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## Habitat preference and biotic pressure of four horned antelope in Sathyamangalam Wildlife sanctuary, Tamil Nadu, Southern India

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### Abstract

Habitat preference of Four-horned Antelope *Tetracerus quadricornis* was studied at Sathyamangalam Wildlife sanctuary. A grid based approach was followed to find out the habitat preference. Due to shy nature and small size of the animal make sightings difficult, so indirect signs also taken into consideration when assessing their preference of habitat. Both direct sightings and indirect signs locations were plotted and prepared a distribution map. The majority of the records (~72%) were on hill/nulla slopes; however this may be due to the terrain being largely composed of such areas. Flat and open areas had only 28% of the records. The encounter rate for signs/sightings was 1.71/km in the open habitat and it was much lower (0.25/km) in the fairly dense forests. Four-horned Antelopes largely prefer open habitat and appear to avoid dense areas.

**Keywords:** Four horned antelope, Sathyamangalam, distribution, southern India

### Introduction

Four horned Antelope (*Tetracerus quadricornis*) is only member of this group with two pairs of horns of which front pair is always shorter than the back (Prater, 1971)<sup>[9]</sup>. Males have horns whereas in females horns are absent. It is a small among antelope community and dull light brown in colour. It has pre-orbital glands (Sharma and Rahmani, 2004) and well developed glands between the false hooves of the hind legs (Prater, 1971; Krishna *et al.*, 2009)<sup>[9, 7]</sup>. It is an endemic to the Indian subcontinent. Approximately 95% of its current global population occurs in India (Rahmani, 2001), with the remaining 5% found in Nepal (Shreshta, 2001 & Krishna *et al.*, 2009)<sup>[7]</sup>. It is distributed in Peninsular India south to the Himalayas where the country is wooded and hilly, but not too densely forested areas (Prater, 1971)<sup>[9]</sup>. The four horned antelope prefers the dry deciduous forests in hilly areas with open canopy (Baskaran, 2009)<sup>[11]</sup> and tree-savanna deciduous habitat sub type with a high degree of deciduousness (Krishna, 2009)<sup>[7]</sup>. It has been reported that the four-horned antelopes are distributed in all of the Indian States south from Uttar Pradesh except Kerala (Rice, 1990).

Four horned antelope is not gregarious and rarely seen more than two individuals together (Baskaran *et al.*, 2009)<sup>[11]</sup>. It is sedentary and inhabits the same region throughout their lives. Unlike most other species, the four-horned antelope does not appear very mobile, the fixed defecation sites indicates that these antelope could be territorial and localized, therefore limiting or reducing the rate of flow of genetic material within the population (Baskaran *et al.*, 2009)<sup>[11]</sup>. Despite being widely distributed in India, this species has received very little scientific attention. A review of literature shows that the species is generally given only a brief treatment in accounts of multi-species studies (Krishnan, 1972; Sharatchandra and Gadgil, 1975; Schaller, 1987; Karanth and Sunquist, 1992). A community study on wild ruminants in the Gir forest ecosystem by Berwick (1974) was the first study that furnished information on population density, age structure, and food consumption of this species. Another significant report was by Rice (1990) on the status of four-horned antelope based on information collected through questionnaires from various sources. Few studies have addressed biology and ecology of this antelope. There have been only three species specific studies under taken so far: (1) at Bandipur National Park in South India (Krishna, 2006)<sup>[5]</sup>; (2) at Panna Tiger Reserve in Central India (Sharma *et al.*, 2005); and (3) at Mudumalai Wildlife Sanctuary in South India (Baskaran, 1999). The IUCN lists the four horned antelope as Vulnerable. Many aspects of this species remain unclear.

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There is no information on four-horned antelope in Sathyamangalam Wildlife sanctuary except its presence (Rice, 1991). Most of the research activities carried out in this division were limited to the Moyar valley and not explored to the Talamalai plateau. The old working plan of the Sathyamangalam division and earlier census reports have not mentioned this antelope presence in Talamalai plateau except it is being reported in Talamalai RF by Rice, 1991. In most occasions the local people who sighted four horned antelope have confused with Barking deer *Muntiacus muntjac* since four horned antelope are very shy and show swift disappearance from sight when seen. The specific objective of the study is to evaluate the distribution of the four horned antelope. Therefore, the present study was undertaken in Talamalai plateau, Sathyamangalam Wildlife Sanctuary from December 2009 to March 2010.

### Materials and Methods

The Sathyamangalam Forest division is located in Erode district of Tamilnadu state in South India. It is the largest division among all in the state with the total area of 1455.31 sq. km. It lies between 11° 29' - 11° 48' N and 76° 50' - 77° 27' E. In November 2008, part of the division (524 sq.km) have declared as Wildlife Sanctuary, it has rich bio-diversity and being a bridge between Western Ghats and Eastern Ghats for the migratory animals. The division shares its boundary with Erode, Kollegal, Chamrajnagar Wildlife (BRT), Bandipur Tiger Reserve, Nilgiris North and Coimbatore forest divisions. It has five forest ranges viz. Talavadi, Bhavanisagar, Hasannur, Sathyamangalam and Tooka Nayakan Palayam. The altitude varies between 280m and 1678m. The average annual rainfall was 755mm receives from both southwest and northeast monsoon. But majority of the rainfall comes from northeast monsoon between August and November. The river Moyar is perennial being a main water source for wildlife, flows in the southern boundary of the division.

Talamalai plateau is situated to the north of Moyar valley and to the east of Bandipur Tiger Reserve. The plateau comprises of part of Talavadi and Bhavanisagar ranges. Majority of this plateau area is covered with open savanna type deciduous forest and dense mixed deciduous forest. The dominant tree species in dry deciduous forests are *Tectona grandis*, *Anogeissus latifolia* and *Terminalia alata*.

### Survey design

The study area was gridded as 1 sq. km and total of 41 grids in which 15 grids were randomly selected in proportion to the vegetation (7 in Open habitat and 8 in fairly dense mixed forest) (Map.1). In all the fifteen grids were laid a transect length of 1 km. A total of 15 transects were walked to assess distribution and relative abundance of Four-horned Antelope in the study area. Data on direct sightings as well as data on indirect signs (defecating sites) were recorded.

A sample from the plateau was selected and stratified the two vegetation type viz: - open savanna deciduous and dense mixed deciduous forests. It was gridded and randomly the grids were selected. In each randomly selected grids were laid a one kilometer transect covering all the microhabitats. While walking transects, the direct sighting of four-horned antelope and its defecation sites were recorded to assess the distribution and relative abundance. For each sighting the GPS (Global Positioning System) coordination was taken

(using Etrex model GPS) to prepare distribution map (Map.2).

### Study on Habitat and Microhabitat Preference

While walking transect, whenever an antelope is sighted or its defecation site is observed, the habitat (vegetation) type was noted to know the habitat preference. The vegetation composition was evaluated using 10 m X 10 m quadrates laid at locations where four-horned antelope direct and indirect signs observed. The data such as tree species and number of trees in each species was recorded. The height and GBH (Girth at breast height) of each tree species were measured. Grass heights were measured at 5 points (at the site where the antelope direct and indirect signs was seen and at distances of 20 m in all cardinal direction from the centre) using a stick. The grass heights were categorized as very low (0 to 10 cm), low (10 to 25 cm), low medium (25 to 45 cm), medium (45 to 70 cm), tall medium (70cm to 1m) and tall (above 1m) (Sharma, 2006).

To identify various types of microhabitats used by antelope, each major habitat in the area were further divided into four microhabitats based on topography flat area, hilltop, hill slope, and nulla (dry stream) edge (Baskaran *et al.*, 2009) [1]. At every antelope sighting, the microhabitat was recorded.

Along these same transect, data on cattle presence was gathered at every 100 meter interval by counting the number of dung pile in a 2 x 10 m plot. Along the same points a 5 x 10 m plot were used to assess woodcutting, all trees (and saplings) with lopping/cutting signs were enumerated along with uncut trees and saplings.

### Results and Discussion

Four-horned Antelope are sparsely distributed over the study area. Four-horned Antelope was sighted only once on one transect (transect #31). Their shy nature and small size make sightings difficult so indirect signs of Four-horned Antelope were also taken into consideration when assessing their distribution and relative abundance in the study area. Four-horned Antelopes signs were seen on only 7 of the 15 transects (Figure 1). Transects 31, 40, 24 and 25 had 2 or more records and this seemed to indicate that they were presently the best areas for this species. Transects 4, 14 and 20 had just one record each while the rest had no records/signs of the species. The majority of the records (~72%) were on hill/nulla slopes; however this may be due to the terrain being largely composed of such areas. Flat and open areas had only 28% of the records. The encounter rate for signs/sightings was 1.71/km in the open habitat (thorn forest and shrub forest) and it was much lower (0.25/km) in the fairly dense forests. Four-horned Antelopes largely prefer open habitat and appear to avoid dense areas.

### Habitat and Micro-habitat preference

The habitat type was recorded at 145 locations where four-horned antelope and its defecation sites observed during the study period. Majority of the observations (77%) were recorded in open savanna deciduous forest and rest 23% were in dense mixed deciduous. The quadrates of 10mx10m in size were laid at 27 locations at where the antelope sighted and defecation site located. A total of 16 tree species were recorded and was observed the dominant species as *Anogeissus latifolia*, *Phyllanthus* spp. and *Lannea coramandelica* (Fig.2). The mean GBH (Girth at breast height) was observed to be 19.22 cm (range 6-96 cm) and

mean height of trees, 7.19 mt (range 1.5-5.5 mt).

The grass heights were measured for 27 observations of four-horned antelope and defecation site areas. The low medium and medium grass height classes were preferred followed by low and medium tall grass areas. The very low and tall grass areas were not used. 74% of the observations fall in these categories of the grass height. Most observations (74%) were occurred between 25 to 70 cm levels of grass height (Fig.3).

The microhabitat was noted for four-horned antelope sightings and defecation sites. The percentage was calculated for microhabitat use by four-horned antelope (n = 121) as the most records were found on hill top (63%) and hill slope (27%). Only 10% of the observations were recorded from flat area.

The study reveals that the four-horned antelope prefers open savanna type deciduous forest as majority of the observations (77%) recorded in this vegetation. Significantly more in dry deciduous forest compared to dry thorn forest (Baskaran. *et al.*, 2011) [2]. In this habitat, the trees are sparsely distributed with open grass patches. *Anogeissus latifolia*, *Phyllanthus* spp. and *Lannea coromandelica* were found as dominant tree species. Fruit of the *Phyllanthus* spp. is a food item of the four-horned antelope (Kannan *et al.*, 1999) [4]. Preference of open savanna deciduous forest could be due to more visibility than in dense mixed forest. From a distance, it can sight the approaching threats in open area. In addition, diversified grass is also available for foraging in this habitat. The four-horned antelope seems to prefer grasses, as it constituted 26.5% of the food items selected (Kannan, *et al.*, 1999) [4], 28.6%, 14 species (Baskaran. *et al.*, 2011) [2]. The edge between dense mixed and open savanna type deciduous forest is an ideal habitat for four-horned antelope especially one which has young ones as there were frequent sightings observed during field survey (Vijayakumar pers. comm.). It uses closed canopy and thick undergrowth for resting and nursing young ones and use open or scrub forest for foraging (Sharma and Rahmani, 2005) [10].

The habitat preference was shown by the four-horned antelope in areas where the grasses are between 25 and 70 cm height. Within the dry deciduous forest, habitat composed of short grass and more open canopy with sparse and stunted trees growth referred as tree-savannah and less weed cover was preferred by antelopes, dry thorn forest site with short grass and more open canopy appears more suitable habitat (Baskaran. *et al.*, 2011) [2]. Above 1 m and below 10 cm grass height areas were not preferred. It shows that it prefers the area according to its size (55 to 65 cm) to cover itself into the

grass patches against predators and also to watch over at threats. The visibility is very poor in tall grass and hardly can see anything around. Likewise the areas where grass heights below 10 cm is not suitable since there is no cover to protect them and expose to threats. These could be the reasons as to why they prefer to use low medium and medium grass areas. The four-horned antelopes were rarely found in tall medium and tall grass areas above 1m and the reason is difficult to keep an eye at threats (Sharma, 2006). In microhabitats, the hill top is very much used by antelope followed by hill slopes. In Mudumalai Wildlife Sanctuary, the hill slope is preferred much followed with hill top (Baskaran, *et al.*, 2009) [1]. The maximum group size was 2 individuals and 74% of the observations were single. The mean group size was 1.26 (range 1 to 2) indicating that this is largely a solitary or semi-solitary species. In Nagarahole National Park, 80% of the observations were solitary individuals and the maximum group size was 2 (Karanth and Sunquist, 1992).

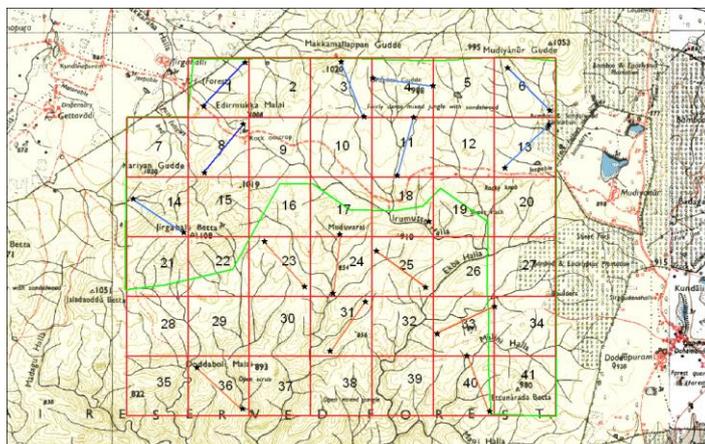
### Biotic pressure on the habitat

Two aspects of biotic pressure on the habitat were measured, first cutting/lopping of trees and saplings along transects was monitored. In addition cattle dung sighted along transects was also enumerated. This gives a coarse indication of human presence and pressure in the Four-horned Antelope habitat. Figure 4 shows the biotic pressure on different transects, only 7 transects were free (relatively speaking – as sampling intensity was not enough to conclusively rule out human activity) of human pressures.

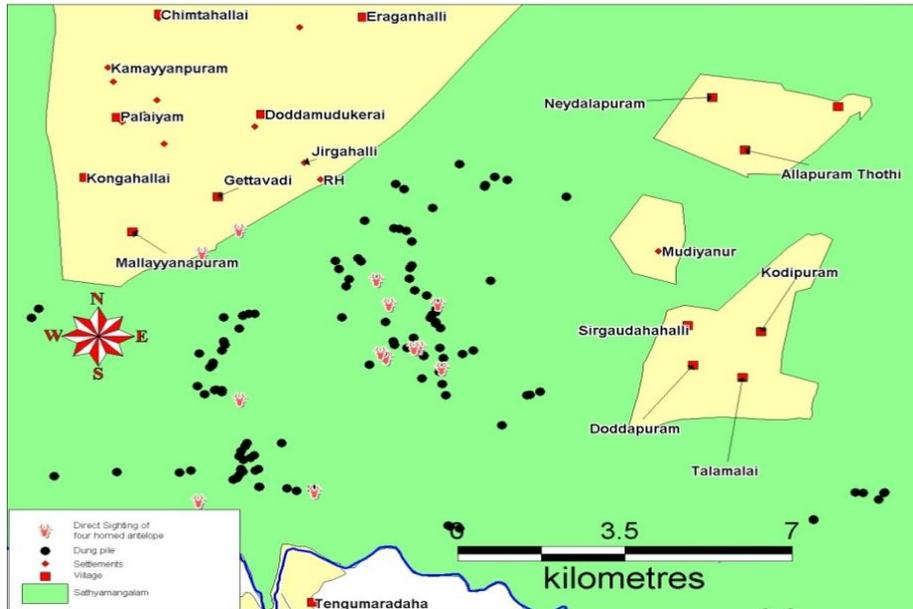
Transects that are closer to the human habitation shows the presence of biotic pressure such as cutting/lopping signs and cattle dung. Out of fifteen transects, eight have both pressure. To the maximum, 3 km from the village boundary the biotic pressures were observed (Map 3).

A total of 1062 trees and saplings were enumerated along transects, of these 94 (8.9%) had been cut and another 141 (13.3%) had been lopped. There was strong correlation ( $r = 0.9$ ) between lopping and cutting of saplings and trees. Lopping of trees and saplings was more common than cutting (Fig. 5).

On all transects where there was cutting or lopping of trees, signs (dung) of cattle were also recorded. This indicates that these transects are exposed to both cattle grazing and fuel wood collection. It would also indicate that other activities like NTFP collection would also exist in the area. Thus increasing the duration, extent and intensity of human disturbances in all areas exposed to human disturbances.



Map 1: Gridded study area map



Map 2: Distribution map of Four-horned antelope in the study area

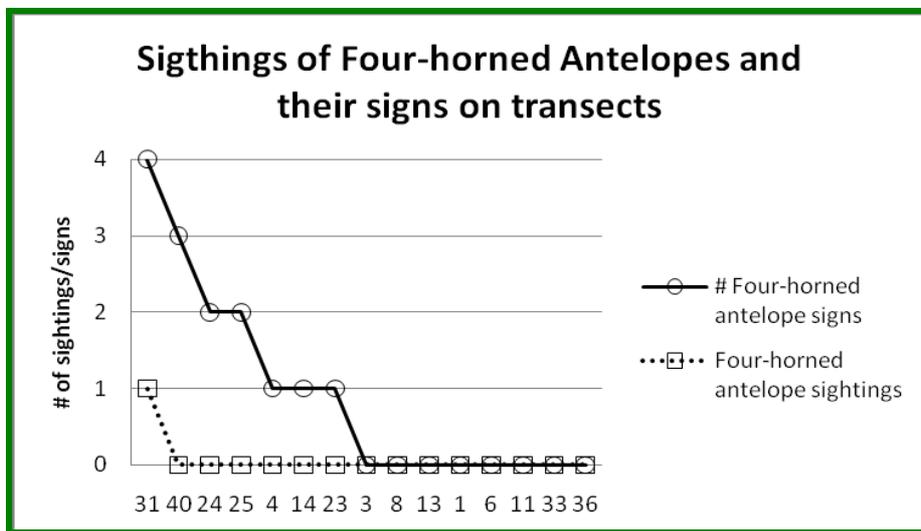


Fig 1: Four horned antelope direct sighting and indirect signs recorded on transects

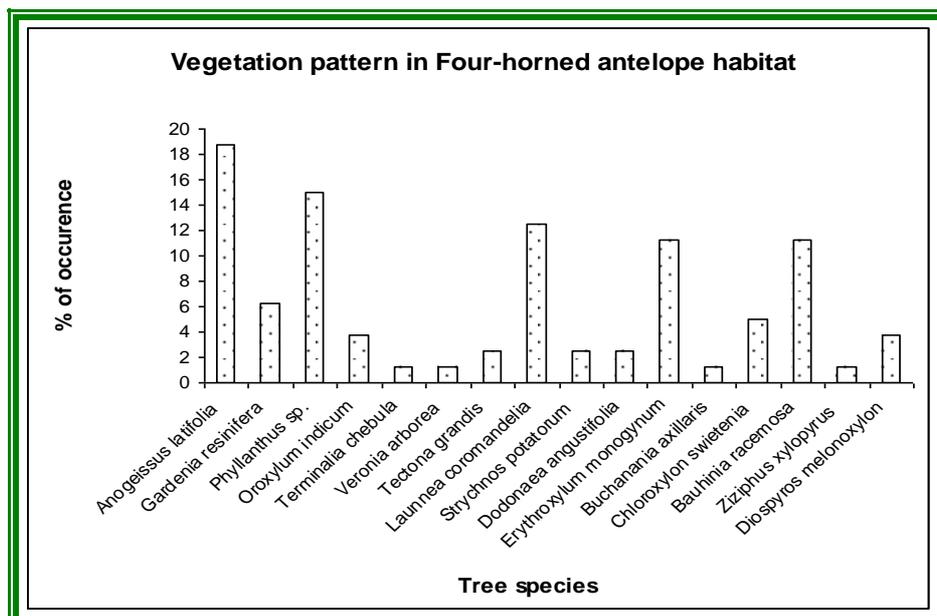
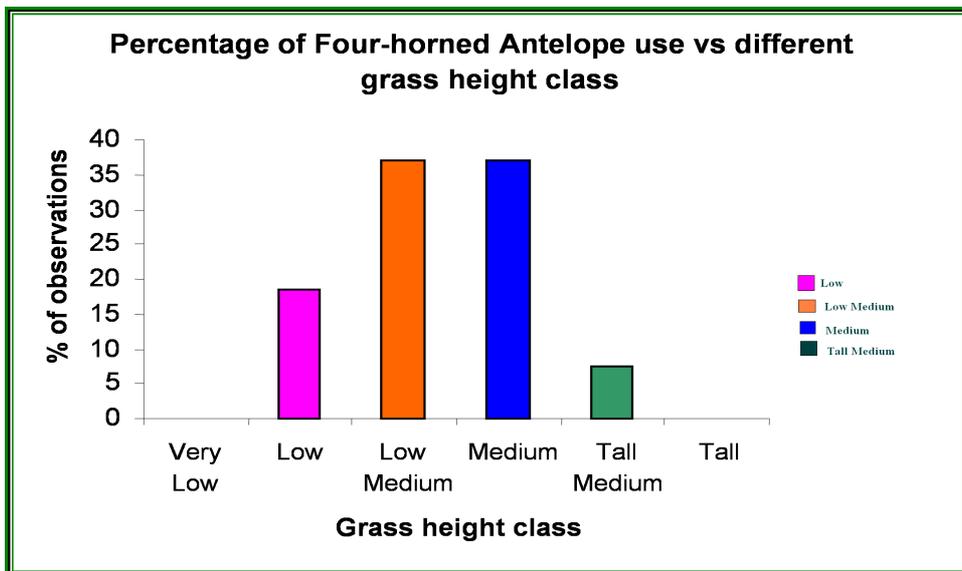
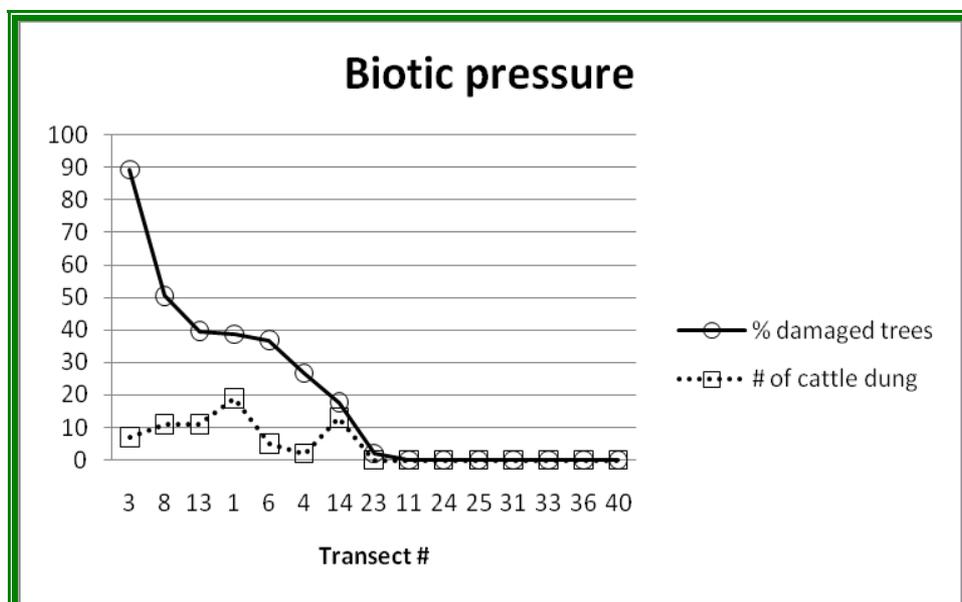


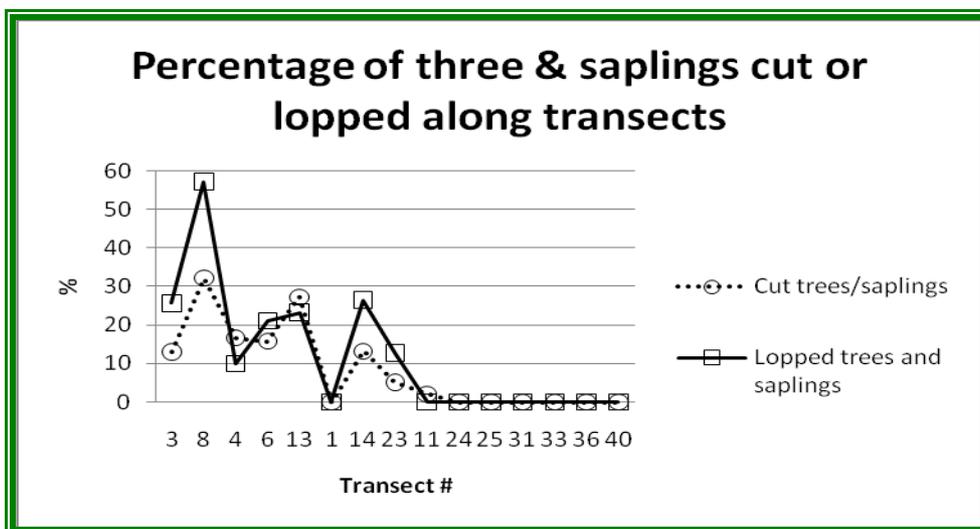
Fig 2: Vegetation pattern in Four-horned Antelope habitat



**Fig 3:** Percentage of Four-horned Antelope use in different grass height class



**Fig 4:** Biotic pressure observed on different transects



**Fig 5:** Percentage of tree cut and lopped along transects

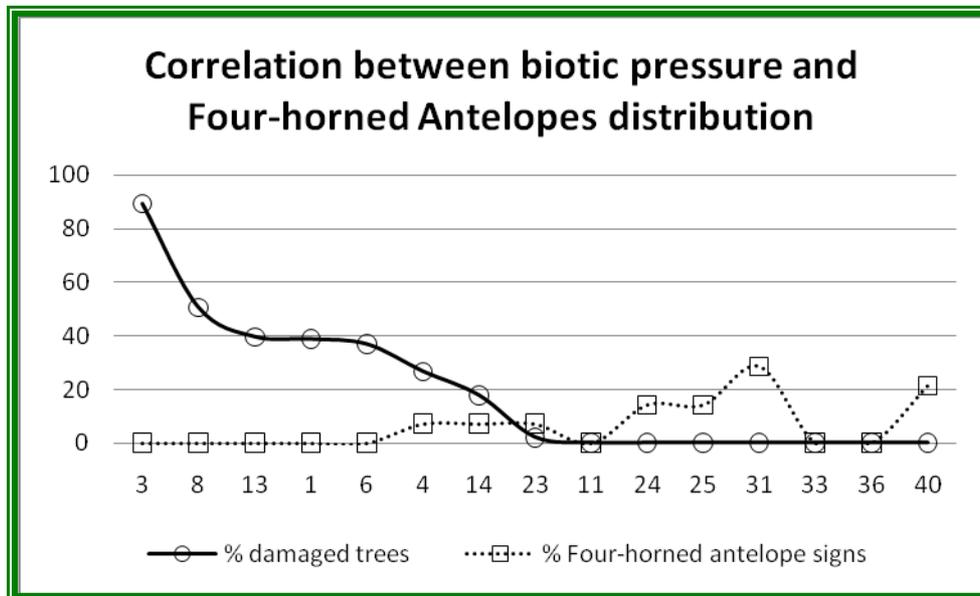


Fig 6: Correlation between biotic pressure and Four-horned Antelopes distribution

### Impact of biotic pressure on the distribution of Four-horned Antelope

An ANOVA between cutting/lopping of trees/saplings and Four-horned Antelopes signs recorded on transects shows that there is statistically significant relationship ( $p=0.06$ ) between the two variables. However the correlation coefficient equals ( $r = -0.492308$ ), showing that there is a negative correlation between biotic pressures (cutting/lopping of trees/saplings) and Four-horned Antelope signs. However the value  $-0.492308$  indicates that the correlation between the two is weak. Figure 6 shows the correlation between damaged trees (due to cutting by humans) and the percentage of signs of Four-horned Antelope seen on different transects.

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