Status and Distribution of *Cuon alphines* in Api Nampa Conservation Area, Darchula, Nepal

(A case study from Tinker of Byas V.D.C.)

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LETTER OF ACCEPTANCE

TRIBHUVAN UNIVERSITY
INSTITUTE OF FORESTRY
HETAUDA CAMPUS

Ref No.

Hetauda, Makwanpur
Nepal

9th April 2017

Institute of Forestry
Hetauda Campus

LETTER OF ACCEPTANCE

The Thesis attached hereby entitled "Status and Distribution of *Cuon alphines* in Api Nampa Conservation Area, Darchula, Nepal. *(A case study from Tinker of Byas V.D.C.)"* prepared and submitted by Ms. Babita Neupane in the partial fulfilment of the requirements for the Degree of Bachelor of Science in forestry under our supervision is hereby accepted.

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DECLARATION

I, Babita Neupane do hereby declare that this dissertation entitled "Status and distribution of *Cuon alphines* (Dhole) in Api Nampa Conservation Area, Darchula, Nepal. *(A case study from Tinker of Byas VDC)* is mine. Errors if any are the responsibility of my own.

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Date: April, 2017

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ABSTRACT

The Cuon alphines or Asiatic Wild Dog are one of the most amazing carnivores in the Asian forest. The Wild Dog is listed as an appendix II species by the (CITES, 2010) and endangered by IUCN Red List of Threatened Species (IUCN, 2010). Api Nampa Conservation Area is the youngest Conservation Area established at 2010 in Darchula, Nepal. The research entitled "Status and Distrubution of Cuon Alphines Api Nampa Conservation, Darchula, Nepal (A case study from Tinker of Byas VDC" was conducted in the Tinker of Byas Village Development Committee. This is the first study of Dhole (Cuon alpines) that was conducted in API Nampa Conservation Area in 2016. Three unindentified pictures of dholes caught on camera trap of snow leopard in 2015 (Safari,, 2015) suspected the presence of Dhole in Api Nampa Conservation Area which was the major reason for conducting this research in order to know about presence or absence of Wild dog in Api Nampa Conservation Area.

Seventeen cameras were used for camera trapping. Inventory, species identification, sign survey, key informant survey and questionnaire survey with local people were carried out to assess the status and distribution of Wild Dog in the area. Similarly, four scats and seven pug marks found during sign survey of Wild Dog was confirmed by local herders. The spatial distribution map of Dhole was prepared under Arc GIS 10.2.2 environment. Direct and indirect sighting records and camera trapping records were used for showing the distribution map. Peoples' perception regarding Wild dog threats was obtained by weighted mean on the Likert Scale to determine the seriousness of threats. Tools like Ms-excel 2013 was used by data analysis.

Habitat types and anthropogenic factors are the major factors affecting the Dholes distribution. Wild dogs are found more in the stream banks and pasture land as 37% and 30% of people have seen Wild Dogs in steam banks and pasture land respectively. Predators killing, disease and natural threats like landslide are found to be prevalent serious threats of Dhole. As 27% of the people said that conservation education is required while 23% of the people said habitat of the Dhole should be conserved for the conservation of Wild Dog. Therefore, reducing habitat destruction should be ensured to conserve Wild Dog. Likewise, anthropogenic activities like grazing, firewood collection and other activities inside the Conservation Area should be controlled strictly. Similarly, knowledge about the species is also lacking, therefore awareness programmes are essential to ensure species conservation.

Key words: Asiatic Wild Dog, Distribution, Habitat, Camera Trapping, Prey Species, Conflict

ABBREVIATIONS

ANCA:	Api Nampa Conservation Area
CBO:	Community Based Organisation
CITES:	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DDC:	District Development Committee
DNPWC:	Department of National Park and Wildlife Conservation
GPS:	Global Positioning System
GIS:	Global Information System
NGO:	Non-Governmental Organisation
IUCN:	International Union for Conservation of Nature and Natural Resources
KIS:	Key Informant Survey
KCA:	Kangchenjunga Conservation Area
KCAP:	Kangchenjunga Conservation Area Project
SLCC:	Snow Leopard Conservation Committee
SPSS:	Spatial Package for Social Science
Sq-KM:	Square Kilometre
N-E:	North East
VDC:	Village Development Committee

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CHAPTER ONE
INTRODUCTION

1.1 Background

The Asiatic wild dog or Dhole (*Cuon alpinus*) is an endangered and little-studied, species with an estimated population of 2,500 individuals in the wild (Durbin *et al.* 2008; IUCN 2012). Dhole are native to, and distributed throughout, the south Asia region including countries such as Nepal, with unconfirmed reports from central and eastern Asia (Johnsingh 1985; Duckworth *et al.* 1999; Durbin *et al.* ,2008; IUCN 2012). The dhole is listed as an appendix II species by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 2010) and endangered by the IUCN Red List of Threatened Species with the decreasing population trend (IUCN 2010). These dogs are distributed from tropical forests to the high mountains of Nepal's protected areas. These dogs received little conservation efforts due to lower charisma factor than other large carnivores of the same area (eg. Tiger, Snow Leopard). Inhabiting a wide range of climates, from cold mountains to tropical valleys, dholes are grouped with wolves, coyotes, and foxes in the taxonomic classification of *canidea*. The term 'dhole' is reported to have an ancient Asiatic origin signifying "recklessness and daring" (Wikipedia 2016). Dholes are of reddish color with beautiful plume like black tail. The prime factors that determine Dhole habitats are prey abundance, water availability, interspersion of forests with grassy openings, minimum human disturbance, and potential den sites (Johnsingh 1985). Dholes are highly social animals with a rigid structure of fixed dominance hierarchies (Iyengar *et al.*, 2005). The spatial distribution of a species is generally determined by availability of key resources such as food, water, and cover. Anthropogenic pressure and other environmental changes can have a negative impact on a species' distribution due to modification and loss of suitable habitats (Mac Nally and Brown 2001; Stuart *et al.*, 2004; Lee *et al.*, 2012). Within this changing landscape, it is hard to manage any species without information on its distribution and ecology. Such information is a prerequisite for planning and developing species conservation strategies (Guisan and Zimmermann 2000; Halstead *et al.*, 2010; Aryal *et al.*, 2012a, 2012b, 2014; Lee *et al.*, 2012). Very little systematic research has been conducted on the distribution and ecology of the dholes in Nepal (Thapa *et al.*, 2013). The existing population has been declining due to habitat destruction, decline of prey populations, and disease transmission from domestic dogs (Durbin *et al.*, 2008; IUCN 2012). Therefore, the dholes are recognized as a priority for

conservation within many of the countries throughout their range (Venkataraman *et al.*, 1995; Kharel 1997; Durbin *et al.,* 2008). Despite their endangered status, there have been relatively few studies of their ecology and distribution (Johnsingh 1985; Venkataraman *et al.,* 1995; Duckworth *et al.,* 1999; Durbin *et al.,* 2008; Khatiwada *et al.,* 2011). Recent efforts to address gaps in our knowledge include exploration of the dhole's diet and landuse requirements within northern Laos (Kamler *et al.,* 2012) and its distribution in Thailand (Jenks *et al.,* 2012). Information on dholes is also emerging from work on the status, habitat, and spatial distribution of large carnivores in India and Cambodia (Gray and Phan 2011; Gray 2012; Ramesh *et al.,* 2012a, 2012b). Within Nepal, the dhole's existence has been confirmed in the Chitwan National Park and Kangchenjunga Conservation Area (Durbin *et al.,* 2008; Khatiwada *et al.,* 2011). In Nepal, dholes are known to inhabit Chitwan National Park and Kangchenjunga Conservation Area, but their presence in the rest of the country has been unknown, or at least unrecorded. But in the 1990s, there were reports that the dogs lived in the Dhorpatan Hunting Reserve, a protected area in the western part of Nepal that the government set aside for hunting. Now a team of researchers has confirmed the presence of dholes in the reserve and found plenty of opportunity for conflict with locals and other wildlife. Despite the species' conservation status, we don't know a whole lot about the dogs' habitats and ecology in many parts of their range. And that hampers any efforts to increase their numbers or stem the decline**.** In our study, we provide information on habitat selection and prey species of dholes in an effort to inform the management about this population, as an understanding of habitat requirements and feeding ecology is a prerequisite factor for creating effective management policies (Kharel 1997; Aryal *et al.*, 2014).

Therefore, our objectives were to determine the current status and distribution of the Dholes in the Api Nampa Conservation Area of Nepal so that conservation efforts can be focused in those locations.

1.2 Statement of problem

Api Nampa Conservation Area (ANCA) is newly established conservations area of Nepal. It is the youngest CA of Nepal established at 2010, therefore facts and information regarding the CA and Dholes are lacking.

Dholes randomly use pasture land, which increases encounter rates between livestock and dholes, thus resulting in human–dhole conflicts (Thinley *et al.* 2011). Similar human–dhole conflict problems are known from other countries within the range of dholes' distribution

(Johnsingh 1985; Duckworth et al. 1999; Wang and McDonald 2009; IUCN 2012). Such conflicts present a major challenge for conserving dhole populations (Thinley *et al.* 2011) found that consumption of livestock by dholes in the Himalayan Mountains is seasonal, based on the seasonal movement of livestock by the heders area where livestock were moved seasonally and based at lower elevations during winter seasons and higher elevations during summer seasons.

Local herders used poison to kill predators such as dholes to combat livestock depredation. However, this anti predator action is not only targeting dholes, as dholes are known to spatially overlap with other large carnivores such as the leopard (Jenks *et al.* 2012; Ramesh et al. 2012b). For instance, Wang and Macdonald (2009) recently reported the killing of dholes by poisoning in Bhutan and also recorded negative public perceptions toward this species.

Other predators also contribute to livestock depredation in the region (Aryal and Kreigenhofer 2009; Aryal *et al.* 2010b). The killing of predators through poisoning has important ecological consequences. For instance, it has previously been found to result in an increased abundance of wild boars in other regions of Nepal (Aryal and Kreigenhofer 2009), and we expect that this also likely occurs within the DHR. Similarly, Harris (2006) recorded that dholes killed blue sheep in China. Although dholes did not favor a single prey species, according to Kamler *et al.* (2012), ungulates comprised the majority of prey biomass. The success of the pack hunting strategy used by wild canids, such as African wild dogs, does not depend on the availability of cover or on the size of the prey group, but on the age of the prey and the size of the hunting pack, with single dogs killing immature and old or sick animals, and larger packs subduing larger prey (Fanshawe and Fitzgibbon 1993). Lack of awareness and knowledge on the issues of knowledge about legal provisions in the NPWCA 1973 regarding fines, imprisonment and punishment for hunting, disturbing or poaching of an endangered animal like Dhole, people living near this CA are harming the habitat of Dhole, unknowing.

Following are the threats and issues seen in dhole conservation;

- Prey depletion
- Occasional forest fire,
- Human persecutions,
- Poisoning
- Habitat fragmentation due to livestock grazing

- Forest product collection
- Disease transmission from domestic dogs,
- Interspecific competition.

1.3 Rationale of the study:

In Nepal, dholes are known to inhabit Chitwan National Park and Kangchenjunga Conservation Area, but their presence in the rest of the country has been unknown, or at least unrecorded. (Thapa *et al.,* 2013) But in the 1990s, there were reports that the dogs lived in the Dhorpatan Hunting Reserve, a protected area in the western part of Nepal that the government set aside for hunting. Now a team of researchers has confirmed the presence of dholes in the reserve and found plenty of opportunity for conflict with locals and other wildlife. Despite the species' conservation status, we don't know a whole lot about the dogs' habitats and ecology in many parts of their range. And that hampers any efforts to increase their numbers or stem the decline.

In our study, we provide information on habitat selection and prey species of dholes in an effort to inform the management about this population, as an understanding of habitat requirements and feeding ecology is a prerequisite factor for creating effective management policies (Kharel 1997; Aryal *et al.* 2014). Therefore, it is important to determine which habitats are preferentially used, so that conservation efforts can be focused in those locations.

1.4 Objectives

- The general objective of the study was:

i) To assess the presence/ absence of *Cuon alphines* (Dhole) in Api Nampa Conservation.

- **The specific objectives of the study were:**

ii) To identify the potential *Cuon alphines* (Dhole) distribution site in the Conservation Area.

iii) To explore the conservation threats of *Cuon alphines (*Dhole) in the Conservation Area.

iv) To determine appropriate Conservation measures for the target species.

v) To determine the prey species of Dhole.

1.5 Limitations of study

a) This study doesn't estimate the population size of the Dholes.
b) During KIS it was difficult to find the people of all age class, and different level of literacy as young and literate people live in the town and cites for study and employment. So only old aged people, female and small children studying in primary level were found.
c) Timing of the Research.
d) Budget and Manpower arrangement.

CHAPTER TWO
REVIEW OF THE LITERATURE

2.1 Origin and scientific classification

According to Thenius 1954; Dundas 1999; and lyengar *et al.* 2005, the Cuon alphines originated from South Asia after the late Pleistocene mass extinction c. 12,000- 18,000 bp, when it became extinct across North America and Europe, along with several other large species such as mammonths and dire wolves. Simpson (1945) placed the Dhole in the subfamily Simocyoninae of the family Canidae, together with the African wild dog (Lycaon pictus) and the bush dog (Speothos venaticus) of South America on the basis of shared anatomical features, most notably the reduction of the reduction of the role of the crushing post-carnassial molars, although the validity of this association has often been questioned (Kleiman 1967; Fox 1971; Clutton *et al.* 1978). It is scientifically classified as:

Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Carnivora
Family: Canidae
Subfamily: Caninae
Genus: Cuon (Hodgson, 1838)
Species: C. alpinus
Binomial name: *Cuon alpinus* (Pallas, 1811)

2.2 Subspecies

There are eleven sub species of Dholes alltogether, of which two sub species are classified as endangered by World Conservation Union and the two other are on the verge of extinction (Durbin *et al.* 2004). The eleven sub species are as follows:

Table 1: Sub species of Asiaitic Wild Dog found, their general characters and distribution in each country

S.N	Sub-species	General characters	Distribution
1.	*Cuon alpinus javanicus*	It has a short and bright red coat. However, may be regional variations.	Java
2.	*Cuon alpines sumatrensis*	It has a short, bright, red coat and dark whiskers.	Sumatra

3.	*Cuon alpines infuscus*	It has a dark brown coat and distinctive cranial features.	Southern Myanmar, Malayasia, Thialand and Vietnam.
4.	*Cuon alpines adjustus*	It has a reddish brown coat.	Northen Myanmar and Indo-China
5.	*Cuon alpines dukhunensis*	It has a red coat, short hair on the paws and black whiskers.	Ganges in India
6.	*Cuon alpinus primaevus*	It has a longer, redder coat than dukhunensis and has long hair on the paws.	Himalayan region of Nepal, Sikkim and Butan
7.	*Cuon alpinus hesperius*	It has a long, bright yellow coat with a white underside and pale whiskers.	Eastern Turkestan, Southern Sibera and Western China (Altai and Tienshan)
8.	*Cuon alpinus laniger*	It has a full yellow- gray Coat.	Kashmir and Southern Tibet
9.	*Cuon alpines*	It has a luxuriant yellowish- red coat with a dark back and gray neck.	Western Szechuan, China and Mongolia
10.	*Cuon alpinus lapturus*	It has a uniform red coat with thick under- fur.	Yangze in China
11.	*Cuon alpinus alpines*	It has a thick tawny-red coat with a grayish neck and and an ochre muzzle.	Eastern Russia (east of eastern Sayans), including Amur

2.3 Description of the Dhole

Dholes also have dark, almost always black, bushy tails. The dhole is an average size canine with head/body length 90cm (35"), tail length 40-45cm (16"-18"), and shoulder height 50cm (20"). The adult dhole is characterized by a rusty red coat with a pale underside; depending on the region, pelage may vary from light brownish gray to a uniform red coat. A dhole is born with a sooty brown color, acquiring an adult color at three months of age. (Shendusou, 2011). It has a wide and massive skull with a well-developed sagittal crest, and its masseter muscles are highly developed compared to other canid species, giving the face an

almost hyena-like appearance. The Dhole is set apart from other canids in that it has an unusually thick muzzle and one less molar tooth on each side of its lower jaw. Other members of the family Canidae have a total of 42 teeth. (Burton 1940). The rostrum is shorter than that of domestic dogs and most other canids. The species has six rather than seven lower molars. The upper molars are weak, being one-third to one-half the size of those of wolves, and have only one cusp as opposed to 2–4, as is usual in canids, an adaptation thought to improve shearing ability, thus allowing it to compete more successfully with kleptoparasites. Adults may weigh over 18 kg, with females usually weighing 4.5 kg less than males. It stands 17–22 inches at the shoulder and measures three feet in body length. Like the African wild dog, its ears are rounded rather than pointed. It has 6–7 teats, sometimes eight.

The general tone of the fur is reddish, with the brightest hues occurring in winter. In the winter coat, the back is clothed in a saturated rusty-red to reddish color with brownish highlights along the top of the head, neck and shoulders. The throat, chest, flanks, belly and the upper parts of the limbs are less brightly color red, and are more yellowish in tone. The lower parts of the limbs are whitish, with dark brownish bands on the anterior sides of the forelimbs. The muzzle and forehead are greyish-reddish. The tail is very luxuriant and fluffy, and is mainly of a reddish-ocherous color, with a dark brown tip. The summer coat is shorter, coarser and darker. The dorsal and lateral guard hairs in adults measure 20–30 mm in length. Dholes in the Moscow Zoo moult once a year from March to May. (Durkworth *et al.,* 1998)

Dholes produce whistles resembling the calls of red foxes, sometimes rendered as coo-coo. How this sound is produced is unknown, though it is thought to help in coordinating the pack when travelling through thick brush. When attacking prey, they emit screaming KaKaKaKAA sounds. Other sounds include whines (food soliciting), growls (warning), screams, chatterings (both of which are alarm calls) and yapping cries. In contrast to wolves, dholes do not howl or bark. Dholes have a complex body language. Friendly or submissive greetings are accompanied by horizontal lip retraction and the lowering of the tail, as well as licking. Playful dholes will open their mouths with their lips retracted and their tails held in a vertical position whilst assuming a play bow. Aggressive or threatening dholes will pucker their lips forward in a snarl and raise the hairs on their backs, as well as keep their tails horizontal or vertical. When afraid, they pull their lips back horizontally with their tails tucked and their ears flat against the skull.

2.4 Other names of the Dhole

English: Asiatic wild dog, Indian wild dog, red dog

French: cien sauvage d'Asie, cuon d'Asie

German: der alpenwolf, rotwolf

Spanish: per salvaje Asiatico

Indigenous name: Assamese: kuang- kukur, rang kukur, Bahasa Indonesia: adjag or ajag, anjing hutan; Bahasa Malaysia: srigala, Bengali: ban kutta, ban kukur; Bhutanese: phara, phou; Burmese: tan-kwe; Buryat:zurbi; Chinese: tsai-lang; Gujarati: kutra; Gurkhali: ban-kukur; Hindi: adivi- kuta, son kuta, sona- kuta, rasa-kuta, jungle kuta, bhansa; Kazakh: chue; Kirigizian: chue, nyar; Kannada: kadu nai, korku, bun-seeta; Kashmiri: jungli-kuta, ram-hun, ban-kuta, bhansa; Kazakh: chue; Khmer: chkai prey; Kyrgyz: chue, nyar; Ladakh: farra, siddaki; Lao: ma nai; Lepcha: sa-tun; Malayalam/Tamil: chen nai; Marathi: kolsun; kolasna: kolasra; Mongolian: dshergul; Nepali: bwaso; Odia: balia kukura; Russian: krasnyi volk, dikaya sobaka, chikalka; Telugu: resu kukka, reza-kutta; Thai: maa nay; Tibetan: farra, hazi; Tungus: dzergil; Vietnamese: chó sói lửa. (Wikipedia, 2016)

2.5 Distribution and Habitat

2.5.1 Distribution

There are currently no confirmed recent reports of dhole being present in Russia, Mongolia, Kazakhstan, Kyrgyzstan or Tajikistan, though one specimen was caught in southern China's Jiangxi district. It is unknown if dholes continue to inhabit Tien Shan, though they possibly occur in small numbers in Gansu Province, with one pack being sighted in the Qilian Mountains within that province in 2006. Dholes still occur in Tibet, and may still inhabit North Korea. Although they have not been recorded in Pakistan, they once occurred in the alpine steppes extending into Kashmir. They occur in most of India south of the Ganges, particularly in the Central Indian Highlands and the Western and Eastern Ghats of the southern states. In north-east India, they inhabit Arunachal Pradesh, Assam, Meghalaya, and West Bengal. The situation of dholes in the Himalaya and north-west India is precarious, and populations fragmented. They may occur in Kashmir's Ladakh area.

Dholes once occurred in the Indo-Gangetic Plain's Terai region. In 2011, dhole packs were recorded by camera traps in the Chitwan National Park. Their presence was confirmed in the Kangchenjunga Conservation Area in 2011 by camera traps.

In Bhutan, dholes have recovered from a poisoning campaign during the 1970s, and became re-established in the 1990s. Today they occur in the Jigme Dorji National Park.

It is unknown whether the species still lives in Bangladesh, where it once inhabited the forested areas of the Chittagong and Sylhet District. The presence of dholes in Myanmar was confirmed by camera trapping in 11 areas and, alongside leopards, have apparently replaced tigers as the country's top predators.

Their range is highly fragmented in the Malaysian Peninsula, Sumatra, Java, Vietnam and Thailand. A camera trapping survey in the Khao Ang Rue Nai Wildlife Sanctuary during January 2008 to February 2010 revealed at least one healthy dhole pack.

In Central Asia, dholes primarily inhabit mountainous areas; in the western half of its range, they live mostly in alpine meadows and high-montane steppes high above sea level, while in the east, they mainly ranges in montane taigas, though may appear along coastlines. In India, Myanmar, Indochina, Indonesia and China, they prefer forested areas in alpine zones, and occasionally also in plains regions.

2.5.2 Habitat

The Dhole is found in wide variety of vegetation types, including: primary, secondary, and degraded forms of tropical dry and moist deciduous forest; evergreen and semi- evergreen forest; dry thron forest; grassland-scrub-forest mosaics; and alpine steppe (above 3,000m a.s.l.) they are not recorded from desert regions. In India, tropical dry and moist deciduous forest may represent optimal habitats, based on the regions thought to hold the largest Dhole populations. And in Nepal, they are found in Chitwan National Park in the Terai (Thapa *et al.,* 2013) and Kangchenjunga Conservation Area (Durbin *et al.,* 2008; Khatiwada *et al.,* 2011) in the high himalayas. Ungulate biomass, particularly that of cervid species, is highest in these vegetation types when compared to others in the same region (A. Venkataranman and V. Narendra Babu unpubl.). In India, tropical dry and moist deciduous forest is subjected to seasonal monsoon climates. Important factors that may influence the

habitat selection include availability of medium to large ungulate prey species, water, the presence of other large carnivorous species, human population level and suitability of breeding sites (proximity to water, presence of suitable boulder structures and sufficient prey). Dholes like open spaces and can often be found on jungle roads, river beds, jungle clearings, and paths, where they rest during the day. Their hunting range is about 40sq km (15sq mi). The dhole can also be found in dense forest steppes, and the thick jungles of the plains as well as the hills. They are never found in the open plains and deserts.

2.6 Denning

For many carnivorous mammals, dens are essential component of their life history and may act as a limiting factor that will affect their abundance and distribution. The access to a den is therefore essential for carnivores in terms of successful breeding and cub rearing. Site selection surrounding dens can therefore be said to influence den use, because it could affect safety from predators and access to food resources. Therefore, availability and use of denning sites are important aspects in the ecology of most candid's and indicative of breeding units within the habitat and consequently a valuable aspect to be considered in species management.

Dens range from earthen burrows to rocky caverns. Fox (1984) reported the denning ecology of Dholes in south-western India which emphasized the den structures. He described four different types of dens, namely:

1. A simple earth den with one entrance,
2. A complex cavernous earth den with more than one entrance,
3. A simple cavernous den excavated under or between rocks with one entrance, and
4. A complex cavernous denning area with several dens in the same vicinity, some of which may interconnect.

Dens are typically located under dense scrub or on the banks of dry rivers or creeks. The entrance to a Dhole den can be almost vertical, with a sharp turn three to four feet down. The tunnel opens into an antechamber, from which extends more than one passage. Some dens may have up to six entrances leading up to 100ft (30m) of interconnecting tunnels. These "cities" may be developed over many generation of Dholes, and are shared by clan females when raising young together. Like African wild dog and Dingoes, Dholes will avoid killing prey close to their dens.

2.7 Diet

Interestingly, only two studies have determined Dhole diet in moist, tropical, evergreen forests in Southeast Asia, and both found small ungulates species such as red muntjac (*Muntiacus muntjak* [20-28kg] –Grassman *et al.*, 2005) or mouse deer (Tragulus [2-5 kg]- Kawanishi and Sunquist 2008) to be the dominant prey item. Kawanishi and Sunquist (2008) concluded that Dholes may live in relatively small packs in the dense tropical forests of Malaysia, and therefore are able to prey primarily on small ungulates. However, ungulate densities were not determined by Grassman *et al.,* (2005) and Kawanishi and Sunquist (2008), therefore it was not known if Dholes preferred small ungulates or only consumed small species as alternative prey because numbers of larger ungulates were reduced due to poaching or other factors. Packs of dholes feast on mammals ranging from rodents to deer. Some of the dhole's favourites include wild pigs, hares, wild goats, sheep, and occasionally a monkey. Unlike many other "dogs," the dhole seldom kills by biting the throat. Larger mammals are attacked from the rear, while smaller ones are caught by any part of the bodies. The smaller mammals are killed by a swift blow to the head; the larger mammals are immediately disembowled. Dholes compete for the food, not by fighting, but by how fast they can eat. An adult dhole can eat up to 4kg (8.8lbs) of meat in one hour. Two to three dholes can kill a 50kg (110 lb) deer in less than two minutes, and they begin to feed on it before it is dead. The larger prey rarely die from the attack itself, but from blood loss and shock as their intestines, heart and liver.

2.8 Hunting Behaviour

Dholes are great communicators and use an eerie whistle to communicate with each other. They also use a variety of other noises, including clucks and high-pitched screams that are not found anywhere else in the candid families. One of the reasons dholes keep such a large home range is the need to find enough prey to eat. Dhole packs often hunt as a group, with one lead dog in charge (Iyengar *et al.,* 2005).

The dholes use these sounds when hunting together. Such communication helps them take down prey many times their own body weight. They then swallow the meat in large chunks and actually carry it back to pack members that way! Like other dogs, dholes use their keen sense of smell to track prey. They have even been seen chasing their prey into water to help slow it down.

Dholes prey on hoofed mammals—in India, they eat deer, wild pigs, buffalo, and wild goats. In Southeast Asia, dholes feed on deer, gaur, and banteng, and in Siberia, they eat deer, wild sheep, and reindeer. Dholes also eat berries, bugs, lizards, and rabbits and can hunt well on their own if needed (Vankataraman *et al.,* 1995; Durbin *et al.,* 2004)

2.9 Reproductive Behaviour

Each pack contains a dominant monogamous pair. Subordinate pack members help care for the young of the dominant pair. The dhole's gestation period is 60-62 days. The mother usually gives birth to eight pups at a time. The pups reach sexual maturity at about a year. Pups are born throughout the end of fall, winter, and the first spring months (November - March). Female dhole can have up to 16 mammae, suggesting their ability to take care of large litters. Dens are constructed near streambeds or among rocks. After a female dhole has given birth, a few other adults take part in feeding the mother as well as the pups. The pups, as early as the tender age of three weeks, and the mother are fed regurgitated meat. (Davir, E.R.C. 1975)

2.10 Protection Status of Dhole

- The Dhole is listed as an appendix II species by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 2010).
- It is categorized as endangered by the IUCN Red List of Threatened Species with the decreasing population trend (Füreder, L., *et al.,* 2010).
- In India, protected under Schedule II of the Wildlife Act, 1972.
- In the Russia Federation, Dholes received the status of the "protected animal" in 1974.
- In Vietnam, the Dhole is protected by Decree 18/HDBT (17/01/1992) and the amendment Decree 48/2002/ND-DP (22/04/2002) under category IIB, which limits extraction and utilization are not quantified and
- In Nepal- National Park and Wildlife Conservaion Act, 1973 put them under Schedule-I (Protected) species.

CHAPTER THREE
METHODOLOGY

Study area

Api Nampa Conservation Area (ANCA) is newly established conservations area of Nepal. It was established in 2010 and covers 1,903 km^2 (735 sq mi) encompassing 21 Village Development Committees in the Darchula District. It is established in 2010 and located between N29°30' to N30°15' and E80°22' to E81°09', in the Far-Western Development Region of Nepal. It occupies an area of 1903 km2 and encompasses the 21 Village. Village Development Committees.The western boundary is formed by the Mahakali River, and the northern by the international border with Tibet. Adjacent to the east are the Bajhang and Baitadi districts (DNPWC 2011). It ranges in elevation from 518 to 7,132 m (1,699 to 23,399 ft) at the Himalayan peak Api, and is within the circumscribed area of the *Kailash Sacred Landscape* (Zomer et.all 2011). Named after the two peaks Api and Nampa, it was established to conserve the unique biodiversity and cultural heritage of the area (DNPWC 2011). It is inhabited by 54,358 people living in 8966 households (DNPWC, 2012).

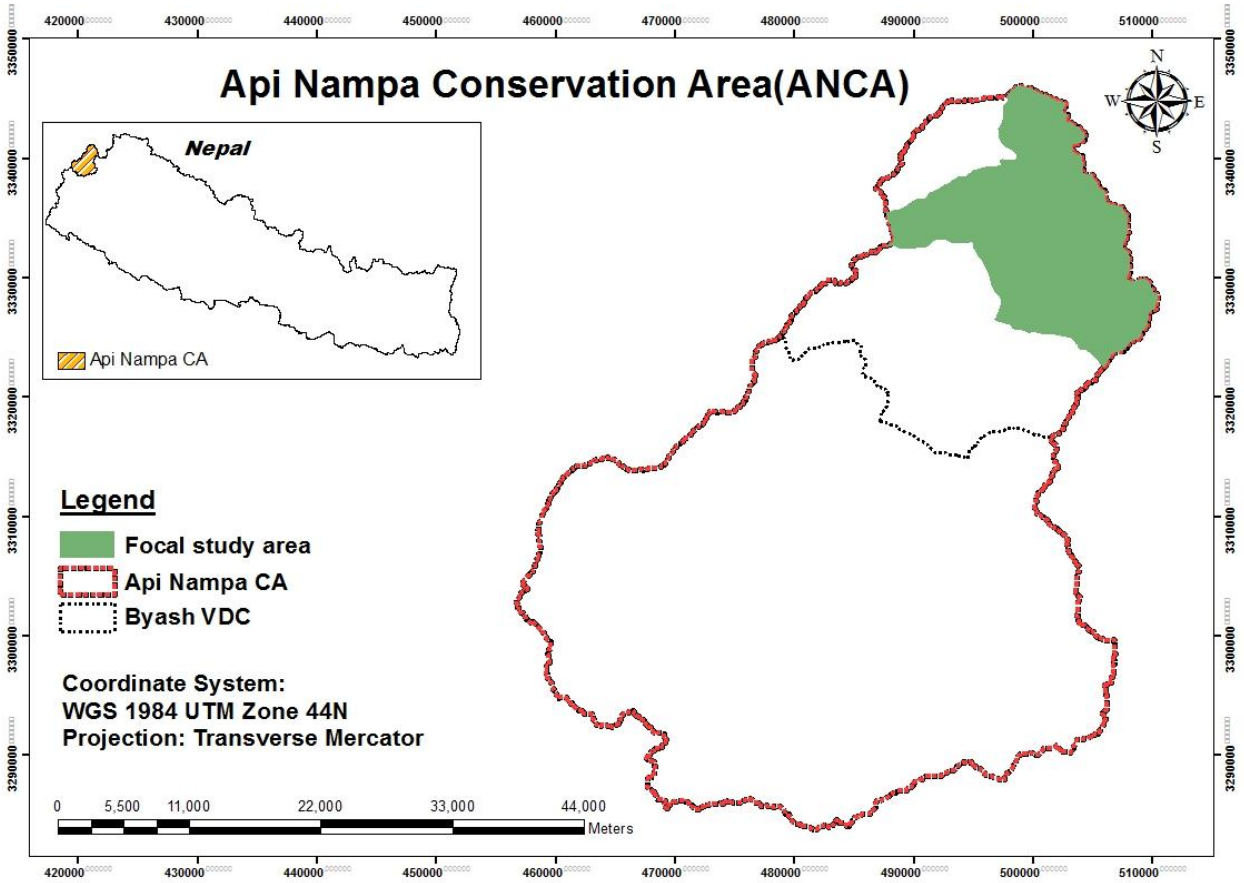


Figure 1: Map of study area

3.1 Floral Diversity

A grasslands plateau is at the center of the area. It is intermixed with various forest types. oak, coniferous forest, and temperate deciduous forest *(*Api Nampa Conservation Area, *2013).*

3.2 Faunal Diversity

Mammalian species include snow leopard, Himalayan black bear, red panda, common langur, Himalayan tahr, Himalayan musk deer, goral and serow. Birds include Himalayan monal, snowcock and blood pheasant (DNPWC 2011). The Api Nampa could potentially serve as a Trans-Himalayan habitat corridor for snow leopard populations in both India and Tibet, thus this could be crucially important for the species long-term survival in the wild.

3.3 Climatic condition

The local climate is generally characterized by high rainfall and humidity. However, the climatic conditions of ANCA vary widely with elevation from subtropical to alpine. Within the elevation range of 1800 to 6500 meters there are limited subtropical valleys in the

south, as most of the area is ecologically temperate or high-land. A cold, generally dry climate exists in the high alpine valleys just north of the southern arm of the Himalaya that cuts across southern Darchula.

In the north, most of the region remains under snow and has an alpine climate, whereas the mid-hills are of a temperate type. The average maximum temperature is 18.6°C and the minimum temperature is 7.7°C. Average rainfall is 2129 mm. All areas experience very high rainfall, with estimates of between 125-350 mm over a 24 hour period (ANCA, 2013).

3.2 Schematic flow of research work

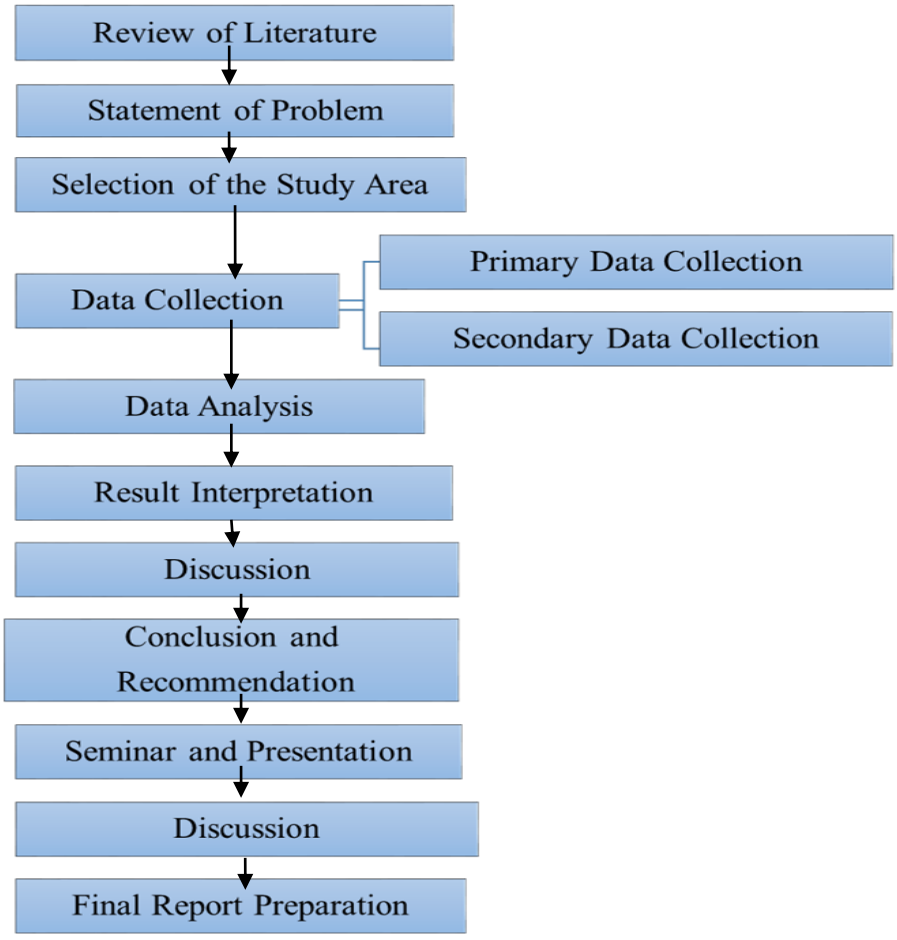


Figure 2: Schematic flow of research work

3.3 Data collection

This study was focus on status and habitat distribution of Dhole in the study area. The research work was carried out from mid-Sept. to mid- April. Surveys and interviews were carried out, to gather data on the status and distribution of the Dhole in the CA. The Seventeen cameras were placed in the strategic locations to identify the Dhole walking route.

The opportunistic locations were recognized by consulting the herders and based on camera trap result of 2015 (Safari, 2015), as three suspected but unidentified photographs of Dholes were captured during camera trap of Snow leopard. Cameras were placed with the support of trees, shrubs, wooden stick and stones along the side of human trails, livestock grazing route and near water resources. The height of the camera vary from 2 feet to 5 feet from ground level but the laser light of every camera was focused below the human knee and fix them with the help of rope to the tree, shrubs and wooden stake. The cameras were camoufl aged and no any bating technique was adopted.

Inventory was done to find was habitat distribution of Dhole. Strip cruising method was adopted to find out pug marks and scat along the study area.

Purposive Sampling for questionnaire survey was carried out to know about sighting reports, live-stock killed by Dholes, Dholes' history, and population trend, most probable pasture lands of Dhole habitat, incident of forest fire and perception of local people regarding Dhole was collected during these survey.

For the social information, interviews was conducted with local people, herders, and members of the CA management council were asked about their knowledge of Dhole distribution, instances of human-wild dog conflict, and the history of Dholes in the study area.

3.4 Vegetation identification

The vegetation data collected was used to know the species diversity and habitat preferences of Dholes. The trees and shrubs found in the study area were; *Juniperus* spp., *Betula* spp., *Quercus* spp., *Abies* spp., *Rhododendron* spp., *Rhododendron arboretum.*

3.5 Data analysis

For showing the distribution sites of Dholes, the GPS locations of the camera trap stations, and location of indirect signs like pug marks and scats were used. The spatial distribution map of Dholes within CA was prepared using Arc GIS 10.2.2 environment. Similarly, Google earth Pro (Version 7.0.3) was used for visual interpretation and cross checking of the map through overlaying. GPS utility 5.02 version was used for the conversion of coordinate system data format. Topological map of Darchula, ANCA, were also used as supplementary materials.

Key informants response, experience and perception towards Dhole real status, threats and conservation measures were analyzed using descriptive tool. Perception of respondents

regarding threats was measured in very high to low (five point scale) using Likert Scale was used to determine the seriousness of threats. The results thus obtained were presented in the form of tables, bar diagrams and pie chart using MS-Excel 2013 tools.

CHAPTER FOUR
RESULTS AND DISCUSSION

4.1 Result

The study found that there is presence of Dhole in Api Nampa Conservation Area. Although no Dholes could be captured in camera trap but scats and pugmarks found in the Conservation Area provide the strong evidence to say the presence of Dhole in CA. There were occasional attacks on livestock. The local population retaliated against dholes by poisoning or shooting them, which led to a dramatic decline in the species' numbers. However, there were no formal studies to confirm that dholes – and not other predators, such as snow leopards – were responsible for the kills. Data collected about sightings by local herders, along with reported killings of domesticated animals, indicated the presence of Dhole in ANCA. Additionally, pug marks and scat of Dholes were photographed on 22th September 2016 with a camera in Tinkar of Byas V.D.C.

Some information about Dhole distribution obtained were;

Aspect:	direction of slope to the north-east
Elevation of Dhole distribution:	3,190m to 4,582m
Cover type:	Grass, trees, shrub
Major flora:	*Juniperus* spp., *Betula* spp., *Quercus* spp., *Abies* spp., *Rhododendron* spp., *Rhododendron arboretum.*
Distance from village:	about 5 km
Distance from water:	near
Distance from livestock shelter:	about 5 km
Sign of anthropogenic influences:	presence of human disturbance, fire wood collection, forest fire
Types of livestock:	Sheep, horse, cattle, goat and buffalo
Illegal hunting:	yes
Presence of prey:	blue sheep, black bear, serow, jackal, musk deer, birds
Forest product collection:	yes

4.1.1 Distribution of Dholes in ANCA

From 17 cameras were used for camera trapping. The camera were placed the in strategic locations to identify the Dhole walking route. The opportunistic locations were recognized by consulting the herders and based on camera trap result of 2015, as three photographs of Dhole were captured during camera trap of Snow leopard in 2015 (ANCA, 2015). Pasture land and stream banks were selected for camera trapping. The indirect sign of Dhole i.e. pug marks and scat were found during indirect sign survey near village at road side stream banks. Although, they were distributed randomly throughout the CA. However, their presence were common in Tinker of Byas VDC.

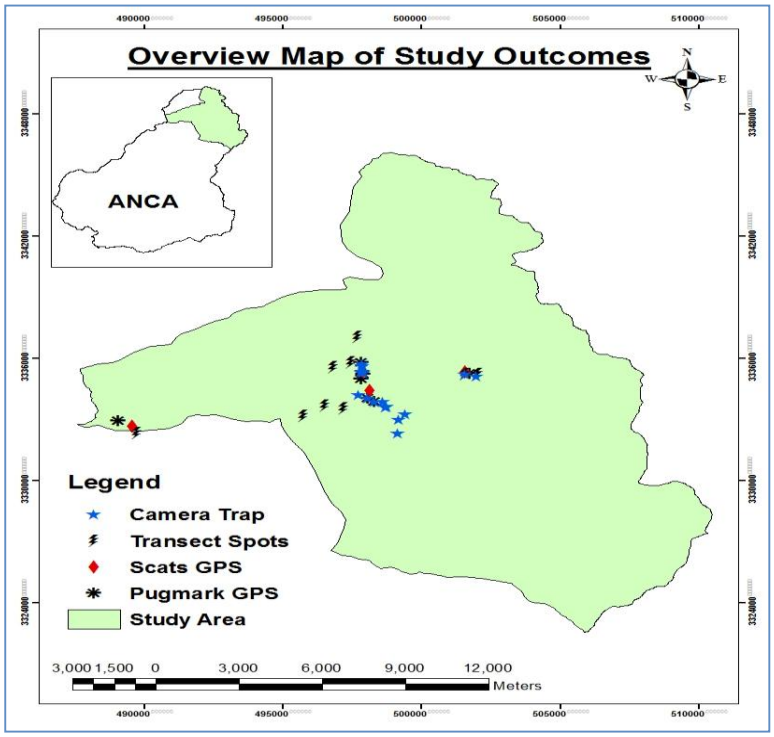
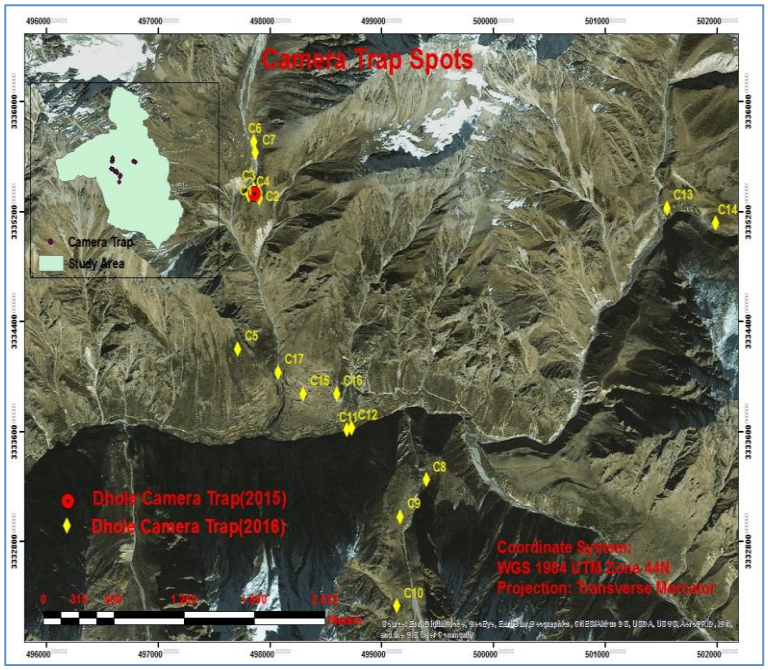


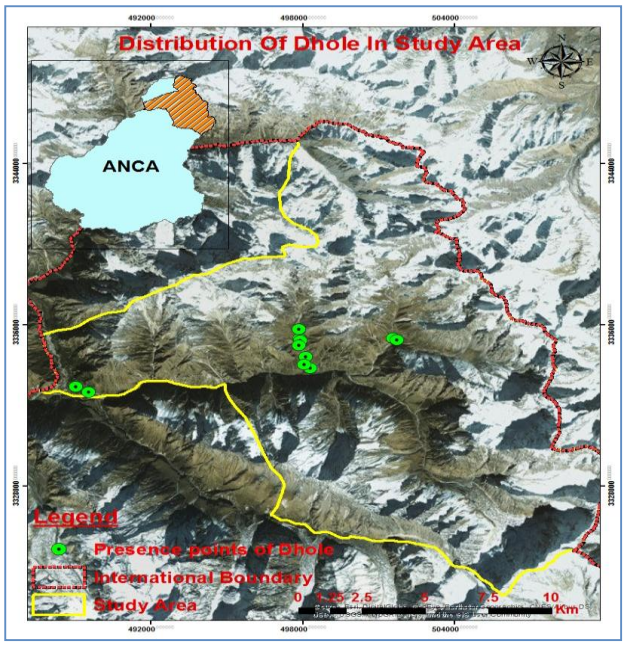
Figure 3: Overview Outcomes of the Study

This map shows the overview outcomes of the study, camera trap spots in ANCA, Map showing the distribution of Dholes based on camera trap, 2016, Map showing pug marks and scat spots, and map showing transects spots respectively.



This map shows the camera trap spots of 2015 and 2016. The red spots in the map shows the GPS coordinates of camera trap result of 2015 where unidentified pictures of Dhole was found and yellow spots in the map shows the GPS coordinates of Camera trap of Dhole 2016.

Figure 4: GPS Location of Camera trap of 2015 and 2016



The map shows the Distribution of Dhole throughout the Study Area. The green spots with black dot inside are the GPS coordinates of pug marks and scat found in the study area. This shows that Dholes are distributed from the elevation of 3,190 m to 4, 130 m.

Figure 5: Map Showing the Distribution of Dhole in Study Area

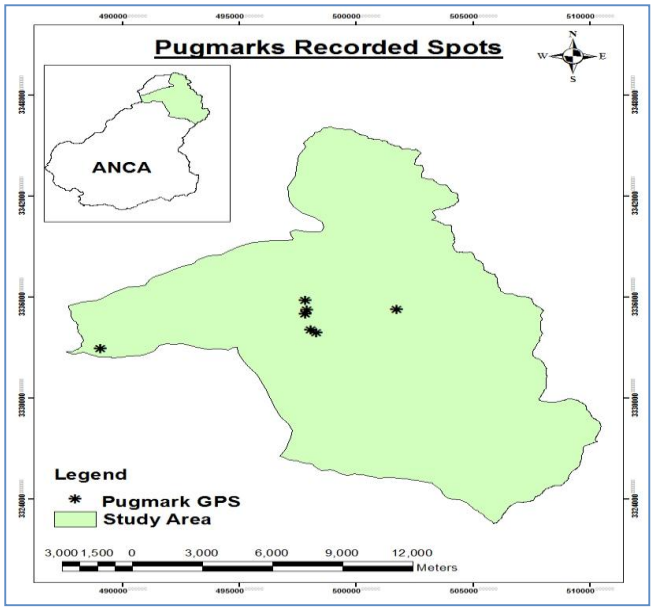


Figure 6: Map Showing the GPS Coordinates of Pug Marks in the Study Area

Table 2: GPS Coordinates of Pug Marks Recorded Spots in the Study Area

S.N	X Coordinates	Y Coordinates	Remarks
1	497908	3335226	Pug marks
2	497843	3334996	pug marks
3	498300	3333870	pug marks
4	498074	3334030	pug marks
5	501738	3335264	pug marks
6	497844	3335786	pug marks
7	489060	3332920	pug marks

The above map shows the GPS coordinates of pug marks recorded spots in the study area. The black asteric in the map are the GPS coordinates of pug marks recorded spots which were found at the elevation of 3,181 m to 4,130m.

4.1.2 Respondents' experience on wild dog distribution and its habitat type

Respondents were asked where they had seen the wild dogs. Based on their responses, five major sites and six habitat types were determined. Most of the respondents had seen wild dog in the stream banks (37%), followed by grass lands (30%), very few had seen them in the human settlement area (13%) and open lands (10%). They also experience the kill of cattle's by wild dogs.

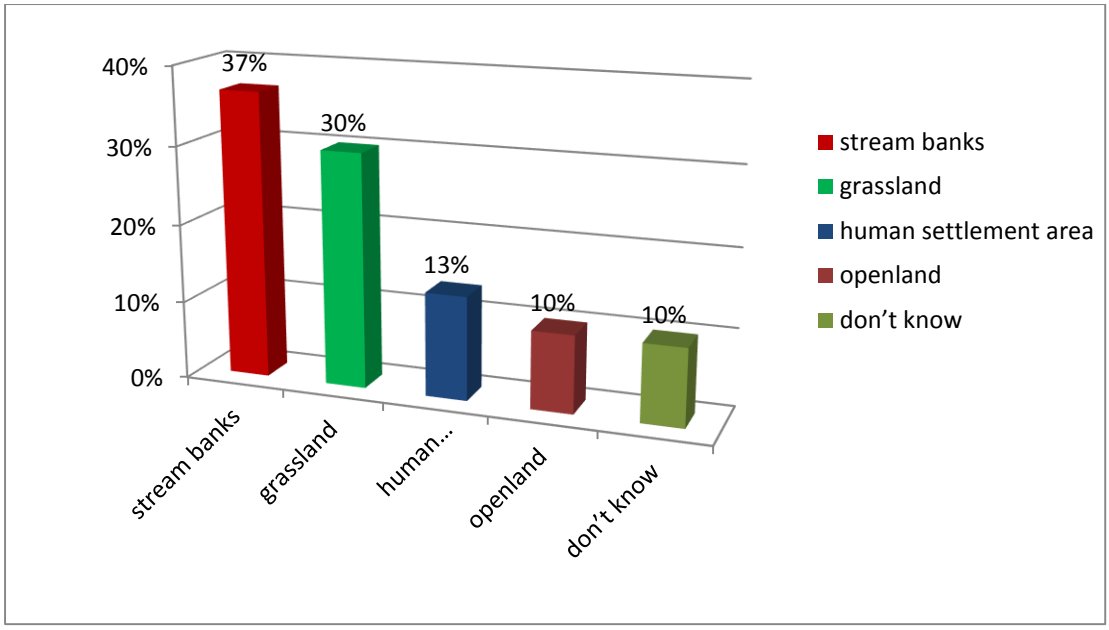


Figure 7: Key informants response on Dhole Distribution on Habitat types

4.1.3 Peoples' response towards Prey species of Dhole

Respondents were asked about prey species of Dholes'. Majority of the respondents i.e. 27% said that prey species of Dhole is Musk deer which is followed by blue sheep and jackel i.e. 23% and 17% respectively. Very few people i.e. 7% and 3% said that birds and cattle are prey species of Dhole respectively.

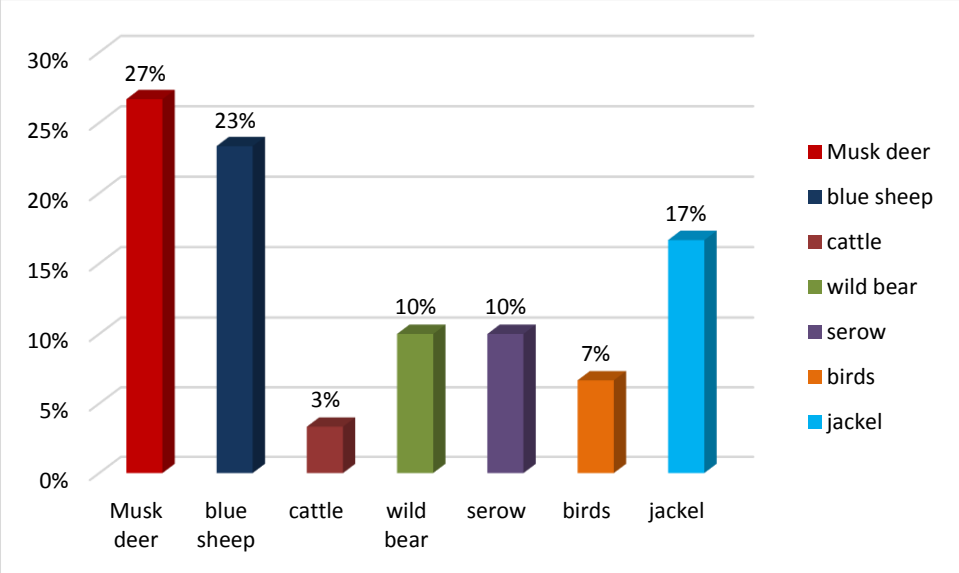


Figure 8: Respondents Response on Prey Species of Wild Dog

4.1.4 Peoples' response towards Dholes' Population

Respondents were asked about Dholes' population trend over last 5 years. Majority of the respondents i.e. 60% viewed that Dholes' population were decreasing. 15% viewed as increasing and 25% were unknown about the Dholes, population trend. It can be concluded that population of the Dhole was being decreased in the study area.

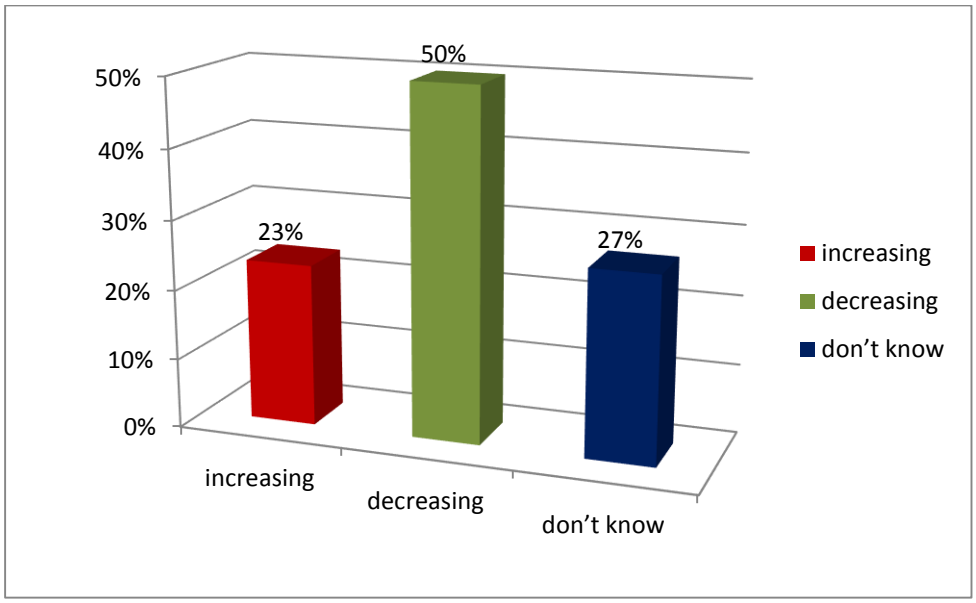


Figure 9: Peoples' Perception towards Wild Dog Population trend Over Five Years

4.1.5 Perception on importance of Dholes conservation

Respondents were asked why should be Dholes conserved. Maximum number (50%) said that it plays an important role in ecosystem regulation. 23% said that to promote ecotourism and recreation. 17% said that it have spiritual value, and 10% have idea about the importance of Dhole.

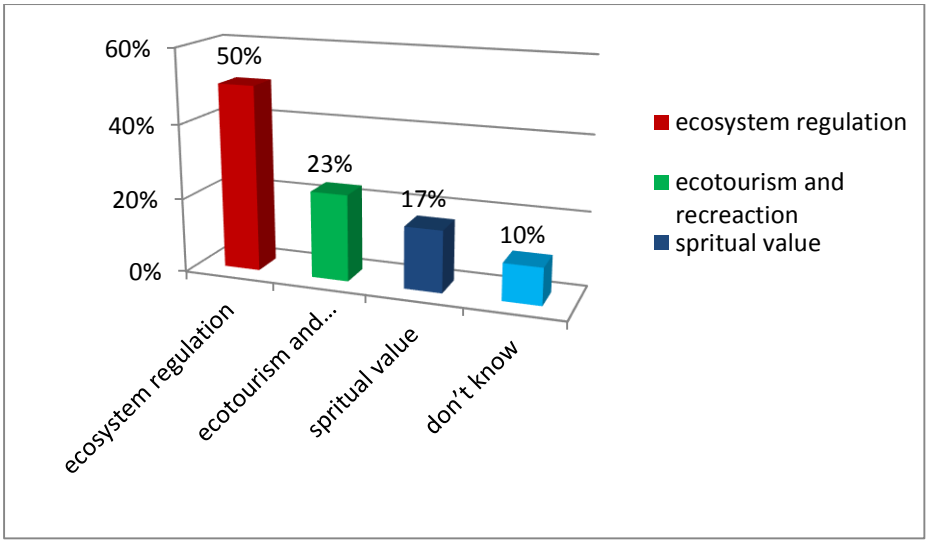


Figure 10: Peoples' Perception on Importance of Wild Dog

4.1.6 Perception towards Dholes threats

Respondents were given to categorize the possible threats of Dholes. Out of 10 possible threats, three threats viz. grazing, habitat loss, natural threats e.g. landslide were found to be more serious threats. The figure below shows the ranking of the threats based on four point Likert Scale.

Table 3: Perceptions towards Wild Dog Threats

S.N.	Threat types	**Respondent response (very high <…….>low) in each category (%)**						Remarks
		Very high (5)	**High (4)**	**Medium (3)**	**low (2)**	**Very Low (1)**	**wt. mean**	
1.	Poaching	0	0	0	0	100	2	L
2.	Grazing	33	17	17	17	17	1.56	L
3.	Decrease of prey species	0	25	25	25	25	1.63	L
4.	Habitat loss	33	17	17	33	0	1.58	L
5.	Disease	0	0	100	0	0	4	H
6.	Shortage of water	0	33	0	33	33	1.78	L
7.	Increased human pressure	50	50	0	0	0	3.25	M
8.	Predators killing	0	50	0	50	0	2.5	M
9.	Climate change	0		0	0	100	2	L
10.	Natural threats e.g. landslide	50	50	0	0	0	2.13	L

4.1.7 Perception towards Dholes conservation measures

Respondents were asked about the appropriate measures of Dholes conservation. The majority of the respondents (27%) said that conservation education is needed while 23% said not to disturb its habitat. Few of the respondents i.e. 17% said that monitoring and strict legal action is required. Likewise 13% said to promote prey species and 3% were unknown about its conservation measure.

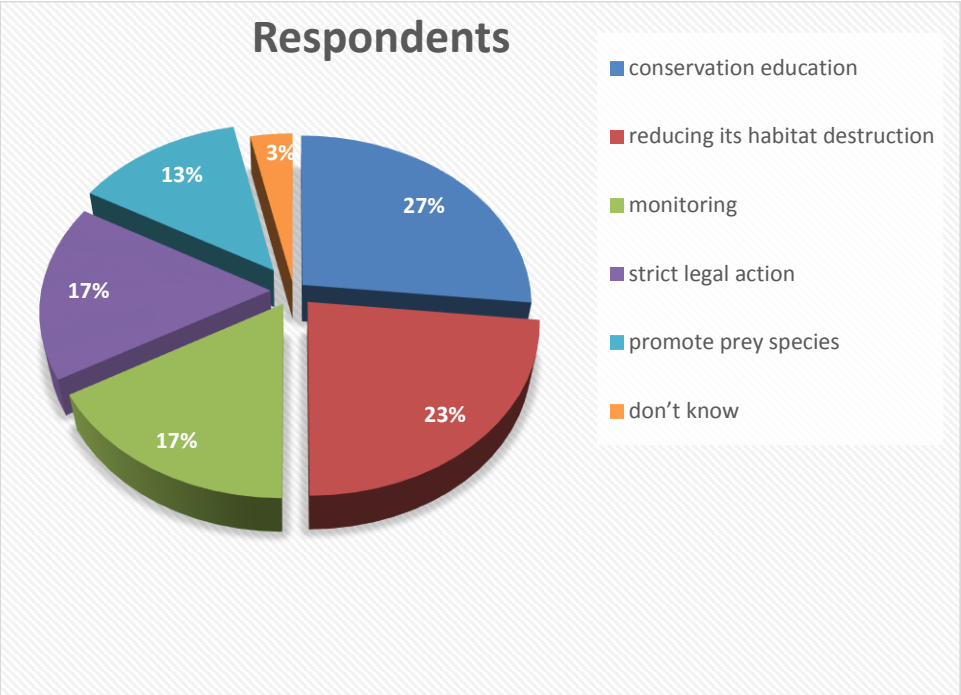


Figure 11: Perception towards Wild Dog Conservation Measures

4.2 Discussion

As this was the first study of Dhole carried out in Api Nampa Conservation Area. This project, find out the basic information on Dholes, habitat distribution pattern, immediate and long term conservation threats, prey species of Dhole, and provides the recommendations to increase the population of Dhole in the API Nampa Conservation Area, which is useful in the preparation of species conservation action plans and to manage the coexistence of people and Dholes within the CA.

Surveys and interviews were carried out, to gather data on the status and distribution of the Dhole in the CA. The Seventeen cameras were placed in the strategic locations to identify the Dhole walking route. Inventory was done to find was habitat distribution of Dhole. Strip cruising method was adopted to find out pug marks and scat along the study

area. Purposive sampling was carried out for Questionnaire survey to know about sighting reports, live-stock killed by Dholes, Dholes' history, and population trend, most probable pasture lands of Dhole habitat, incident of forest fire and perception of local people regarding Dhole was collected during these survey. For the social information, interviews was conducted with local people, herders, and members of the CA management council were asked about their knowledge of Dhole distribution, instances of human-wild dog conflict, and the history of Dholes in. In our study there were no livestock kill record, except one cattle injury is seen in last 5 years. Therefore, there is no special compensation scheme to local people for damage due to Wild Dog. Population trend of last five year shows that Population of Wild Dog in Api Nampa CA is decreasing. Disease, predator's killings and natural threats like landslides were found major threats for Dholes' in Api Nampa CA.

Likewise, in the study of Dhole in Kangchenjunga Conservation Area found that more than a decade ago, prior to the establishment of KCA, Wild dog populations were relatively high in Yamphudin, and there were occasional attacks on livestock. The local population retaliated against dholes by poisoning or shooting them, which led to a dramatic decline in the species' numbers. The population revived somewhat after the establishment of KCA, and in 2007 communities again began to report sightings and livestock kills by Wild dog. However, there were no formal studies to confirm that dholes – and not other predators, such as snow leopards – were responsible for the kills. The SLCC Yamphudin sector record shows that most of the depredation was by Wild Dog rather than snow leopard.

Dholes are widely distributed throughout KCA and are found at elevations between 1,900 and 4,350 meters. Rarely will they seek out domesticated animals as prey but due to increasing interaction with domesticated animals in pasture lands and being easy to prey than wild animals, the dholes attack on domesticated animals had increased.

In 2006, the Kangchenjunga Conservation Area Project (KCAP) initiated a livestock insurance scheme with the SLCC to reduce human-snow leopard conflict. The SLCC has already provided NRs. 35,000 in relief funds to dhole affected herders, to discourage them from killing the predators that attacked their livestock. The SLCC provides NRs. 2,500 per cow killed by a snow leopard or dhole (there is no insurance for goats and sheep). (Khatiwada, *et al.*, 2010).

Habitat fragmentation due to slash/burn practice, forest products collection, and human-dhole conflict are current threats to dholes in KCA. The local people have negative attitudes towards dholes because of their livestock killing behaviour. Sometimes, the herders secretly use poison against dholes to reduce the loss of their livestock in the pasturelands,

which is causing an increased threat to dhole survival in KCA. Additionally, with the establishment of KCA, herbivore populations have increased and there has been an increase in crop raiding by muntjak deer, Himalayan porcupine and macaque (B. Phembo, K. Limbu, G. Sherpa, A. Rai pers. comm.). Therefore, the dholes would have important role to regulate the herbivore population to minimize the loss of crops (Khatiwada, *et al.,* 2010).

CHAPTER FIVE
CONCLUSION AND RECOMMENDATION

5.1 Conclusion

- Habitat types are the major factors affecting the Dholes distribution
- Anthropogenic factors also play key role in Dholes distribution
- Wild dogs are found more in the stream banks and pasture land
- Respondents' response is indifference about Dholes population trend
- Predators killing, disease, Natural threats like landslide are found to be prevalent serious threats
- Musk deer, blue sheep and jackel are major prey species of Wild dog
- Knowledge about the species is lacking

5.2 Recommendation

- Undisturbed habitat should be ensured.
- Anthropogenic activities like grazing, firewood collection and other activities inside the CA should be avoided.
- Prey species of Dhole should be promoted.
- Conservation awareness programmes are essential to ensure species conservation

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ANNEXES

Annex-1

Questionnaire survey form to know people´s perception on Wild dog:

1. **General information about respondent:**

a) Survey date (d/m/y):

b) Name of district:

c) Name of VDC:

d) Ward no:

e) Name of tole:

f) Name of enumerator:

g) Name:

h) Age:

i) Gender:

j) Caste:

k) Literacy:

l) What is your occupation?

A. Government services B. Tourism

C. Agriculture D. Others

2. **Information of Dhole status.**

A. Are you familiar with Dhole?

a) Yes B. No

B. Do you know what does it feed?

a) sheep b) goat c) Grass d) Other

C. Do you know where does it live?

a) Burrow b) Tree c) cave d) oher

D. How many Dholes can be found in one group?

a) 1 b) 2 c) 4 d) many

E. How can you know the presence of Dhole?

a) Footprints b) Scratches c) Scales d) Others

F. Can you recognize male, female and baby Dhole?

a) Yes b) No

If yes, then how?

a) Mammary gland b) Body size c) Genital organs d) Others

G. What do you think,is Dhole harmful or useful?

a) Useful b) Harmful

H. Which part of the Dhole is useful?

a) Whole bodyb) skin c) headd) others

I. What are the reasons of illegal hunting?

a) poverty b) illetracy c) others

J. What is the status of Dhole you have seen before 5years and now?

a) Increasing b) Decreasing c) No change d) Don't know

K. Do you think this area is good for Dhole habitat?

A. Not at all B. Little C. Very much

L. What do you think Dhole bring positive or negative impact?

Questionnaire for Conservation area staff

Name:

Date of interview: Interview no:

1. How long have you been working here?

   .....

2. What change good or bad have you seen since you started working here?

   .....

3. What do you think has this area have the potential of Dhole?

   .....

4. What kind of facilities do these areas have for the ecotourism?

   .....

5. What is the status of Dhole in this area increasing or decreasing?

   .....

6. What do you think the main weakness of this area for Dhole habitat?

   .....

7. Any project involved for Dhole conservation here? If yes then what are they?
   .....

8. What do you think what improvement should be done for Dhole conservation?
   .....

Check list for focus group discussion, stakeholders and key informant survey:

- Status of Dhole
- Effect on Dhole and their habitat due to encroachment
- Conservation strategy for Dhole Conservation (if any). Any kind of help by any governmental and non-governmental organization and management team to conserve the Dhole and their habitat?
- Role and participation of women, poor, marginalized group in adapting conservation measures
- Are you satisfied from these adaptation strategies and is the conservation area conserved by the strategy?
- What should be done for proper conservation of Dhole habitat?
- In your opinion, how to minimize impacts of climate change?

Annex-2

GPS coordinates of Transit, Camera trap, Pug marks and scat

S.N	X Coordinates	Y Coordinates	Remarks	Elevation(Meters)
1	496800	3335563	transit	4582
2	497460	3335790	transit	4247
3	497204	3333552	transit	3558
4	496512	3333668	transit	3520
5	495747	3333175	transit	3493
6	489727	3332332	transit	3061
7	497694	3337053	transit	4556
8	502281	33335123	transit	4103
9	502037	3335229	transit	4091
10	501558	3335226	transit	4014

1	497908	3335226	pugmark	4130
2	497843	3334996	pugmark	4013
3	498300	3333870	pugmark	3713
4	498074	3334030	pugmark	3709
5	501738	3335264	pugmark	4053
6	497844	3335786	pugmark	4176
7	489060	3332920	pugmark	3181
1	497880	3335318	scat	4139
2	498121	3334423	scat	3868
3	501579	3335339	scat	4059
4	489560	3332677	scat	3190

PHOTO PLATES

Photo 1: Api Nampa Conservation Area

Photo 2: Scat of Dhole

Photo 3: Pug Marks of Dhole

Photo 4: Pug Marks of Wild Dog

Photo 5: At Field Visit

Photo 6: At Field Visit

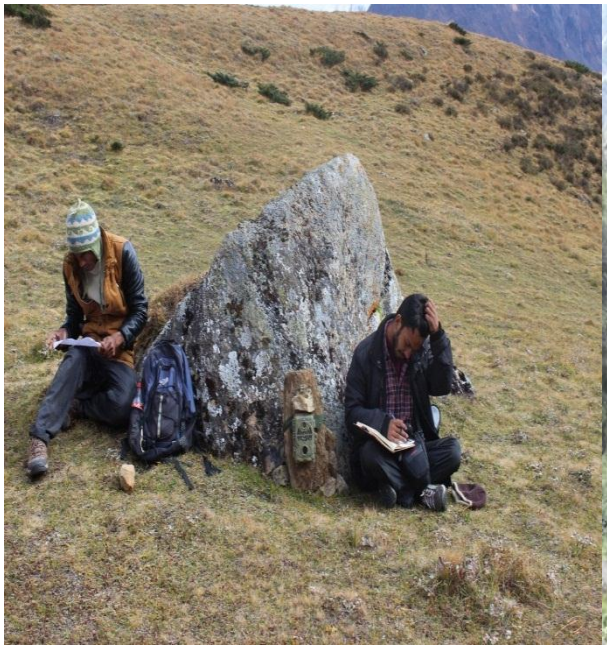

Photo 7: Collecting Data from field

Photo 8: At Field Visit

Photo 9: Game Scouts after Field Visit