787	1886	Forest
54	641029	3053787	1900	Forest
55	641138	3054390	1811	Forest
56	641059	3054420	1809	Forest
57	640970	3054430	1833	Forest
58	640357	3054390	1901	Forest
59	640268	3054410	1891	Forest
60	639911	3054746	1900	Forest
61	639813	3054746	1905	Forest
62	644635	3052347	1976	Cropland
63	644648	3052372	1978	Cropland
64	644676	3052372	1966	Cropland
65	644826	3052400	1922	Cropland
66	644848	3052403	1928	Cropland
67	644854	3052879	1720	Cropland
68	644845	3052922	1704	Cropland
69	644311	3053049	1939	Cropland
70	644400	3053088	1717	Cropland
71	644945	3053144	1617	Cropland
72	644918	3053188	1618	Cropland

SN	x	y	Altitude	Area
73	643270	3052960	1822	Cropland
74	643176	3053021	1818	Cropland
75	643265	3053027	1787	Cropland
76	642405	3053896	1654	Cropland
77	642355	3053925	1655	Cropland
78	641821	3054301	1682	Cropland
79	641910	3054291	1666	Cropland
80	641445	3054351	1725	Cropland
81	641534	3054370	1706	Cropland
82	641256	3054843	1778	Cropland
83	641379	3054861	1784	Cropland
84	640676	3055037	1718	Cropland
85	640219	3055230	1777	Cropland
86	639849	3055406	1880	Cropland
87	639516	3054934	1938	Cropland
88	639892	3055201	1882	Cropland
89	645867	3053846	1618	Cropland
90	645768	3054123	1638	Cropland
91	644965	3055050	1678	Cropland
92	645044	3055063	1705	Cropland
93	644213	3055617	1843	Cropland
94	641984	3056187	1892	Cropland
95	641799	3056253	1926	Cropland
96	641628	3056477	1872	Cropland
97	641364	3055620	1774	Cropland
98	641285	3055659	1819	Cropland
99	643567	3053404	1689	Cropland
100	643672	3053351	1688	Cropland
101	643738	3053179	1744	Cropland
102	643356	3054274	1684	Cropland
103	643290	3054301	1717	Cropland
104	642459	3054775	1802	Cropland
105	642406	3054789	1786	Cropland
106	642063	3055395	1724	Cropland
107	642050	3055475	1740	Cropland
108	641879	3055580	1763	Cropland
109	641720	3055765	1762	Cropland
110	643949	3051372	1894	Cropland
111	643949	3051478	1935	Cropland
112	643277	3051227	1985	Cropland
113	643343	3051042	1982	Cropland
114	643066	3051161	1966	Cropland
115	644424	3051253	1846	Cropland
116	644912	3051715	1883	Cropland
117	644688	3051979	1921	Cropland
118	644675	3052124	1954	Cropland
119	644543	3052203	1983	Cropland
120	645150	3052599	1822	Cropland
121	644820	3052757	1737	Cropland
122	645110	3053113	1618	Cropland
123	644622	3053219	1637	Cropland
124	644372	3053549	1602	Cropland
125	643857	3053615	1680	Cropland
126	643738	3053878	1648	Cropland
127	643976	3053958	1598	Cropland
128	643699	3054881	1720	Cropland
129	643712	3055066	1768	Cropland
130	640467	3055092	1769	Cropland
131	640388	3055079	1760	Cropland
132	639412	3054578	1972	Cropland
133	639451	3054578	1981	Cropland
134	639333	3054472	1987	Cropland
135	639333	3054538	1989	Cropland
136	642696	3053008	1780	Cropland
137	642630	3053140	1872	Cropland
138	642736	3053100	1802	Cropland
139	642868	3053061	1731	Cropland
140	643963	3052850	1739	Cropland
141	644002	3052889	1728	Cropland
142	644042	3052981	1771	Cropland
143	643778	3053034	1792	Cropland
144	643818	3053074	1778	Cropland
145	644712	3052717	1769	Cropland
146	644659	3052777	1750	Cropland
147	644652	3052761	1747	Cropland
148	645203	3052742	1763	Cropland
149	645205	3052765	1751	Cropland
150	645248	3051960	1893	Cropland
151	645263	3052055	1896	Cropland
152	645307	3052107	1865	Cropland

SN	x	y	Altitude	Area
153	645681	3052004	1772	Cropland
154	645696	3052070	1787	Cropland
155	645784	3052158	1779	Cropland
156	645534	3052195	1738	Cropland
157	645703	3052709	1638	Cropland
158	642996	3053767	1598	Cropland
159	642917	3053767	1630	Cropland
160	642712	3053934	1635	Cropland
161	642447	3053395	1768	Cropland
162	642349	3053327	1829	Cropland
163	641467	3053366	1784	Cropland
164	641399	3053425	1732	Cropland
165	640811	3052719	1905	Cropland
166	640870	3052768	1870	Cropland
167	640301	3052788	1775	Cropland
168	640223	3052788	1776	Cropland
169	640135	3052778	1810	Cropland
170	640076	3053062	1829	Cropland
171	640076	3052974	1839	Cropland
172	639723	3052807	1942	Cropland
173	641085	3053611	1858	Cropland
174	641066	3053503	1898	Cropland
175	640674	3053905	1874	Cropland
176	640693	3053914	1875	Cropland
177	640595	3054375	1862	Cropland
178	640487	3054659	1896	Cropland
179	643819	3051318	1901	Cropland
180	642868	3050995	1813	Cropland
181	642976	3051005	1853	Cropland
182	644348	3052660	1757	Cropland
183	644220	3052670	1734	Cropland
184	644044	3052670	1739	Cropland
185	643926	3052592	1782	Cropland
186	642996	3053238	1731	Cropland
187	643094	3053278	1718	Cropland
188	642761	3053571	1687	Cropland
189	642663	3053571	1709	Cropland
190	642506	3053523	1786	Cropland
191	646395	3052935	1596	Cropland
192	642770	3054099	1692	Scrubland
193	642721	3054099	1698	Scrubland
194	642705	3054159	1732	Scrubland
195	642755	3054159	1738	Scrubland
196	642813	3054118	1708	Scrubland
197	642751	3054560	1761	Scrubland
198	642722	3054576	1742	Scrubland
199	642697	3054585	1733	Scrubland
200	642713	3054564	1740	Scrubland
201	645185	3054696	1721	Scrubland
202	645305	3054787	1753	Scrubland
203	642713	3054424	1738	Scrubland
204	642551	3054211	1692	Scrubland
205	641500	3055093	1778	Scrubland
206	641544	3055115	1788	Scrubland
207	641442	3055159	1817	Scrubland
208	640912	3055527	1895	Scrubland
209	640765	3055475	1820	Scrubland
210	640780	3055857	1918	Scrubland
211	640979	3055887	1863	Scrubland
212	640912	3055813	1869	Scrubland
213	640743	3053322	1800	Scrubland
214	646681	3052293	1773	Scrubland
215	646725	3052411	1622	Scrubland
216	643462	3051350	1886	Scrubland
217	643543	3051298	1894	Scrubland
218	643543	3051247	1854	Scrubland
219	643484	3051262	1863	Scrubland
220	643418	3051423	1936	Scrubland
221	643381	3051453	1941	Scrubland
222	643653	3050843	1761	Scrubland
223	643697	3050953	1763	Scrubland
224	643712	3051005	1802	Scrubland
225	643771	3050946	1769	Scrubland
226	643764	3051034	1841	Scrubland
227	643749	3050960	1794	Scrubland
228	644013	3050902	1818	Scrubland
229	644080	3050931	1824	Scrubland
230	644182	3050968	1791	Scrubland
231	644197	3050894	1718	Scrubland
232	644947	3050799	1772	Scrubland

SN	x	y	Altitude	Area
233	644976	3050821	1777	Scrubland
234	645086	3050821	1756	Scrubland
235	645072	3050733	1698	Scrubland
236	644939	3050659	1697	Scrubland
237	645556	3050909	1660	Scrubland
238	645630	3050843	1620	Scrubland
239	645740	3050894	1668	Scrubland
240	645814	3051027	1698	Scrubland
241	645725	3050960	1722	Scrubland
242	645608	3050916	1680	Scrubland
243	645887	3051100	1638	Scrubland
244	645880	3051196	1636	Scrubland
245	645836	3051137	1653	Scrubland
246	645968	3051129	1637	Scrubland
247	646005	3051085	1656	Scrubland
248	646137	3051144	1693	Scrubland
249	646019	3051196	1724	Scrubland
250	645931	3051365	1732	Scrubland
251	645476	3051431	1842	Scrubland
252	645277	3051497	1846	Scrubland
253	645410	3051585	1935	Scrubland
254	645703	3051681	1895	Scrubland
255	645645	3051504	1857	Scrubland
256	645902	3051791	1816	Scrubland
257	645380	3051460	1864	Scrubland
258	644616	3051666	1943	Scrubland
259	644741	3051703	1908	Scrubland
260	644609	3051556	1918	Scrubland
261	646762	3052261	1654	Scrubland
262	646548	3052224	1692	Scrubland
263	642573	3054157	1700	Scrubland
264	643371	3051508	1988	Scrubland
265	642704	3051254	1923	Scrubland
266	642682	3051343	1937	Scrubland
267	642671	3051287	1925	Scrubland
268	642738	3051282	1954	Scrubland
269	643674	3051343	1926	Scrubland
270	643658	3051403	1932	Scrubland
271	644711	3051651	1858	Scrubland
272	644716	3051739	1934	Scrubland

SN	x	y	Altitude	Area
273	640384	3055525	1918	Scrubland
274	640296	3055466	1887	Scrubland
275	640453	3055662	1940	Scrubland
276	640717	3055721	1905	Scrubland
277	640845	3055574	1867	Scrubland
278	640698	3053281	1905	Scrubland
279	640668	3053223	1868	Scrubland
280	644379	3055831	1793	Scrubland
281	644495	3055809	1784	Scrubland
282	644644	3055875	1744	Scrubland
283	644457	3055875	1737	Scrubland
284	644368	3055809	1810	Scrubland
285	644413	3055803	1795	Scrubland
286	642759	3054084	1693	Scrubland
287	642759	3054139	1732	Scrubland
288	644148	3055787	1822	Scrubland
289	644126	3055787	1830	Scrubland
290	644115	3055787	1829	Scrubland
291	640880	3055506	1882	Scrubland
292	640896	3055506	1828	Scrubland
293	644275	3056117	1705	Scrubland
294	644275	3056084	1718	Scrubland
295	644236	3056084	1735	Scrubland
296	640389	3056489	1954	Scrubland
297	640428	3056489	1954	Scrubland
298	640428	3056489	1952	Scrubland
299	640400	3056478	1943	Scrubland
300	640367	3056450	1939	Scrubland
301	640340	3056467	1956	Scrubland
302	640439	3056114	1813	Scrubland
303	640472	3056070	1814	Scrubland
304	640483	3056092	1880	Scrubland
305	640902	3056412	1902	Scrubland
306	640919	3056351	1913	Scrubland
307	640874	3056390	1921	Scrubland
308	640191	3056208	1906	Scrubland
309	640208	3056219	1898	Scrubland
310	641288	3056252	1816	Scrubland
311	641293	3056235	1814	Scrubland
312	641310	3056224	1810	Scrubland

SN	x	y	Altitude	Area
313	641310	3056213	1806	Scrubland
314	641321	3056197	1799	Scrubland
315	641222	3056544	1856	Scrubland
316	641271	3056533	1822	Scrubland
317	642693	3055348	1818	Scrubland
318	642643	3055364	1776	Scrubland
319	642638	3055381	1776	Scrubland
320	642732	3055348	1838	Scrubland
321	642688	3055331	1815	Scrubland
322	642952	3054615	1822	Scrubland
323	642974	3054631	1816	Scrubland
324	643013	3054631	1796	Scrubland
325	640742	3053285	1876	Scrubland
326	640704	3053268	1892	Scrubland
327	640693	3053251	1880	Scrubland
328	640687	3053218	1861	Scrubland
329	640659	3053180	1839	Scrubland
330	642627	3054076	1672	Scrubland
331	642677	3054054	1663	Scrubland
332	641464	3055051	1786	Scrubland
333	641464	3055112	1794	Scrubland
334	641701	3055101	1763	Scrubland
335	641707	3055057	1759	Scrubland
336	641685	3055090	1760	Scrubland
337	641657	3055200	1802	Scrubland

SN	x	y	Altitude	Area
338	641613	3055200	1803	Scrubland
339	640880	3055188	1811	Scrubland
340	640902	3055177	1820	Scrubland
341	640808	3055210	1779	Scrubland
342	641012	3055348	1868	Scrubland
343	640825	3055982	1842	Scrubland
344	640797	3055987	1841	Scrubland
345	640764	3056004	1860	Scrubland
346	642401	3055794	1858	Scrubland
347	642368	3055805	1820	Scrubland
348	642517	3055943	1937	Scrubland
349	644583	3056362	1680	Scrubland
350	644622	3056318	1674	Scrubland
351	644600	3056401	1676	Scrubland
352	644567	3056384	1774	Scrubland
353	644732	3056026	1653	Scrubland
354	644765	3055998	1660	Scrubland
355	644804	3055965	1672	Scrubland
356	644396	3056015	1746	Scrubland
357	644385	3056164	1740	Scrubland
358	644032	3056020	1782	Scrubland
359	642866	3055384	1807	Scrubland
360	642849	3055425	1828	Scrubland
361	642816	3055429	1842	Scrubland