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Conserving the endangered Asiatic wild dog *Cuon Alpinus* in Western Arunachal Pradesh

Fostering Better Coexistence For Conservation

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-Gopi.G.V

Executive Summary

Asiatic Wild Dog or dhole (*Cuon alpinus*) population has been estimated to be less than 2,500 mature individuals in the wild. This has led the IUCN to declare Dholes as endangered. Though threatened with extinction, so far it has received very little academic and conservation attention. There have been very few long term studies in the peninsular India. But there are literally no studies or conservation efforts carried out in other parts of the geographic range of this species especially in the Himalayas. It's this very gap in our understanding that this project planned to address by understanding the ecology and conservation requirements for dholes in the Arunachal Himalaya.

C. 84 kms were surveyed on the existing trails and along perennial streams and nullahs for direct and indirect evidence of dhole and its prey species in the intensive study area *i.e.* the Pakke Tiger Reserve. Sign survey was done throughout the study area along the road, trails and streams. Total encounter rate was 0.26/ km. The encounter rate was high in Stream (0.14/km), roads and trails had almost same encounter rates. The results of the density estimation analyses using Program DISTANCE showed that Wild pig (5.4 individuals/ sq.km) and barking deer (4.4/sq.km) are the prey species with the highest density in Pakke tiger reserve. Followed by Sambar (3.1 individuals/ sq.km and Langur 1.9 / Sq.km). Gaur was the lowest density with 1.6 individuals /sq.km. Over all density of the study area was 17.02 (CV16.2%). Overall Encounter rate was high for Gaur (0.22/ $Km_{2)}$ followed by Wild boar (0.16/ Km_2), Sambar (0.15 Km_2), Barking deer (0.14 Km_2) and lowest encounter rate found was Langur (0.08 Km2). 95 scats of dhole were collected analysed which indicated dhole consumed minimum five prey species. Most frequent prey species was of Wild pig followed by that of Sambar, Barking deer, Gaur and Rodents. Wild boar (36%), was found to be highly consumed by dhole in terms of biomass followed by Sambar (34%) Barking deer (14.7%) and Gaur (10.8%). Bonferroni's simultaneous confidence intervals when constructed showed that Prey species were taken proportional to their availabilities.

About 400 households from 52 villages were sampled surrounding three major protected areas of Arunachal Pradesh viz. Pakke Tiger Reserve (PTR), Itanagar Wildlife Sanctuary (ITWLS) and Talle Valley Wildlife Sanctuary (TVWS) for wild dog-people conflict targeting two indigenous communities i.e. Nyshi and Apatani. Wild dog was the prime livestock predator across various clusters of villages (69.2%). Proportion of *Mithun* depredated by a large predator was reported as highest (27.1%) and Wild dog accounted for the major proportion (79.5%) of this depredation. Depredation by Wild dog was high near north-eastern PTR (32.2%), medium in Apatani valley (10.6%) and low in ITWLS (4.5%), eastern (8.8%) and northern PTR (4.4%) and negligible in Naumura (0.8%) areas. Out of 44 killings of carnivores, 15 wild dogs were killed in retaliation. More than half of the respondents hunted for wild meat at some point or the other (62.3%). Motive for hunting was for sustenance (54.9%).

The local communities, school children, college and university students, academicians, researchers were sensitized about the ecological significance of conservation of Asiatic Wild dogs. Local communities were made aware about the process of claiming compensation from the forest department rather than going for retaliatory killing of dholes.

CHAPTER 1

Background

-Gopi.G.V, Salvador Lyngdoh and Muthamizh Selvan.K

1.1 Origin of work: Dhole ecological research in the Himalayan ecosystem is still in infancy compared to the detailed work carried out elsewhere in the country. Dholes are least studied carnivore in the wild. It was in early 70's Cohen's detailed review enriched the scientific knowledge. This was followed by a two year field research study by Johnsingh in Bandipur Tiger Reserve, in southern India; this study augmented the base line information of dholes in the country. This study gave insights and empirical information in feeding ecology and prey selection, spatial use patterns, social dynamics, and reproductive behaviour.

Another study was followed after a decade gap by Venkataraman and was carried out in Mudhumalai Sanctuary (geographically connected to the previous study site of Johnsingh). There is a huge lacuna of knowledge base on this rare species in a critical biodiversity hotspot. Together with the increasing conflicts level with local people, there is a higher threat of local extinction of this species if left unnoticed. It is henceforth imperative to enrich the current knowledge on conservation ecology of this endangered species. This project aims to strengthen the existing knowledge base by conducting status surveys in select localities of western Arunachal Pradesh. This project also aims to impart conservation efforts through the local communities by integrating traditional and scientific knowledge for the conservation of this species. Here, we propose to develop a long term research and conservation program focusing on the endangered dholes. This survey is a first step in establishing the program. The survey aims to assess the current status of dholes in western Arunachal Pradesh and threats to their conservation, and to identify areas/habitats important for long-term conservation of this species.

1.2 Justification of this study: Dholes are listed as 'threatened' according to the Indian Wildlife (Protection) Act of 1972 (Schedule II), 'vulnerable' by the IUCN (1996) and listed in Appendix II of CITES. Considering the complete lack of information and almost extinct status of some subspecies, these statuses have to be redrafted in future. Such investigations on their status, distribution and abundance estimates of sub-populations throughout their geographical range are imperative for the conservation of this endangered species. All three existing long-term studies on dholes have been conducted in geographically connected (all located within the Nilgiri Biosphere Reserve) and similar habitats. There is a great need for further ecological data on dholes from other bio geographic zones like Himalaya. There have been no quantitative assessments of the use of different habitats by dholes, especially habitats with anthropogenic presence. Until such information is recorded, assessment of threats to existing dhole populations, and remedial action, would be greatly handicapped. In view of all these, this study attempts to address the conservation of dholes by collecting biological and ecological information in a least studied region.

1.3 Objectives:

1. To investigate the prey availability and prey selection of Asiatic Wild dog in western Arunachal Pradesh

2. To assess socio-economic status of target communities and the human- wild dog conflicts in western Arunachal Pradesh

3. To conduct conservation education and awareness programmes for various stake holders in western Arunachal Pradesh

1.4 Organization of the report: The report is organized in to four technical chapters. The first chapter deals about the background and justification of this project, second chapter deals about the food habits of dholes, third chapter deals about the socio-economic status of the indigenous communities and human-wildlife conflict with reference to dholes and the final chapter provides information about the conservation awareness programmes conducted in various localities of western Arunachal Pradesh.

CHAPTER 2

Prey availability and prey selection of Asiatic Wild dog

-Muthamizh Selvan.K, Gopi.G.V and Salvador Lyngdoh

2.1 Introduction: The dholes are social canid and vigorous pack hunting animals (Pocock, 1984; Johnsingh, 1982). They are communal hunters, occasionally forming pack of 30 individuals (Fox, 1984). Depending upon prey availability, they may also hunt alone or in pairs (Cohen et al, .1977; Venkataraman et al 1995). The feeding ecology of the dholes has been studied in some of its range in India viz. Bandipur tiger reserve in Karnataka (Johnsingh 1982, 1984, 1985; Venkataraman, 1995: Karanth Sunquist, 2000), Mudumalai Wildlife Sanctuary in Tamil Nadu (Johnsingh, 1984, Cohen.1978, Venkataraman.1995) and Pench Tiger reserve in Madhya Pradesh (Acharya.B.B.2007). Dholes show behavioural thermoregulation which influences daily activity and they rarely resort to high movement during the day and generally prefer to hunt during dawn or dusk. Rarely do they hunt during nights but prefer moonlit nights (Fox & Johnsingh, 1975). In Bandipur, Karanataka, India; nearly 70% of the kills were made before sunrise and before sunset; while approximately 20% were made after sunrise and after sunset. Moonlit nights also showed 2/3 of the kills made at night (Johnsingh, 1983). Dholes prefer to hunt during the morning and evening (Venkataraman *et al*., 1995). Keller (1973) observed that hunting pack sizes in Kanha were larger in the morning than in the afternoon and evening, and a hunting success of 20 % for dhole packs in Kanha.

Prey preferred by dholes is usually medium sized prey (Karanth & Sunquist, 2000) while they are said to hunt large sized prey in a separate study (Wang & Macdonald, 2009). The most preferred kill in Nagarhole, India by dholes was Chital (*Axis axis*) followed by sambar (*Rusa unicolor*) and hare (*Lepus nigricollis*) (Karanth & Sunquist, 1995; Johnsingh, 1983). In another study it was shown that sambar are more common in dhole scats suggesting that they were preferred (Wang & Macdonald, 2009; Cohen *et al*., 1978). Among age class dholes prefer adult male then yearlings, fawns then females in case of Chital (Karanth & Sunquist, 1995). Dholes have also been reported to hunt blue sheep in the Quilan Shan region of China (Osgood, 2005). Johnsingh's (1983) study estimated that an adult dhole (15-17 kg) consumed 1.86 kg meats per day, or 0.103kg per kg of its body weight.

Studied conducted in Bandipur (Johnsingh 1983 and 1992) and in Nagarahole (Karanth and Sunquist 1995) documented that the size of the major prey was positively related to the size of the predator. Karanth and Sunquist (1995) found that dholes usually focussed on prey in the 31-175 kg size class. Re-analysis of Johnsingh's (1982b) Bandipur data showed that dholes appear to select the medium-sized ungulate prey species (chital) and proportionally more male chital were killed (Patel 1992). This was attributed to the fact that male deer tended to range more widely during the rut, and were often solitary, possibly increasing their vulnerability to predation. The same pattern was observed with respect to sambar males, attributed to their solitary habits making them more prone to dhole predation (Johnsingh 1992). Dholes in Bandipur also preferred to kill chital males that had longer antlers, possibly because stags with large antlers may be hampered when running through

dense vegetation and are easily killed (Johnsingh 1983). Juvenile animals (excluding gaur calves) appear to have been taken non-preferentially by all three predators (Karanth and Sunquist 1995). The investigation carried out by Venkataraman et. al. 1995, Venkataraman 1998 on communal hunting, established no relation between adult pack size and the weight of the prey killed. Also, re-analysis of Johnsingh's (1982b) data revealed a negative relation between per capita food intake and pack size.

Fox (1977), who studied food habits of dholes in south India, he found that 74% of Chital consumed by wild dogs. Johnsingh (1982) study showed that dholes prefer to hunt medium sized prey (Chital), but Easa (1995) found that though Nilgiri tahr was abundant prey species, sambar was preferred as the major prey of dhole in Eravikulam national park where chital is absent. Dholes can consume small prey (Cohen *et al*., 1978) proportionally more adult male chital were killed (Lekagul & McNeely, 1977; Cohen, 1978; Patel, 1992, Johnsingh, 1992; Karanth & Sunquist, 1995; Venkataraman, 1995).

In 1987 Cohen stated that common hare (*Lepus nigricollis)* was the commonly represented prey species. Venkataraman, *et al*., (1995) studied feeding habits of two packs. He found that both the packs preferred to hunt chital. According to Acharya (2007), Chital was highly hunted by Dholes, but scat analysis indicated sambar was highly consumed by dholes more than their availability, Chital and langur were consumed less than their availability whereas sambar was the highest percentage among seven prey species (Jimmy et al., 2009) in Satpura tiger reserve at central India. Dholes used at least four prey species in Thailand (Grassman, 2005) and seven prey species in Pench Tiger Reserve, India. (Acharya, 2007). Dholes also scavenge when prey was scarcity especially during dry season (Dubin *et al*. 2008). Dholes have also been reported to have eaten elephant and Gaur carcasses in Mudumalai Wildlife Sanctuary (Venkataraman and Arumugam.Unpub). Dholes also scavenged on Tiger kills and Leopard kills (Johnsingh, 1983), on dead wild pigs (Grassman, 2005), on muntjack carcass originally killed by Python (Nettelbeck, 1995). Desai (1987) reported about an incident were dhole scavenged on chital which was originally killed by Python.

Hunting behaviour is usually of two types, by forming a line while any adult locates and starts a chase toward the prey or the second strategy is by interception by some members while it is being driven toward them. Most kill chase last for less than 500m. Dholes generally attack larger prey from the back (Johnsingh, 1983). Intentional drowning is also observed in killing of prey (Sankhala, 1977). Snout injury or rump and flank evisceration are common in killing of a prey by dholes that causes loss of blood or shock (Karanth & Sunquist, 2000; Johnsingh, 1983). Throat injury is not part of a dhole hunting forte (Johnsingh, 1983). Time taken to make a successful kill is between 7 to 15 minutes. Dholes do not cache their prey (Karanth & Sunquist, 2000). Total meat consumed by a dhole is roughly 2 Kg/day (Johnsingh, 1983). Domestic cattle constitute a very small portion of dhole diet (Wang & Macdonald, 2009; Johnsingh, 1983; Fox, 1984; Barnett, 1978; Cohen *et al*., 1978; Krishnan, 1972). Dhole has excellent sense of smell, which they use to locate the prey aided by sight (Johnsingh, 1983; Jerdon, 1867; Prater, 1980). Dhole pack selects a particular prey individual in order to separate from the groups (Krishnan, 1972; Waller, 1972). Gaur and buffalo herds are stampeded by the dhole pack in order to attack the calves (Wood, 1929; Prater, 1980). Dholes often drive the deer in to the water, where they can surround them. A sambar stag

have been observed to be driven to water and killed by dhole (Ali, 1926; Grassman, 2005). Similarly dholes killing a sambar in a pond in Khao Yai National park have been reported by Lambert & Graham, 1997. Similarly a chital was killed in India (Karanth & Sunquist, 2000). Generally dholes focus on medium sized prey in the class range between 30 to 175 kg and have selectively preyed on adult male chitals (Karanth & Sunquist.1995). Among the medium sized prey barking deer was the highest preferable for dhole (Aiyadurai, 2003). Average weight of the prey killed by the dhole was 55.3 kg (Acharya.B.B.2007).

When a pack of dholes hunts down a prey, individuals attack simultaneously on different body parts of the prey like mouth, nose, hind legs, thigh, buttocks and flanks (Brander, 1923; Johnsingh, 1984, Burton, 1940; Waller, 1972) by grasping and holding on the prey wherever possible (Cohen, 1977). A common technique used by dhole is to blind the prey by biting at the eyes (Grassman, 2005). However, Fox & Johnsingh, 1975 reported that dhole do not blind the prey. Austin (2002) his study observed significant eye injuries on sambar. It has also been believed that dhole urinate on prey eyes in order to make them blind, wild dog urine has no special blinding property and that the animal does not deliberately doing (Burton, 2003), Canids often urinate when excited (Davidar, 1975), while attacking the prey dhole occasionally brings wet tail in to contact the prey eyes (Fox, 1977).Wild dogs prefer to eat liver, kidneys, lungs and some portion of the intestine (Johnsingh, 1984). They can consume about five kg per dog within four minute with little aggression (Johnsingh, 1983). The alpha male contributes much during the hunt that may eat first followed by others (Zarri, 2003); A pack of 15 can easily eat an adult male sambar of 90 to 100 kg (Johnsingh, 1984). Chital was the most preferable prey among the prey items (Davidar, 1975) but they can hunt sambar as well. Nilgiri langurs have also been consumed by dholes (Davidar, 1975, Nythian-Adams, 1949). Large packs can attacks buffalo (Fox, 1984; Barnett, *et al*., 1980; Prater, 1965). Dholes hunt wild Sheep, Goats, Badger and Musk Ox (Sosnovskii, 1967; Novikov, 1962; Cohen, 1978; Muller-Using, 1975). Other items include birds, lizards, insects and vegetables materials including grass, leaves and fruits (Barnet et al., 1980; Fox, 1984, Muller-Using, 1975; Kotwal.1983).

In order to collect basic information on the prey availability and prey selection of dholes in a least studied area, this study was conducted to estimate the density, encounter rates, biomass, and the population structure and composition of the major prey species and prey selection by dholes within the intensive study area i.e. the Pakke Tiger Reserve.

Objectives:

1. To estimate the density and biomass of the wild prey species in Pakke Tiger Reserve

2. To examine the prey selectivity of dholes

2.2 Study area: The intensive study was carried out in Pakke Wildlife Sanctuary (862 km², 26°54′ –27°16′ N, 92°36′ –93°09′ E) situated in the foothills of the Eastern Himalaya in the east Kameng District of Arunachal Pradesh bordering the state of Assam. It was declared a sanctuary in 1977, and has been recently declared a tiger Reserve. The vegetation of the entire area is classified as Assam Valley tropical semi evergreen forests (Champion & Seth 1968). At places, evergreen and semi-evergreen vegetation types merge into one another. The forests are multi-storied and are rich in epiphytic flora and woody lianas. Tropical semi evergreen forests are scattered along the lower plains and foothills, dominated by *Jutuli Altingia excelsa, Nahar Mesua ferrea, Banderdima Dysoxylum* and *Beilschmedia sp*. and other middle storey trees belonging to the Lauraceae and Myrtaceae. The dominant species are hollock (*Terminalia myriocarpa)* borpat (*Ailanthus grandis*), khokun (*Duabanga grandiflora*), dhuna (*Canarium strictum*), paroli *(Pterospremum chelonoides*) udal (*Sterculia villosa*), jhari udal (*Firmiana colorata*), outenga (*Dillenia indica*) and bhelu (*Tetrameles nudiflora*). Subtropical broadleaved forests of the Fagaceae and Lauraceae dominate the hilltops and higher reaches. About eight species of bamboo also occur in the area (Singh 1991; Datta & Goyal 1997). At least 60 mammal species are reported from the park, including 7–8 species of felids, one bear and two canid species, 16 viverrids, mustelids and herpestids, seven large herbivores and four primate species. The larger herbivore fauna found here include elephant (*Elephas maximus*), gaur *(Bos gaurus*), sambar (*Cervus unicolor)*, barking deer (*Muntiacus muntjac*) and wild pig (*Sus scrofa*). Carnivore fauna includes the tiger (*Panthera tigris*), leopard (*Panthera pardus*), clouded leopard (*Neofelis nebulosa*) and other smaller cats and several civet species (Datta & Goyal 1997). The three primate species viz., Rhesus macaque (*Macaca mulatta*), Assamese macaque (*M. assamensis*) and capped langur (*Semnopithecus pileata*) and the four squirrel species, the Malayan giant squirrel (*Ratufa bicolor)*, Pallas red-bellied squirrel (*Callosciurus erythraeus*), the hoarybellied squirrel (C. *pygerythrus*) and the Himalayan striped squirrel (*Tamiops macclellandi*) are the most commonly encountered mammals (Datta &Goyal 1997). Different species of snakes also reported from this area.

Thirteen to fifteen villages and small settlements are located near the South-Eastern boundary of the park adjacent to the Pakke river with an adult population of about 4,000 people (mostly belonging to the Nishi tribal community).

2.3 Methods

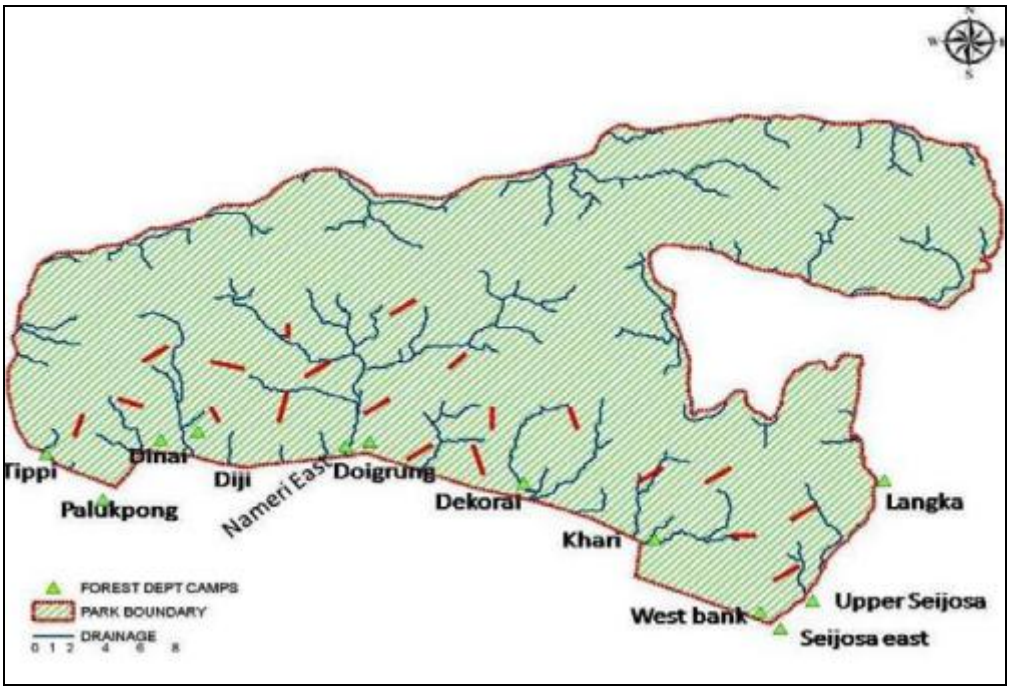
Prey density estimation:

Line Transect: The line transects method was used to estimate the densities of prey species in the study area. Standard line transect methodology are applicable to large terrestrial herbivores (Buckland *et al*., 2001; Karanth, Thomas & Kumar, 2002). This method has been effectively used to determine animal densities under similar tropical conditions (Karanth & Sun quit, 1992, 1995, 2000).Transects were laid almost covering the entire study area wherever possible. Field survey data collected from 6.00hrs in the morning and each transect was surveyed three times for animal signs. (1) Sighting angle (with a compass); (2) sighting distance (visually estimated); (3) group size; (4) sex and age class of the individuals were the recorded variables.

Table 1.Details of line transect.

NO.OF TRANSECT	BEAT	TOTAL km Walked	LENGTH
1	West bank	6	2
1	Lanka	6	2
3	Khari	18	2
3	Upper Dekorai	18	2
2	Doigrung	12	2
3	Nameri East	18	2
3	Nameri West	18	2
2	Dinai	12	2
2	Diji	12	2

Figure 1.Transect locations.



Encounter rates: Encounter rates of prey along roads and streams have also been used as a measure of prey encounter by carnivores (Krüger et al., 1999). Encounter rates for each of the prey species was estimated by dividing the total number of animals of a particular species sighted by the total length of road (Trail and stream) travelled in a given time.

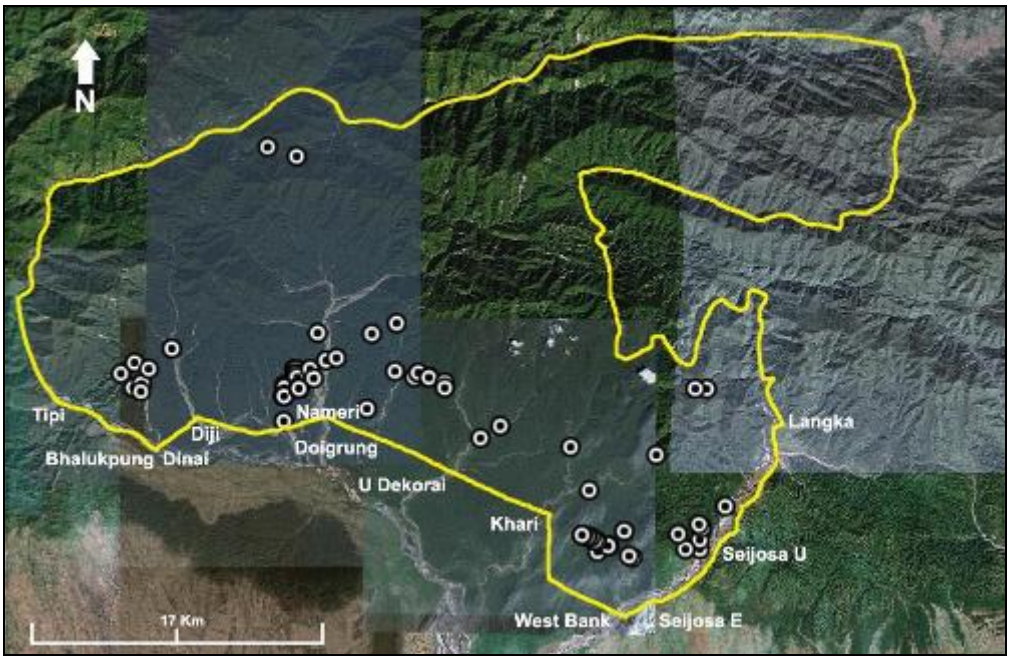
Biomass: A commonly expressed version of density in terms of total biomass is the biomass density. This is calculated by multiplying the density of prey species by their average individual weights. The average body weight of each prey species required for biomass calculation was taken from available literature (Schaller 1967; Prater 1980; Karanth and Sunquist 1995).The animals encountered from trails, roads and streams were pooled to get the biomass of area.

Food habits: The diet of dholes was estimated using two techniques. Firstly, analyses were conducted on dhole scats (faeces), since remains of prey species are very much evident in carnivore faeces. Besides determining the relative frequency of occurrence of prey remains in dhole diet, this method also gives information on the various species of prey consumed by dholes and kill observation. Only 3 kills were encountered an observed during the study.

Scat: To determine the food habits of dholes, we used scat analysis it has been done previous diet studies of dholes (Johnsingh.1983, Karanth &Sunsquit.1995 and Venkataraman, et al., 1995).

Scat collection: The methodology of scat analysis has been reviewed (Putman 1984; Reynolds & Aebischer 1991) and applied in earlier food habit studies of carnivores either alone (Norton et al. 1986; Emmons 1987; Rabinowitz 1989). Scats were collected either by actively searching for them on forest roads or paths, or as and when encountered during the course of fieldwork. When defecation was visually observed, details such as predator species, defecation date and time etc., were noted before the scat was collected. Dhole scats were easily identified be-cause these animals often defecate collectively ("dung pile"), a phenomenon not reported for the sympatric domestic dogs or Asiatic jackals (*Canis aureus*). Scat identification was confirmed by their distinctive odour and appearance, and the presence of dhole tracks. One seat was collected from each dropping site located. Tiger, Leopard and wild dog scat were collected in the field. Dhole scat were small appears in groups, left expose on soli, where as tiger and leopard scats were larger and stickier (Johnsingh.1995).

Figure 2.Scat location maps.



Scat processing: Scats were collected in polythene bag, latter small piece of scat preserved in 70% alcohol and remaining scat dried in sunlight. Dried scat was washed in water in order to remove prey remains. These washed remains were dried under direct sunlight for at least half a day, following which they were stored under moisture-free conditions in dry paper bags retaining the original labelling containing the specific identity of the individual scats, pending analyses. The processed samples were identified in Wildlife Institute of India research laboratory by following procedures. A minimum of 20 hairs was taken from each scat (Mukherjee *et al.* 1994) were washed in Xyline and mounted in a slide by DPX mount. Prey hair found in each scat sample was compared with this reference collection, following the micro-histological methods as described in Reynolds and Aebischer (1991). Examined under the microscope.

Kill observations: Standardized analyses of prey remains were performed the independent samples of dhole scats. Since scat samples were independent, it was assumed that 'identifiable' prey remains in each scat represented one prey individual, following Floyd et al (1978).

Analytical Methods:

Prey estimation: Distance 6.0 (Thomas et al., 1992) was used estimate the line transect data for prey density estimation for dholes. Density estimates obtained from transects were used to calculate the biomass of prey species in the study area.

Encounter rate: To estimate the encounter rate of the each prey species we divided total individual animal sightings by total length of road, streams or trails travelled.

Biomass: Average weight of each prey species obtain from published literature (Schaller 1997; Johnsingh 1983; Karanth 1995).The proportional representation of individual age-sex classes of each prey was computed. Using these proportions, the average unit weight of each prey species was calculated that was weighted by the proportions of each age-sex class of that species. The overall densities of animals for each species were multiplied by their average weight following Berwick (1974) and Karanth & Sunquist (1992) to calculate the wild ungulate biomass.

Prey selectivity: To estimate the prey selectivity by dhole's selectivity, the scats containing each prey were compared to expected numbers of scats containing that prey in the environment, using multinomial likelihood ratio tests, based on the null hypothesis of random, non-selective prey killing by dhole. The software program SCATMAN (Hines 2006) was used to compute bootstrapped estimates of expected number of scats and frequencies of each dhole prey species in scats. If two prey items occurred in a scat, we counted each as 0-5(Link &Karanth1994; Karanth &Sunquist 1995). Percentage occurrences of different prey species in dhole scats were calculated by enumerating the number of scats with remains of a particular species out of the total number of scats with prey remains, depicted in the form of a percentage figure (Reynolds and Aebischer 1991).Ackerman (1984) correction factor used to understand the dhole predation.

$Y(i) = 0.035 + 0.020\ X(i)$,

where:

$Y(i)$ = weight of prey species *i* consumed per field collectible dhole scat

$X(i)$ = average weight of an individual of species *i*.

The average number of collectable scats produced by dholes from an individual of prey species *i* was also calculated as:

$\lambda i = Xi / Yi$

Further, using these values, the estimated number of individuals of species *i* killed and relative biomass contribution of species *i* to dhole diet were computed, following Ackerman *et al.* (1984)

$\pi i = di\ \lambda i$

$\Sigma i\ di\ \lambda i$

d *i* = population density of species *i*

λi = number of scats produced from a single dhole kill of species *i*

the Ivlev's Preference Index (PI) (Ivlev 1961) was used:

$$PI = \frac{(U - A)}{(U + A)}$$

where U = proportion used, A = proportion available.

2.4 Results

Prey abundance estimates

Transect: The results of the density estimation analyses using Program DISTANCE showed that Wild pig (5.4 individuals/ sq.km) and barking deer (4.4/sq.km)) are the prey species with the highest density in Pakke tiger reserve. Followed by sambar (3.1 individuals/ sq.km and Langur 1.9 / Sq.km). Gaur was the lowest density with 1.6 individuals /sq.km. Over all density of the study area was 17.02 (CV16.2%).

Abundance Parameters for Major Prey Species from analyses of line transect data using Program DISTANCE.

Prey Species	n	GS	ESW ± SE	f(0)	p	Enc(I)
Barking deer	27	1.2	5.4±0.8	0.1	0.9	km-
Sambar	27	2	11.82±3.9	0.11	0.19	0.5
Wild Pig	21	1.6	5.2±2.1	0.1	0.7	0.45
Gaur	5	3.8	50±5.5	0.14	0.8	0.22
Langur	7	4.4	10.7±1.5	0.06	0.17	0.12

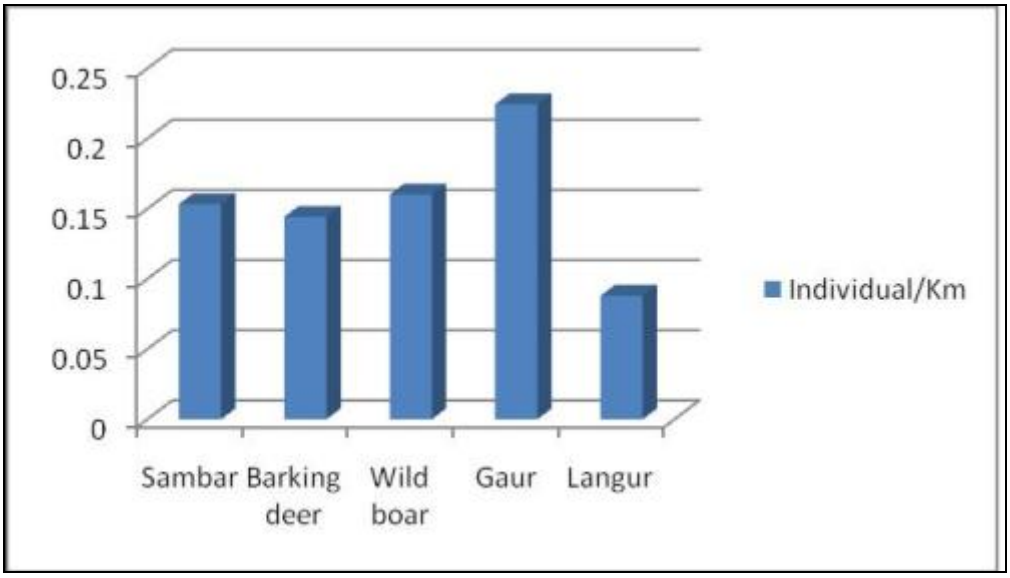
Encounter rates: Overall Encounter rate was high for Gaur (0.22/ Km_2) followed by Wild boar (0.16/ Km_2), Sambar (0.15 Km_2), Barking deer (0.14 Km_2) and lowest encounter rate found was Langur (0.08 Km_2) (Figure 3).

Table 2. Estimates of density for major prey species in Pakke Tiger Reserve.

Prey species	Di	DiCV %	DiSE%	Dg	Dg CV%	Di 95% Confi intre		Dg 95% Confidi inter	
						Lower	Upper	Lower	Upper
Barking deer	5.02	34.8	4.5	1.5	10.06	2.5	9.9	1.2	1.9
Sambar	3.1	34.2	6.1	1.3	20.8	1.5	6.1	1.1	2.1
Gaur	1.6	38.3	1.5	4.4	13.64	0.5	5.05	3.01	6.1
Langur	1.9	32.1	2.1	3.8	8.8	1.03	3.8	3.1	4.7
Wild Pig	5.4	28.01	9.4	2.1	14.7	3.1	9.4	1.3	2.5

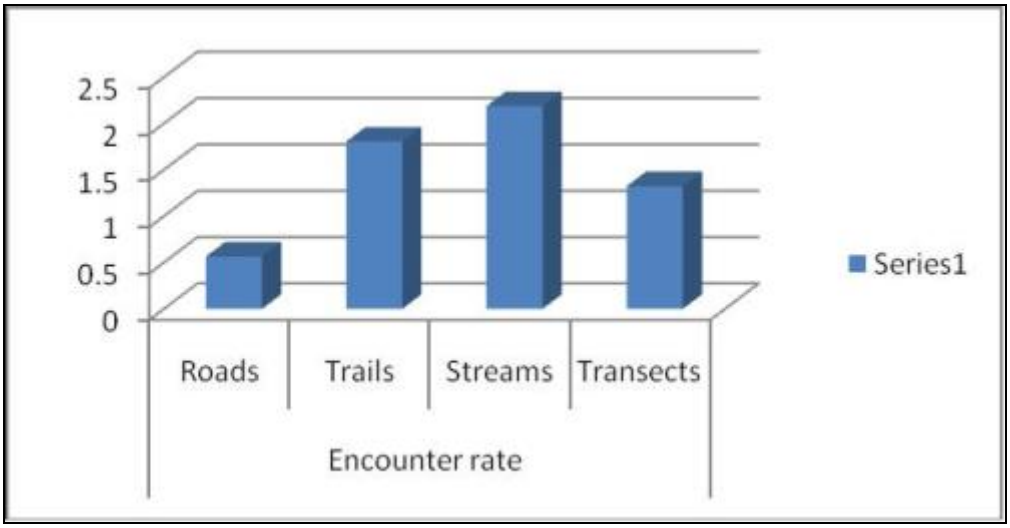
Di—Individual density ,Dg-Group Density, SE – standard error on mean, CV – coefficient of variation

Figure 3. Encounter rate of major prey species in Pakke Tiger reserve.



Encounter rate was calculated for trails, roads,streams and transects. Highest encounter rate was in Streams (2.18/km) followed by tails (1.8 /km), transects (1.3/km) and roads (0.56/km) Fig (4).

Figure 4. Encounter rate of major prey species along the road, trails, streams and transects in Pakke Tiger reserve.



Biomass: Table 3.depicts the proportional biomass contribution of individual age; sex Classes, and their unit weights representative of the actual population structure. Unit weight of the Sambar was 127.34Kg , Barking deer 22.56kg, Wild boar 40.25 kg, Langur 12.27 kg and Gaur 476.24 kg.

Table 3.

	Age class	Numbers	Weight Kg	(kg) % in pop	Prop wt	Unit weight
Sambar	Adult male	59	225	19.73	44.39	
	Sub adult male	41	50	13.71	6.86	
	Adult female	135	150	45.15	67.73	127.34
	Sub adult female	64	50	16.72	8.36	
Barking deer	Adult male	67	30	25.58	7.67	
	Sub adult male	17	10	6.49	0.65	
	Adult female	130	25	49.67	12.4	22.56
	Sub adult female	48	10	18.32	1.83	
Wild boar	Adult male	80	60	26.67	16	
	Sub adult male	18	15	6	0.9	
	Adult female	159	40	53	21.2	40.25
	Sub adult female	43	15	14.33	2.15	
Langur	Adult male	44	5	25.43	3.81	
	Sub adult male	6	15	3.47	0.17	
	Adult female	101	12	58.38	7	12.27
	Sub adult female	22	5	25.43	1.27	
Gaur	Adult male	76	745	19.14	142.61	
	Sub adult male	48	250	12.09	30.22	
	Adult female	174	550	43.82	241.05	
	Sub adult female	99	250	24.93	62.34	

Biomass estimates shows that Gaur formed the major amount of prey 47.7 % followed by sambar (28.27%) despite lower density than barking deer and wild pig. Total prey biomass of area was 1510.7 kg per sq.km (Table 4).

Table. 4 Biomass density and total biomass estimates of major dhole prey species.

Species	D	Unit weight	Kg/Km2	Biomass%
Barking deer	5.02	22.56	113.2512	7.11
Sambar	3.1	127.34	394.754	28.27
Gaur	1.6	476.24	761.984	47.7
Langur	1.9	12.27	23.313	1.27
Wild pig	5.4	40.25	217.35	15.57

Relative density of dhole:

Dhole Sign Encounter rate : Sign survey was done throughout the study along the road, trails and streams. Encounter rate was calculated by total sign divided by total km covered. Total encounter rate was 0.26/ km. The encounter rate was high in Stream (0.14/km), roads and trails almost same encounter rates.

Fig.5.Dhole sign density in the Pakke Tiger Reserve.

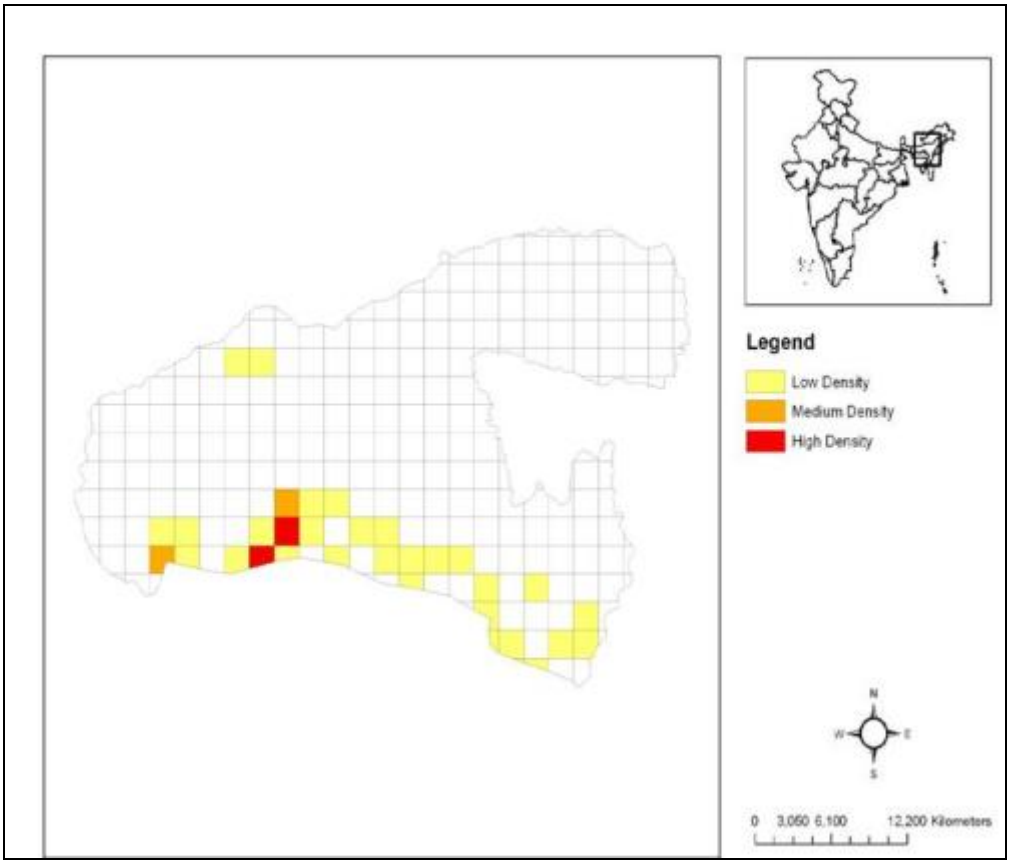
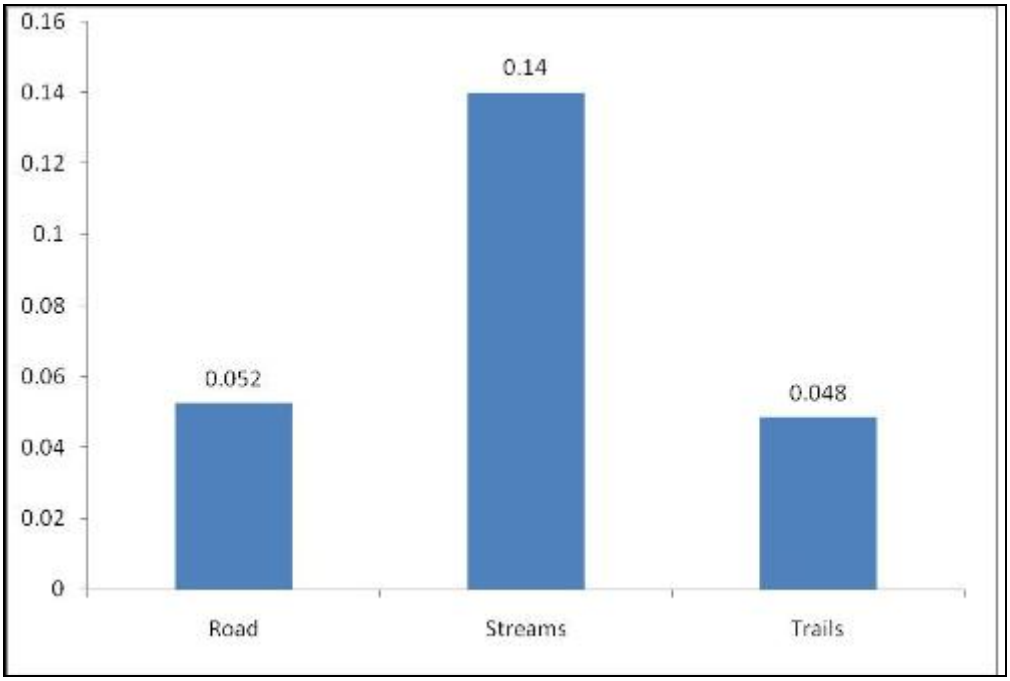
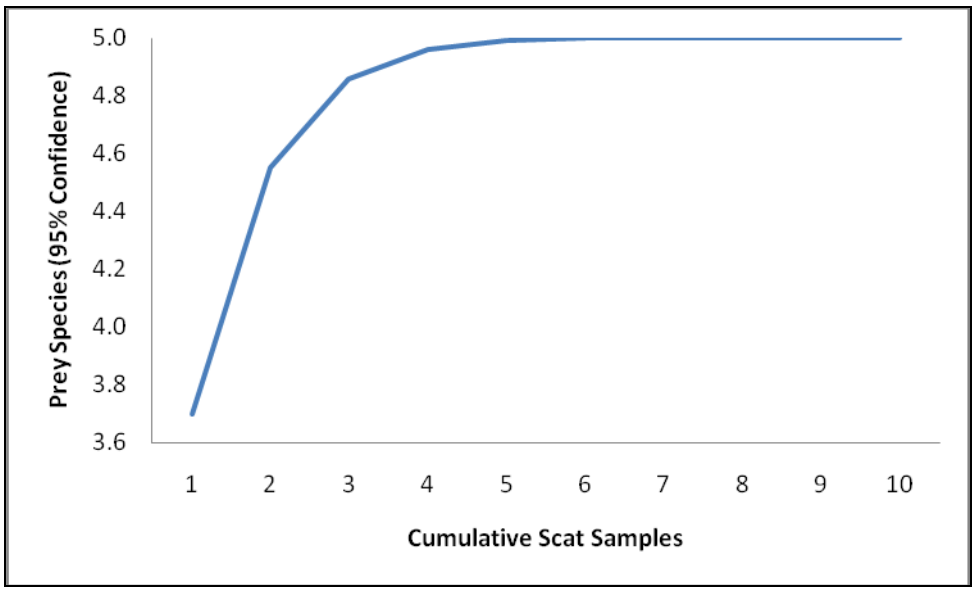


Fig.6.Encounter rate of Dhole signs.



Dhole predation: Totally 95 scats were analysed and the results indicate dhole consumed minimum five prey species. The most frequent prey was found to be Wild pig 47.6 %(n=50) followed by that of Sambar 19.1% (n=18), Barking deer 16.1% (n=15), Gaur 10.4 % (n=11) and Rodents 6.67% (n=6).Table (5)

Figure 5. Calculation of sample adequacy for analyses of dhole scats collected in Pakke Tiger Reserve (1=10 scats).



Rare fraction curve shows minimum 50 scats need in pakke tiger reserve for scat adequacy to find out the maximum prey species from the scat samples.

Table 5 .Details of prey items recorded from dhole scats.

Species	No.of scat present	No.of times present	% of time present
SAR	18	20	19.1
BAR	15	17	16.1
PIG	45	50	47.6
GAR	11	11	10.4
Rodents	6	7	6.67

Relative biomass : Wild boar (36%), was the highest consumed by dhole in terms of biomass followed by Sambar (34%) Barking deer (14.7%) and Gaur (10.8%).

Figure 6. Relative biomass consumed by dhole.

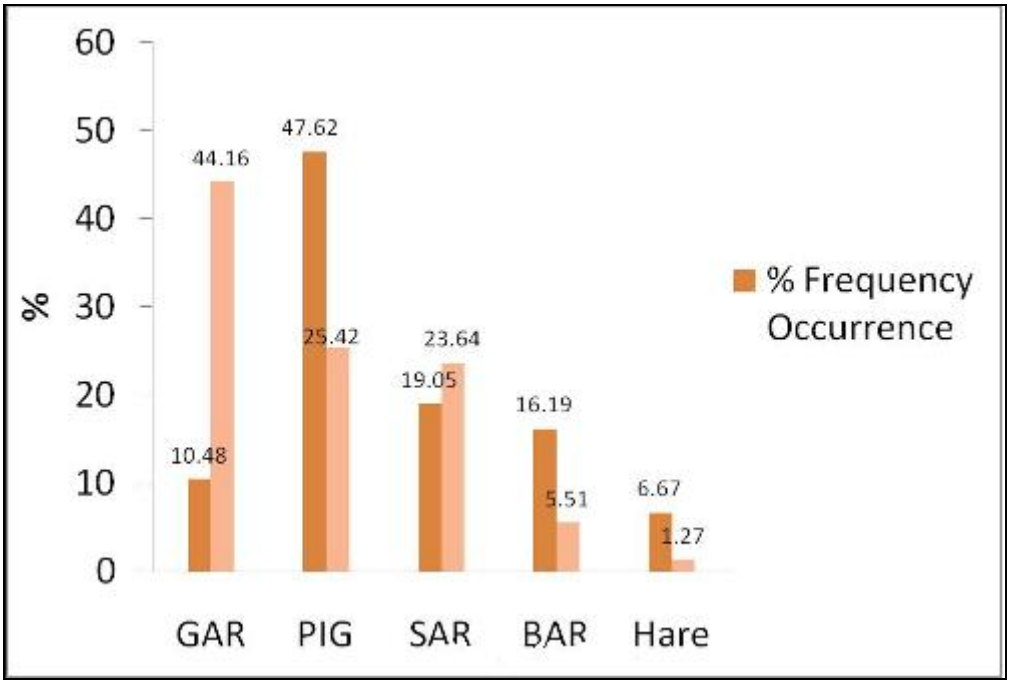


Figure 7. Comparison of observed and expected frequencies of prey consumption by dholes of the four major prey species, generated by Program SCATMAN from 95dhole scats.

When Bonferroni's simultaneous confidence intervals were constructed on the above results, it was found that Prey species that was taken proportional to their availabilities. (Table.6 and Fig) P>0.05.

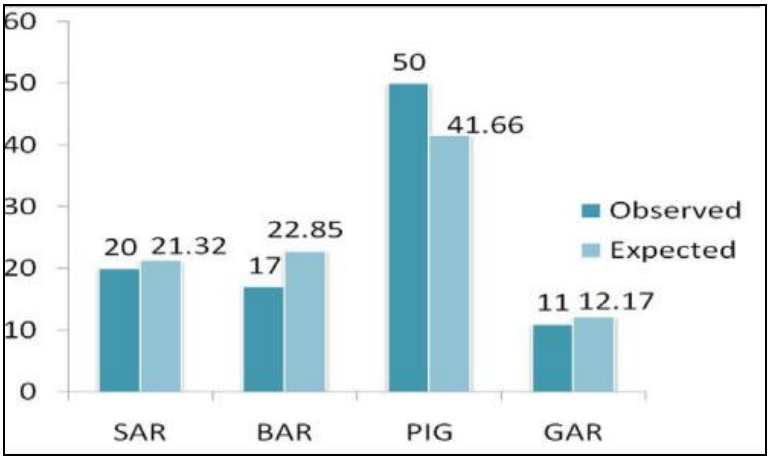
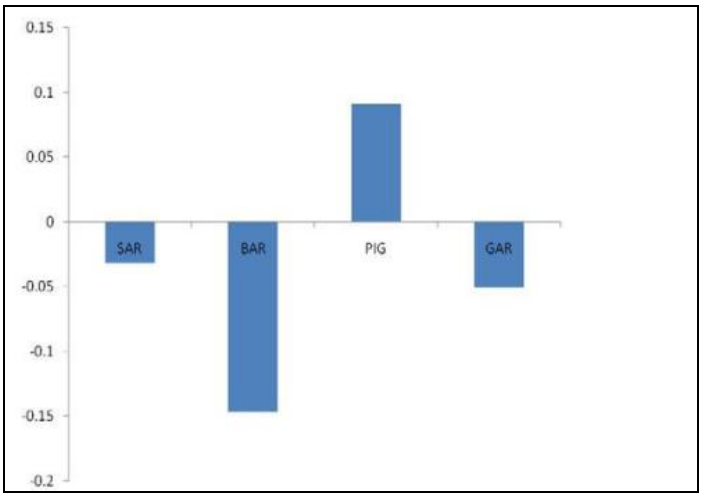


Table 6. Prey selectivity by dholes of the four major prey species, using Bonferroni's Confidence Intervals (Neu *et al.* 1974), from 95 dhole scats. Overall prey selection based on availability of prey species.

Prey Species	Observed fraction of Scat PO	Expected fraction of scat PE	Bonferroni intervals for PE
Sambar	0.2	0.21	0.10 ≤ p ≤0.31
Barking deer	0.17	0.23	0.08 ≤ p ≤ 0.27
Wild pig	0.5	0.42	038 ≤ p ≤ 0.63
Gaur	0.11	0.12	0.032 ≤ p ≤ 0.19

Figure 8. Prey selectivity using Ivelve index, from analyses of dhole scats.



Kill Observation: Only three kills were identified, in which two kills were Sambar and one kill was sub adult of barking deer.

2.5 Discussion:

Prey Density: Among prey species Wild boar formed the major prey in terms of number and densities. Wild boar was found almost in the entire habitat in Pakke Tiger Reserve. Wild pig which feeds selectively on a variety of plant and animal foods, such as roots, tubers, fruits, insects and carrion (Prater 1980), attain highest densities (5.4 km^{-2}). Wild boar densities are higher than that of Nagerhole National park 3.4 Wild Pigs km^{-2}, (Karanth and Sunquist1995) and lower than Pench Tiger Reserve (20.3 Wild Pigs km^{-2}. Acharya. 2007.) Barking deer had the second highest density (4.4 km^{-2}) this might be because, small bodied and more productive ungulates (barking deer) may be more resilient to hunting pressure (Datta et al., 2008). The density of barking deer was similar to that of Nagarhole (4.2 km^{-2}). Sambar density was comparatively higher than Kanha and Gir lion sanctuary. In case of group density gaur was found to be high (4.4 km^{-2}) this is higher than Pench Tiger Reserve (1.1 km- 2), followed by langur (3.8 km-2) and wild pig (2.1 km-2). We were unable to achieve the desired levels of precision (CV) in some cases, probably because of variability in the data collected across temporally changing detection conditions. Best model fit was selected based on low AIC value and for density estimates half normal cosine model which was best fit for all the animals. The encounter rate was high for Gaur (0.22 km^{-2}) and Wild boar (0.16 km^{-2}), due to the easily detectable by groups in along the streams and trails than other animals.

Prey density in different places:

Prey Species	Pakke TR	Gir Lion Sanctuary	Pench TR	Kanha TR	Ranthambore TR	Nagerhole NP	Bandipur TR
Sambar	3.1	1.8	12.2	1.5	17.1	5.5	7
Barking deer	4.4			0.4		4.2	1
Wild pig	5.4	2.1	20.3	2.5	9.7	4.2	2.5
Gaur	1.6			0.4		9.6	0.5

Approximately, an overall density of 13.1 group's km^{-2} having 17.02 individuals km^{-2} was estimated. Other dhole site especially Pench total wild prey density was 212 individual km^{-2} was estimated and in Nagerhole 91 animals km^{-2}.

Prey Biomass: Total biomass was estimated to be 1510.7 kg km^{-2} (Table 1). Gaur and Sambar contributed highest biomass though individual density is comparatively lower than other prey species, followed by Wild boar, Barking deer and Langur. Present study is comparable with previous studies viz. Ranthambhore 4937 kg km^{-2} (Kumar 2000), 7638 kg Km^{-2} in Nagerhole NP (Karanth & Sunquist 1992) and 6013 kg Km^{-2} in Pench TR (Biswas & Sankar 2002).

Biomass density in different habitat types.

Area	Habitat types	Biomass Density /sq.Km
Pakke	TR Semi evergreen forest	1510.7
Gaboii	Evergreen forest	1 020
Barri-o Colorado	Evergreen forest	3 553
Manu	Evergreen forest	1 220
Ranthanbore	TR Tropical dry forest	4937
Gir Lion sanctuary	Tropical dry forest	1646
PenchTR	Tropical dry forest	6013
Nagerhole	Tropical dry & moist forest	7638
Kaziranga	Moist alluvial grassland	4252

Prey selection: Scat analysis showed Wild pig evidence was found to be high (n=50, 36.6 % of times) in 95 dhole scats and was highly consumed by Dhole, followed by Sambar (34.5%) and Baking deer (20.7%). In Pench though the wild pig density was high, dhole preferred Sambar more than its availability (Acharya 2007), our studies shows that wild pig was preferred prey by dhole may be due to the low density of Sambar. The observed proportion of prey species in scats was compared with the expected proportions derived from their density estimates to conclude the dhole predation was proportional to their availability there was no significant ($P > 0.05$) relationship found in dhole predation, when compared to studies from other areas, mainly the studies that were conducted in central and southern India. In Southern Indian studies such as Nagerhole (Karanth & Sunquist 1995), Bandipur (Johnsingh 1983; Andhereia 2007) and in Mudumalai (Venkataraman 1995) studies shows dholes prefered adult male chital whereas in central India, in Pench (Acharya 2007) Sambar was taken significantly higher than its availability. The predation was random in our study and this non-selective predation patterns have also been reported from other tropical forests which may be due to the result of scarcity of large prey (Karanth & Sunquist 1995). In Pench TR wild boar was taken occasionally (Acharya 2007) but in Pakke Wild boar was takenfrequently due to the high density of wild pig than other dhole sites (Johnsingh 1992). Ivelv index shows that though there is no significance in prey selection there is order in prey preference. Wild pig was preferable prey followed by Sambar. Earlier Aiyadurai (2003) has reported among medium sized prey barking deer was highly preferred by dhole, the presence study shows though the barking deer density was high (4.4 km^{-2}) than other dhole site, it was not preferred by dholes.

Kill: We did not get much kill data unlike scat. Two adult male Sambar and one barking deer sub adult kill were found during our study; due to the insufficient sample we could not do any useful estimate. All the kills that were found nearby streams which was also reported in past studies (Grassman 2005; Karanth & Sunquist 2000).

CHAPTER 3

Socio- economic status and wildlife conflict with reference to Asiatic Wild dog

-Salvador Lyngdoh, Gopi.G.V and Muthamizh Selvan.K

3.1 Introduction: Massive conversions of forest land or virgin land into plantations (FAO, 2006) and declining prey populations of the dhole (*Cuon alpinus*) have had an effect on its population around the world. Over the past ten years these trends have had an effect on the habitat which has been lost to agriculture, human settlements, and infrastructure development. Now the current range of this canid is only a fraction of its former distribution i.e. central and south east Asia. Not only that, its status declined to endangered from vulnerable only in the last ten years (IUCN, 2010; IFAW, 2009). These remaining lands are no less troubled as there is bound to be conflict as it is between wildlife and humans, a significant problem in many parts of the world (Saberwal *et al*., 1994). Hence, conflict can be particularly serious, where rural people live in close association with protected areas (Mishra, 2001 and Conforti and de Azevedo, 2003). Also persecution by humans still remains the greatest source of mortality for many large carnivore species occurring both outside and inside protected areas (Woodroffe and Ginsberg, 1998). These attitudes towards carnivores are shaped by understanding and knowledge of a particular species, as well as by past and present interactions with that species, these particular reasons aggravate the losing causes of conservation especially where large carnivores prey upon livestock, thus local people often hold negative attitudes, as reported for snow leopards (*Panthera uncia*) (Oli *et al.*, 1994) and wolves (*Canis lupus*) (Lenihan, 1996) . Even though these attitudes which are based partly on the extent to which different species conflict with human interests, they have also risen partly due to human prejudices and the predation problem as it is has always been poorly understood (Kellert *et al*., 1996; Kellert, 1985). Canids have been considered pests by herders and pastoralists since they prey upon human livestock (Wang & Macdonald, 2005). Indeed, killing of animals considered predators of livestock has driven the extinction of several species, including the Falkland Island wolf (*Dusicyon australis*) in 1876, the Guadelupe caracara (*Polyborus lutosus*) in 1900; (Fuller, 2000) and the thylacine (*Thylacinus cynocephalus*) in 1930; (Paddle, 2000), an investigation of wild dog predation on livestock in Zimbabwe suggested that farm workers' claims were exaggerated, with african wild dogs (*Lycaon pictus*) truly responsible for fewer than half of the reported attacks (Woodroffe *et al*., 2005). Indian archives, which include ancient texts as well as colonial proceedings, depict wolves as gluttonous and lacking nobility (Rangarajan, 2001). In the Jungle book dholes known as "red dog" were considered as outcast and fearful creatures who are disliked (Kipling, 1894). The asiatic wild dog (*cuon alpinus*) faces no lesser threat and ridicule, especially in Northeast India which holds hunting both as retaliatory as well a major practice for subsistence, ritual as well as pleasure (Datta, 2008).

Retaliatory killing, hunting and livestock depredation are the cause and effect which pose a threat to wild dog populations. Studies in Africa have shown that prey densities have been negatively related to high livestock killings (Rasmussen, 1999). Killing of wildlife directly affects a species abundance in a particular habitat, along with habitat destruction and selective logging which in turn run into a cycle of increased pressure on primary habitat such

as tropical forests (Vanthomme *et al*., 2010). Tropical forests have low productivity comparatively and hence hunting for bush meat is considered to be significant; studies in the savannah have shown that hunting practices have resulted in a steady decline of its wild species, this situation is less studied in the asian context (Nielson, 2006; Robinson and Bennet, 2000). Humans have been hunting now for almost 100,000 years, current rates of population and overhunting will not sustain species even if human density is 1 Km^{-2} in tropical forests. Those who depend on hunting are usually the marginalised people whose only source of protein is wildmeat. This has resulted in Asia alone, a disappearance of 12 large vertebrates in the last 40 years due to unsustainable hunting. The main reason for increased extinctions due to hunting has been the dramatic increase of human population, development and forest loss (Milner-Gulland *et al*, 2003)**.** Arunachal Pradesh consists of 20 major tribes, a population density of 13 Km^{-2} who have a culture closely linked with various hunting practices (MHRD, 2001). Considered to be the most forested state as well as one of the biodiversity hotspots in India, it has a looming cloud of danger over its forests being termed as empty (Datta *et al*, 2008).

The present study focuses socio-economic factors that drive the decline of wild dog populations in Western Arunachal Pradesh. We believe that hunting and livestock depredation are a major cause in determining future status of wild dogs (*Cuon alpinus*) in the state. Considered to pests or vermin by the local due to their vigorous hunting behavior. This behavior amounts to losses of the feral cattle *Mithun* due to depredation has nearly allowed for a social hatred towards this species. We try to answer questions as to what is the extent of livestock depredation. Which areas are more prone to such acts? Which economic backgrounds have a significant problem?. Also, in this context we look into hunting of wild meat. We question the status, need, accessibility, education and awareness levels that could lead to possible reasons which cause hunting.

The main communities concerned here are the *nishi* and the *apatani* who are primarily agropastoralists living around mature forests. We also try to measure the extent of their forest dependency. We compare between the two communities, their agricultural and social practices that could contribute to a threat to wildlife. Hence we put forward constructive reasons for hunting, depredation, forest utilization and need. The goal is to evaluate conflict regimes that operate given these settings in the two distinct animistic tribal communities of Arunachal Pradesh.

Objectives:

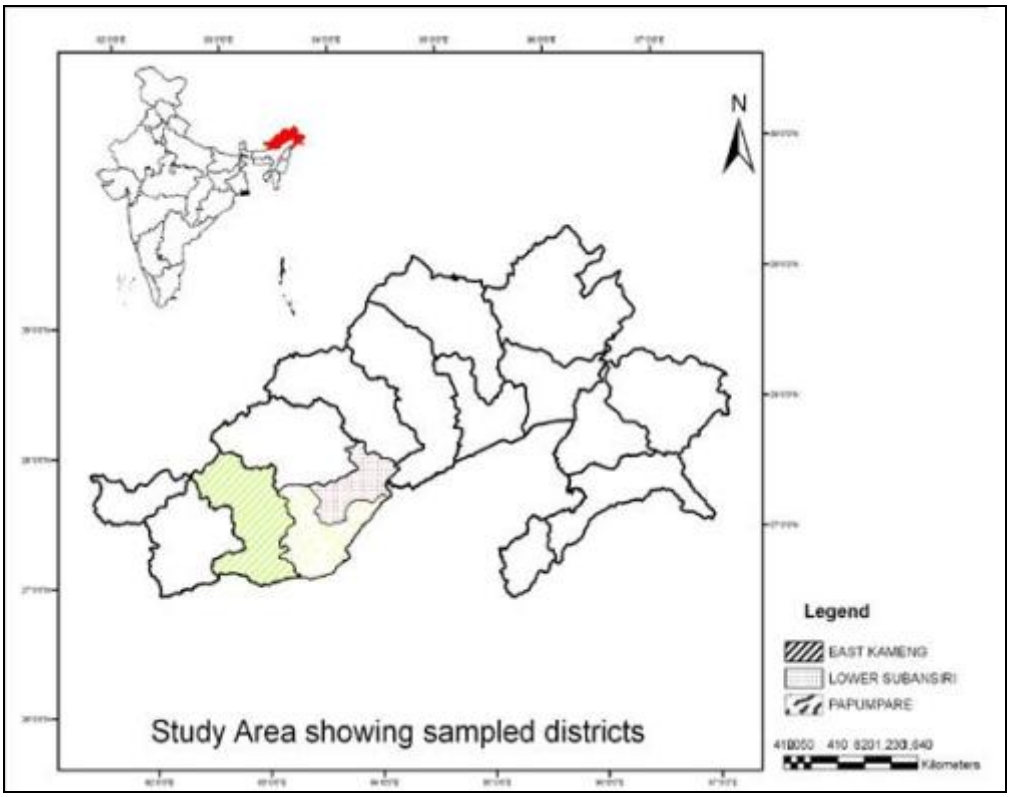
1) Determine livestock depredation instances by wild carinvores, their frequency, periodicity and extent with emphasis on asiatic wild dog (*cuon alpinus*).

2) Determine the reasons and extent of hunting among the two communities, areas and their varied economic status.

3) Evaluate local attitudes towards conservation.

3.2 Study area: The area consists of villages from East Kameng, Papumpare and Lower Subansiri districts. East Kameng holds a dominant tribe called the *Nishi* along with other tribes such a *Aka*, *Miji* and *Sulung*. The *sulung* tribe has been historically associated with the *Nishis* who are their providers in return for the services the former provide. The inhabited region is dominated by semi-evergreen to evergreen forests and ranges in altitude from to. Primary occupation of the people is agriculture. *Mithun* rearing is a matter of pride and social importance in the context of the *Nishi* of this area. The literacy rate is 40.6% in the district (Govt. of AP, 2006). Papumpare houses the state capital Itanagar which overlaps the wildlife sanctuary by the same name. Located at a lower elevation of around 600 mts above district (Govt. of AP, 2006). Lower Subansiri district constitutes two main tribes, *Nishi* and *Apatani*. The Apatani people were only interviewed. They live on scenic valley of Ziro located at around 1500 mts above sea level. Mostly agriculture is practiced, but no slash and burn (*Jhum*) is practiced by these people. Around the valley mature forests and Talle valley sanctuary houses many mammals. Hunting is predominantly common in this area. Literacy rate is 59.4% in the district. (Govt. of AP, 2006).

Fig 1: Location of study area in Arunachal Pradesh, India.



3.3 Methodology: The main method of evaluating socio-economic status was through a interviews with local people. A set of open-ended and closed-ended questions were prepared in the form of a questionnaire. The questionnaire was gradually refined after a few mock in interviews and then finalized.

Questions that were asked focused on :

a) Household information (age, sex, number, marital status, etc)

b) Assets (movable and immovable)

c) Livestock owned (Number, effort, value and uses)

d) Occupation (skilled, unskilled, nature of work)

e) Forest dependency (NTFP, timber,etc)

f) Development levels (Govt. Schemes, schools, dams, electricity

g) Conflicts (depredation levels, crop raiding, hunting)

h) Awareness (Wild animal seen, conservation attitudes and remarks)

The target community were the *Nishi* and *Apatani* who are animists and a primarily agropastoralists. The selected households for interviews were those that lived close to mature forests. Care was taken as to include those living in remote as well as semi-modern set up. Village *gamburas*, hunters and local people were interviewed to get better information pertaining to general state of the village. Individuals were selected on random among the villages.

Interviews were mostly taken for 10 minutes to avoid dis-interest. Both Men and Women were interviewed together in most cases and remarks were taken as one when noted down on the questionnaire. An attempt was made to ensure a good spatial spread of villages interviewed to represent three districts : East Kameng, Papumpare and Lower Subansiri of Western Arunachal Pradesh.

3.4 Results:

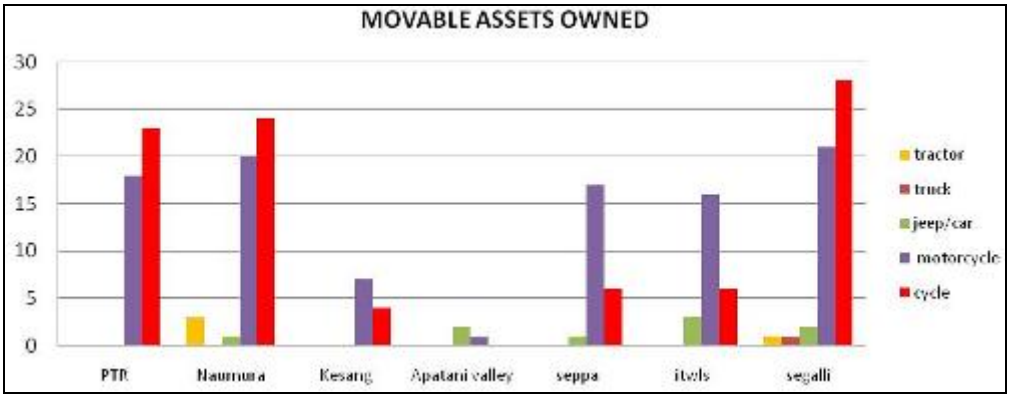
Status of socio-economy district and area wise: A total of 410 households were interviewed from 52 villages across three districts. Interviews were normally conducted when all the members of the house were present. All the observation were noted down on a structured questionnaire and also any extra remarks were noted down. A sampling effort was 20–30 %.

Table No.1: Number of villages and houses sampled area wise.

Circle/ Block	Number of Villages sampled	Number of Households sampled
Seijosa	8	70
Pakke kessang	7	55
Segalee	15	77
Seppa	5	49
ITWLS	6	31
Naumura	4	49
Apatani valley	4	40
Total	49	371

Among the villages sampled only one village (Sabba) refused to answer questions pertaining to wild life conflict.

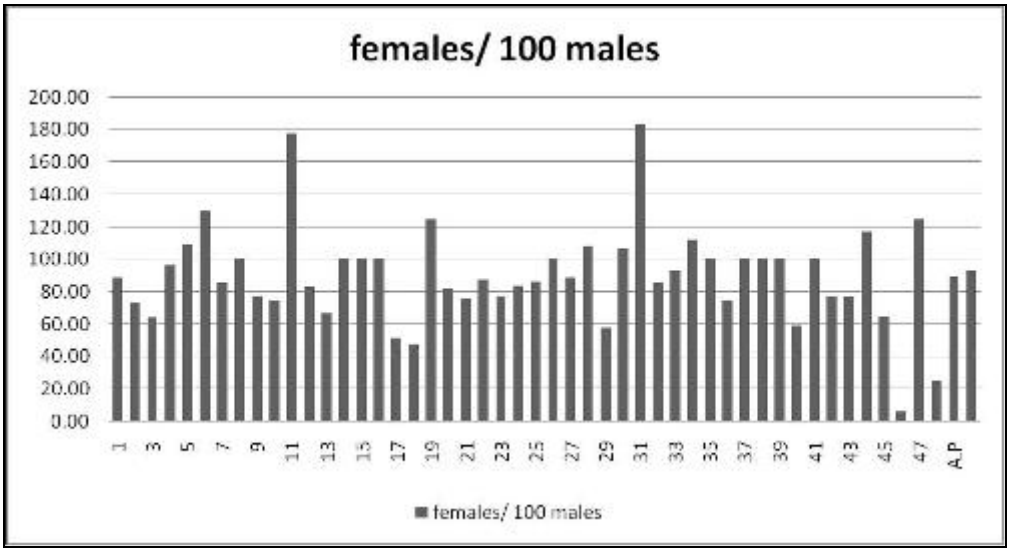
Fig 2a. Movable assets of households sampled.



Note: PTR means Seijosa, Kessang means Pakke Kesang, ITWLS means Itanagar wildlife sanctuary

Cycles were found to be widely used as a means of transport for much of the local commuting in Seijosa, Naumura (>20%) and Segalee (>25%). In Seppa area though motorcycles were higher comparatively. In all the areas viz. Seijosa, Naumura, Seppa, ITWLs and Segalee showed motorcycles being used widely i.e above 15% households reported owning one. Though Pakke Kesang and Apatani valley had lesser average. Segalee showed a much more variety of motor transport available with at least 2% of the respondents owning a vehicle.

Fig 2b: Age and sex composition of villages sampled.

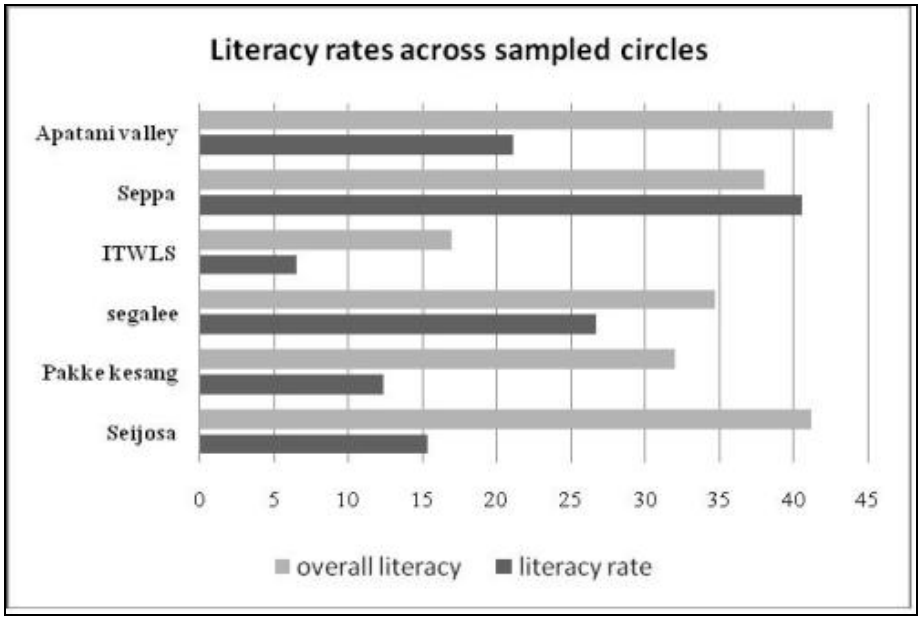


1.A2 block 2. Mabuso 3.Darlong 4.lower Bali 5.upper Bali 6.Bali Basti 7. Langding 8. Jarjee 9. Sango 10. Leporiang 11.bubia 12. Kamlang 13. Segalli 14. Gotupi 15 hajye rangpa 16 rissing 17 Rakap 18 Poma 19 Reelo 20. Defra 21. Rakap 22. Kamir 23. Lanka 24. Joly 25. Thohar bura 26. Yarte Pobe 27. Alang tapte 28. Wesi 29. Rahang 30. Sede 31. Hija 32. Kalung 33. Hari 34. Hong 35. Nepa cheda 36. Tatatra 37. Sechung 38. Pakke kesang 39. Bazaar line 40. Palap 41. Upper Baliso 42. Baliso 43. Dipik 44. Taraso 45. Digalmukh 46.Khodaso 47. Keko 48. Langpung

The sex ratio of females per 100 males was found to be much higher compared to the state average of 843 females per 1000 males in cases of Bubia and Hija (above 160%). Though low rates were observed in case of Khodaso and Langpung (below 20% and 25% respectively). Reelo also recorded a higher ratio of 120%.

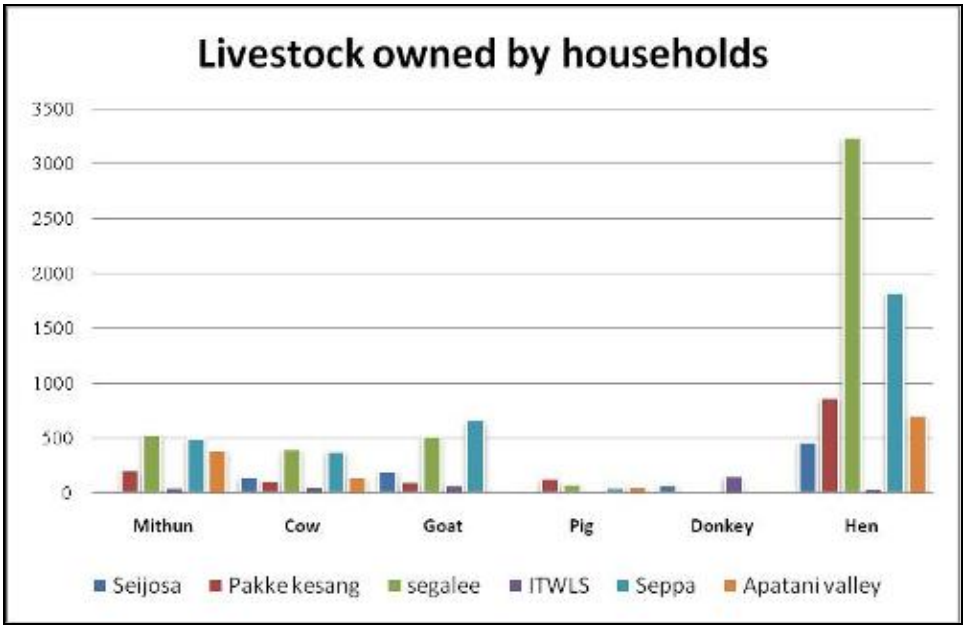
Literacy rates of adults only fared closer to the state average of 54.74% while others recorded lower rates. All other adult literacy rates fared lower than 25%. The overall literacy rates of Apatani valley, Seppa and Seijosa were above 35%. The Lowest being that ITWLS followed by Pakke kesang and Segalee.

Fig 3: Literacy rates across circle in percentage.



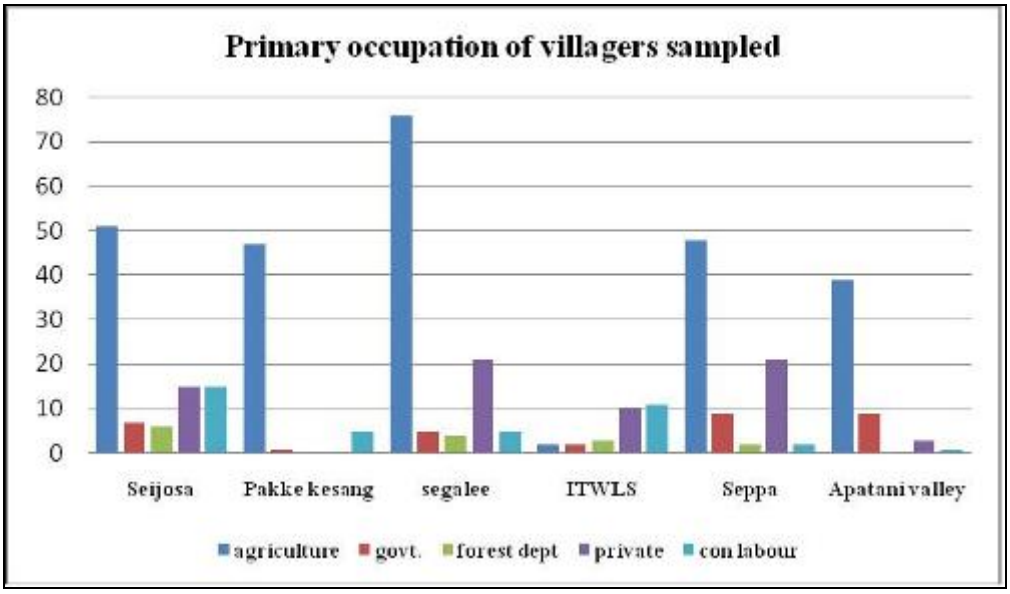
Note: Sabba not included in calculation of literacy rate

Fig 4: Livestock ownd by individuals in different circles sampled.



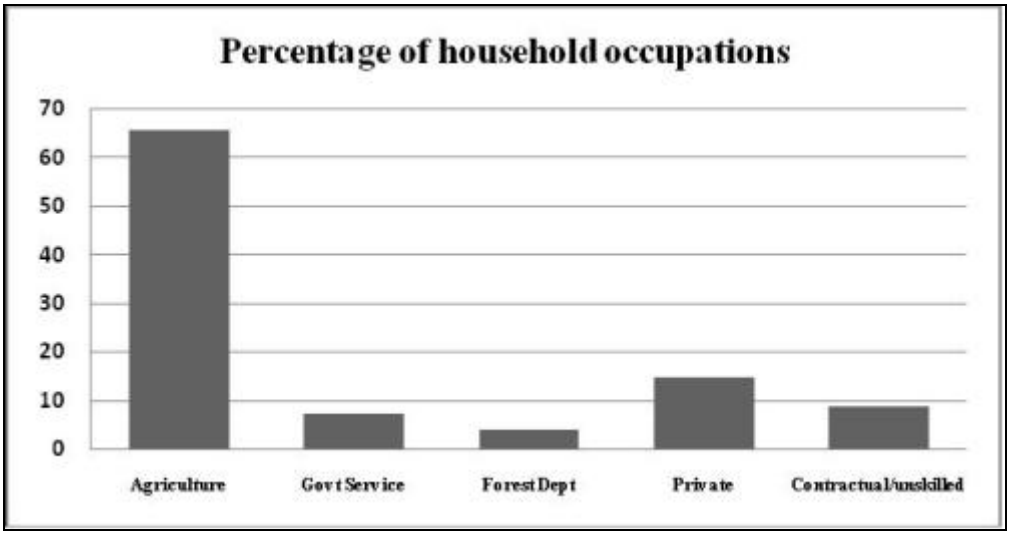
Pakke Kesang, Segalee and Seppa had high Mithun populations reared by locals. Seijosa had none rearing Mithun along with Naumura. Cows were more preferred livestock. Chicken and pig were common in most households but in low numbers. The highest chicken numbers were recorded from Segalee followed by Seppa.

Fig 6: Graph showing primary occupation of people in villages sampled circle-wise.



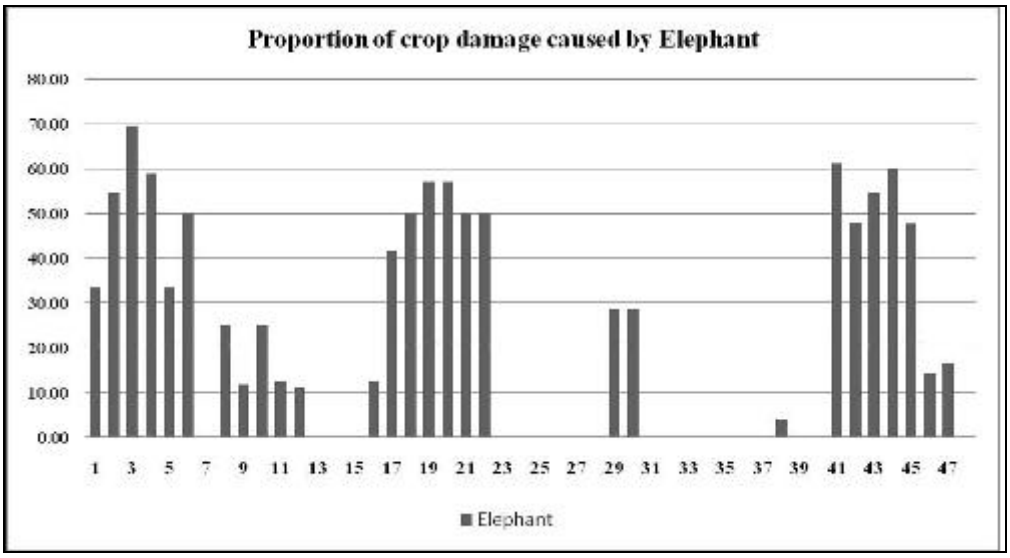
The primary occupation of people in different areas was agriculture both in permanent as well as *jhum* form. The next was private business or contractual labour which would amount to annual incomes of Rs. 2500-3000 monthly. Apatani valley shows a lower agriculture based economy and higher government based appointments. In Seijosa and Segalee considerable appointments are due to the forest department.

Fig7: Occupation in percentage of households sampled.



Conflict Status in Western Arunachal Pradesh: Crop Damage.

Fig7: Graph showing crop damage by elephant proportionally.

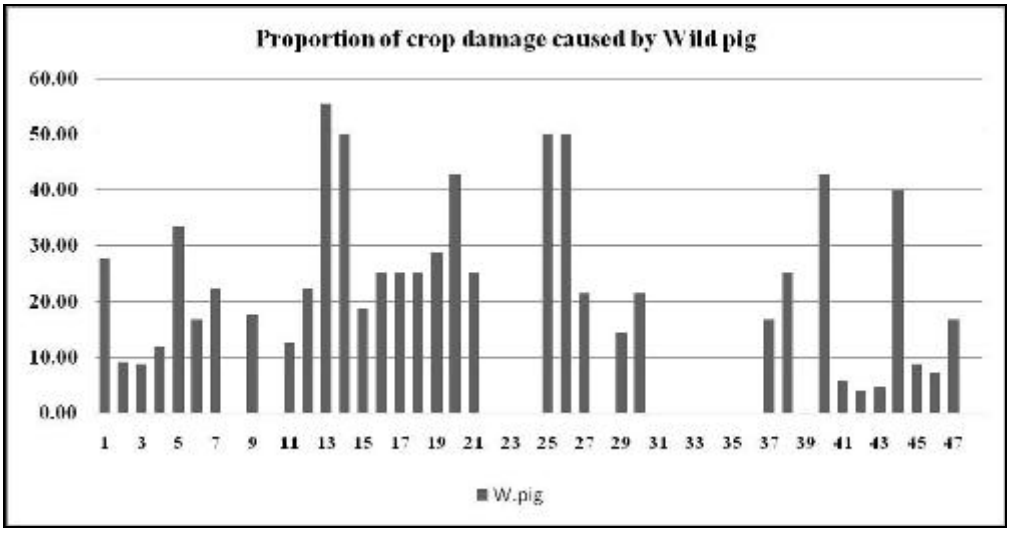


1.A2 block 2. Mabuso 3.Darlong 4.lower Bali 5.upper Bali 6.Bali Basti 7. Langding 8. Jarjee 9. Sango 10. Leporiang 11.bubia 12. Kamlang 13. Segalli 14. Gotupi 15 hajye rangpa 16 rissing 17 Rakap 18 Poma 19 Reelo 20. Defra 21. Rakap 22. Kamir 23. Lanka 24. Joly 25. Thohar bura 26. Yarte Pobe 27. Alang tapte 28. Wesi 29. Rahang 30. Sede 31. Hija 32. Kalung 33. Hari 34. Hong 35. Nepa cheda 36. Tatatra 37. Sechung 38. Pakke kesang 39. Bazaar line 40. Palap 41. Upper Baliso 42. Baliso 43. Dipik 44. Taraso 45. Digalmukh 46.Khodaso 47. Keko 48. Langpung

Crop damages caused by elephant are a serious problem in many places. Villages in Seijosa, Naumura and parts of Segalee showed much proportion (> 30%) of crop damage by elephants. While areas like Seppa and Apatani valley showed relatively no damage by elephants. High damages by elephants were caused by villages Darlong, Mabuso, Bali, Upper Baliso, Reelo, Defra, Dipik, Digalmukh, Baliso and Taraso.

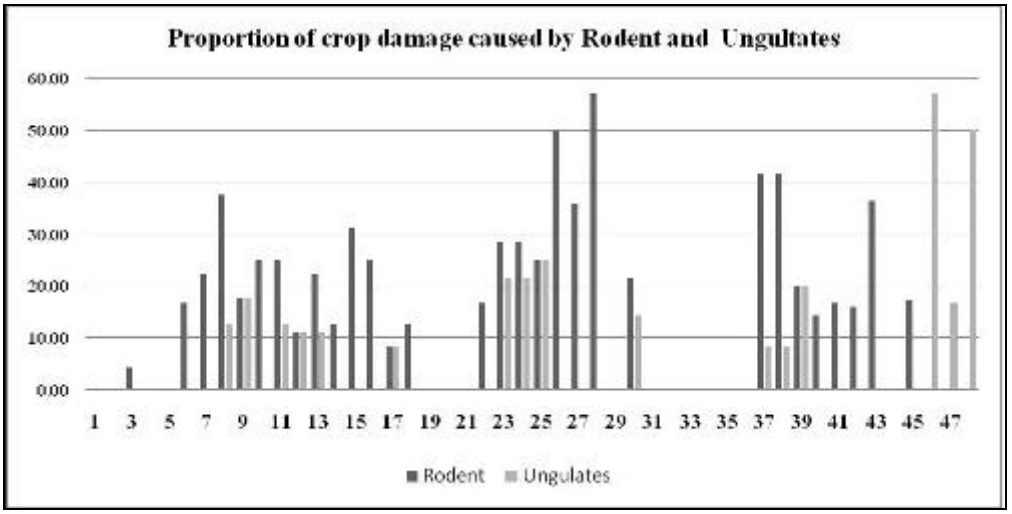
Villages Thohar Bura, Palap, Segalee, Gotupi, Yarte pobe and Taraso showed high damages by Wild pigs. Jarjee, Tatatra,Kamir, Lanka, Joly, Hija, Kalung, Hari, Hong, Nepa cheda, Leporiang show no damages due to wild pigs. Similarly Rodents caused crop damages in similar areas. Ungulates though showed much higher damages in Langpung, Keko and Khodaso.

Fig8: Graph showing crop damage by wild pig proportionally.



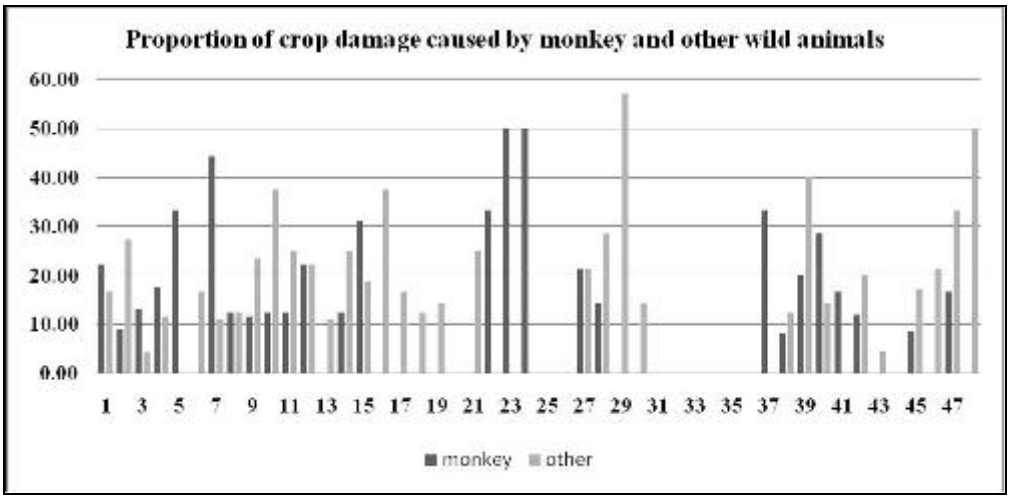
Note: Calculated asspecific animal damage case/ total damage cases for fig.7,8, 9 & 10.

Fig9: Graph showing crop damage by rodents and ungulates proportionally.



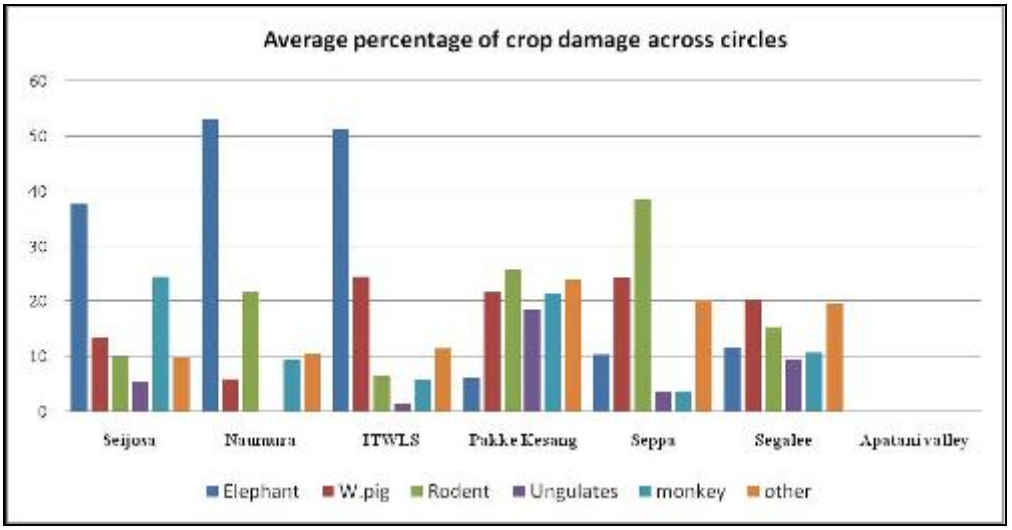
1.A2 block 2. Mabuso 3.Darlong 4.lower Bali 5.upper Bali 6.Bali Basti 7. Langding 8. Jarjee 9. Sango 10. Leporiang 11.bubia 12. Kamlang 13. Segalli 14. Gotupi 15 hajye rangpa 16 rissing 17 Rakap 18 Poma 19 Reelo 20. Defra 21. Rakap 22. Kamir 23. Lanka 24. Joly 25. Thohar bura 26. Yarte Pobe 27. Alang tapte 28. Wesi 29. Rahang 30. Sede 31. Hija 32. Kalung 33. Hari 34. Hong 35. Nepa cheda 36. Tatatra 37. Sechung 38. Pakke kesang 39. Bazaar line 40. Palap 41. Upper Baliso 42. Baliso 43. Dipik 44. Taraso 45. Digalmukh 46.Khodaso 47. Keko 48. Langpung

Fig10: Graph showing crop damage by monkey and other wild animals proportionally.



25 villages did not record and damage due to monkey and other primates. A2, Upper Bali, Bali, Kamir, Lanka, Joly, Sechung and Palap had damages (>20%) caused by monkeys. Other animals that caused damage include birds, insects etc.

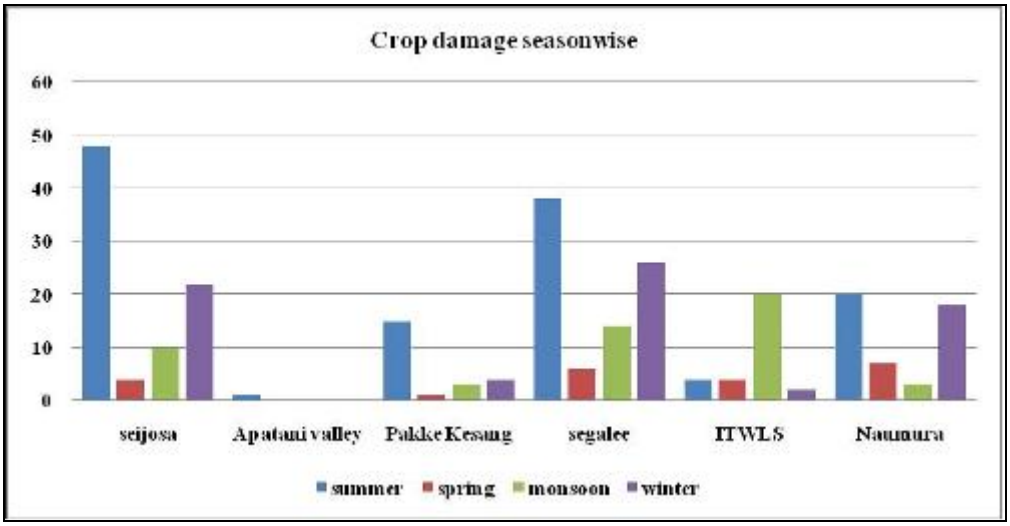
Fig 11. Graph showing percent crop damage blockwise by wild animals.



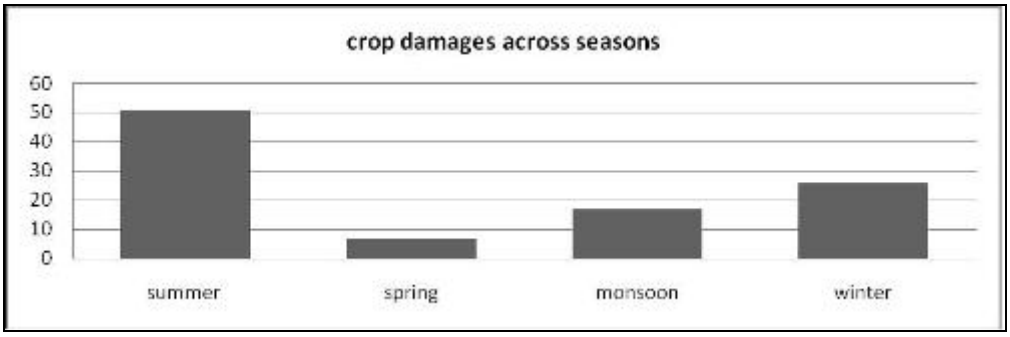
Note: Calculated as sum of specific percent animal damage cases per area devided by number of vilages of the area Apatani valley no cases

As mentioned earlier Elephants caused much of the crop damage (Fig 10) in Seijosa, followed by monkeys, Wild pigs, others, Rodent and wild ungulates. In Pakke Kesang, Rodents affected much of the fields followed by wild pig. Wild ungulates, monkey and others fared much similar proportions to damage caused. Segalee showed more damages due to wild pig and others. ITWLS showed much of the damages caused by elephants and wild pigs. Seppa recorded damages due to rodents and wild pigs namely. Apatani valley showed no crop damage caused by wild animals. Seasonality of damage was recorded mainly in the summer followed by winter (Fig 11).

Fig 11. Crop damage according to season in different blocks.

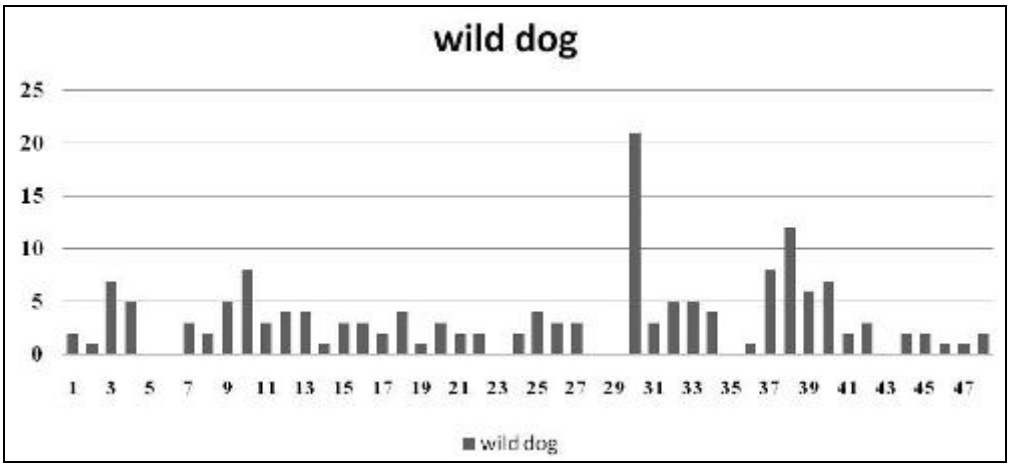


Note: Apatani valley no cases were reported



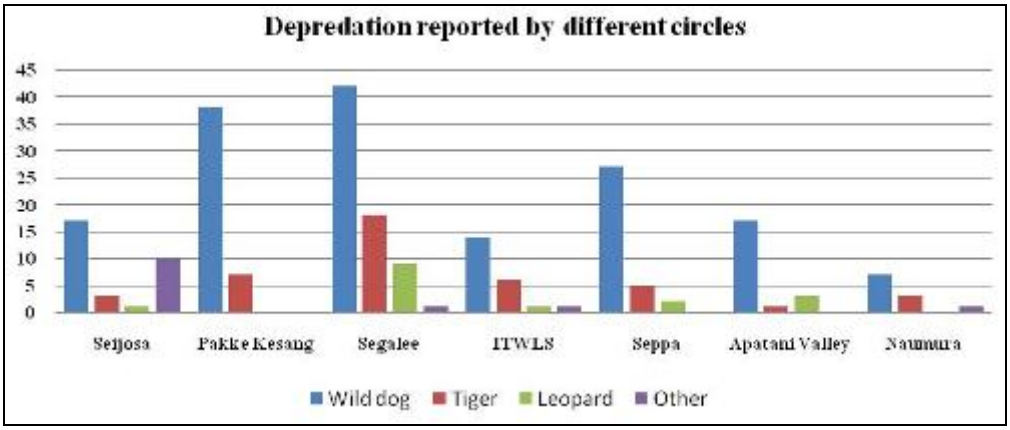
Conflict Status in Western Arunachal Pradesh: Livestock depredation.

Fig 12. Cases on Livestock depredation by wild dog reported in villages sampled



1.A2 block 2. Mabuso 3.Darlong 4.lower Bali 5.upper Bali 6.Bali Basti 7. Langding 8. Jarjee 9. Sango 10. Leporiang 11.bubia 12. Kamlang 13. Segalli 14. Gotupi 15 hajye rangpa 16 rissing 17 Rakap 18 Poma 19 Reelo 20. Defra 21. Rakap 22. Kamir 23. Lanka 24. Joly 25. Thohar bura 26. Yarte Pobe 27. Alang tapte 28. Wesi 29. Rahang 30. Sede 31. Hija 32. Kalung 33. Hari 34. Hong 35. Nepa cheda 36. Tatatra 37. Sechung 38. Pakke kesang 39. Bazaar line 40. Palap 41. Upper Baliso 42. Baliso 43. Dipik 44. Taraso 45. Digalmukh 46.Khodaso 47. Keko 48. Langpung

Fig 13. Livestock depredation by different species as reported by villages in different circles sampled.



High depredation rates were reported from villages Sede, Sechung, Pakke Kesang, Bazaar line and Palap. Bali, Lanka, Wesi, Rahang, Nepa Cheda and Dipik reported no Depradation by wild dogs (Fig 12). Even in different circles wild dog was found to be the animal to have depredated mostly follower\d by tiger and leopard. In Pakke Kesang, Segalee and Seppa depredation is very high.

In Pakke Kesang shows (Fig. 14) high wilddog depredation of Mithun followed by segalee, ITWLS and then Apatani valley. Naumura has no records of wild dog depredation above 5. In Seijosa main depredation in that of smaller livestock like chicken etc. ITWLS, Apatani valley and Naumura show no other conflict in terms of depredation.

Fig 14: Different livestock depredated in 2008, 2009 & 2010 in different circles as reported by sampling.

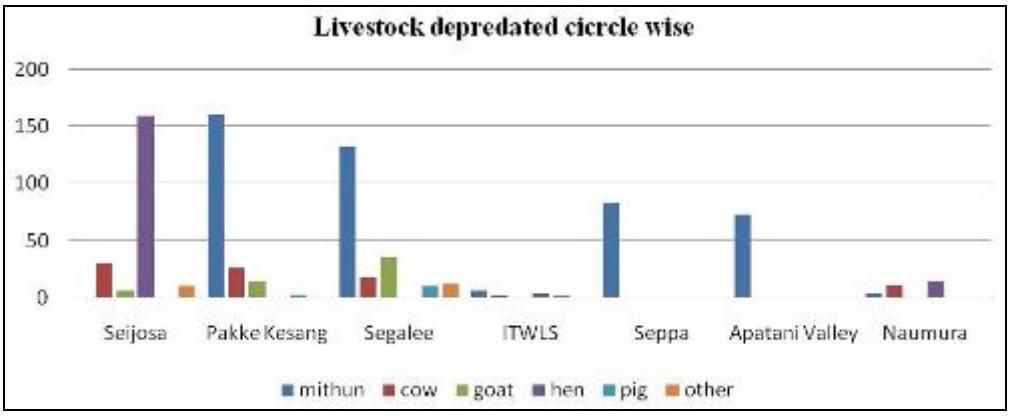
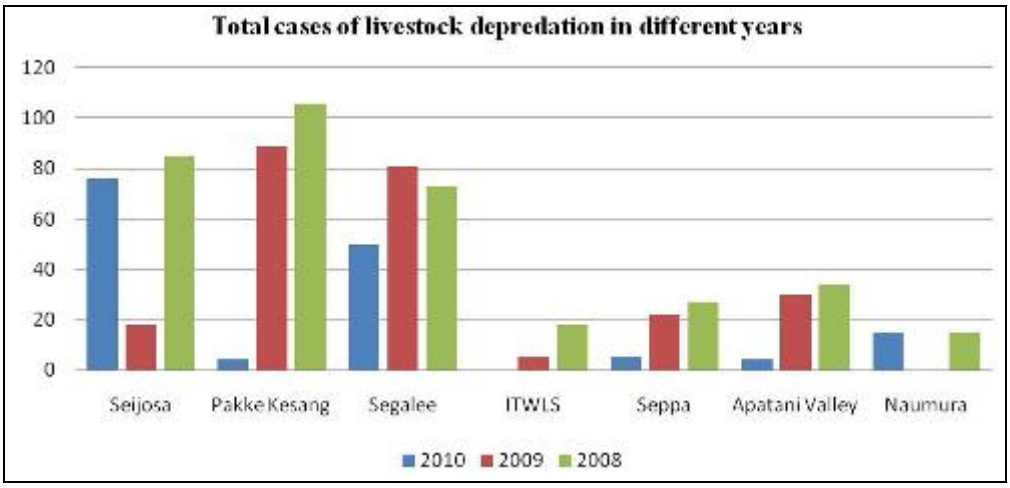
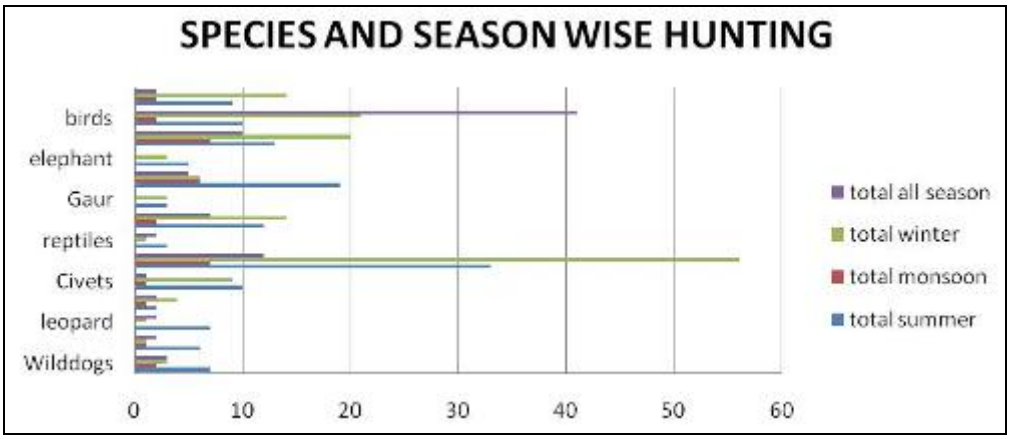


Fig 15: Number of livestock depredated in 2008, 2009 &2010 as reported by sampling.



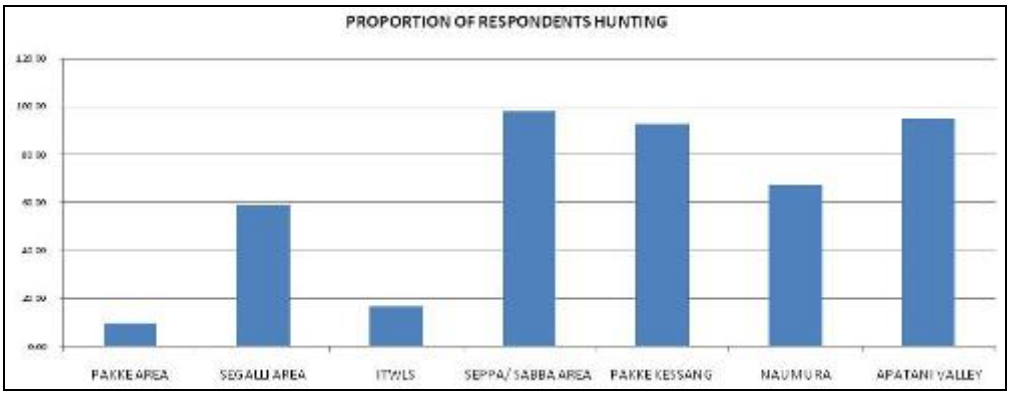
Conflict Status in Western Arunachal Pradesh: Hunting Pressure.

Fig 16: Hunting pressure arranged species wise along the seasons.



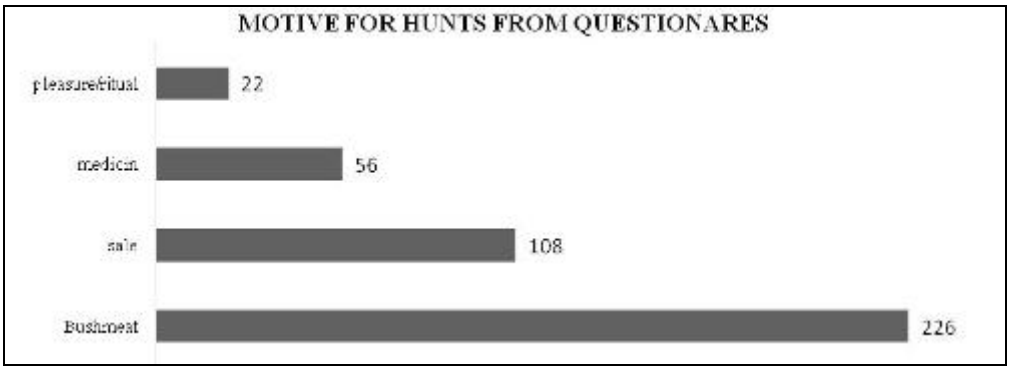
Most of the hunting (Fig 16.) activities were concentrated during winter and early summer. Except for a bird species they were hunted throughout the year. Hunting for deer is high during winters and contributes to nearly 60% of the hunting effort. Wild pig figured next in the list of preferred hunted mammal as well as bear. Wild dogs, Tiger and leopard were hunted during summer. Seppa, Pakke Kesang, Naumura and Apatani valley respondents showed that above 60% hunted wild animals in some other form. Others like Segalee , Seijosa (Pakke area) and ITWLS showed lower hunting activity by people (Fig 17.).

Fig 17: Proportion of hunting actively among the sampled households in different circles.



Most of the hunting activity was for the consumption of bush meat as 226 respondents reported to hunt for wild meat. Sale was the second best reason for hunting along with local consumption.

Fig 18: Motive for hunting among different respondents irrespective whether hunt or not.



Tiger were reported to have been hunted in many areas of Seppa and Pakke Kesang. While deer meat figured in most areas to be hunted commonly followed by birds and monkeys. Elephants figured in hunting by Naumura region (Fig 19).

Fig 19: Animal hunted most in different circles sampled.

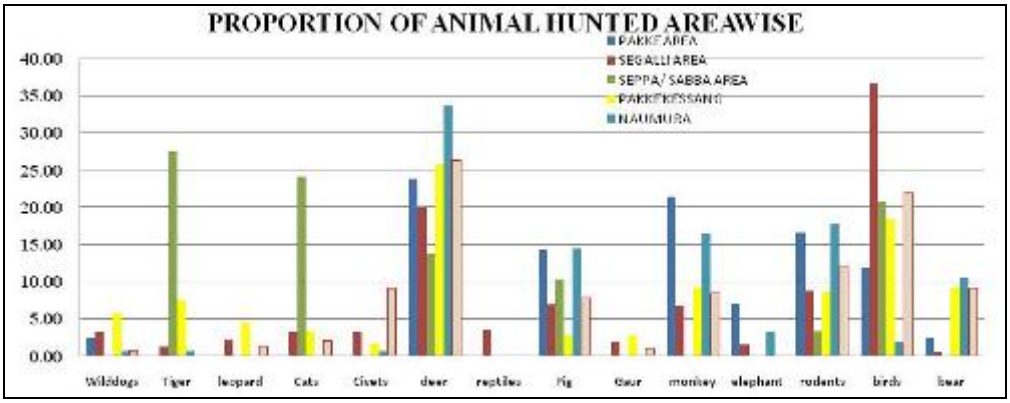


Table 2. Attitudes of respondents in percentages.

	Yes	No	Can't say
a) Are aware of wild-dog population declining?	67.23	24.58	8.19
	Yes	No	Can't say
b) What do you think about the decline?	56.35	30.16	13.4
	Yes	No	Can't say
c) Are you aware that fuel wood extraction is causing harm to forest?	51.92	24.73	23.35
	Yes	No	
d) Has the Govt. been helpful to WL conflict situations	36.29	63.71	
	Good	Bad	Indifferent
e) How is your perception towards Wildlife/ Forest Dept?	37.72	13.16	49.11
	Yes	No	Can't say
f) Would you use Gas as a substitute for fuel wood?	51.39	29.37	19.24
	Yes	No	Can't say
g) Do you know hunting is bad?	76.24	8.01	15.75
	Yes	No	Can't say
h) Are you aware the wild animal population is declining?	77.36	7.82	14.82
	Yes	No	Can't say
i) Don't you think its bad?	70.77	10.93	18.31
	<Rs.150	Rs. 150-200	Rs.200-300
j) How much would you pay for LPG?	85.84	8.67	5.49

3.5 Discussion: The main mode of transport of the people was found to be cycles. Motorcycles were the next owned mode of transport that was common in the areas sampled except for Apatani valley. Due to bad roads and remoteness of the villages these two modes were found to be the most used machine that was used. With respect to the sex ratio, low sex ratios were seen in most cases even though either cultures or communities practice polygamy. Literacy rates confirm that much of the villages survive with basic knowledge and heavily rely on traditional practices.

Livestock owned by households (Fig 4) also show that the primary occupation is herding and rearing of cattle along with agricultural practices. Mithun is the prime livestock owned by the people. In lower elevation which cannot support it, the animal is substituted more often by cows. Pig and chicken are common throughout many households. As mentioned earlier, primary occupation of agriculture among al the four areas is seen. The local people heavily rely on their own produce for sustenance. Comparatively very few numbers of employment at any other occupation or organization.

Depredation occurred at varying levels throughout the circles and villages visited. Naumura recorded very low levels of livestock depredation. Also it has to be noted that this area has more anthropogenic influences comparatively to the other areas. Primarily areas located at close proximity to mature forests were Seijosa, Pakke Kesang and Segalee. These showed higher depredation rates of cow, Mithun and goat. Seppa and Apatani valley recorded *mithun* depredation rates mostly. This could be particularly due to the fact that *mithun* is a semi domesticated animal which regularly visits forested areas. Further grazing patterns of feral *mithun* have to be investigated. Depredation over the years has been lower compared to 2010. This could be explained as a case of loss of information since many respondents

would have not remembered incidents of depredation over a year clearly. Wild dogs were considered to be the main predators of peoples livestock followed by tiger and leopard.

Hunting of wild animals is prohibited my laws of the state but in the case of Arunachal Pradesh these laws are almost ignored (Datta *et al*, 2006). Pakke area which includes Pakke tiger reserve has much better law enforcement around its areas, hence hunting activities are restricted. Itanagar wild life sanctuary (ITWLS) area is relatively higher disturbed than other areas since it also houses the state capital. These reasons could contribute to its lower hunting pressure. Other areas ie. Segalli, Seppa, Apatani valley and Pakke Kesang have very high proportion of respondents hunting (above 50%). More investigation onto the real driving factors of hunting in these areas will determine as to the exact factors which determine hunting effort and frequency as well as abundance. Respondents normally hunted for bushmeat. Some of the meat was sold though ost of it was for local consumption. Deer meat and bird meat was the most hunted. Rodents and other figured less in hunting importance. Snares, traps, poison and guns were used for hunting mainly.

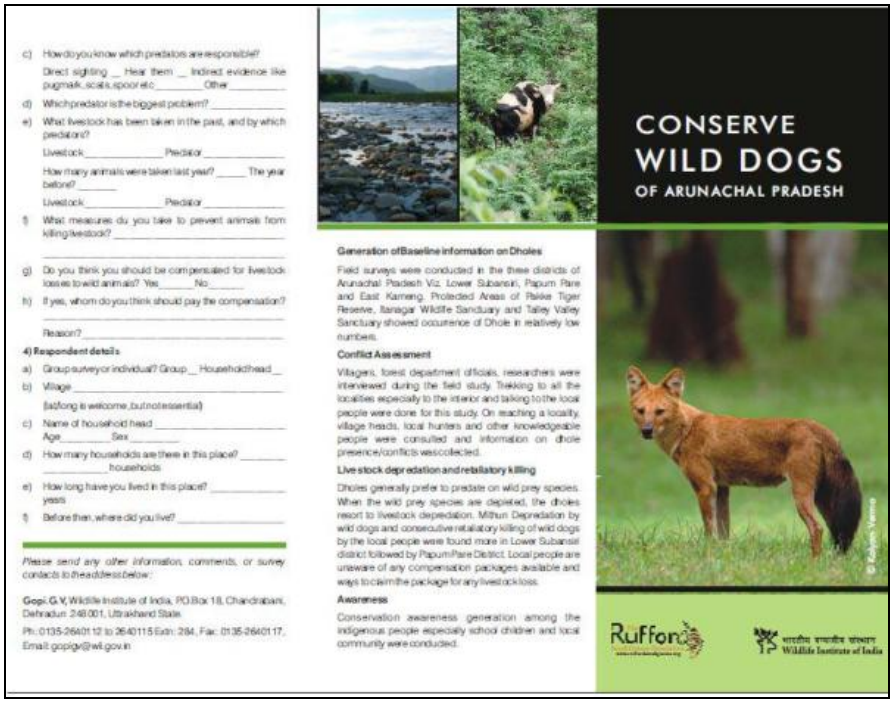
When assessing the local attitudes of people, most were aware of declining wild dog population and fared it as a welcome thing since wild dogs are the main predators which depredate on *mithun.* Even though the people who lived in the villages primarily depended on the forest resources for fuel wood and other biomass, they were aware that this extraction was causing harm to the forest but also replied that it was a necessity since no LPG/ Gas was available for them. If given chance many of them were willing to pay at a subsidized rate, though winters would be still dependent of fuel wood for battling the cold. Also many villages reported to have no electricity and were completely dependent on solar systems or fuel wood. As regards to perceptions towards hunting, most of respondents felt it was a necessary evil if conducted throughout the season and rampantly. Wild population decline was noticed by most of the villagers. Nearly 70% of the respondents considered this unhealthy since it would mean lesser wild meat consumption for them.

CHAPTER 4

Conservation Education and Awarnes Programme

-Gopi.G.V, Muthamizh Selvan.K and Salvador Lyngdoh

4.1 Over 1000 nos brochures which were widely circulated.



c) How do you know which predators are responsible?
Direct sighting __ Hear them __ Indirect evidence like pugmark, scats, spoor etc _____ Other _____
d) Which predator is the biggest problem? _____
e) What livestock has been taken in the past, and by which predators?
Livestock _____ Predator _____
How many animals were taken last year? _____ The year before? _____
Livestock _____ Predator _____
f) What measures du you take to prevent animals from killing livestock? _____
g) Do you think you should be compensated for livestock losses to wild animals? Yes_____No_____
h) If yes, whom do you think should pay the compensation?
Reason? _____

4) Respondent details

a) Group survey or individual? Group __ Household head __
b) Village _____
(list)long is welcome ,but not essential)
c) Name of household head _____
Age_____Sex _____
d) How many households are there in this place? _____ _____households
e) How long have you lived in this place? _____ years
f) Before then, where did you live? _____

Please send any other information, comments, or survey contacts to the address below:

Gopi. G. V, Wildlife Institute of India, P.O.Box 18, Chandrabani, Dehradun 248 001, Uttrakhand State.
Ph.: 0135-2640112 to 2640115 Extn: 284 , Fax: 0135-2640117.
Email: gopigv@wii.gov.in

Generation of Baseline information on Dholes

Field surveys were conducted in the three districts of Arunachal Pradesh Viz. Lower Subansiri, Papum Pare and East Kameng. Protected Areas of Pakke Tiger Reserve, Itanagar Wildlife Sanctuary and Talley Valley Sanctuary showed occurrence of Dhole in relatively low numbers.

Conflict Assessment

Villagers, forest department officials, researchers were interviewed during the field study. Trekking to all the localities especially to the interior and talking to the local people were done for this study. On reaching a locality, village heads, local hunters and other knowledgeable people were consulted and information on dhole presence/conflicts was collected.

Live stock depredation and retaliatory killing

Dholes generally prefer to predate on wild prey species. When the wild prey species are depleted, the dholes resort to livestock depredation. Mithun Depredation by wild dogs and consecutive retaliatory killing of wild dogs by the local people were found more in Lower Subansiri district followed by Papum Pare District. Local people are unaware of any compensation packages available and ways to claim the package for any livestock loss.

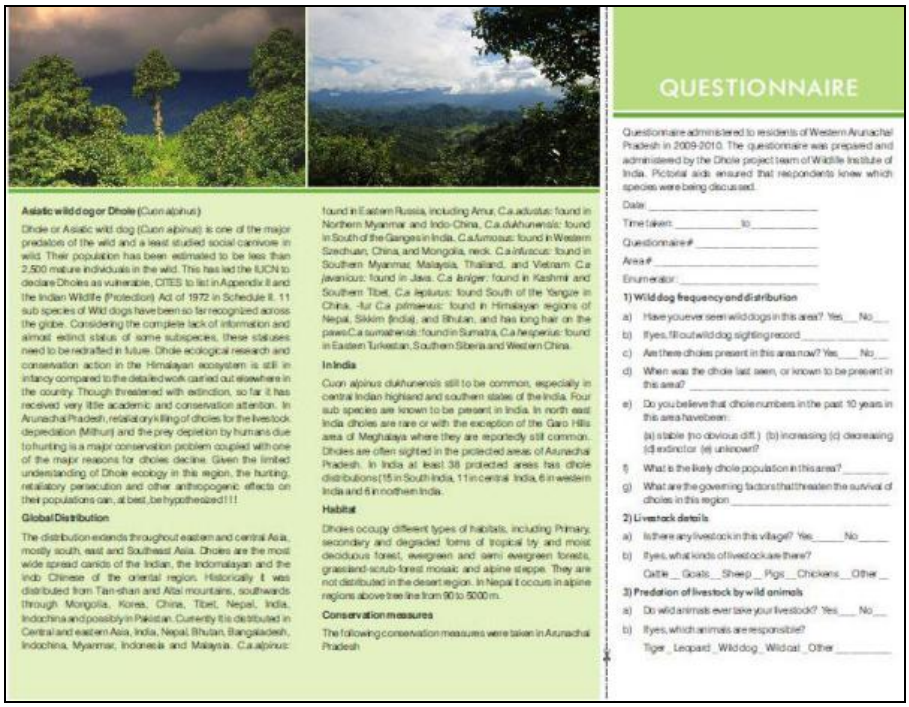
Awareness

Conservation awareness generation among the indigenous people especially school children and local community were conducted.

CONSERVE
WILD DOGS
OF ARUNACHAL PRADESH

Ruffords

भारतीय वन्यजीव संस्थान
Wildlife Institute of India



Asiatic wild dog or Dhole (*Cuon alpinus*)

Dhole or Asiatic wild dog (*Cuon alpinus*) is one of the major predators of the wild and a least studied social carnivore in wild. Their population has been estimated to be less than 2,500 mature individuals in the wild. This has led the IUCN to declare Dholes as vulnerable, CITES to list in Appendix II and the Indian Wildlife (Protection) Act of 1972 in Schedule II. 11 sub species of Wild dogs have been so far recognized across the globe. Considering the complete lack of information and almost extinct status of some subspecies, these statuses need to be redrafted in future. Dhole ecological research and conservation action in the Himalayan ecosystem is still in infancy compared to the detailed work carried out elsewhere in the country. Though threatened with extinction, so far it has received very little academic and conservation attention. In Arunachal Pradesh, retaliatory killing of dholes for the livestock depredation (Mithun) and the prey depletion by humans due to hunting is a major conservation problem coupled with one of the major reasons for dholes decline. Given the limited understanding of Dhole ecology in this region, the hunting, retaliatory persecution and other anthropogenic effects on their populations can, at best, be hypothesized !!!

Global Distribution

The distribution extends throughout eastern and central Asia, mostly south, east and Southeast Asia. Dholes are the most wide spread canids of the Indian, the Indomalayan and the Indo Chinese of the oriental region. Historically it was distributed from Tan-shan and Altai mountains, southwards through Mongolia, Korea, China, Tibet, Nepal, India, Indochina and possibly in Pakistan. Currently it is distributed in Central and eastern Asia, India, Nepal, Bhutan, Bangladesh, Indochina, Myanmar, Indonesia and Malaysia. *C.a.alpinus*: found in Eastern Russia, including Amur, *C.a.adustus*: found in Northern Myanmar and Indo-China, *C.a.dukhunensis*: found in South of the Ganges in India, *C.a.fumosus*: found in Western Szechuan, China, and Mongolia, neck. *C.a.infuscus*: found in Southern Myanmar, Malaysia, Thailand, and Vietnam. *C.a javanicus*: found in Java. *C.a.laniger*: found in Kashmir and Southern Tibet. *C.a.lepturus*: found South of the Yangze in China. -fur *C.a.primaevus*: found in Himalayan regions of Nepal, Sikkim (India), and Bhutan, and has long hair on the paws.*C.a sumatrensis*: found in Sumatra, *C.a hesperus*: found in Eastern Turkestan, Southern Siberia and Western China.

In India

Cuon alpinus dukhunensis still to be common, especially in central Indian highland and southern states of the India. Four sub species are known to be present in India. In north east India dholes are rare or with the exception of the Garo Hills area of Meghalaya where they are reportedly still common. Dholes are often sighted in the protected areas of Arunachal Pradesh. In India at least 38 protected areas has dhole distributions (15 in South India, 11 in central India, 6 in western India and 6 in northern India.

Habitat

Dholes occupy different types of habitats, including Primary, secondary and degraded forms of tropical dry and moist deciduous forest, evergreen and semi evergreen forests, grassland-scrub-forest mosaic and alpine steppe. They are not distributed in the desert region. In Nepal it occurs in alpine regions above tree line from 90 to 5000 m.

Conservation measures

The following conservation measures were taken in Arunachal Pradesh

QUESTIONNAIRE

Questionnaire administered to residents of Western Arunachal Pradesh in 2009-2010. The questionnaire was prepared and administered by the Dhole project team of Wildlife Institute of India. Pictorial aids ensured that respondents knew which species were being discussed.

Date: _____
Time taken: _____to_____
Questionnaire# _____
Area# _____
Enumerator: _____

1) Wild dog frequency and distribution

a) Have you ever seen wild dogs in this area? Yes___No___
b) If yes, fill out wild dog sighting record _____
c) Are there dholes present in this area now? Yes___No___
d) When was the dhole last seen, or known to be present in this area? _____
e) Do you believe that dhole numbers in the past 10 years in this area have been:
(a) stable (no obvious diff.) (b) increasing (c) decreasing (d) extinct or (e) unknown?
f) What is the likely dhole population in this area? _____
g) What are the governing factors that threaten the survival of dholes in this region _____

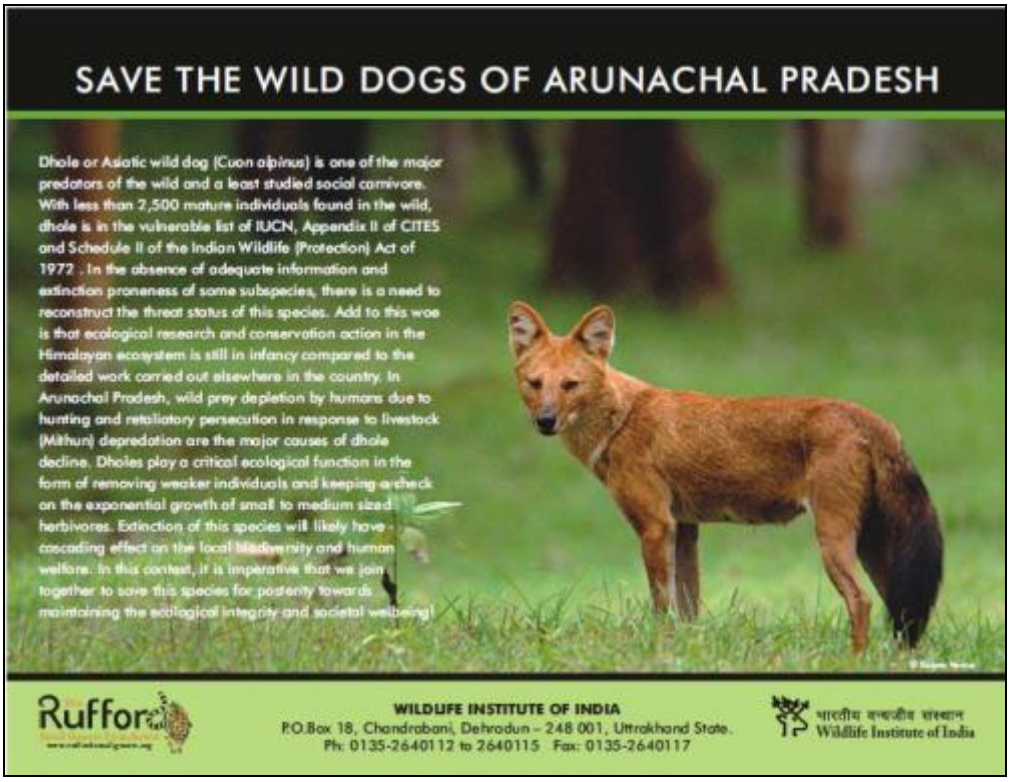
2) Livestock details

a) Is there any livestock in this village? Yes_____No_____
b) If yes, what kinds of livestock are there?
Cattle__Goats__Sheep__Pigs__Chickens__Other__

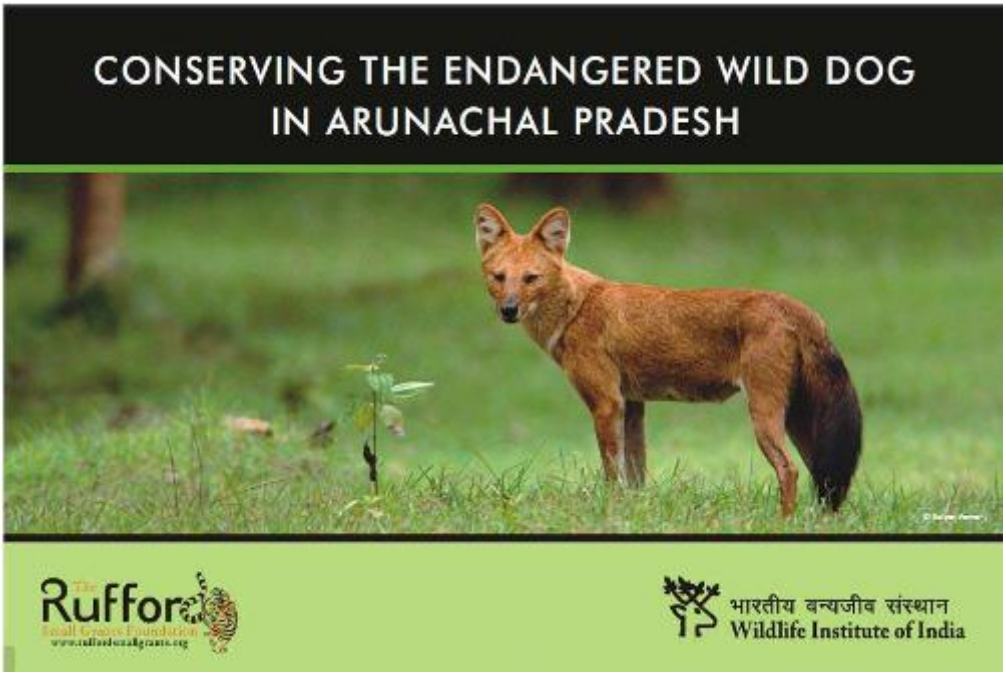
3) Predation of livestock by wild animals

a) Do wild animals ever take your livestock? Yes___No___
b) If yes, which animals are responsible?
Tiger_Leopard_Wild dog_Wild cat_Other _____

4.2 Over 1000 nos of posters that were widely circulated.



4.3 Printed Banner and used for stake holders workshops.



4.4 Stake holders awareness workshops.

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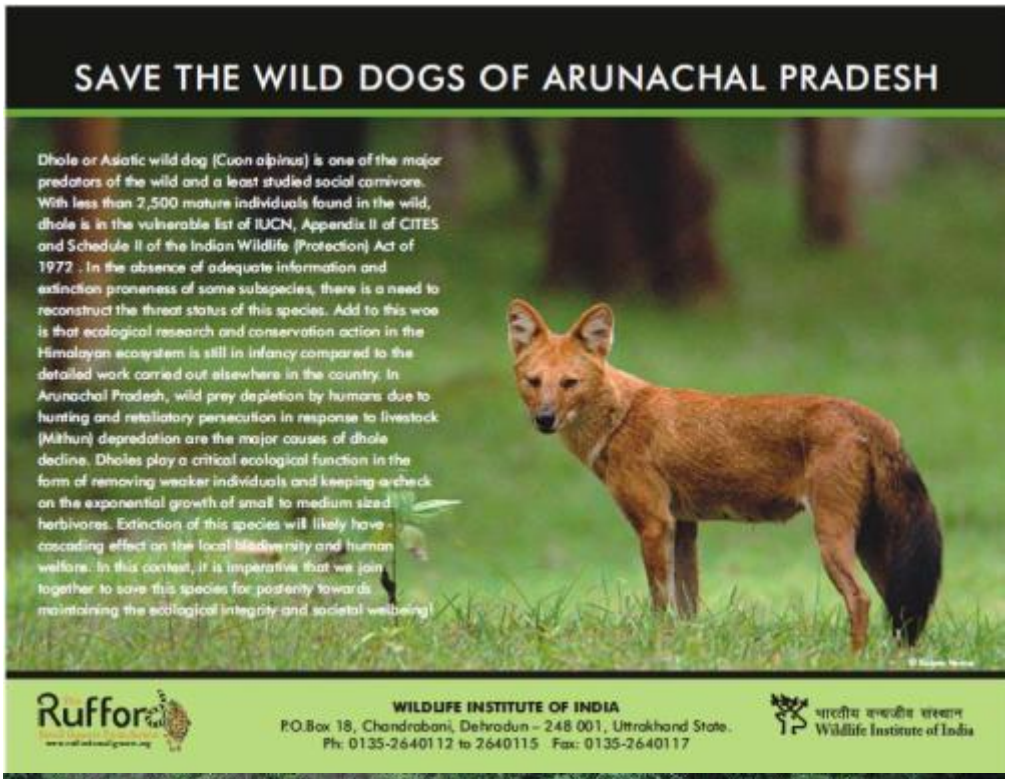

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