

Recovery Plan for the Nilgiri Tahr (*Nilgiritragus hylocrius*)



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Mohan Alembath
James Zacharias
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**Asia Biodiversity Conservation Trust
& Care Earth Trust**

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INTRODUCTION

The Caprinae are majestic creatures, which George Schaller called the *Mountain Monarchs*. All Caprinae carry horns, which is the characteristic of the bovids. Almost all the members of the Caprinae are social ungulates with external sexual dimorphism. Members of this subfamily are herbivorous ruminants. According to Shackelton (1997), the range of subspecies common in Caprinae represent distinct gene pools serving as a significant genetic resource adapted to extremely wide range of ecosystems and harsh environmental conditions. Caprinae has been considered important because of both the consumptive and non-consumptive uses. The wild Caprinae are also important because of the ancestry of two domestic livestock; the domestic sheep (*Ovis aries*) and goats (*Capra hircus*) and thus the present day populations could be a source of new genetic material for improving the domestic breeds. Many wild Caprinae populations are threatened with extinction because of genetic isolation, specialized habitat requirements and low reproductive rates.

Duff and Lawson (2004) mention about 34 extant species of Caprinae. However, the classification adopted by IUCN/SSC Caprinae Specialist group points out the uncertainty and apparent disagreement amongst scientists. The adaptation of the Caprinae populations to mountainous regions and scattered distribution prevent immigration and emigration and the resultant isolation have contributed to the evolution of Caprinae (Shackleton and Lovari, 1997). Shackleton and Lovari (1997) had taken the recent developments in the classification of the Caprinae and have suggested a taxonomic organisation to be followed in the survey by IUCN/SSC Specialist group. They suggested 32 extant, autochthonous species with 91 subspecies spread over 70 countries. Of these, Fox and Johnsingh (1997) enumerated 10 species in India of which nine are confined to the Himalayas and the other one, the Nilgiri tahr is found in the parts of Western Ghats. The Nilgiri Tahr belongs to the tribe Caprini and is more allied to the true sheep (*Ovis spp*).

1.1 Taxonomy and morphology

The Nilgiri tahr was first described by Gray from a drawing and notes of General Hardwicke, and they were said to have been sent from Nepal and from Chittagong. The specific name given by Gray was the *Tamul* word for rock or precipice goat. It was called Ibex by sportsmen in Madras (Jerdon, 1874). However, Rice (1984) gives a detailed description on the taxonomic

history of tahr. The first member of the genus to be scientifically recognized was the Himalayan tahr and it was named *Capra jemlahica* in 1827 by H. Smith (Lydekker, 1913). Hodgson (1833) created a synonym *Capra jharal* and did not make any reference to Smith's earlier description. Discovering that it has four mammae, Hodgson modified this to *Hemitragus quadrimammis*. In 1847, Gray established a variation on the original specific name of the Himalayan tahr, referring to it as *Hemitragus jemlahicus*. Gervais was the first to recognize the affinities between Himalayan and Nilgiri tahr as he adopted the then current name for Nilgiri tahr. However, in 1891, Sclater was still using the genus *Capra* for both the tahr species. In 1913, Lydekker reestablished the original name for Himalayan tahr, *Hemitragus jemlahicus*. The Nilgiri tahr was first named *Kemas hylocrius* by Ogilby (1838). In 1842, Gray named it *Capra warryato* and then changed to *Kemas warryato* in 1852 (Lydekker, 1913). Blyth included the Nilgiri tahr in the genus *Hemitragus* in 1859 and called it *Hemitragus hylocrius*. There was strong opinion that the three tahr are subspecies (Haltenorth, 1963). However, based on molecular phylogenetic analysis, Ropiquet and Hassanin (2005) proposed the name *Nilgiritragus hylocrius* for the species as it is claimed that the 3 species of tahr (Himalayan, Arabian and Nilgiri) have had different lineages.

The Nilgiri tahr is typically a goat. The commonly used English name has been derived from two languages; Tamil (*Nilagiri* = Blue Mountains) and Nepalese (*Tahr* = Serow/Wild Goat). The well-known Tamil and Malayalam local name *varai-aadu* literally means 'goat of the cliffs'. George Schaller had described the Nilgiri tahr and other Himalayan wild sheep and goats as 'Mountain Monarchs' (Schaller, 1977; Shackleton, 1997). Thyagarajan (1958) reported the widespread belief among the people in the hills that the tahr possesses almost magical medicinal properties. The medicinal property of their flesh is believed to be the result of eating *silajit*, a brownish, translucent semi solid exudation from the rocks. This has been used for treating innumerable diseases. Thyagarajan (1958) himself could not come across anything to authenticate this. The Nilgiri tahr is amongst the tallest of the Indian Caprinae species comparable in stature to the Takin and Serow – maximum height at the shoulder being 110 cm (Prater, 1965). Adult males are known to weigh 80-100 kg with horns (that are larger than that of females) measuring 40cm in length and with a girth of 22cm at the base (Schaller, 1970). Female Nilgiri tahr weigh around 60 kg (Hawkins, 1986) and have 2 teats (Walker, 1964).

Prater (1965), Schaller (1970) and Davidar (1978) identified three rather distinct kinds of male Nilgiri tahr, at least in the color pattern. The oldest males tend to sport a dark (almost black) coat and develop a distinctive pale ‘saddle patch’ on the loins which from a distance appears almost white. The other kind of mature males are dark brown (also called brown bucks). The third category of adult males that are grey are often quite difficult to separate from the adult females as they quite resemble them in the overall coloration. However, Rice (1984) has suggested that the males and females can be differentiated by the more prominent white line that is anterior to the eye (males) and the relative prominence of the knee-patch. Brief description of the different age/sex classes of the species are provided in Table 1.

Table 1 Description of the external appearance of the different age/sex classes of the Nilgiri tahr

Class/category/sex	Age (years)	External appearance
Young	0-1	Grey-brown or light brown; maximum 45cm height at shoulder; horns 7cm in length
Yearling	1-2	Grey-light brown; height intermediate between young and adult female; horns to a maximum of 12cm
Adult female	2 and above	Grey-brown; carpal (knee) patch black; height at shoulder 70-80cm; horns slender to a maximum of 30cm
Grey/Light brown male	2-4	Hard to tell from adult females except at close quarters by the more prominent facial stripe and paler knee-patch; easily identified when the genitals are visible; larger horns are often evident
Dark brown male	5	Grey-brown to dark brown; larger and more robust than adult females; larger horns and more distinct facial markings; the distinct white knee-patch is characteristic
Saddle-back male	6 and above	Prominent pale (white-silvery) ‘saddle’ patch on back and sides; the dark knee-patch (above the white) blends with the color of the rest of the foreleg

1.2 Genetics

The ancestry of the Nilgiri tahr has been traced to an extinct species of bovid mammal (*Myotragus balearicus*) that inhabited the Balearic Islands during prehistory (Lalueza-Fox *et al*,

2000). With regard to the chromosomal numbers and affinity, the Nilgiri tahr and the Arabian tahr are similar in that both species have 29 pairs of chromosomes (diploid number 58) (Bernischke and Kumamoto, 1980). The Himalayan tahr on the contrary has only 24 pairs with a diploid number of 48 (Rice, 1984).

1.3 Social organisation

Nilgiri tahr is a social animal and usually stays in herds of 2 or more. A herd or group is recognized by the presence of 2 or more animals that stay within 50 m of each other (Madhusudan, 1995). The average herd size is around 23; but herds may vary in size between 6 and more than 100 depending on the season and habitat (Schaller, 1970). Sterndale (1884) observed 3 herds of 60, 65 and 120. Kinloch (1926) reported herds with 60 and 90 individuals. Fischer (1915) reported one herd with 86 animals. According to Schaller (1970), the average herd size was 23 from the observations of 23 mixed herds. Healthy herds are apparently structured rather predictably in that saddle-backs comprise not more than 11%, dark brown males 3-11%, light brown males 4-20%, adult females 33-46%, yearling 9-22% and young 12-30% (Schaller, 1970; Davidar, 1971; Rice, 1984). In other words, not less than half the animals in healthy herds are adult females and young. This pattern has been more or less consistently observed in 3 different landscapes where the species is most numerous: the Nilgiri Hills, Anaimalai Hills and High Range (Schaller, 1970; Davidar, 1971). The normally observed sex ratio of 2:1 suggests that there are more females than males (Davidar, 1978). Rice (1984) based on an analysis of sex ratios across the Nilgiris, Grass Hills and Eravikulam National Park has shown that there could be in all 60 males for every 100 females.

1.4 Behaviour

Like many other species of Caprinae, the Nilgiri tahr has two basic types of social groups: mixed and all male groups (Rice, 1984). Mixed groups contain all sex and age classes although they are predominantly of adult females and their sub-adult offspring. Adult males join the group during rut and leave them at other times of the year. The unstable male groups are invariably of adult males. During a study of the tahr population in the Eravikulam National Park in the months of November 1994 to April 1995, it was observed that mixed groups were most frequently encountered. Bachelor groups were also frequent (Madhusudan, 1995). Mixed groups are from 2

to 150 animals with an average size of 42 individuals. Male groups ranged from 2 to 20 with an average size of 3. The lone females are very rare compared to the lone males (Rice, 1988a).

1.5 Habitat requirement

Madhusudan (1995) while observing that the large males occurred in social units separate from female units, reported differential use of space and habitat types. Males were restricted to higher elevation areas whereas the females used the rocky terrain of higher slope angles closer to cliffs. Large males also spent more time resting than the small males or females. Females also spent a greater proportion of their time in moving than did males. Rice (1984) reported similar observations. The mixed groups normally avoided the shrubby country below the steep cliffs and slabs and never penetrated the thick tall growths of *Eupatorium* and *Chrysopogon*. Mixed groups also made use of shola fringes and browsed occasionally in smaller sholas. Rice (1984) reported that there was never even a single sighting of tahr in the central portion of the plateau. But these areas are utilized by tahr for movement between areas.

Observations of Murugan (1997) indicate variations in the areas utilised by different tahr groups in the Nilgiris. The Nilgiri Peak herd was active in 6 km² where as the Mukurthi herd utilized only 4 km². The smallest area utilized was 1.5 km² by the Western catchment II herd and the largest was by Sispara and Nadugani herd where they utilized 12 km².

1.6 Food and feeding

Most of the observations on food and feeding of tahr is from Rice (1987). Tahr are grazers in Eravikulam National Park. However, they are observed to be browsers in lower drier areas (Davidar, 1978). In Eravikulam, forbes exceeded grasses in number of species fed on by tahr, but grasses were taken in much greater volume. Tahr also had preferences for certain parts of some of the plants. It had strong preferences for some of the rare plants and avoided some of the common plant species. There are strong seasonal preferences for plant parts. After the pre-monsoon burning, the tahr fed on the entire new shoots of *Chrysopogon zeylanicus*. The forage quality of grass lands in winter is the lowest with lower density of preferred food species. Tahr moves at least 10 m inside sholas in the dry season and browsed on trees and shrubs (Rice, 1987).

1.7 Reproduction

The rutting season occurred during monsoon and the birth season was from January to mid February. However, there had been reports indicating calving throughout the year (Stockley, 1928; Willet, 1968). Kinloch (1926) and Prater (1965) mentioned the beginning of hot weather as the birth season. Leydekker (1898) reported June and July as the birth season. Schaller (1970) strongly argued that most young are born between December and February. Davidar (1978) observed a peak calving season during winter and a second peak in August-September. The gestation period is estimated at 179 days. According to Sterndale (1884), tahr usually has twins. It is reported that the tahr can conceive again if the first one dies at an age of less than two weeks (Rice 1988b). Rice (1984) reported January – March as the birth season though there had also been some births in monsoon. Infant mortality was highest during the first two weeks after birth and those born during monsoon also had a high mortality rate. The birth season is determined by weather and the birth season is timed to minimize thermal stress. The tahr females are presumably able to increase the lifetime reproduction by giving birth twice in a year. However, the mortality rate of the second one is high (Rice, 1988b). There is annual variation in the production of young and this can have short term impact on the population level. Higher mortality rates have been observed among males compared to females (Rice, 1988b). According to Schaller (1970), as many as 1/6th of the adults die each year.

1.8 Survivorship

The short life expectancy of tahr (3-3.5 years) and the reproductive failures can have severe and rapid repercussions for tahr. This will be less serious in the case of larger populations with several subpopulations. A larger initial population will ensure faster recovery. Since most tahr populations are less than 100, these are possibly vulnerable (Rice, 1988). According to Rice (1988a), the population stability observed in Eravikulam could be due to density dependant regulatory mechanism. Such a mechanism will have impact on natality or mortality, which in turn is affected by nutrition. The level of nutrition in the case of tahr is affected by rainfall and grassland fires. Natality was observed to have been affected by environmental factors especially burning of grasslands before the rutting season. The nutritional condition of females also had an impact on the mortality of young ones.

1.9 Predation

Annual mortality in Eravikulam was estimated to be 44-52% for young, 31-37% for yearlings and 17-24% for adults. The potential causes of mortality at Eravikulam include predation, disease, accidents, and injury during intraspecific combat (Rice, 1988b). According to Rice (1984), predation is an important mortality factor in Nilgiri tahr life history. The reports on predation in different areas varied a lot. Leopards seems to take a toll in Eravikulam (Rice, 1986). However a detailed study on prey-predator relations in the same area did not agree to this and the scat analysis did not show much predation by leopard and there was only one sample with tahr remains (Easa, 1995).

1.10 Diseases

Ova of strongyle nematodes were found in 75% and evidences of coccidiosis were found in 49% of the faecal samples examined (Rice, 1988 b). Ova from tapeworms were seen in 25% and from whipworm nematodes in 17%. There is of course no reason to correlate the presence of these to the mortality. Observations elsewhere indicate impact on the health of related species (Olsen, 1967; Soulsby, 1982). Rinderpest is said to have almost decimated the High range population long ago (Schaller, 1970) and observations of lame animals in april were attributed to foot and mouth disease. Davidar (1978) reported a growth on the liver of a saddle back which was shot dead. An adult female with a large growth on its rump was observed. According to Davidar (1978) the tahr in Rajamalay were in poor condition.

2. ABUNDANCE AND DISTRIBUTION

The information on historic distribution is rather scant and is mostly from the reports of hunting successes in different areas. Most of the observations on the distribution of Nilgiri tahr in the past was from the efforts taken by Davidar (1963, 1971, 1972, 1975, 1976, 1978). He and his team of trackers visited nearly all the locations counting the tahr in the identified areas. In addition, he had also gone for an organized simultaneous counting in identified blocks through direct sighting, especially in Nilgiris. His publications also indicated the disturbance factors for each location. The smaller populations are never censused with seriousness. The populations of these animals have to be monitored after making a bench mark data for the population size and

structure. The total number of adult females and the subadults are considered to be the good indicators to measure the trend in the population (Rice, 1988 a).

2.1 Historic abundance and distribution

Nilgiri tahr once ranged through most of the Western Ghats (Davidar, 1978). Mukherjee (1974) considered the entire southern half of Peninsula extending up to most of Karnataka as tahr range in historic time. As late as 1954, tahr were found in the Agumbe Ghat in Karnataka as confirmed by Mr. G. J. Rajasingh, Conservator of Forests, Tamil Nadu, who saw a small herd in the course of a boundary survey (Davidar, 1978). Davidar noted that the tahr was found in a few isolated localities along the crest of the ranges between $11^{\circ}30'$ and $8^{\circ}20'$ N at elevations ranging from 1300 m to 2600 m. There are a few locations of lower elevations also. The following descriptions are mostly from his observation and his estimate for the entire Western Ghats was 2210. One of the most interesting reports on the distribution is from McMaster (1883). He recalls the report of Jerdon “on the occurrence of tahr in Cochin; their familiarity and tameness as Jerdon describes, at the temple being so utterly opposed to their habits as observed by sportsmen”. “Nevertheless it is or was a fact, for I remember well, hearing Colonel Frederick Cotton corroborate what Jerdon now says about the animals frequenting the church referred to, for he (Colonel Cotton) found one on his visit to the locality actually reposing within the porch of the building”. The descriptions of Jerdon and Colonel Cotton refer to the Malayattur church where the tahr or any other animal is currently not seen.

The status and distribution of tahr in the range is given by different authors. The following details on the abundance and distribution are from Davidar (1978).

2.1.1 Nilgiris: The tahr ranged over most of the plateau until the early part of the last century. Some place names are evidences to this. Some herds got isolated on some of the cliffs on the North, South and Eastern sides of the plateau. One by one these populations have disappeared, some as recently as 1960s. Tahr retreated to the West where they now inhabit a narrow strip of grassland bordering the cliffs. Records indicate that tahr were on the verge of extinction in the Nilgiris in 1870s due to hunting. Russel (1900) however reported observations of herds readily in 1886 and 1888. Pythian-Adams (1927) reported 400 tahr in western Nilgiris and not less than 500 in 1932 (Pythian-Adams, 1939). Pythian-Adams (1955) reported the results of a census conducted in 1954, when 296 were sighted in 17 herds from Nilgiri peak to Sispara and

Ankinmalai. A herd of 42 was seen Billithadahallah area. Thus a total of 338 were counted. The present stock was built from the remnants of those that were left, perhaps a few dozen animals at most, by regulating hunting and careful management. Credit goes to Nilgiri Wildlife and Environment Association and Government. A small herd on the Glenmorgan Cliffs on the Northern slopes, which was closed to shooting over a long period disappeared. About 30 animals were counted here in 1947 (Pythian-Adams, 1955). Schaller (1970) quotes an Old Shikari (1880), who recorded “in former times, that is about fifty years ago, the ibex appears to have roamed at will in vast herds over all the grassy uplands of the higher plateau of the Nilgiris”. The estate workers were reported to poach with snares and trained dogs. Total population could be about 450 though only 334 were seen. Nadgani had a large population (Table 2).

The Ankinda in Silent Valley is contiguous with Nilgiri population and there is free movement of animals between these areas (Davidar, 1978). The estimated population is about 30. The area was frequently visited by poachers.

According to Davidar (1976), since 1963 many new roads and wattle plantations have come up. Wattle has been planted even up to the cliff line. Because of the plantations, the grasses were not burnt and thus became unpalatable. Large herds of cattle penned in the Tirupanthorai Hundi (near Western Catchment Dam No. 2) were being grazed on the hills adjoining the cliffs. This is an annual summer exodus. The graziers cause accidental fires, which is good for tahr once the Hundi is vacated. Poachers were reported even from far away areas including Kerala via Sispara. Evidences of poachers were seen in Anginda in January 1978. The population at Anginda could be about 30.

2.1.2 Siruvani: According to Davidar (1978), Vellingiri Malai was disturbed and did not seem to have tahr. In 1976, 20 tahr were seen on the top of Kunjara Malai (1965 m). Tahr were believed to migrate occasionally between Kunjara Malai and Elival Malai. Elival malai with about a dozen spurs of which two dominant ones *viz.* Palamala (2080 m) and Karimala (2180 m) constitute the tahr habitat. Karimala ridge is about 10 km long. There is no path to Karimalai from Palamala and are separated by evergreen forests. The Karimala is clothed in dense forest and at two points (Karimala peak and Kondamal), the grasslands are topped by cliffs. The Palamala grass hill or grass *mottai* along with side spur is about 3 to 4 km long. At Palamala,

about 48 were counted. Elival is reported to have 60-80 animals. Poaching in Palamala was through driving. Shri K. C. Prasad, ACF has recorded 22 animals in Palamalai in 2003.

Table 2. The details of tahr count in Nilgiris (Davidar, 1976)

Location	1963	1969	1975
Mukurti	79	63	49
Nilgiri Peak terrace			--
Mukurti slope			16
Chinna Mukurti			10
Chinna lower slopes			16
Be Betta			4
Western Catchment	66	--	42
King Dhar			26
Between Western Catchment and Dam			6
Igandi			10
Chembar	35	--	--
Nadgani	65		207
Nadgani			101
Varayattuparai			58
Ridge beyond Varattuparai			11
Sausage hills			2
Nadgani cliffs			13
Simon hut			22
Bangitappal	47	113	40
Billithadahala waterfall			22
Cruz hill			6
Bangi Ridge			6
Bangi slope			6

Davidar (1978) suggested declaration of a sanctuary in Elival mala as Palamala and Karimala Ridges hold the largest population of tahr in Kerala next to Eravikulam. Protection guards to be engaged and posted. He also suggested controlled burning in the grass land areas.

2.1.3 Nelliampathi Hills: Kinloch (1926) reported herds of 60 to 90 in the area. Hill Top or Peria Attu Malai is the major tahr area in Nelliampathi (Davidar, 1978). Kumul mala is adjacent. Cruz Malai and Chinna Attumala near Manalroo estate are also good tahr habitat. Twenty three tahr were reported by Davidar (1978). Poaching was reported to be the main threat to the population. About 150 tahr were reported from the area in 1950s. Govinda mala had tahr earlier

but none were seen in 1976 by Davidar. However, it is mentioned as a potential habitat. Total population of tahr in Nelliampathis would be about 30 in 1976.

2.1.4 Anamalais has always been considered as a tahr haunt. Hawkeye (1881) saw tahr in herds of hundreds. Hornaday (1885) found them quite abundant. Davidar (1971) estimated about 200 animals. Davidar (1978) treated the populations in the Parambikulam – Topslip regions as one.

Pandaravarai has three sections; Panadaravarai in the middle and Nanduvai and Katradi on either side. Only a third of the ridge is in Tamil Nadu, the rest being in Kerala. The grass lands are cut up and were beginning to erode. About 30 tahrs were mentioned as possible. Prior to 1973, the tahr was subjected to poaching.

Kolumbu malai extend all the way to Aliyar dam on the south. No resident tahr was reported in Umayamalai, but evidences of droppings indicated their presence in the area. Worm casts of fine soil varying in size are thrown up all around. These pellets are washed down with heavy rain leading to erosion.

Perunkundru: A good habitat with about 40-50 tahr in 1977.

Palagakundru: A good area with sightings of lots of pellets in 1978. Davidar (1978) suggested a study to confirm the theory that tahr migrate over fairly long distances through jungle.

Vengoli malai: The Vengoli ridge start at Vellimudi/Umayamalai in Topslip and passing through the middle of the two sanctuaries terminate at Vengolimudi in Thunacadavu. In 1976, a herd of 11 were seen in Kerala side.

Karimala Gopuram: Only five were seen. The sex ratio indicated a non-viable population.

Eastern slopes of Anamalai is with rugged rocky hills on the eastern slope. Tahr here became isolated on either side of the road to Valparai. There were five tahr populations.

Aliyar: The rocky hills west of Valparai road is the tahr habitat. These hills form a ring around the valley drained by a little jungle stream known as the Chinnar, with Pachamalai at the apex. The area is known as Villoni. The tahr country ranges from 500 to 1200 m elevation. The Pachamalai is a good tahr habitat. The tahr habitat is 12-15 km² in extent. About 20 tahrs were reported in 1977 and the estimated population was about 60. No poaching reported.

Chetta Guttu – Ninth Hair pin bend Hill: The row of hills to the south east and the Aliyar/Attakatti hills ‘meet’ at the ninth hair pin bend on the Pollachi-Valparai Road. This was favoured habitat of tahr before quarrying for PA project started. The quarry was abandoned in 1977. Five tahr were seen.

Attakatti: About 35 km from Pollachi to Valaparai road at 1000 m., the tahr habitat is about 3-4 km stretch of cliffs. Estimated number was 20-25 along with Varayaiattu mottai.

Thadaganachi Mala: The area is West of Aliyar dam. With a height of 1693 m, it is the highest peak in the area. The area around this twin peak is the tahr habitat. The range is connected to the main range through a series of low hills. Cattle grazing and poaching were reported. About sixteen tahrs were seen.

Navamalai: Navamalai (meaning nine hills) is located around the top of Aliyar. Puragundu on the north western end is the main tahr habitat. About thirty were estimated. The population is reported to be moving between Thadaganachi and Navamalai. The population was said to be on the increase in 1977.

Grass Hills in Anamalais: This area is contiguous with the extensive grass hills of Kannan Devan on the South and South East. About 65 km² in extent, it has on the North and North West the forests and tea plantations. North East, west and South west are also bordered by jungle. Five herds were seen. Kallar malai, Chdayandi malai, Tanaka Malai, Koram Parai and Usi Malai are major cliffs in the area. One hundred and thirty eight animals were counted. A comparison of tahr herd composition is given in Table 3.

Table 3. Composition of tahr population in three areas (Schaller, 1970)

Sex and age class	Nilgiris(%)	High Range (%)	Grass Hills(%)
Saddle back	9.1	11.0	1.0
Dark brown male	4.3	4.2	3.0
Light brown male	7.9	4.2	10.0
Adult female	34.2	33.6	45.0
Yearling	18.9	17.3	14.0
Young	25.6	29.6	27.0

Jambukal in Amaravathi was not considered as a tahr habitat because the highest point in the area is only 919 m. Mr. Muthuswamy Nadar, a shikari from Udumalpet informed Davidar that there were about 50 tahr in the area in the 60s. Poaching and habitat destruction has almost wiped out the population. However, in 1977, reported about a dozen animals which are not frequently sighted.

The Erumai malai is at the head of the Amaravathi reservoir and the hills are only 500 to 600 m high. Only a third of the 12 km² area falls under tahr habitat. The habitat is also described as scrub. The census by Davidar and his team resulted in sightings of about 45 individuals. Twenty

five percent of the population was young indicating the possibility of a good population. The estimate was about 100.

Elumalaiyar Koil Hills is located to “the north and almost parallel to the Udumal-Munnar road, where it enters the hills is a spur which joins the Anamalai hills in the North and High Range in Kerala, in the West. The upper crest of the spur and adjoining ranges are typical tahr country. It is reported that the hills around Maraiyur have been cleaned out of tahr by the Muduvans, a hill tribe, some of them being expert and enterprising poachers” (Davidar, 1971). The spur is named after the temple for the deity Elumalaiyan. The tahr appear to be on the North Eastern end of the ridge, known as Rasivarai and the South Western end, Vedankottai (hunter’s fort). The elevation ranges from 800 to 1200 m. Only five tahrs were sighted during the expedition in 1977. An abandoned partially crippled young was also seen by Davidar and his team. The evidences indicated the presence of at least 30 to 40 animals in Rasivarai. Twenty five animals in one herd were seen at Vedankottai. The ridge to the south of these is reported to hold a small herd. Davidar estimated about 130 tahrs in the area. Poaching is the major problem and the villages nearby depend on this area for small timber.

The Swamimalai Karadu, an off shoot of the Palni hills, is located south of Amaravathi and lies in Madurai district. H. H. the Raja of Pudukottai who had hunted in the area reported the presence of tahr in Karadu. He reported sighting of 15-20 animals in Swamimalai in September, 1976.

2.1.5 Eravikulam National Park has the largest population in a vast stretch of tahr habitat. Schaller (1970) reported 500 tahr after counting the animals in seven blocks. Davidar reported a population of 119 animals in the area.

2.1.6 Tertian plateau in Munnar lies above and in between Gundumallay and Chenduvarai/Kundlay estates. Mr. Samar Singh, a manager of the Kannan Devan Tea reported 11 animals including two young in 1976.

Karinkulam lying above Aruvikad and Yellapatty estates harboured about 17 tahr and this population is reported to have declined from 60-80 within 15 years.

Periyavurrai-Kannimally ridge reportedly had four tahrs, which was presumed to have moved from Rajamalai area.

2.1.7 Palni Hills: The entire plateau with several cliffs (Adukkam, Perumal Malai and Poomparai) are ideal habitat for Nilgiri tahr. According to H.H. Raja of Pudukottai, who had been hunting in the area, there were well over 1000 tahr in the 1950s. The cliffs 20 km around Kodai used to have good tahr population even in the 1960s. Davidar counted about 23 animals in Marian Shola Varai, Karian Varai and Koravan Thotti in 1973 (Davidar, 1975). A herd of 12 were reported from Kaluguthorai and Vannathi odai cliffs. Another ten animals were reported by Raja in Sooriyankanal. Davidar (1975) estimated about 60 in the Upper Palnis. The Kookal (Papalai varai) was reported to have a herd.

2.1.8 The Highway Mountains or the Megamalai is in the border of Periyar Tiger Reserve with no true plateau. The average elevation is about 1600 m with some summits reaching 1800 m. Until 1931, when a tea company obtained concession over the mountains from Gandamanikanur Zamindar, the area was covered with sholas. Some of these still survive in places not converted to tea (Davidar, 1975). The tahr inhabited Metla malai, Kudamparai, Plot No. 28, Varayatu Mottai and Attu Mottai (Pathukudisal). The grass lands are on the cliffs which are not more than about thirty meter high and are not more than a few square kilometers. It was possible to approach closer to Varayattu Mottai by road while other areas could be approached only by trekking. According to Davidar (1975), Mr. E.W.G. Haggar, a Director of the plantation company who had been familiar with the area since 1955 wrote about seeing herds of over 100 tahrs on the Metla and Varayatu Mottai in 1956. Davidar thought about 500 tahrs lived on the hills in 1950s. The decline in the population was attributed to the opening up of the Varashunad Valley and the road to Vellamalai. Hutton(1947) recorded sightings of Nilgiri Tahr in Metlamallai in the Highway.

Davidar (1975) counted about 13 tahrs in Padicattu Metla, 4 in Mudal Metla, 16 in Varayatu Mottai (Venniar), 4 in Attu Mottai and 9 in Plot No. 28 in 1973. Subsequent counts in the area in the same period were of 5 in Kudamparai, 9 in Attu Mottai, 20 in Padicattu Metla and 27 in Mudal Metla. Davidar (1975) commented that the tahr in the area seemed to have adapted to the new environment by visiting the sholas adjacent to the grass lands. Cattle grazing was a problem in Metla, Plot No. 28 and Varayattu Mottai. Poaching was worse in Attu Mottai. Development in connection with the hydro-electric project brought in hundreds of workers and a store was located very near to Varayatu Mottai. Davidar (1975) estimated about 100 tahr in the Highway.

Mudaliar Oothu is a perennial spring in Srivilliputhur and there is a 9 km long ridge extending from Kodakkalparai in the north and terminating at Peimalai Mottai at an altitude of 1582 m. The precipitous slopes on the eastern side of the ridge held a fair population of tahr (Davidar, 1978). The nearby Veilkathan Mottai and Sambaltheri also held a good population. Tahr reportedly visited the Kodakkalparai area mainly during northeast monsoon in October-December, spending most of the rest of the year in the adjacent areas. The tahr mostly remained in the middle terraces because of poaching pressure. The total number of tahr encountered during a survey in May 1976 was 51 with Variaatupallam holding 28 animals. Considering the unseen tahr in the Peimala Mottai area, it is estimated that the entire ridge had a population of about 70. In addition to poaching, the area has been used for cattle grazing. Lakshmi Kidai at the western slope, Chinnaputtu at the base of Veilkathan Mottai and Rakheevuduthi at the base of Sambaltheri became established cattle pattis some time in 1950s. In addition, Periaputhukidai, Ooruni kidai, Karuveppila kidai and the charalai are also used for penning cattle. The cattle (numbering at least 600) were a source of disturbance by way of overgrazing and trampling leading to soil erosion.

Funnel Valley and Vellakkaltheri are in the hills West of Rajapalayam. Davidar (1978) sighted 15 animals in Vellakkaltheri in May 1976.

Puliangudi is South of Rajapalayam and the long chain of hills held a good population in olden days (Davidar, 1978). There had been difference of opinion on the presence of tahr in the area even in 1976.

2.1.9 The Ashambu Hills is spread over Tamil Nadu and Kerala on the southern extremity of the Western Ghats. The Tirunelveli section is generally referred to as the Singampatti hills. A motor road cuts across the section of the hills from Kalladaikurichi in the plains in the East through Manimuttar and Manjulai estates and terminates at Kodayar hydroelectric project. From about half way up the hills the road traverses part of Kalakadu.

Panchanhangi Malai is a promising tahr habitat supporting a good population. It is also known as Muthalathi malai (Davidar, 1978). In 1977, the estimated population was about 20 and the area could not be surveyed properly due to tall grass.

Varaiattu Mottai in the area was reported to hold a good population of tahr but thought to have disappeared due to poaching according to Davidar (1978). However, there had been unconfirmed sighting reports by minor forest produce collectors.

Kulirati Mottai is on the South East of Sengaltheri, which could be approached through a bridle path from Kalladaikurichi – Kodayar road. It is at an altitude of 1300 m. The area was reported to have tahr in 1977.

Pechiparai Cliffs became popular because of the reservoir at the foot of the hills. The tahr habitat is known as Variattu Mottai is bounded by the road on the top, the trolley line to the Kodayar power house on the north, thick forest on the south and the plains below. This is about 8 km² in extent at an altitude of 700-1200 m. In 1969, Davidar saw six tahrs, J. C. Daniel (1971) saw 12 in 1970 and Davidar saw 14 in 1976.

Klamala overlooks the Kodayar power house and is called as Variattu mudi, Paivarai kattu, Aduppukal, Venkalamalai, Klamala and Mahali at different points. The part of the hills is in Kerala and partly in Tamil nadu. In 1976, Davidar reported two herds of 13 and 9. The population estimated in 1977 was 70.

Thiruvannamalai Peaks lies in the Boothapandi Forest Range and is the southern most habitat of Nilgiri tahr. The Thulukkamabari River flows on the north western side of the northern peak (1596 m). There used to be heavy poaching pressure even in 1976. From the reports and evidences, it was estimated to have about 40 to 50 animals. The adjacent hills Kattangathatty, Mayamparambu, Kannikatti, Kacherimottai and Vanamutti were reported to have tahr till 1971. Cattle grazing was a problem at the time.

3. THE RECENT SURVEYS

Kerala Forest Department (1989) published the status of Nilgiri tahr in the state based on a state wide survey, the time of which varied according to the locations ensuring better visibility and more reliable count. In Eravikulam National Park, the bounded count method was employed where the entire area was divided into blocks and counts were organized simultaneously. The results are summarized below.

- 1. Silent Valley** – Tahr were observed in Ankindamalai and Sispara Pass, which are closer to the Mukurti Tahr sanctuary of Tamil Nadu. Movement of animals between these areas was reported. Thirty eight tahr including 18 young were observed. Indirect evidences of tahr was observed in Neelikkal.

2. **Elivalimala** falls in Olavakkodu Range of Palakkad Forest Division and is composed of about a dozen spurs. Of these Palamala and Karimala constitute the tahr habitat, which is very extensive supporting a reportedly good population. Poaching from Kalladikod and Dhoni side is the major issue.
3. **Parambikulam and Nelliampathy Hills** – The high altitude hill ranges in these areas support a good population in Karimala Gopuram (12 animals), Vengoli (32), Kattadimudi (Valia and Cheriya-) bordering Tamil Nadu (3), Kundrachola, Pullamala and Cliff Point (44). Most of the populations had young ones also. Poaching was reported to be the major threat in some of the areas.
4. **Eravikulam National Park** supported a population of 783 animals, which included 276 young ones.
5. **Tertian plateau** is planted with Eucalypts but still supported a population of 22 tahr including 6 young ones. The grass lands in the area are extensive.
6. **Silent Valley Plateau** is also an ideal habitat where tahr presence was confirmed.
7. **Managapara in Chinnar Wildlife Sanctuary** is a tahr habitat which is contiguous with Tamil Nadu. Tahr presence in the area was confirmed though no figure for the actual number was available.
8. **Mangaladevi and Manalar in Periyar Tiger Reserve** are contiguous to Highwavys and Vellakatheri in Tamil Nadu. Both these are considered to be good tahr habitat. Tahr was reported long back from Varayattumudi in vallakadavu range and Varayattumutta in Thekkady Range. Both these are isolated and with grass lands.
9. **Varamalkettu area of Varayatumudi in Neyyar Wildlife Sanctuary** borders the extensive tahr habitat in Tamil Nadu. Fifty two animals were recorded from the area.
10. **Ibex Hill near Ponnudi** in Trivandrum Forest division supports a good population of tahr.

The recommendations included strict protection measures in vulnerable areas, interstate co-operation, reintroduction in the former ranges and monitoring of the population and habitat.

Abraham *et al.* (2006) conducted a survey in the Kerala part of the Western Ghats recording the number of animals, assessing the habitat quality and estimating the extent. The summary from the survey is given below.

3.1 Siruvani-Muthikulam Hills

The Siruvani hills is contiguous with Attappady and is one of the smallest hill ranges in the Western Ghats. The peaks (Vellingirimala, Kunjaramala, Peria Kunjaramala, Ayyappanmudi (or Periya Attumala) and Elivalmala) rise sharply from the basin reaching heights between 1500 and 2100 m. Smaller grass-covered hills are found in this area. Elivalmala (which means rat's tail mountain) lies to the north and west of the Palghat gap and south of Muthikulam. The extent of the grassland area is about 10 ha and is bordered by evergreen forests on the northeast and south and rocky cliff on the western side. Eleven tahr were seen during the visit. One was a lone saddleback, about 6 year old. A group was sighted very near to the cliff and had 6 adult females, 2 sub adult males and 2 sub adult females. The forest officials of the Singappara Forest station reported that they had observed a herd of 30 in December 2000. The abundance of tahr pellets clearly indicates that this area is used by more than one herd.

A recent survey by Predit of WWF reported 23 tahr in Periya Attumalai, 2 in Chinna Attumalai, 24 in Elival malai, 35 in Attumalai and 15 in Palamalai (Predit, 2009). There were about 20-30 in Kalladikodan malai. Another tahr habitat is the Kunjaramala, which borders the Kerala-Tamil Nadu in the south end of the Siruvani dam. It is contiguous with the Ayyappanmudi and is about 1 km² in extent. The central land grassland extends to over 2 ha. The major part of the area is steep cliffs. Stunted evergreen forests border the top portion of the hill. Though no tahr were sighted during the visit, fresh droppings indicated their presence in this area. The grasslands are quite good. The Elival area is under heavy pressure due to the adjacent human habitation. The tribes depend on the shola forests nearby for the Non Timber Forest Produce resources. The population is also subject to poaching, according to the tribes.

3.2 Pandaravara

Pandaravara is a prominent ridge running north to south and could be seen from the Top Slip forest rest houses. The ridge is in three sections, Pandaravara in the middle, which is the highest point (1300 m), Naduva and Kattadi mala on either side. The grassland and cliffs occupy about 6 to 8 km². The presence of date palm (*Phoenix humilis*) indicates low altitude grasslands.

Four tahr were seen resting on the rocky cliff on the north side of the Pandaravara. The herd included two adult females and two yearlings. There were sufficient indirect evidences to prove that this area was intensively used by tahr in the past. The extent of grassland is on the decrease and is highly eroded with frequent fire. The food species were also very low in abundance.

3.3 Shettivara hills

The Kerala part of the Vengoli hills, known as Shettivara hills, faces the forest settlements in Thunakadavu across the lake. Only one saddle back was sighted in the lower base of the hill at about 600 m altitude. The abundance of pellets indicates a small group of tahr in the area. The animals are said to be moving to the Valparai area. The area has changed drastically in the recent past. The food species is almost lacking and the area is already with shrubby vegetation.

3.4 Karimalagopuram

Karimalagopuram consists of two peaks, the Karimala (1445 m) and Kalyanathy mala (1418 m) on the southern part of Parambikulam Wildlife Sanctuary. Karimalagopuram is an ideal habitat for Nilgiri tahr with sheer cliffs on one side and undulating grasslands extending to 3 to 4 km². Nine animals were seen during the visit in the Kalyanathy mala, five adult females and four sub adults. No tahr was seen in Karimala. But the presence of pellets indicates that this area is highly utilized by tahr. *Themeda tremula*, *Arundinella mesophylla* and *Heteropogon contortus* are abundant in this area. The lemon grass, *Cymbopogon flexuosus* covers almost all parts. The area is vast but the observations indicated lack of food species (as recorded from Eravikulam) in the area. However, it is possible that tahr may be using different species depending on the availability.

3.5 Kuchi Mudi

Kuchi mudi is located in the northern part of Parambikulam Wildlife Sanctuary. The area is dominated by dry deciduous forest intermixed with bamboo thickets. The hills rise abruptly in

the north with an altitude of 1290 m. Thick undergrowth of *Cymbopogon flexuosus* and hill date palm is dominant in this area. During the present study, no animals were seen but the indirect evidences indicate that more than two tahr are using this area. The area is contiguous with Nelliampathy hills. The labourers in the nearby estate reported sightings of 15 tahr at the time of forest fire in the grasslands. The estate nearby is a source of disturbance due to human pressure and the area is subjected to fire every year. The population reportedly moves to other areas in Nelliampathy and hence escapes from much of the anthropogenic pressures.

3.6 Mangala Devi in Periyar Tiger Reserve

The Mangala Devi contains low altitude grasslands and rocky patches. Twelve animals were seen going down to the lower dry deciduous forest in Tamil Nadu side. Alembath (2002) reported 16. The area has abundant food species but fire is frequent.

3.7 Kochupamba

This area falls under the Goodrickal Reserved Forests of Ranni Forest Division. The tahr habitat is a fragmented area of about 10 km long and about 1 km wide. The maximum altitude is 1180-1200 m. A total of 22 animals were sighted during the visit. This included four saddlebacks seen on the southern extremity of the area. Alembath (2002) sighted 23 animals. The number of cliffs is more on the western side of the ridge. There was reliable count of about 42 by James Zacharias (per. comm.). The dominant plant species is the Lemongrass, *Cymbopogon flexuosus*. It is not fed by tahr mainly because of high tannin content. Other dominant species are *Arundinella ciliata*, *A. purpurea*, *Heteropogon contortus*, *Ischaemum indicum*, *Panicum notatum*, *Themeda triandra* and *Tripogon bromoides*. As many as eight species are found to be fed by tahr in this area. *Ischaemum indicum* was the most preferred and abundant species. The other major food species are *Arundinella ciliata*, *A. purpurea*, *Heteropogon contortus*, *Themeda triandra* and *Tripogon bromoides*. The area is good in terms of extent, abundance of food species and the number of cliffs. It is not much disturbed but for cattle grazing in some portions and fire in summer.

3.8 Ponmudi Hills

Ponmudi hills is a continuation of the Agasthyamala region. The grasslands found on the top of the hills are dominated by date palm. The highest peak is the Ponmudi peak with an altitude of

1080 m. There are private plantations of tea and rubber in the peripheral areas of this mountainous region. Tahr were seen on two peaks, Sarkar Motta and Ponmudi peak. Eighteen tahr were seen during the survey. GREENS (2000), a voluntary organization, sighted two groups of tahr consisting of 13 and 18 individuals with five yearlings in 2000. The area, though rich in food species is highly disturbed due to human interference from the adjoining plantations. It is also subjected to frequent fire.

3.9 Varayattu Mala

The Varayattu Mala is located on the higher elevations of Neyyar Wildlife Sanctuary with the crest line height of the Ghats not exceeding 1500 m. Extensive grasslands are spread along the rim of the valley starting from Kodayar Reserved Forest to Agasthyar Peak. Fifty eight animals were observed in the area. Only six could be classified. A recent survey by Sharon (2010) sighted 76 animals. The grasslands are dominated by *Imperata* sp., date palm and *Themeda* sp. This area is adjacent to Kalakkad–Mundanthurai Tiger Reserve of Tamil Nadu. The area is rich in food species and is extensive with cliffs. Human pressure, mostly from Tamil Nadu is reported in this area. Poaching has also been reported to be a problem, especially from Tamil Nadu.

3.10 Nelliampathy Hills

A total 38 animals were sighted in Kurisumala - Hilltop (37) and Mampara (1). The workers of the estates nearby reported sightings of about 80 animals at Kurisumala – Hilltop area. The sighting of five yearlings in the herd during the present survey also indicates recruitment to the population. The grasslands at Hilltop have extensive cliffs and abundant food species. However, the area is highly disturbed due to various human activities including tourism, which lead to fire in summer. Poaching is also reported from the area. Cattle grazing is the major degradation factor.

3.11 Meesappuli Mala

The area in Silent Valley plateau in Munnar region is one of the best ideal habitats of tahr in terms of food species, extent and the lack of disturbance. The count in the area has shown that there are at least 64 animals in the area. Predit (2009) observed 50. There are actually no factors observed as degrading the habitat. However, there had been serious doubts on the safety of animals in the southern part due to human accessibility.

3.12 Gundumala

The area is near the Tertian plateau in Munnar with a population of about 60 tahr. Food is abundant and the area is extensive with not much human pressure.

3.13 New Amarambalam - Anginda areas above Silent Valley National Park and New Amarambalam Reserve Forests of Nilambur South Division is known to have a population of tahr. However, it cannot be treated as a fragmented population because of the contiguity with the adjacent tahr habitat of Mukurthi National Park.

3.14 Chinnar

Three animals were sighted in Chinnar Wildlife Sanctuary during the present survey. The tahr habitat is a small hill called Jamba Mala (or Kasi Mala) near Mangappara settlement. The grassland is approximately 2 km². James Zacharias (per. comm.) sighted 18 animals in this area in 1988. Food species are not abundant apparently due to frequent fire. French Institute, Pondicherry as a part of the landscape study reported 12 locations in Kerala with Nilgiri tahr (Ramesh *et al.* 2005). Of these, Charpapadam, Pandimudi, Sulimala, Vagirian, Manjakkallan and Minampara are new additions to the existing knowledge (Table 4).

Table 4. Nilgiri tahr habitats in the Landscape

Sl. No.	Division	Location	Population
1	Parambikulam	Karimalagapuram	30-40
2	Parambikulam	Vengoli	6-10
3	Parambikulam	Pandaravarai	5-10
4	Vazhachal	Charpapadam	10-15
5	Chalakudy	Pandimudi	10-15
6	Malayattoor	Sulimala	< 5
7	Malayattoor	Vagirian	5-10
8	Malayattoor	Manjakkallan	30 – 50
9	Nemmara	Minampara	10-15
10	Nemmara	Padagiri (Hilltop)	30-40
11	Nemmara	Kottangadi estate uphill	5-10
12	Nemmara	Korakkunnumala	5-10

It was noticed that the tahr populations in Vengoli and Pandaravarai were ranging in the neighbouring similar habitats (separated by woody vegetation) along the same hill range. Also

the population in Manjakallan of Idamalayar Range traversed along the ridges that extends about 2 km and occasionally cross the valley on the south and utilize the similar habitats of the other side. Among the 12 populations reported, habitat survey in selected locations indicated that almost all the areas had fairly good amount of fodder species represented by grasses and herbaceous elements. The important fodder species such as *Heteropogon contortus*, *Andropogon lividus*, *Arundinella pupurea*, *Ischamem indicum*, *Tripogon* sp., etc that form the major diet of tahr are found in almost all the identified locations. The major threats to these populations are poaching and other anthropogenic pressures such as grazing by cattle, fire, etc. Fire totally eliminates the fodder species of tahr, while grazing by cattle reduced the fodder availability to the species and disperses diseases. Cattle grazing have been noticed in all the locations in Nemmara. Out of the twelve locations, nine are in the territorial divisions and the Hilltop, Minampara and Manjakallan are very close to the tea estates coupled with absence of forest administrative infrastructures (protection units).

Easa and Sivaram (2002) developed a Habitat Suitability Index Model for Nilgiri tahr taking Eravikulam for bench mark data. The developed model was applied only to some selected tahr habitat and the values are given in Table 5. An assessment based only on the HSI1 and the density of the animal indicates that Meesappuli Mala, Gundu Mala, Elival Mala and Nelliampathy Hills may be areas worth considering for conservation. The critical elements that determined the distribution of the Tahr were altitude, cliffs and food availability especially the extent of grass cover. In the habitats of fragmented tahr populations, cattle grazing, poaching, human disturbance and fire were the important habitat degradation factors identified. HSI models were formulated based on the habitat- density relationship. This clearly indicates that the Tahr prefers habitats with sufficient extent of cliffs, presumably to escape from the predators.

The Forest department in Kerala and Tamil Nadu had been organizing 'census' in most of the important tahr areas almost regularly though there had been no synchronization between areas and uniformity in methods. The results are also normally not published nor reflected in the management prescriptions. However, these exercises are carried out with utmost care ensuring NGO/NGI participation at least in Eravikulam National Park. The census figures for Srivilliputhur Grizzled Squirrel Wildlife Sanctuary are given in Table 6.

Table 5. Suitability index values for different tahr habitats

No	Name of the place	SI1	SI2	HSI1
1	Mangaladevi	0.84	0.58	0.70
2	Karimala	0.84	0.62	0.74
3	Elival mala	1.00	0.90	0.95
4	Nelliampathy	1.00	0.66	0.81
5	Chinnar	1.00	0.76	0.87
6	Varayattumala	1.00	0.44	0.67
7	Ponmudy hills	1.00	0.36	0.60
8	Meesappuli mala	1.00	1.00	1.00
9	Gundumala	1.00	0.95	0.97
10	Kochupamba	1.00	0.53	0.73

Table 6. The Number of Nilgiri tahr observed in Srivilliputhur Grizzled Squirrel wildlife sanctuary surveys

Area	1999	2000	2001	2003	2004	2007	2009
Kuliratti Mottai	17	9	12	34	26	12	8
Kottamalai	46	32	52	34	39	12	4
Chinna Kottamalai	-	-	-	-	16	-	-
Mavarasiammankoil	18	24	17	9	12	-	-
Kambathu Perumalkoil	17	26	12	34	18	-	10
Vellakaltherimedu	21	17	21	19	22	-	-
Perimalai	-	-	-	-	-	11	-
Mudaliyar Oothu	8	17	21	29	16	-	5
Veilangal	7	13	7	18	22	-	-
Athladi Kidai	-	-	-	-	-	6	-
Taliarutan Keni	-	-	-	-	-	21	-
Tiruvakalmottai	-	-	4	6	16	-	-
Kottamalai Sapthur	26	18	12	15	21	4	-
Perumal Mottai	11	7	16	12	8	-	-
Mayandi Kidai	-	-	-	-	-	-	11
Monkanoothu Mottai	-	-	-	-	-	-	2
Saralai	-	-	-	-	-	-	7
Pachayaru Mottai	-	-	-	-	-	-	7
Kampathu Mottai	-	-	-	-	-	-	4
Pachikal Mottai	-	-	-	-	-	-	5

The trends for the well studied areas are given in Table 7 and the recent estimates of Nilgiri tahr in different areas are summarized in Table 8.

Table 7. Population trends in selected Nilgiri Tahr Protected Areas (Daniels *et al.*, 2006)

Protected Area	Reported population size			
	1969-1978	1979-1988	1989-1998	1999-2006
Eravikulam NP	500-700	550	890-1000	670
Mukurti NP	334	450	150*	200-250
IGWLS & NP (Grass Hills)	133	240	250-300	411

Source: Schaller (1970); Davidar (1976 & 1978); Rice (1984); Easa (1995); Mishra and Johnsingh (1998); Shackleton (2000); Daniels (2006); Tamilnadu Forest Department, Wildlife Warden's Office, Pollachi; R Arumugam, unpublished census report; *this estimate was based on 2-3 days of census on foot (Sumithran, 1997).

Table 8. Most recent estimates of Nilgiri Tahr population (Daniels *et al.*, 2006)

Locality	Population size	Year of estimation	Source of information
Eravikulam NP	670	2005	Kerala Forest Department
IGWLS	626	2006	TN Forest Department
Mukurti NP	200-250	2004	R Arumugam; unpublished Census Report
Palani Hills	280-310	2001	Bala (2001)
Kerala (excluding Eravikulam NP)	303	2001	Abraham <i>et al</i> (2006)
Tirunelveli Hills	14-85	2006	Daniels <i>et al</i> (2006)
Kanyakumari Hills*	778-889	2006	Daniels <i>et al</i> (2006)
Total	2871-3133	-	-

Predit (2009) reported a total of 480 tahr in Nilgiris including locations in Silent Valley and Nilgiri South Forest Division.

The habitat suitability of tahr locations, based on various authors is given in Table 9.

Table 9. Habitat suitability as assessed by Mishra and Johnsingh (1998) and Abraham *et al* (2006) in recent years

Landscape	Location	Suitability	Source
Anaimalai-Parambikulam & Nelliampathy Hills	Pandaravarai (= Pandarava; Table 13)	Extensive; 6-8km ² ; low elevation grasslands; frequent fire and low density of food grasses	Mishra & Johnsingh (1998); Abraham <i>et al</i> (2006)
	Perunkundru (Table 13)	Poaching observed	Mishra & Johnsingh (1998)

	Palagankundru (= Palagakundru; Table 13)	Restricted and isolated	Mishra & Johnsingh (1998)
	Vengoli-Pamban Malai Ridge (Vengoli Malai; Table 13)	Narrow and restricted	Mishra & Johnsingh (1998)
	Shettivara Hills (= Vengoli Malai; Table 13)	Degraded; scrub; contiguous with Valparai (TN)	Abraham <i>et al</i> (2006)
	Karumalai Gopuram (Table 13); = Karimalagopuram	Extensive; abundance of food grasses; poaching likely	Mishra & Johnsingh (1998); Abraham <i>et al</i> (2006)
	Kuchi Malai-Mullan Malai & Kuchi Mudi	Drier habitat; human pressure from estates ; fire; poaching severe; nomadic herds	Mishra & Johnsingh (1998); Abraham <i>et al</i> (2006)
	Kurimumala Hill Top (= Cruz Malai & Hill Top; Table 13)	Extensive with abundant food; cattle grazing; fire; poaching	Abraham <i>et al</i> (2006)
	Aliyar-Kolumbumalai (Table 13)	Fragmented & heterogeneous; poaching likely	Mishra & Johnsingh (1998)
	Navamalai (Table 13)	6-8km ² of habitat; poaching severe	Mishra & Johnsingh (1998)
	Thadaganachi Malai (Table 13)	Over-grazed habitat; <i>Lantana</i> & <i>Parthenium</i> prolific; poaching severe	Mishra & Johnsingh (1998)
	Varaiattu Malai-9 th Hairpin Bend	Extensive along the road	Mishra & Johnsingh (1998)
	Pacchaipul Malai	Fragmented & heterogeneous	Mishra & Johnsingh (1998)
	Grass Hills (Table 13)	Extensive & heterogeneous; poaching severe	Mishra & Johnsingh (1998)
	Chinnar WLS	Grasslands 2km ² ; low density of food plants; fire	Abraham <i>et al</i> (2006)
Nilgiris-Siruvani Hills	New Amarambalam-Anginda (= Ankinda Malai; Table 13)	Contiguous with Mukurti NP; safe	Abraham <i>et al</i> (2006)
	Vellingirimala (= Vellingiri Malai; Table 13)	Not extensive	Abraham <i>et al</i> (2006)
	Kunjaramala (= Kunjara Malai Ridge; Table 13)	Grasslands 'quite good'	Abraham <i>et al</i> (2006)
	Elivalmala (= Elival malai; Table 13)	Grasslands c. 10ha; bordered by forests; human pressures on habitat and poaching	Abraham <i>et al</i> (2006)
High Range	Meesappuli Mala	'Ideal'; human impacts severe	Abraham <i>et al</i> (2006)
	Gundumala	Abundance of food plants; less human interference	Abraham <i>et al</i> (2006)

Srivilliputtur Hills-High Wavy Mountains-Periyar TR	Mangaladevi	Low altitude grasslands; abundance of food plants; frequent fire	Abraham <i>et al</i> (2006)
	Kochupamba (Gudrichal)	'Good' in extent; abundance of food plants; occasional grazing & fire	Abraham <i>et al</i> (2006)
Tirunelveli Hills-Agasthya Malai	Ponmudi Hills	Fragmented grasslands; rich in food plants; high human impacts; fire	Abraham <i>et al</i> (2006)
	Varayattu Mala (Neyyar WLS)	Extensive; contiguous with Kalakad Mundanthurai Tiger Reserve; rich in food plants; poaching reported	Abraham <i>et al</i> (2006)

4. REASONS FOR CONSIDERING THE TAHR AS ENDANGERED

Habitat loss and fragmentation of the available habitat are the major concern while considering the conservation of a species. These also have adverse impact on the diversity richness in general. The tahr, being confined to a narrow belt of higher elevation areas in a restricted geographical region and because of the specialized habitat requirement, is all the more threatened. A major part of the historical range of the tahr has been lost to plantations including tea. Parts of the remaining grasslands have been planted with eucalypts, wattle and pine. This is especially pervasive in Nilgiris and Palnis. Some plantations have also been established in the territorial forest divisions in Kerala posing threats to the adjoining tahr habitat. The habitat has also been threatened with weeds thereby reducing the availability of food species. Some areas like Panchanhangi Mottai in Kalakad have been abandoned by the tahr recently (in the last ten years). There may also be other areas from which it has been exterminated or the number has been reduced.

The developmental activities in the areas connecting different habitats have also been a major threat forcing the herds to be within a small area and possibly leading to genetic problems due to isolation of subgroups. Most of the tahr habitat have also been surrounded or bordered by estates or agricultural land where conservation awareness is lacking among the new generation of

managers. The cattles grazing in and around tahr habitat compete with tahr and other wildlife for the scant resources and pose the potential of spreading disease.

The population decline poses a major problem in areas where the level is brought to a level where there is reduced resilience. The tahr populations in the areas bordering Periyar and falling under the administrative control of the Thirunelveli Forest Division are probably the most fragmented with low number of individuals. The hunters had taken a heavy toll in the past even in Nilgiris, Anamalais and Munnar. Though the claim has always been that hunting ensured protection, the impact is never measured mostly because the earlier literature including the survey reports had been by former hunters. Poaching using different techniques had its own impact on some of the populations.

5. THE CURRENT MANAGEMENT PRACTICES

The tahr areas in Protected Areas are currently managed under Management Plans. However but for the Eravikulam and Mukurthi National Parks, the Management Plans do not give stress on tahr centered conservation activities. The Management Plan for Eravikulam probably is the best in terms of protection, fire management and population estimation and also tourism management including public awareness programmes. The recent Management Plan of Mukurthi also considers many of the concerns in terms of tahr conservation including the removal of exotics. The stress of these two Parks is of course the Nilgiri tahr.

Though the Management Plans of Anamalai Tiger Reserve and Kalakad – Mundanthurai Tiger Reserve do not have tahr as a priority species, separate Tahr Conservation Plans have been prepared. The Management Plans for other Protected Areas within tahr distribution has not specifically included any programmes relevant to tahr conservation. The Conservator of Forests, Southern Circle in Kerala, has also prepared a Tahr Conservation Plan for the two areas (Ponmudi and Kochu Pamba) falling under his jurisdiction. The other Territorial Divisions currently do not have any specific activities for tahr conservation. However, most of the protection measures will definitely help the whole areas.

Eravikulam, Nilgiris and Srivilliputhur are probably the only areas where periodical annual monitoring of the population is carried out. The involvement of voluntary organizations and individuals in these places also ensure the seriousness of the work and transparency. In Periyar, this is mostly done as a part of the routine population estimation.

6. THE PROCESS

The ultimate goal of the project was to prepare a Recovery Plan with the objective of protecting the Nilgiri tahr, maintaining sufficient number of individuals in different populations and maintain quality habitat ideal for the long term conservation of the species. The process involved the following

- Scanning the literature for information on the distribution, status, ecology and behavior
- Personal discussions with the Researchers, present day Officials of tahr areas and limited field visits
- Workshop with Forest Officials and Researchers and NGO representatives to comprehensively assess the state of knowledge about the distribution and conservation status of tahr, to identify priority areas for its conservation and to build a consensus for conservation of the species
- Compilation of information and preparation of maps showing the distribution
- Limited field visit and discussions with field officials for clarifications of doubts
- Identification of Tahr Conservation Units defined by potential habitat comprising different meta populations and habitats.

During the workshop, the participants sat with an area map and the available information based on the published literature. It was assumed that each participant could identify tahr locations on the map with minimum error. Four basic data types were solicited from the workshop participants: (1) the geographic extent of their knowledge about tahr status and distribution, whether or not tahr are present in an area ("extent of knowledge"); (2) the area where tahr are currently present ("known, currently occupied range"); (3) important areas for tahr conservation ("Tahr Conservation Units"); and (4) Locations where tahr have been observed during the current period and the basis of population figures. The information obtained from the workshop is summarized in Table 10.

At the workshop the data were examined systematically in regional groups to resolve discrepancies and build a consensus information base. These were later verified with field visits and corrections made based on the discussions with officials who had in turn collected more detailed information after the workshop. These data were compiled in geographic information system databases (Arcview–GIS). The details of identified tahr locations in three landscapes are

presented in Tables 11-13. The names of tahr locations, the geographical co-ordinates and the extent of each habitat are also included in the Tables. These areas are also given in Figures.

The information from Rice (1984) and Murugan (1997) were considered while delineating conservation units. Due to the lack of detailed information for many areas, subjective assessments were necessary. However, this subjectivity was based on the information obtained from the workshop participants and from personal experience. Tahr Conservation Units (or TCUs) are defined as areas with at least current population of about 100 individuals and habitat large enough to support a viable population giving enough scope for movement between habitat patches. It would have been ideal to consider the minimum viable population size and critical minimum area for maintaining such a population. In the absence of such information, the attempt is to ensure as large areas possible for long term conservation.

Table 10. The number of tahr locations and population estimates from the workshop

Division	Number of locations	Number (Approx.)
Kanyakumari	9	290-385
KMTR	11	435-445
Thiruvananthapuram (Wildlife)	2	50-65
Thiruvananthapuram	1	20-25
Thirunelveli	18	405-505
Srivilliputhur GS Sanctuary	16	317-347
Theni	8	320-360
Ranni	1	40-50
Anamalai Tiger Reserve	41	368
Eravikulam National park	1	747
Palnis	4	40-60
Munnar	6	60-80
Nilgiris	16	350-400
Silent valley	3	40-50
Parambikulam –Nelliampathis	7	90 –120
Mannarkad, Walayar and Olavakod	12	100-120
Chalakydy, Vazhachal, Malayatur	5	60-105
Total	161	2617-4232

The extent, linkages, habitat quality, poaching pressure and population status of tahr in different locations were considered while giving weightage. Although all TCUs represent areas with

substantial populations and adequate habitat, not all TCUs occur in areas classified as high-probability for the long-term survival of tahr. The TCUs are given in the maps attached with the Plan.

Table 11. Details of tahr locations in the Nilgiris landscape

SN	Tahr Locations	Extent of tahr habitat (km ²)	Longitude	Latitude	Altitude (m)
1	Yella Malai	1.22	76.4949	11.4069	2400
2	Terrace Estate	0.29	76.5270	11.4130	2100-2200
3	Pandiar Top	0.18	76.5355	11.4095	2100-2200
4	Nilgiri Peak	0.78	76.4814	11.3854	2475
5	Deva Betta	2.06	76.5103	11.3763	1900-1950
6	Mukurti Peak	3.86	76.5113	11.3517	2000-2560
7	Western Catchment II	7.63	76.5477	11.3017	2500-2600
7a	Western Catchment I	0.41	76.5678	11.3239	2500
8	Kolari Betta	0.90	76.5407	11.2831	2500
9	Arikkaran malai	2.06	76.5204	11.2758	2470-2500
10	Western Catchment I	0.32	76.5369	11.2711	2553
11	Western Catchment II	0.42	76.5477	11.2791	2500
12	Deva Malai	0.53	76.5594	11.2698	2300
13	Bangitappal	1.25	76.5009	11.2628	2343-2400
14	Nadukani, Sispara Pass. Anginda	8.67	76.4565	11.2089	2070-2470
15	Sispara Silent Valley	0.57	76.4254	11.1959	1900-2100
16	Mukkau Mudi	2.19	76.4617	11.1639	2050-2200
17	Nelli Kunnu	0.31	76.4930	11.1734	1850
18	Bison Swamp	7.08	76.5261	11.2021	2230-2300
19	Uli Malai and Mallad Malai	7.45	76.5759	11.1996	2190-2350
20	Varagapallam	1.05	76.6375	11.1507	792
21	Malleswaran Mala	1.58	76.5524	11.1020	1664
22	Attu Mudi	3.60	76.4627	11.0620	1250-1300
23	Vellingiri Mala	3.36	76.6850	10.9960	1800
24	Elival, Attumalai, Kumban Malai, Pallamalai & Karimalai	38.23	76.6493	10.9253	960-2070
25	Kalladikodu mala	7.47	76.5644	10.9021	630-1150
26	Cherumbankumban	0.28	76.3830	11.1086	1160
27	Madamudi	0.51	76.3869	11.0934	1160
28	Aduppukooty mala	3.39	76.7418	10.8437	820-850

Table 12. Details of tahr locations in the Periyar landscape

SN	Tahr Locations	Extent of tahr habitat (km²)	Longitude	Latitude	Altitude (m)
1	Thiruvakkal mottai	1.90	77.6262	9.7526	1250-1300
2	Perumal mottai	9.06	77.6777	9.7184	750-1270
3	Kottamalai-Saptur	10.56	77.6024	9.7159	890-1300
4	Pilavukkal dam-saralai area	1.79	77.5473	9.6822	815-830
5	Mettala Malai	1.06	77.4095	9.6934	1500
6	Varayattumottai (Upper Venniar)	1.49	77.3286	9.6360	1600
7	Mangaladevi	3.30	77.2201	9.5949	1200-1340
8	Mudaliar Oothu	17.08	77.5367	9.5822	730-1650
9	Peimalai	3.03	77.5167	9.5534	1500-1700
10	Vellakkaltheri Medu	1.40	77.4742	9.5366	1230
11	Kambattuperumalkovil mottai	0.30	77.4664	9.5414	1350
12	Kambattu mottai	0.73	77.4460	9.5413	1350
13	Varayattumottai	1.78	77.4330	9.5539	1700-1750
14	Kottamalai, Chinna Kottamalai	1.80	77.4229	9.4970	1190
15	Kodappan Varai	0.66	77.4291	9.4814	750-900
16	Kuliratti Estate	2.61	77.4082	9.4501	1150
17	Pachayar mottai	0.28	77.3691	9.4477	1300-1500
18	Pambamala-Gavi	0.82	77.1418	9.3745	1180
19	Mel Bommarajapuram	0.63	77.3864	9.6227	1102-1670
20	Kochupamba	1.99	77.1381	9.3949	1150-1192
21	Kallimalai Estate	0.26	77.3515	9.4127	750
22	Avvayyar kovil - Srivilliputhur border	0.58	77.3618	9.4087	675
23	Udumbutteri Estate	0.20	77.3461	9.3978	950
24	Totti Malai	2.09	77.3429	9.3734	1500-1650
25	Mathalampara	0.15	77.3412	9.3464	1100
26	Kallakadai Mottai	0.98	77.3403	9.3287	1000-1300
27	Sivagirimalai	0.45	77.3048	9.3220	1445
28	Theerthaparai	0.84	77.3406	9.2834	1150-1200
29	Kalli Malai Extension	0.87	77.2944	9.2749	1610
30	Kalli Malai	0.35	77.3011	9.2683	1735
31	Anavilundankadavu, Kallimalai	0.97	77.3165	9.2622	1350-1400
32	Pudumalai Mottai	0.58	77.3060	9.2416	1000

33	Kattadi Mottai Extension	0.62	77.3291	9.2366	425
34	Kattadi Mottai	0.39	77.3157	9.2327	710
35	Neduntheri Malai	0.44	77.2973	9.2245	900
36	Eechantheri mottai	0.28	77.2826	9.2174	1195
37	Puliyankudi- Vaniyankavu mottai	0.68	77.3082	9.2124	800
38	Kodaliparai Mottai	0.43	77.2725	9.2007	1540
39	Pariyasundangi Malai	0.83	77.2916	9.1848	1200-1300
40	Urani Mottai	0.23	77.2545	9.1875	1700
41	Aruvitalai Mottai	0.49	77.2673	9.1589	1625
42	Kaikkettah Komban	0.40	77.2709	9.1468	1465
43	Periyattu Mottai	0.68	77.2620	9.1428	1100-1150
44	Eechentheri mottai	0.61	77.1971	9.0435	900-1100
45	Pillayarkovil mettu	0.84	77.1576	8.9967	600
46	Padikattu Malai	0.26	77.1990	8.9501	850
47	Kottamalai, Varayattumalai	3.01	77.2852	8.8869	1050-1265
48	Vengalakkal mottai	1.24	77.2789	8.8501	950-1050
49	Kudiraittheri	2.17	77.3038	8.7719	950
50	Ponmudi, Sirkar Mottai	3.16	77.0992	8.7388	1040-1075
51	Chemmunji Mottai	0.75	77.2081	8.6853	1580-1715
52	Eetiyyattupudavu	0.67	77.2824	8.7174	1125
53	Krishnan mottai	0.27	77.3429	8.7099	485
54	Aduppukal mottai	2.35	77.2678	8.5859	1000-1100
55	Kattadi mottai	0.78	77.4463	8.5935	760
56	Panchanhangi mottai	3.11	77.4666	8.5771	1100-1200
57	Klamalai, Varayattumudi (Tvm, Kanyakumari), Noolmudi	19.40	77.2961	8.5377	365-950
58	Varayattumottai (3 peaks), Iruttusholai, Pandadikalammottai, Vanamuttimalai, Golden peak, Upperwinch	26.20	77.3954	8.4846	1580-1780
59	Mahindragiri, Thiruvannamalai Mottai (Kanyakumari, KMTR), Parvadamalai	17.09	77.4892	8.3912	920-1700
60	Mahindragiri	1.01	77.5089	8.2880	450-550

Table 13. Details of tahr locations in the Anamalai landscape

SN	Tahr Locations	Extent of tahr habitats (km²)	Longitude	Latitude	Altitude (m)
1	Pundi Mudi	0.75	76.5256	10.4022	1115
2	Charpa padam	0.75	76.5869	10.3645	850
3	Padagiri (Hilltop)	1.24	76.6472	10.5124	995-1525
4	Kottangadi estate hill top	0.14	76.7123	10.5118	1230
5	Minnampara	1.78	76.7313	10.5379	1585-1635
6	Kuchimalai	0.84	76.8474	10.5322	1100
7	Pandaravarai, Kartadi mudi	1.40	76.8226	10.4989	1250-1290
8	Karimala gopuram	5.36	76.7456	10.3670	1150-1450
9	Korakunnu mala	1.49	76.7085	10.3158	838
10	Vengoli and Pamban Malai	1.17	76.8184	10.4261	1050-1130
11	Kolambu, Sottakkal, Kombanpalli, Periyasallukatti, Pacha malai	12.98	76.9497	10.4642	615-1400
12	Ramar malai	1.41	76.9329	10.4429	1490
13	Perumkundru Malai	1.84	76.8925	10.4357	1500-1735
14	Tadaganachi malai, Manjimedu	1.01	77.0398	10.5052	1050-1400
15	Karimedu	0.83	77.0618	10.5031	890-910
16	Navamalai, Bhutakundru	4.18	77.0156	10.4716	910-1190
17	Varayattu mala 9th hairpin bend	2.64	76.9740	10.4336	1050-1720
18	Periyathalanar, Nadumkundru, Chinnathalanar Malai	7.08	76.9518	10.3977	1150-1510
19	Tumman kundru	1.52	76.8681	10.3415	1090-1170
20	Palagankundru	0.60	76.8478	10.3463	1173
21	Mudiyan parai	1.84	76.8258	10.3350	1218
22	Adichal thotti (Vagirian)	1.49	76.8241	10.2697	450-650
23	Suli Mala	1.15	76.8543	10.2261	1340
24	Manjakallan	0.36	76.8756	10.2601	650
25	Pachchaipal malai	2.39	77.0311	10.4003	1280-1770
26	Attu malai	1.53	77.0653	10.4179	1445
27	Puttu malai	1.83	77.1185	10.4510	1225

28	Kanji malai, Varaiyattutittu, Keda malai	1.38	77.1466	10.4571	870-1140
29	Pottu, Sengallu, Kota, Rasi malai	4.64	77.2088	10.4415	940-1350
30	Pambu Malai	2.82	77.1781	10.3949	1880-2025
31	Pichchi malai	2.94	77.1517	10.4056	1530-2100
32	Varasatti malai, Ten malai	3.30	77.1280	10.4178	1310-1585
33	Akka, Thangachi, Tanaka malai	7.67	77.0710	10.3614	2190-2515
34	Usi malai	4.75	77.0433	10.3148	1700-2150
35	Periyar Malai	1.76	77.0573	10.2949	1800-2000
36	Podumalai, Kallarmalai, Sadayandi	6.84	77.0866	10.3147	1140-1285
37	Nandalamalai	0.74	77.1433	10.3104	2000-2370
38	Kumarikkal malai	4.74	77.1150	10.2739	1545-2525
39	Kollukkan malai	1.29	77.0482	10.2363	2050-2280
40	Samban-Rajamalai part	14.03	77.0723	10.1907	1670-2690
41	Sankumala, Pambadumpara	4.30	77.0108	10.1444	2000-2100
42	Kundala	1.00	77.1628	10.1569	2000-2400
43	Jambumalai, V-cut, Vellingiri	0.00	77.2549	10.2542	1840-2400
44	Erumai Malai	0.96	77.2503	10.3730	740-750
45	Sandu Malai	1.12	77.3063	10.3929	950
46	Ellaigundu Malai	0.85	77.3120	10.3678	1250
47	Mudi Malai	4.46	77.3236	10.3174	1830-1905
48	Kukkal, Pappalamman Malai	1.20	77.3644	10.2952	2200
49	Ibex Cliff	10.86	77.3727	10.1351	1950-2520
50	Chulagu Malai	1.13	77.3860	10.0683	1650
51	Kolukkumalai Ext.	3.34	77.2343	10.0780	2000-2280
52	Silent Valley, Meesapuli, Kulukan	5.13	77.2035	10.0968	2400-2650
53	Suryanelli	6.13	77.1956	10.0686	2170-2550
54	Chokkanadu mala	4.25	77.1075	10.0286	1300-2200
55	Mathikettan NP East Bodi Range	1.69	77.2694	9.9890	1650-1850
56	Bahirava malai	0.65	77.1142	10.4005	1800-1850
57	Kokkanamalai	1.03	77.0948	10.3917	1980-2215
58	Arasi Ammal malai	0.62	77.1894	10.4077	1720
59	Nadukanda malai	4.00	77.4252	10.0955	1985-2000

7. CONSERVATION PRINCIPLES IN THE RECOVERY PLAN

7.1 Population consideration

Species conservation calls for conservation of populations and addressing genetic issues (Lande, 1988). The conservation of tahr also needs to take into consideration the current knowledge on habitat use, population dynamics, behavior and spatial population structure. However, the threats to the population seem to pose a greater short term risk in the conservation of a species. Gilpin and Soule (1986) highlight the importance of population parameters in the conservation of small populations as fluctuations in the population parameters (natality, mortality, immigration and emigrations rates, population structure) influence vulnerability to extinction. Lande (1988) felt that population parameters are of more immediate importance than genetic concerns. The smaller number of Nilgiri tahr, its limited distribution and the existence and distribution in several sub groups are of importance to ensure the viability of entire population.

The subpopulations are presumed to be connected through movement of at least saddle backs and these meta populations are considered to be in a state of balance between population extinctions and colonization (Hanski and Gilpin, 1991). As in the case of bighorn sheep (Geist,1971), Nilgiri tahr also seems to be slow colonizers as evident from the abandonment of Panchanthatangi Mottai in Kalakad –Mundanthurai Tiger Reserve from which the animals have disappeared reportedly due to lemon grass invasion. Thus these meta populations could be considered as non-equilibrium meta populations where extinctions occur at a faster rate than colonization (Harrison, 1994; Hanski and Simberloff, 1997). Gilpin (1991) cautioned that such system should be managed carefully to avoid extirpation of the smaller groups while promoting colonization of habitat. This would mean a reversal of the processes that caused the population decline and making attempts to increase the size of the meta populations by enhancing the chances of movement between the populations.

7.2 Genetic Considerations

Loss of genetic variability can lead to inbreeding depression and inability of population to respond to long term environmental changes (Meffe and Carroll, 1994; FitzSimmons *et al.*, 1995). This loss of genetic variation can reduce the growth rate and resilience of populations (Lacy, 1997). This loss is all the more important in the case of smaller populations. Further, the isolation of subpopulations with no connectivity between habitat fragments increases the risk of

losing genetic variability leading to vulnerability to natural fluctuations in the population. The current knowledge about genetic variation within and among the tahr populations is nil. However, the recovery plan is to ensure as near a natural geographic distribution as possible to continue evolutionary and ecological processes (Meffe and Carroll, 1994). This could be achieved by ensuring multiple groups in sub populations and providing ample opportunities for movement between groups. This can also be achieved through population augmentation, reintroduction and captive breeding programmes (Ryman and Laikre, 1991; Elliott and Boyce, 1992).

7.3 Ecosystem Protection

The major threats to the long term survival of the tahr have been described throughout this Plan. Loss of habitat and degradation and fragmentation of the available habitat have been listed as the most important ecosystem related conservation issues. The potential negative impact on the loss and degradation of habitat has been visible in most of the tahr areas where isolated populations occur. There are also the unmanaged habitats of isolated populations about which nothing much is currently known. The limited studies and observations in the Nilgiris and Eravikulam have given some insight into the habitat requirement of the species in high altitude areas. But there could be variations in other locations of low altitude from where tahr has been reported. However, the stress in the Recovery Plan is to ensure conservation larger ecosystems minimising human disturbance and developmental activities with the sole aim of maintaining as many viable populations as possible.

Unfortunately, lack of long term studies providing information input with management implications was a limitation while preparing the Recovery Plan. Population Viability Analyses or Vulnerability Analyses, which the conservation biologists use for better understanding of the species are not available for the Recovery Plan.

8. OBJECTIVES AND CRITERIA

8.1 Recovery Objective

The plan aims to protect and maintain sufficient individuals and habitat of Nilgiri tahr, which would help the species get established in a larger suitable landscape leading to removal of the

endangered status. The objectives of the Recovery Plan could be considered as achieved once the number of Nilgiri tahr in the identified units increase to a level where the risk of extirpation from any event is sufficiently reduced. This could be assessed by monitoring the population numbers and structure, habitat quality and connectivity. It is proposed to achieve the goal of tahr recovery through population and habitat management practices. The recovery strategy is based on the synthesis of information available till date and consists of improving population variables and securing and managing habitats including the linkages.

9. OUTLINE FOR RECOVERY ACTIONS TO ADDRESS THE THREATS

The proposed actions are divided into the general and site specific, the former being applicable to the entire or most of the tahr ranges addressing issues of common nature. The tasks are either interim or long term to achieve management goals and the suggested activities range from single event actions to continuous efforts.

9.1 Promoting Population Increase and Protection of Habitat

9.1.1 Protection, acquisition, enhancement and restoration of habitat

The historic ranges of Nilgiri tahr has considerably reduced due to development, agriculture and other activities leading mostly to fragmentation and modification of habitat. Unfortunately most of the earlier descriptions on the distribution of species were incomplete as it was limited to only a few areas. Later surveys have brought in information from new areas. However, it is definitely clear that tahr has been pushed to the core of the earlier ranges at least in some areas forcing them to limit their area of activity to fragments or smaller areas. Thus the recovery of the Nilgiri tahr is dependent on the availability of larger suitable habitat and hence the recovery effort is to be directed towards the protection and restoration of habitat.

9.1.2 Protection of essential habitat

The habitat suitability index model using the largest tahr habitat in Eravikulam National Park has highlighted the importance of altitude, cliffs and food availability in the habitat of tahr. The historical distribution records available from publications and the selected tahr conservation units with ideal habitats, along with the resources such as food, water and cover, are considered here

as essential tahr habitat to support a natural population for long term conservation and with all capabilities of resilience.

Even the historical ranges where tahr has disappeared in the last few years are also critical assuming that these habitats may be colonized and inhabited by tahr subgroups in future. According to May (1991), destruction of only a fraction of available habitat could drive a meta population to extinction by disrupting the balance between colonization and extinction rates. Hence it is important to maintain larger suitable habitats for future colonization of tahr.

There have been several reports of tahr subgroups (Female and sub-adults moving from Pandaravarai to Kolumban in Topslip crossing highway and through deciduous patches), saddle backs (from Eravikulam to Iddali mottai areas (James Zacharias)) and once in Thannikudy in Periyar (M. Balasubramanian). There were a few observations of tahr movement in Kavala area of Chalakudy by the Forest staff and Kadar tribes of Anapandam in Chalakudy. There had also been several observations from different areas where doubts have been raised on the movement of animals between areas.

The habitats delineated in the maps are the essential habitats. The present delineation of tahr areas is based on knowledge base of forest officials and researchers. However, information provided by the local people especially tribals have also been used. The over all population numbers still remains low and small populations use only a portion of the available habitat. Reliable data on habitat use are rather scant. Only one work (Easa and Sivaram, 2002) has attempted to describe the habitat suitable for Nilgiri tahr. In this recovery plan, it is assumed that all habitat types used by the tahr are necessary for their population viability. However, the habitats between two cliffs, required for movement between populations are also taken as essential. Altitude could have been a better criterion for delineating habitat once the tahr locations were identified. But the knowledge on the tahr locations clearly shows high variation in altitude depending on the area.

The tahr habitat or habitats adjacent to the currently used habitats, which are considered crucial for long term viability could be secured through purchase/ acquisition if under private ownership. The habitats, which are not essential but falling within the movement area of tahr/connectivities and thus identified as important for population viability are managed/restored/protected to ensure habitat viability. A list of areas to be secured is to be prepared and prioritized. The habitat

between two populations and adjacent to populations are crucial for geographical expansion when the population increase. The areas falling under the government may be managed to maintain habitat connectivity. The owners/ corporate of the private areas may be encouraged to manage their land under a plan so that the Nilgiri tahr populations are benefitted and the land is available for free movement of animals.

9.1.3 Removal of exotics and prevention of further invasions

Invasion of grasslands and sholas by exotics have been reported from most of the primary tahr areas, especially Nilgiris where *Cytisus scoparius* (scotch broom) and *Ulex europaeus* (Gorse) have been threatening the natural areas. The frequent fire and lemon grass (*Cymbopogon flexuosus*) invasion has been reported to be the cause of disappearance of tahr from Panchanthatangi Mottai in Kalakad – Mundanthurai Tiger Reserve.

The mean temperatures in the tropics are expected to increase by at least 1-2⁰ C over the next few decades (IPCC, 1992). General circulation models predict an intensification of the Indian summer monsoon as a consequence of increased temperature (Hulme and Viner, 1995). Though there is much uncertainty as to the magnitude of climate change, it has been predicted that increased temperature could lower the incidence of frost and facilitate spread of wattle, which is a C₃ plant. The montane shola could expand into grasslands and C₃ grasses and herbs are predicted to replace C₄ grasses (Sukumar *et al.*, 1995; Ravindranath *et al.*, 1997). Active management of the habitat is required to reduce the impact of climate change on Nilgiri tahr.

Planting of exotics like wattle and pines in some of the areas has reduced the availability of ideal habitat especially in Nilgiris and Palnis. The tahr habitats in Nilgiris and Palnis have been considerably reduced because of wattle. The impact of wattle on the grassland ecosystems are yet to be studied in detail. However, observations indicate invasion of wattle into the shola patches. The management of Mukurti had attempted removal of wattle from selected blocks. In Palnis, the tahr is reported to use the pine and wattle plantation. It is however suggested to remove the plantations from these areas in a phased manner with overall goal of securing these areas through conversion into ideal grassland habitat. The removal of exotics from such plots is to be monitored for changes in plant composition and habitat use by animals.

9.1.4 Indigenous communities in tahr conservation

Majority of the tahr areas are at the higher elevations and are not accessible by road. These areas are normally considered to be tough and hence trekking through these habitats has been rather not regular. It has always been the traditional natives who had been engaged in perambulation of tahr areas. The services of Muduvans in Eravikulam and the Kanis in Kalakad – Mundanthurai are good examples of protection by the native tribal community. This could be followed in most of the thar areas where there are such communities. In addition, there are a few tahr areas which do not normally falls in the patrolling route of the Forest staff. This is also because of the remoteness, inaccessibility and also the higher altitude in most of the cases. Adichila Thotti in Malayattur is probably the best example. Such areas often have a tribal community nearby and could be entrusted with the protection and monitoring by rewarding the community for the good works. Wherever possible, members of the local tribal community should be engaged as Watchers and also other works in tahr areas.

9.1.5 Fire management plan

Prevention of fire and protection of the habitat seems to be the rule in most of the tahr areas except in Eravikulam National Park where early controlled burning is used as a tool for preventing late hazardous fires. In most of the tahr ranges, even with stringent protection to prevent fire, at least a part of the habitat invariably gets burnt in summer. Cold burning of grass in blocks in alternate years providing a mosaic of burnt and unburnt areas have been suggested as early as 1940 (Velupillai, 1940). He gave the details of fire management practices in the Travancore state. According to him, the system of early burning of the forests was introduced in all the forests in 1925. This was mentioned as “similar to the methods adopted for the protection of the grass forests in British India”. According to the system, the grass undergrowth was burnt when it was still partially green and took a lot of time and labour as the forests were taken up block by block. “Burnt grass will put on fresh green shoots in a short time and the areas so treated will be practically immune from fire during that season”. This system was adopted throughout the Travancore state in 1940. This has also been the traditional practice followed in management of tahr habitat as evident from various publications on tahr (eg. Davidar, 1978). The early burning of grass has also been used by old time poachers to attract the tahr to the fresh

grass growth. Rice (1984) suggested cold burning to improve the nutritional content of the food species. Studies on the impact of fire on tahr habitat have been limited and the burnt areas have not been systematically monitored. It is important to take up research on the use of fire as management tool.

It is also argued that cutting the grasses with long knife with sharp blades during the cold season would also have the same result as burning in providing fresh palatable grasses. This would be better to avoid the adverse impacts of grassland burning as the cutting would not result in disturbance of any sort to the breeding birds, reptiles, amphibians, insects and the soil fauna. This may look labour and time consuming but will not be so if practised regularly by experienced workers. Given the positive points of nil disturbance to the fauna, this could be tried at least on an experimental basis and followed if results are encouraging.

9.1.6 Elimination or reduction of cattle population from tahr habitat

At least a few tahr areas or part of a few tahr habitats have the pressure from cattle grazing. This is especially evident in Srivilliputhur, where hundreds of cattle use the tahr areas traditionally. Some of the areas (eg. Attumalai in Walayar) are also affected by goats. An animal (saddleback) came down with a herd of goat which went for grazing in Attumalai in Walayar. The animal was kept in Deer park in Walayar and then released in Elival malai sometime in 2003 (K. C. Prasad, ACF pers. Commn.). Grazing by domestic animals reduce the resource availability and compete with the wild animals for the meager resource in the higher elevations especially in summer. Most of the grazed areas are also made barren enhancing erosion possibilities. The cattle could also function as potential vectors for diseases.

9.2 Educational/Awareness Programmes

The current awareness programmes in tahr areas are limited to Nature Camps mostly in Protected Areas in Kerala and programmes organized in connection with wildlife week celebrations. Eravikulam national park is the only place with a well planned Interpretation Centre. Public are likely to keep away from activities detrimental to tahr and its habitat if they are given the right message on the impact of such activities on the animals and also the precarious position of this animal in the international conservation scenario. It is also important to have a well informed media to take the conservation message to the public. The plan for each area is given under the sections.

9.3 Population Estimation and monitoring

The Recovery plan preparation is actually a Herculean task because of lack of information on the distribution, extent of habitat and the population including structure. Most of the information are based on the publications of Davidar and Schaller. The recent estimates by Abraham *et al.*, (2006) and Daniels *et al.*, (2006) also did not cover the entire tahr countries as evident from the lack of information on the population in Thirunelveli forest areas. Annual population estimation is done only in Mukurthi National Park, Eravikulam National Park and to a certain extent in Srivilliputhur and Anamalai Tiger Reserve. However, there is neither uniformity in methods of estimation nor synchronization in the estimation within the contiguous areas. The Eravikulam national Park has been conducting the annual count in April using bounded count method. Thanks to the initiative of the Department of Mathematics, U. C. College, Aluva who experimented with the method and established a procedure. The involvement of trained volunteers is also a speciality of Eravikulam count. The method is described below in detail.

The Tahr population in ENP was estimated using bounded count technique proposed by Regier and Robson (1966). Twelve blocks based on the home range, as suggested by Rice (1984) are taken as the basic units for population estimation. The blocks were repeatedly covered on foot for a fixed period, recording the animals sighted for five days. It is to be mentioned that this method is known to have a bias of order $1/m^2$, so when applying to other areas, sufficient number of survey days should be maintained (Wildlife demography: analysis of sex, age, and count data By J. R. Skalski, Kristen Elaine Ryding, Joshua J. Millspaugh). The population estimations are normally conducted during April to May.

The unknown population size, N , is estimated as

$$\hat{N} = x_m + (x_m - x_{m-1}) = 2x_m - x_{m-1}$$

where $X_{(1)} \leq X_{(2)} \dots \leq X_{(m-1)} \leq X_{(m)}$ represent the numbers observed in consecutive days, arranged in increasing order. However, it is also mentioned that they need not be consecutive. It is more important that the probability of detection remains constant. So, if the weather turns bad, it would be better to come back when it improves and weather won't affect the probability of seeing animals.

The lower and upper confidence limits of N are

$$N_L = X_{(m)}$$

$$N_U = X_{(m)} + [X_{(m)} - X_{(m-1)}] [(1-\alpha)/\alpha]$$

where $X_{(m)}$ and $X_{(m-1)}$ are the largest and second largest counts obtained respectively. α is the Type-I error, which was taken as 20 per cent.

The bounded count method requires knowledge on the habitat use (home range) of known herds. Murugan (1997) has given some idea on the tahr habitat use in Nilgiris and similar observations in Anamalais, Srivilliputhur and Kalkkad-Kanyakumari areas will also yield useful information to follow the bounded count method. It is also suggested to do the population estimation in the contiguous areas as given below.

- Mukurthi National Park could co-ordinate with Silent Valley National park, Mannarkad and Nilambur South Forest Divisions
- Eravikulam National park to co-ordinate with Anamalai Tiger Reserve, Parambikulam Tiger Reserve, Chinnar wildlife Sanctuary and Kodaikanal, Mankulam and Munnar Forest Divisions.
- Periyar Tiger Reserve to co-ordinate with High Wavys (Theni Forest Division) and Thirunelveli Division
- Kalakad-Mundanthurai tiger Reserve to co-ordinate with Kanyakumari Wildlife Sanctuary and Trivandrum wildlife and Forest Divisions.

The isolated populations in all the areas could be separately covered by a team of field staff and volunteers on a date within the month.

9.4 Reintroduction

Nilgiri tahr would be able to colonise new ranges. Male move away from the birth range widely and hence could be the first to be introduced. They will presumably be best acclimatized to the new areas and could be followed by a group of females. If the males leave the introduction site immediately, introduction of female groups could be considered. Geist (1975), in the case of mountain sheep, proposed introduction of a human imprinted lamb to a new range and leaving yearlings with the lamb after an year. Tahr habitat requirements are not very rigid and identical habitat is not an absolute requirement for reintroduction (Rice, 1987). Panchanthatangi Mottai in

Kalakad is an ideal location to attempt reintroduction because these are the habitat from where tahr had vanished recently. There are also earlier reports of tahr in Varayattu mudu above Thannikudy in Periyar Tiger Reserve, where the Management Plan prescribes reintroduction. The habitat, though well protected, do not have any tahr at present. This area could also be considered for reintroduction.

The low population in some of the areas is real concern. There had been few attempts in the country to save isolated smaller populations confining themselves in larger enclosures in its natural range thereby excluding all the potential threats and allowing them to increase in numbers. The wild buffaloes in Sitanadi-Udanti in Chattisgarh and Dancing deer in Manipur are reported to be good examples where such actions are helping in conservation. Such an attempt could be made in areas with larger habitats but low numbers of tahr. It could be tried in one of the selected locations in Kudal in Kodaikanal area, Kalakad-Mundanthurai Tiger Reserve and Elival mala in Kerala. The attempt should be on a pilot scale in one of these locations and if found successful could be copied to other areas.

9.5 Genetic studies

A review of the recovery plans in US indicate that in general, genetics appear to play a minor relatively ill defined part in the recovery planning process (Moyle *et al.*, 2003). According to Lande (1988) and Caughley (1994), genetic data is unlikely to be as informative or valuable as demographic data in assessing biological status or determining appropriate management strategies for critically endangered species. There is also discrepancy between available data for genetics and demography. This is also due to the comparative difficulty to collect data on genetic diversity, inbreeding depression or gene flow. However, it has been pointed out that it is all the more important to have explicit consideration of genetic factors in species recovery planning. Genetic data may offer unique insight into determining which unit to preserve or use as source material. This is especially important for extant populations. It is suggested that the smaller populations in the non Protected Areas is given priority while undertaking genetic studies. The information thus collected could be integrated to the current guidelines for recovery making appropriate changes in the plan.

9.6 Research and Monitoring

The Recovery Plan preparation revealed lack of information on most of the aspects of tahr ecology and behavior, which are very crucial for management of the species. It is important that the following details are collected through field work from all areas.

- Verification of all the listed tahr habitats especially in Thirunelveli, Theni, Mannarkad, Chalakudy, Nemmara, Vazhachal, Malayattur and Munnar Forest Divisions for the extent, connectivity and quality of habitat and population details
- List out the threat factors in all the locations
- Identify credible agencies in all the locations for involving in conservation programmes
- Engage identified Research Institutions/NGOs with proven scientific capabilities in long and short term studies on food and feeding habits, movement pattern and social organization in the little known areas in Anamalais, Nelliampathis, Kalakkad, Munnar, Kanyakumari and Mannarkad
- Conduct predator prey studies in identified Conservation Units
- The impact of controlled burning as evident from the habitat utilization, plant species composition and changes in the soil structure and fauna. Impact on other groups of animals could also be taken up.

The success of the Recovery Plan implementation requires periodic evaluation. This would mean monitoring of population and habitat parameters and review of activities conducted. The habitat quality and population structure could be two parameters of importance for evaluation. These could be entrusted to Institutions/NGOs with proven scientific capabilities. The habitat quality parameters could include the availability of food species, presence of weeds, habitat utilization by tahr, etc. The population parameters include the number, population structure, and inferred natality and mortality.

9.7 NGOs and NGIs in tahr conservation programmes

The Nilgiri tahr has been the much sought after game and the preservation was mostly the necessity of the elite hunters. The hunting ethics and the knowledge base of the hunters contributed a lot in conserving the species. Declaration of closed season and areas closed to shooting and population estimation exercises in different areas in addition to the support extended to Researchers for further studies have all been the contributions by these Associations.

Bassett (1962) highlighted the role played by the High Range Game Preservation Association in enforcing protection leading to recovery of animal populations in the High Ranges in Kerala. The conservation activities of sportsmen have been highlighted by Schaller, Davidar and Rice in their publications. Subsequently, the name has been changed to High Range Wildlife and Environment Preservation Association (HRWEPA) and HRWEPA works in close association with the Forest department. Davidar (1978) mentioned about the role played by the Konalar Fishing Association (KFA) in preserving the wildlife in the Grass Hills. Unfortunately, KFA is reported to be not active. Recently, the Wildlife Association of Rajapalayam (WAR) based in Rajapalayam in Tamil Nadu, have been actively involved in conservation awareness programme and assist the forest department in protection activities. The Nilgiri Wildlife and Environment Association has been actively participating in tahr conservation areas and still assist Forest department in their programmes. The activities of Nilgiri Wildlife and Environment Association are mostly confined to organizing population estimation, which is meticulously organized in addition to other related works. The HRWEPA assist the Government in promoting protection around the Eravikulam National Park. The credit for maintaining the viable population of Nilgiri tahr in Nilgiris, Anamalais, Eravikulam and Srivilliputhur could also be shared by these organizations. This is especially true in the case of Nilgiri Wildlife and Environment Association in Udagamandalam and HRWEPA in Munnar. These two were responsible in maintaining the populations before the declaration of the Mukurthi and Eravikulam as National Parks and were also catalysts for declaring these as Protected Areas. The involvement of these voluntary organizations in the tahr conservation programmes could be ensured by discussing these with those concerned and identifying their current capabilities and potential. At least the Nilgiri Wildlife and Environment Association, HRWEPA and WAR could be involved in specific activities of awareness, protection of the surrounding areas and also in monitoring tahr populations. Thyagarajan (1958) mentioned the Palni Hills Game Association, the status of which is not currently known. The Palni Hill Conservation Council, which was active in tahr conservation through monitoring is currently reported to be active in shola regeneration activities.

10 THE SITE SPECIFIC PLANS

The general prescriptions offered above are applicable to all the locations. However, the threat factors differ from area to area and thus need special mention as a part of the Recovery Plan.

10.1 Nilgiris

Twenty eight locations spread over 107 km² are identified as tahr habitat in Nilgiri Landscape, of which ten locations are in Mukurthi National Park. Seven of the locations in Mukurthi are shared with New Amarambalam of Nilambur South and Anginda of Silent Valley. Some of the fourteen locations in Kerala are shared with Tamil Nadu. Six locations in Tamil Nadu are in Territorial Divisions (2 in Coimbatore and 4 in Nilgiri south). The estimated total number of tahr in the landscape is about 470 including 353 in Mukurthi estimated by the bounded count method. The smallest areas are Cherumankooban with 0.28 km² and Terrace Estate with 0.29 km². The Park is currently managed under a well prepared Management Plan. The management problems and the suggested actions are summarised in Table 14.

Table 14. The Management problems and suggested solutions in Nilgiris

Management Issue	Suggested Actions
Lack of information on actual extent of tahr habitat and characteristic features	survey of the areas with trained team including a botanist/wildlife biologist and an ecologist
Lack of information on connectivity of habitat and movement of animals between areas	long term studies using telemetry/DNA technique
Fire management issues	Cold burning to be done in selected patches in alternate years. Engaging fire prevention squads – co-ordination with adjacent Divisions/State
Weeds and exotics (Recent origin - spread of exotics like <i>Cytisus scoparius</i> (Scotch Broom) and <i>Ulex europia</i> (Grose)(about 0.1 km ²) and Wattle (<i>Acacia sp</i>) (about 20 km ²)	removed in a phased manner and monitored for success evaluation and impact.
Collection of grass/cane and bamboos by Thodas for their requirements from Mukurthi peak area	possibility of providing these from outside
Tamil Nadu Electricity Board camps at Parsons Valley Porthimund and Upper Bhavani on S/SW. Tea plantations near Pykara/ T.R. Bazaar (adjoining Mudimund area near Mukurthi beat. Shrine on the top of the	Regulate through dialogue with the concerned and involve voluntary organizations

Mukurthi Peak - Badagas visit every year between February and April and offer prayers	
At present anti-poaching camps at Bangitappal/ Nadugani/ Western Catchment area and near Mukurthi Fishing Hut	Arrange more camps. Interstate/Division co-ordination required. Staff strength to be increased. Young and energetic staff preferably from indigenous communities) trained for high altitude areas with an aptitude for trekking and out door life to be selected and motivated (rotation of staff could be tried and ration may be provided in the camp). Tribal watchers may be engaged by providing the same facilities given to staff. Camping facilities (sleeping bags/ sheets)/ warm clothes (windcheaters/ jackets)/ rain coats given. Intelligence gathering to be done with trained staff without uniform.
Lack of motivation and training for staff	Training to staff on crime prevention detection and legal procedures. Training to staff on scientific methods and periodic refresher programmes. Training and regular documentation of all sightings of animals with details and changes in vegetation
Lack of communication facilities	Strengthening and maintenance of the wireless communication network. Cell phones?
Lack of year round data on population	Monitor Population and habitat. Generate bench mark data and monitor the changes with appropriate techniques
Lack of veterinary care	A veterinary unit with at least a Live stock Inspector and all facilities to be stationed. Periodic cattle vaccination in the peripheral areas. Wildlife health monitoring – periodic and team for contiguous areas irrespective of state boundaries.
Lack of awareness among public leading to little support for conservation	Awareness programmes with preference to Ootacamund residents. Organise nature camps. Interpretation Centre at Ooty will reach more visitors. A Nature Education Officer could be appointed.
Lack of trained staff for research	Appoint Wildlife Biologist/Ecologist and Botanist and conduct research on topics such as Mapping of tahr areas with details. Tahr habitat and population are to be monitored. Prey predator relations. Undertake faunistic and floristic studies and grass land ecology. Monitor the impact of fire on habitat and tahr populations. Dependence of indigenous and fringe area communities on tahr areas may be evaluated. Impact of pilgrimage on tahr habitat and population could also be taken up.
Some of thar areas fall outside the PA	Consolidate the tahr areas by adding Nilgiri Peak RF (Part) - 15.40 km ² , Porthimund RF (Part) - 9.30 km ² and Kundah RF (Part) - 8.30 km ² .

The conservation issues outside the Protected Areas need a special approach and the suggestions are summarized in Table 15.

Table 15. Conservation issues and suggested actions in tahr habitat outside Protected Areas

Lack of information on habitat extent/quality and population of tahr	Identify and demarcate areas with extent and estimate population
No fire management strategies in place	Control public movement and go for early cold burning in alternate blocks.
No special effort for protection of tahr areas	Strengthen protection with anti poaching camps and intelligence network at appropriately selected locations.
No support from the public	Form tahr conservation brigades with local involvement. Conduct Awareness programmes.
Protection not enough in the Tahr Conservation Unit II (Elival Malai and Kaldikodan malai)	Declare these as Protected Area or High Value Biodiversity Area
Tahr areas contiguous to Protected Areas do not get enough attention and are managed separately (Eg. The location 39, 40 and 41 near Eravikulam and the locations in Nilgiris adjacent to Mukurthi NP)	Add these to the existing PAs or bring it under same management as that of PAs for effective protection and habitat management

10.2 Anamalai landscape

Fifty nine locations including Grass Hills and Eravikulam are identified in the landscape. The total extent is about 310 km² and the population is about 1988. Thirty two locations are in Anamalai Tiger Reserve. Of these five are shared between Tamil Nadu and Kerala. Eighteen locations are identified in Kerala. Four locations in Tamil Nadu fall within territorial Divisions. Eravikulam with Grass Hills form the largest tahr area in the whole of its range.

The issues in Anamalai Tiger Reserve are similar to those in Nilgiris. The same type of activities suggested for Nilgiris is suggested for Anamalai Tiger Reserve. However, considering the number of habitations within the Reserve, it is suggested to assess the dependence and identify areas for reducing impact and also through implementation of eco-development programmes.

The suggested Conservation Units III and IV fall within Protected Areas. The information available on TCU V and TCU VI is scant. Hence the priority in these areas should be to assess the habitat and estimate the population. These TCUs, with about 10.86 km² and 14.86 km² respectively are believed to have a good population. The areas in Kodaikanal Forest Division

have plantations which may be experimentally removed to start with monitoring the impact. If this is successful in bringing back the original habitat, the work could be continued and expanded. The areas adjacent to Eravikulam are currently under Munnar Forest Divisions (Locations 39, 40, 41). These may be brought under the management of the Munnar Wildlife Division thereby adopting a uniform management for the entire area. The Tahr Conservation Unit VI is currently under pressure from the adjoining areas. These may be curtailed by regulating movement. Controlled burning should be practiced in all the areas in territorial Divisions. Munnar being the centre of several tahr areas could be the best for a well planned and managed Interpretation Centre in the town. This could also highlight local biodiversity richness and its uniqueness. The Nelliampathy population is mostly in the midst of estates and though protected is under tremendous pressure from tourism and related activities. These areas have to be demarcated and a special team formed to protect and monitor them. Antipoaching camps are also suggested near the tahr habitat to keep round the clock vigil.

10.3 Periyar landscape

The landscape is the one with highest number of locations and they are widely scattered. Sixty locations include those in Kalakad – Mundanthurai Tiger Reserve, Srivilliputhur Grizzled Squirrel Wildlife Sanctuary and Kanyakumari Wildlife Sanctuary. The locations are spread over an area of about 159 km² with a population of about 1900 tahr. Kanyakumari WLS with a roughly estimated population of about 290 – 385 are in 4 locations 3 sharing with KMTR and one with Trivandrum Wildlife Division. Kalakad – Mundanthurai Tiger Reserve has an estimated population of about 415 – 455 in 11 locations 3 of which are shared with Kanyakumari WLS and one with Trivandrum Wildlife Division. Srivilliputhur GSWLS has about 63 as estimated in 2009 in 13 locations one of which is shared with Theni. The number could be an underestimate considering the earlier figures. Theni has 120– 150 tahr in 4 locations and is promising though in the middle of estates. Thirunelveli Forest Division has about 405 – 505 in 27 locations. These are probably the areas where immediate assessment of habitat and population estimation needs to be taken up. These locations are mostly along the border of Kerala and Tamil Nadu and are smaller. There is not much information available on the threat factors. Trivandrum WL has two locations with about 50 – 65 and Trivandrum Forest Division is with 20 – 25 tahr in Ponmudi. In addition, the Kochu Pamba population and location in Goodrickal also needs special attention because of its isolated nature.

10.4 Srivilliputhur Grizzled Squirrel Wildlife Sanctuary

Management problems in the Sanctuary are similar to other tahr areas. Those special to the area include lack of a fire management plan, the presence of 17 estates spread over about 600 ha either in or near tahr habitat, about 4-5000 “scrub cattle” attended by a few persons and the cattle is used mostly for dung, the proposed road from Kilavankovil to Kodikulam kudusai cutting through sanctuary, encroachment up to the top from Varashunad side, the two farms at the lower side of the Pilavukal dam, the road passing from Mallaipuram to Varashunad through the corridor of tahr and pilgrimage at Saduragiri temple at Saptur with three routes.

The cold season burning suggested for other areas could be followed in Srivilliputhur also. Most of the estates are abandoned and at least a few of them are willing to dispose @ Rs. 100000/acre. These could be purchased in a phased manner after prioritization and added to the sanctuary. A dialogue with the help of a social scientist could be initiated with scrub cattle owners after assessing the number, its activities and the impact on the habitat. These could be weeded out either through purchase and by providing alternate employment or by providing alternate areas outside the sanctuary for grazing. A dialogue could also be initiated with the temple authorities on reducing the impact by regulating pilgrimage. The proposed roads should be stopped through lobbying and the encroachment evicted or shifted through administrative actions with political support.

Though creation of waterholes for tahr areas are not recommended anywhere in its range, considering the drier nature of the tract in the easternmost range of tahr, it is recommended to have waterholes in Saptur Range in Srivilliputhur. This area reportedly had traditional artificial waterholes made of mud and local materials, which were of course meant for cattle but used by wildlife also. It is suggested to use the traditional methods for providing water to wildlife.

The veterinary requirement of the area is currently met from Coimbatore. A Veterinary unit stationed at Rajapalayam could cater to the needs of all the areas in South. A well planned Interpretation Centre could also be planned as a part of the awareness programme.

10.5 Kalakad – Mundanthurai Tiger Reserve and Kanyakumari WLS

The issues specific to the area include presence of nine settlements in the core area who are engaged in NTFP collection and depend on the forest for firewood. The dependency of the settlements on the tahr areas may be studied and regulated depending on the impact.

Panchanthangi mottai, Nandoothu mottai and Vengalappara are the areas from which tahr have disappeared in the recent past. The habitat may be assessed for various parameters and adopt habitat improvement measures. Considering the comments of Rice (1984) and Davidar (1978), a reintroduction programme could be planned by following the suggestions of Rice (1984). The protocol for such reintroduction may be followed during the operation. It would be good to collaborate with agencies like Management of Nature Conservation in Abu Dhabi, UAE who had been carrying out breeding programme for Arabian Tahr.

Considering the tahr habitat connectivity with the adjoining states, it is suggested to have a co-ordination between the forest officials of the concerned divisions for protection and implementation of management plans.

11.HEALTH MONITORING

Tahr is an integral part of the mountain ecosystem and have many fascinating aspects making them difficult to study and monitor. Death due to predation, poaching, disease and factors controlling the breeding and survivability of the new generation, pollution and climatic change are the major factors regulating the population. The fragmented habitat and lack of corridor makes many forests a large enclosed area leading to closed populations and inbreeding. Many such factors justify an efficient health monitoring and interventions.

11.1 The health includes genetic, physical and psychological health.

The genetic diversity should be studied and monitored continuously of all small and large populations. This will help to understand the level of outbreeding/inbreeding and genetic diversity. This shall be done using dung pellets and materials from postmortem examination and collected during any invasive procedures. The DNA finger printing shall be done at some government institutions on a long term MOU.

11.2 The physical health is governed by infectious and non-infectious factors.

The physical health shall be monitored through a body condition index. Seasonal direct observation and photographs of a large number of animals shall be taken and analyzed and a site-specific index shall be developed on a four-point scale “Poor, Average, Good and Very good”. This shall be repeated every season. The breeding status is also an indicator of the overall health since any disease will directly affect the number of new borns.

The infectious factors are internal and external parasites, bacterial diseases and viral diseases. The infectious diseases shall be monitored through direct and indirect methods. It is highly difficult to find a carcass in the field due to many factors and so direct sample collection is near impossible. Indirect methods such as analysis of dung pellets for parasites, liver function and digestion are to be done. A pilot study shall be done at selected large and small populations. Periodic study shall be done at all populations based on techniques and procedures standardized from the pilot study. During post mortem examinations samples of all organs shall be collected for histo-pathological examination and PCR based DNA studies of various diseases. A regular monitoring and disease surveillance shall be done among the forest grazing domestic animals in association with the state Animal Husbandry Department.

The non-infectious diseases are due to macro and micronutrients. Climate and pollution are also contributing factors. Seasonal nutritional study of the food available shall be done in all sites. Monitoring of the same shall be done at selected sites on rotation basis in all Tahr habitats. These studies shall be done along with other ecological studies.

The monitoring shall be done by a Veterinarian with the help of local manpower and infrastructure in collaboration with other activities of the area and shall prepare a monthly report and submit to the local authorities and a technical committee. A technical committee at state and landscape level shall be constituted for the monitoring and shall meet and assess every 3 months and shall submit a consolidated report to the chief wildlife Warden and local management.



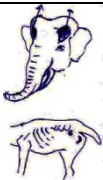

Appropriate interventions after very careful analysis such as deworming and preventive vaccinations to Foot and Mouth Disease, Anthrax etc to forest grazing domestic animals, deworming and mineral supplementation (round the year or seasonal), translocation of breeding males to address any inbreeding shall be done as and when necessary.

Body Condition Evaluation Form

Division:

Section:

Range:

Date	Place	Age and Sex	Scores for different body parts								Samples Collected/ Remarks
			Lumbar Self (Back side view)				Body Parts in General				
			Poor	Average	Good	Very Good	Poor	Average	Good	Very Good	
											

Recording of Disease Spread Data

Name of Investigators:

Name of Disease	Date	Place	Animal (Species)	Age and Sex	No. of Animals	Reported by whom	Name of Nearest Veterinary Hospital	Samples collected/ Remarks

12. REFERENCES

- Abraham, S K, Easa, P S and Sivaram, M. 2006. Status and distribution of Nilgiri Tahr *Hemitragus hylocrius* in Kerala part of the Western Ghats. *Zoos' Print Journal* 21(): 2379-2385.
- Alembath, Mohan 2002. *Distribution and abundance of Nilgiri tahr, Hemitragus hylocrius(Ogilby) in Periyar Tiger Reserve*. Research report prepared for India Eco-development Project, Periyar Tiger Reserve, Kerala.
- An Old Shikarri,' (1880): Nilgiri sporting reminiscences. Higginbotham and Co., Madras.
- Bala, T. 2001. *Habitat analysis of the Nilgiri Tahr (Hemitragus hylocrius Ogilby) in Palnis using remote sensing and GIS*. MSc Thesis, University of Pondicherry, Pondicherry.
- Bernischke, K. and Kumamoto, A. K. 1980. The chromosomes of the Nilgiri tahr, *Hemitragus hylocrius*. *International Zoo Yearbook*. 20: 274-275.
- Caughley, G., 1994. Directions in conservation biology. *J. Animal Ecol.*, 63: 215–244.
- Daniel, J. C. 1971. The Nilgiri Tahr *Hemitragus hylocrius* Ogilby in the high ranges, Kerala and the Southern hills of the Western Ghats. *Journal of the Bombay Natural History Society* 67: 535-542.
- Daniels, R. J. R. 2006. *The Nilgiri Tahr: An Endemic South Indian Mountain Goat*. New Delhi, Mac Milan (India) and High Range Wildlife and Environment Preservation Association.
- Davidar, E. R. C. 1963. Census of the Nilgiri Tahr *Hemitragus hylocrius* Ogilby in the Nilgiris. *J. Bombay nat. Hist. Soc.* 60: 251-252
- Davidar, E. R. C. 1971. A note on the status of the Nilgiri Tahr in the grass hills in the Anamalais. *Journal of the Bombay Natural History Society* 68(2): 347-354.
- Davidar, E. R. C. 1972. Nilgiri Tahr (*Hemitragus hylocrius*) 'saddle backs'. *Journal of the Bombay Natural History Society* 69: 173-174.
- Davidar, E. R. C. 1975. The Nilgiri Tahr. *Oryx* 13: 205-211
- Davidar, E. R. C. 1976. Census of the Nilgiri Tahr in the Nilgiris, Tamil Nadu. *Journal of the Bombay Natural History Society* 73: 143-148.
- Davidar, E. R. C. 1978. Distribution and status of the Nilgiri Tahr (*Hemitragus hylocrius*) 1975-78. *Journal of the Bombay Natural History Society* 75: 815-844.
- Duff, A. and Lawson, A. 2004. *Mammals of the World: A Checklist*. A & C Black, London.

- Easa, P. S. 1995. *Prey-predator studies in Eravikulam National Park*. KFRI Research Report no 105.
- Easa, P. S. and Sivaraman, M 2002. *Habitat suitability index model for Nilgiri Tahr Hemitragus hylocrius (Ogilby) in Eravikulam National Park*. KFRI Research Report no 242.
- Elliott, L. F. and Boyce, W. M. 1992. Implications of captive breeding programs for the conservation of desert bighorn sheep. *Desert Bighorn Council Transactions* 36:54-57.
- Fischer, C. 1915. The Nilgiri wild goat (*Hemitragus hylocrius* Jerdon). *Journal of the Bombay Natural History Society* 24: 189.
- FitzSimmons, N. N., Buskirk, S. W. and Smith, M. H. 1995. Population history, genetic variability, and horn growth in bighorn sheep. *Conservation Biology* 9(2): 314-323.
- Fox, J. L. and Johnsingh, A. J. T. 1997. Status and distribution of Caprinae by Region – India. In: Shackleton, D. M. (Ed.) *Wild Sheep and Goats and their relatives: Status survey and conservation action plan for caprinae*. The IUCN/SSC Caprinae Specialist Group Switzerland and Cambridge, IUCN/Gland.
- Geist, V. 1971. *Mountain Sheep: a study in behavior and evolution*. The University of Chicago Press. Chicago and London.
- Geist, V. 1975. On the management of mountain sheep: theoretical considerations. In: J. B. trefethen (ed.), *The Wild sheep in Modern North America*. Boone and Crocket Club, Winchester Press, New York.
- Gilpin, M. E. 1991. The genetic effective size of a metapopulation. *Biological Journal of the Linnaean Society*, 42, 165–175.
- Gilpin, M. E. and M. E. Soule 1986. Minimum viable populations: processes of species extinction. Pages 19-34 in *Conservation biology: the science of scarcity and diversity*. M. E. Soule, ed. Sinauer Associates, Inc., Sunderland, Massachusetts. S84pp.
- GREENS, 2000. Ponmudi Ibex Hill-A vanishing habitat for Nilgiri Tahr. A study report. Greens, Nature lover's club in the Government secretariat, Thiruvananthapuram. 15pp.
- Haltenorth, T. 1963. Klassifikation des Säugetiere: Artiodactyla. *Internat. Hanb. Zool.*, Berlin, 8: 1-167.
- Hanski, I. and M. Gilpin. 1991. Metapopulation dynamics: brief history and conceptual domain. *Biological Journal of the Linnean Society* 42:3-16.
- Hanski, I. and D. Simberloff. 1997. The metapopulation approach, its history, conceptual domain, and application to conservation. Pages 5-26 in *Metapopulation biology: ecology*,

- genetics, and evolution*. I. Hanski and M. E. Gilpin, eds. Academic Press, Inc., San Diego, California.
- Harrison, S. 1994. Metapopulations and conservation. Pages 111-128 in *Largescale ecology and conservation*. P.J. Edwards, N. R. Webb, and R. M. May, eds. Blackwell Scientific Publications, Oxford, England.
- Hawkeye. 1881: Game. Higginbotham and Co.. Madras.
- Hawkins, R. E. 1986. *Encyclopedia of Indian Natural History*. Oxford University Press and Bombay Natural History Society, New Delhi.
- Hornaday, W. 1885: Two years in the jungle. Kegan Paul, Trench and Co., London.
- Hulme, M. and Viner, D. 1995. A climate change scenario for assessing the impacts of climate change on tropical rainforest. Reports of the Climate Research Unit, University of Eastern Anglia.
- IPCC. 1992. Climate Change: The IPCC 1990 and 1992 assessments. World Meteorological Organisation and United Nations Environment Programme.
- Jerdon, T. C. 1874. Mammals of India; Natural history of all the animals known to inhabit continental India. John Wheldon, Great Queen Street, London.
- Kerala Forest Department. 1989. Status Survey of Nilgiri Tahr in Kerala. Government Press, Trivandrum
- Kinloch, A. 1926. The Nilgiri tahr (*Hemitragus hylocrius*) *J. Bombay nat. Hist. Soc.* 31(2): 520-521.
- Lacy, R. C. 1997. Importance of genetic variation to the viability of mammalian populations. *J. Mamm.* 78 (2): 320-335.
- Lande, R., 1988. Genetics and demography in biological conservation. *Science*, 241: 1455–1460.
- Lalueza-Fox, C, Bertranpetit, J, Alcover, J A, Shailer, N and Hagedberg, E (2000) Mitochondrial DNA from *Myotragus balearicus* an extinct bovid from the Balearic Islands. *Journal of Experimental Zoology* 288: 56-62.
- Lydekker, R. 1898: Wild oxen, sheep, and goats of all lands. Rowland Ward, London.
- Madhusudan, M. D. 1995. *Sexual segregation in the Nilgiri Tahr* (*Hemitragus hylocrius*). Unpublished MSc Dissertation, Rajkot, Saurashtra University & Dehra Dun, Wildlife Institute of India.

- May, R. M. 1991. The role of ecological theory in planning re-introduction of endangered species. Beyond captive breeding: reintroducing endangered mammals to the wild. *Symposia of the Zoological Society of London* 62:145-163.
- McMaster, A. C. 1883. Notes on Jerdon's Mammals of India by an Indian Sportsman and lover of National History. Higginbotham and Co., Madras.
- Meffe, G. K. and C. R. Carroll. 1994. Principles of conservation biology. Sinauer Associates, Inc. Sunderland, Massachusetts.
- Mishra, C and Johnsingh, A. J. T. 1998. Population and conservation status of the Nilgiri Tahr in Anamali Hills, south India. *Biological Conservation* 86: 199-206.
- Moyle, L. C., Stinchcombe, J. R., Hudgens, B. R. and Morris, W. F. 2003. Conservation genetics in the recovery of endangered animal species: a review of US endangered species recovery plans (1977–1998). *Animal Biodiversity and Conservation*, 26.2: 85-95.
- Murugan 1997. *Habitat analysis of the Nilgiri Tahr in the Mukurti National Park*. Unpublished Report, Nilgiri Wildlife and Environment Association.
- Olsen, O.W. 1967. *Animal Parasites: Their biology and life cycles*, 2nd edition. Minneapolis, Burgess.
- Phythian-Adams, E. 1927. . Game preservation in the Nilgiris. *J. Bombay nat. Hist. Soc.* 32(2): 339-343.
- Phythian-Adams, E. 1939. The Nilgiris Game Association-1879-1939. *J. Bombay nat. Hist. Soc.* 41(2) : 384-396.
- Prater, S. 1965. The book of Indian animals. Bombay Natural History Society, Bombay.
- Predit, M. A. 2009. Status and current distribution of Nilgiri Tahr – An Interim report. WWF India Western Ghats Landscape, Coimbatore.
- Ramesh, B. R., Loseen, D., Karunakaran, P. V., Balasubramnian, M., Pierre, C., Aravazhi, S., Patil, S. V., Lucie, D., Ayyappan, N. and Ramalingam, S. 2005. Forest Landscape Analysis and Management Plan for Kerala. French Institute, Pondicherry.
- Raveendranath, N. H., Sukumar, R. and Deshingkar, P. 1997. Climate change and Forests: Impacts and adaptations, a regional assessment for Western Ghats, India – Atmospheric environment issues in developing countries. Series No. 4. Stockholm Environment Institute, Stockholm, Sweden.
- Regier, H.A., and Robson, D.S. 1966, Estimating population numbers and mortality rates. In S.D. Gerking (ed.). *The biological basis of fresh water fish production*. Blackwell Scientific Publication, Oxford. U.K.

- Rice, C. G. 1984. *The behaviour and ecology of the Nilgiri tahr (Hemitragus hylocrius Ogilby 1838)*. Unpublished PhD Thesis, Texas, A & M University.
- Rice, C. G. 1986. Observations on the predators and prey at Eravikulam National Park, Kerala. *Journal of the Bombay Natural History Society* 83(2): 283-303.
- Rice, C. G. 1988a. Habitat, population dynamics and conservation of the Nilgiri Tahr *Hemitragus hylocrius*. *Biological Conservation* 44(3): 137-156.
- Rice, C. G. 1988b Reproductive biology of Nilgiri Tahr, *Hemitragus hylocrius* (Mammalia: Bovidae). *Journal of Zoology* 214(2): 269-284.
- Rice, C. G. 1988c. Agonistic and sexual behaviour of Nilgiri Tahr (*Hemitragus hylocrius*). *Ethology*, 78(2): 89-112.
- Rice, C. G. 1989. Growth, maturation and physical characteristics of Nilgiri tahr (*Hemitragus hylocrius* Ogilby). *Journal of the Bombay Natural History Society* 86(2): 129-134.
- Rice, C. G. 1990. Nilgiri Tahr, Eravikulam National Park and Conservation. In: Daniel, J C and Serrao, J S (eds) *Conservation in Developing Countries: problems and prospects*. Proceedings of the Centenary Seminar of the Bombay Natural History Society, New Delhi, Oxford University Press.
- Ropiquet, A and Hassanin, A. 2005. Molecular evidence for the polyphyly of the genus *Hemitragus* (Mammalia, Bovidae). *Molecular Phylogenetics and Evolution* 36(1): 154-168.
- Russell, C. 1900. *Bullet and shot in Indian forest, plain and hill*. W. Thacker and Co., London.
- Ryman, N. Laikre, L. 1991. Effects of supportive breeding on the genetically effective population size. *Conservation Biology* 5(3): 325-329.
- Schaller, G. B. 1970. Observations on Nilgiri Tahr (*Hemitragus hylocrius* Ogilby, 1838). *Journal of the Bombay Natural History Society* 67(3): 365-389.
- Schaller, G. B. 1977. *Mountain Monarchs: Wild sheep and goats of the Himalaya*. Chicago, University of Chicago Press.
- Shackleton, D. M. (Ed.) 1997. *Wild Sheep and Goats and their relatives: Status survey and conservation action plan for caprinae*. The IUCN/SSC Caprinae Specialist Group Switzerland and Cambridge, IUCN/Gland.
- Shackleton, D. M. (Ed) 2000. *Caprinae*. Newsletter of the IUCN/SSC Caprinae Specialist Group. December Issue.
- Shackleton, D. M. and Lovari, S. 1997. Classification Adopted for the Caprinae Survey. In: Shackleton, D. M. (Ed.) *Wild Sheep and Goats and their relatives: Status survey and*

- conservation action plan for caprinae*. The IUCN/SSC Caprinae Specialist Group Switzerland and Cambridge, IUCN/Gland.
- Sharon, V. 2010. Rapid assessment on the population status of isolated populations of nilgiri tahr in Kerala. M.Sc Dissertation submitted to Department of Ecology and Environmental Science, Pondicherry University.
- Soulsby, E. J. 1982. Helminths, arthropods and Protozoa of domesticated animals. 7th edition. Lea and Febiger, Philadelphia.
- Sterndale, R. 1884. Natural history of the mammalia of India and Ceylon. Thacker, Spink and Co.. Calcutta.
- Stockley, C. 1928. Big game shooting in the Indian Empire. Constable and Co., London.
- Sukumar, R., Suresh, H. S. and Ramesh, R. 1995. Climate change and its impact on tropical montane ecosystems in Southern India. *Journal of Biogeography* 22: 533-536.
- Sumithran, S. 1997. *Status and ecology of the Nilgiri Tahr in the Mukurti National Park, south India*. Unpublished Ph. D Thesis, Blacksburg, Virginia Tech.
- Thyagarajan, N. 1958. The vanishing ibex. *Indian Forester* 84: 188-191.
- UC College, Aluva 1984. Status survey of wildlife at Eravikulam National Park. Census of Nilgiri tahr. Project Report.
- Velupillai, T. K. 1940. Forests In: Travancore State Manual, Chapter XVI: 272-273.
- Walker, P. 1964. *Mammals of the World: Volume II*. The John Hopkins Press, Baltimore.
- Willet, J. 1968. The Nilgiri tahr, *Hemitragus hylacrius* Ogilby. *J. Bombay nat. Hist. Soc.* 65(3): 769-771.

Budget

The budget part of the proposal is justified because of the following.

- **The areas occupied by Nilgiri Tahr are also biodiversity rich and the home to several plant and animal species, which are endemic to the Western Ghats. Some of them are also facing the threats of extinction. The tahr conservation plan would also extend protection to the biodiversity of the area.**
- **Tahr mostly occupies the higher reaches of the Western Ghats thereby assuming importance in watershed and soil conservation.**
- **Tahr habitats are in remote areas and hence considered challenging in terms of protection and other activities.**

Area	Activities	unit cost	1 st year	2 nd year	3 rd year	4 th year	5 th year	Total
Kanyakumari Wildlife Sanctuary								
Anti-poaching Activities								
	Engaging Watchers for protection	12 Nos. @Rs. 3000/ per month per person	4.32	4.32	4.32	4.32	4.32	21.60
	Ration provision	Four camps @ 2000/ per camp with minimal annual increase	0.96	0.98	1.00	1.02	1.04	5.00
	Secret fund	Lumpsum	0.25	0.25	0.25	0.25	0.25	1.25
	Trek path maintenance	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
		Sub Total	6.53	6.55	6.57	6.59	6.61	32.85
Habitat Improvement								
	Additional watchers for fire management	Twelve watchers @ Rs. 3000/- per month per person for 6 months	2.16	2.16	2.16	2.16	2.16	10.80
	Removal of Alien Invasive plants	Three Ha every year @Rs. 10,000/ha	0.30	0.30	0.30	0.30	0.30	1.50
		Sub Total	2.46	2.46	2.46	2.46	2.46	12.30

Infrastructure strengthening								
	Anti poaching camps	Two camps @ 3 lakhs	6.00	0.00	0.00	0.00	0.00	6.00
	Field gears for patrolling and camping equipments	Lumpsum	1.00	0.50	0.50	0.50	0.50	3.00
	Binoculars/ spotting scope/camera/GPS	Lumpsum	1.50	0.00	0.50	0.00	0.50	2.50
	Arms and ammunitions	Lumpsum	1.00	0.50	0.50	0.50	0.50	3.00
	Communication network	Lumpsum	1.00	0.50	0.50	0.50	0.50	3.00
		Sub Total	10.50	1.50	2.00	1.50	2.00	17.50
Wildlife Research, Education and Nature Awareness								
	Audio-visual equipments (LCD projector, computer etc.)	Lumpsum	1.50	0.25	0.25	0.25	0.25	2.50
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	0.75	0.75	0.75	0.75	0.75	3.75
	Awareness programme for public	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Awareness programme for media	Lumpsum	0.00	0.50	0.30	0.00	0.50	1.30
	Awareness material publications	Lumpsum	1.00	0.50	1.00	0.50	1.00	4.00

	Mapping of tahr habitats – Research	Lumpsum	1.00	0.25	0.00	0.00	0.00	1.25
	Field Research - ecological, behavioural, wildlife health	Lumpsum	4.00	3.00	0.00	3.00	2.00	12.00
	Habitat assessment – Research	Lumpsum	3.00	1.00	0.00	0.00	0.00	4.00
		Sub Total	12.25	7.25	3.30	5.50	5.50	33.80
Staff development and Capacity building								
	Training in use of specialized equipments	Lumpsum	0.25	0.00	0.50	0.00	0.50	1.25
	Exposure visit to other tahr areas	Lumpsum	0.50	0.00	0.00	1.00	0.00	1.50
		Sub Total	0.75	0.00	0.50	1.00	0.50	2.75
Wildlife Veterinary care								
	Veterinary support	Lumpsum	0.25	0.25	0.25	0.25	0.25	1.25
Kalakad Mundanthurai Tiger Reserve								
Anti-poaching Activities								
	Engaging Watchers for protection	14 Nos. at seven locations @ Rs. 3000/ month	3.72	3.72	3.72	3.72	3.72	18.60
	Ration provision in anti-poaching camps	For seven camps @ Rs. 1000/ per camp per month with minimal annual increase	0.84	1.00	1.20	1.30	1.50	5.84
	Secret fund	Lumpsum	0.25	0.25	0.25	0.25	0.25	1.25

	Trek path maintenance	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
		Sub Total	5.31	5.47	5.67	5.77	5.97	28.19
Habitat Improvement								
	Additional watchers for fire management	21 watchers @ Rs. 3000/ per month for six months	3.78	3.78	3.78	3.78	3.78	18.90
	Fireline maintenance	50 km @ Rs.3000/km	1.50	1.50	1.50	1.50	1.50	7.50
	Removal of Alien Invasive plants	20 ha/year @Rs.10,000/ha	2.00	2.00	2.00	2.00	2.00	10.00
		Sub Total	7.28	7.28	7.28	7.28	7.28	36.40
Infrastructure strengthening								
	Anti poaching camps	Two @ Rs. 2 lakh	4.00	0.00	0.50	0.00	0.50	5.00
	Arms and ammunitions	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Field gears and camping equipments for staff and field watchers	Lumpsum	1.50	0.50	1.50	0.50	1.50	5.50
	Binoculars/ spotting scope/camera/GPS	Lumpsum	2.00	0.00	0.50	0.00	1.00	3.50
	Communication network	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
		Sub Total	9.50	2.50	4.50	2.50	5.00	24.00
Wildlife Research, Education and Nature Awareness								
	Audio-visual equipments (LCD projector, computer, screen, etc.)	Lumpsum	2.00	0.25	0.50	0.25	0.50	3.50

	Reintroduction project	Lumpsum	2.00	12.00	3.00	3.00	3.00	23.00
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	1.50	1.50	1.50	1.50	1.50	7.50
	Awareness programme for public	Lumpsum	1.00	1.50	2.00	2.50	3.00	10.00
	Awareness programme for media	Lumpsum	0.00	0.50	0.00	0.50	1.00	2.00
	Awareness materials/ publications/films	Lumpsum	1.50	1.00	2.00	1.00	2.00	7.50
	Mapping of tahr habitats – Research	Lumpsum	1.00	0.50	0.00	0.00	0.00	1.50
	Habitat assessment and monitoring for impact of weed removal and fire management – Research	Lumpsum	1.00	3.00	1.00	3.00	1.00	9.00
	Research - ecology, behaviour	Lumpsum	4.00	3.00	3.00	3.00	2.00	15.00
	Assessment of dependence on tahr areas by the communities – Research	Lumpsum	2.50	0.50	0.00	0.00	0.00	3.00
		Sub Total	16.50	23.75	13.00	14.75	14.00	82.00
Staff development and Capacity building								
	Exposure visit to other tahr areas	Lumpsum	0.50	0.00	0.00	0.75	0.00	1.25

	Attending seminar related to Caprinae	Lumpsum	0.00	1.00	0.00	0.00	1.00	2.00
		Sub Total	0.50	1.00	0.00	0.75	1.00	3.25
Staff Welfare activities								
	Staff amenities fund for welfare measures	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
		Sub Total	1.00	1.00	1.00	1.00	1.00	5.00
Wildlife Veterinary Care								
	Vetrinary care	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
		Sub Total	1.00	1.00	1.00	1.00	1.00	5.00
Thirunelveli Division								
Anti-poaching Activities								
	Protection Watchers	26 watchers @ Rs. 3000/- for 7 months	5.46	5.46	5.46	5.46	5.46	27.30
	Anti poaching camps	Two @ Rs. 2 lakh	4.00	0.00	0.50	0.00	0.50	5.00
	Ration provision in five anti-poaching camps	Five camps @ Rs. 2000/ per camp per month with minimal annual increase	0.70	0.80	0.90	1.00	1.10	4.50
	Secret fund	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
		Sub Total	10.66	6.76	7.36	6.96	7.56	39.30
Habitat Improvement								

	Fireline maintenance	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Removal of Alien Invasive plants	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
		Sub Total	1.50	1.50	1.50	1.50	1.50	7.50
Infrastructure strengthening								
	Arms and ammunitions	Lumpsum	1.00	0.00	1.00	0.00	1.00	3.00
	Field gears and camping equipments for staff and field watchers	Lumpsum	0.50	0.50	1.00	0.50	1.00	3.50
	Binoculars/ spotting scope/GPS	Lumpsum	1.00	0.00	0.00	0.00	0.00	1.00
	Communication network	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
		Sub Total	3.50	1.50	3.00	1.50	3.00	12.50
Wildlife Research, Education and Nature Awareness								
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	1.50	1.50	1.50	1.50	1.50	7.50
	Awareness programme for public	Lumpsum	1.00	1.00	1.50	1.50	2.00	7.00
	Mapping of tahr habitats – Research	Lumpsum	2.00	0.50	0.00	0.00	0.00	2.50

	Habitat assessment and monitoring for impact of weed removal and fire management – Research	Lumpsum	2.00	2.00	2.00	2.00	2.00	10.00
	Assessment of dependence on tahr areas by the communities – Research	Lumpsum	0.00	2.50	0.30	0.00	0.00	2.80
		Sub Total	6.50	7.50	5.30	5.00	5.50	29.80
Staff development and Capacity building								
	Training in use of specialized equipments	Lumpsum	0.25	0.00	0.25	0.00	0.25	0.75
		Sub Total	0.25	0.00	0.25	0.00	0.25	0.75
Staff Welfare activities								
	Staff amenities fund for welfare measures	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
		Sub Total	1.00	1.00	1.00	1.00	1.00	5.00
Srivilliputhur Grizzled Squirrel Sanctuary								
Anti-poaching Activities								
	Engaging Watchers for protection	20 Nos. at five locations @ Rs. 3000/ month	7.20	7.20	7.20	7.20	7.20	36.00

	Ration provision in anti-poaching camps	For five camps @ Rs. 2000/ per camp per month with minimal annual increase	1.20	1.25	1.30	1.35	1.40	6.50
	Patrolling vehicle	One @ Rs. 5.5 lakhs	5.50	1.00	1.00	1.00	1.00	9.50
	Secret fund	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
	Trek path maintenance	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
		Sub Total	14.90	10.45	10.50	10.55	10.60	57.00
Habitat Improvement								
	Additional watchers for fire management	Ten watchers @ Rs. 3000/ per month for six months	1.80	1.80	1.80	1.80	1.80	9.00
	Purchase of private areas adjacent to tahr habitats	Lumpsum	2.00	5.00	5.00	5.00	5.00	22.00
	Providing traditional waterholes in selected areas	Lumpsum	4.00	0.50	1.00	0.50	1.00	7.00
	Removal of cattle in a phased manner	Lumpsum	1.00	5.00	5.00	5.00	2.00	18.00
		Sub Total	8.80	12.30	12.80	12.30	9.80	56.00
Infrastructure strengthening								
	Arms and ammunitions	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00

	Field gears and camping equipments for staff and field watchers	Lumpsum	2.00	0.50	1.00	0.50	1.00	5.00
	Interpretation Centre	Lumpsum	10.00	5.00	1.00	1.00	1.00	18.00
	Binoculars/ spotting scope/camera/GPS	Lumpsum	1.00	0.00	0.25	0.00	0.50	1.75
	Communication network	Lumpsum	2.00	1.00	1.00	1.00	1.00	6.00
		Sub Total	16.00	7.50	4.25	3.50	4.50	35.75
Wildlife Research, Education and Nature Awareness								
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	1.50	1.50	1.50	1.50	1.50	7.50
	Awareness programme for public	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Awareness programme for media	Lumpsum	0.50	0.00	0.50	0.00	0.50	1.50
	Awareness materials/ publications/films	Lumpsum	0.75	0.75	0.75	0.75	0.75	3.75
	Mapping of tahr habitats – Research	Lumpsum	1.50	0.50	0.00	0.00	0.00	2.00
	Habitat assessment and monitoring for impact of cattle, pilgrimage and fire management – Research	Lumpsum	3.00	2.00	0.00	0.00	0.00	5.00

	Assessment of dependence on tahr areas by the communities – Research	Lumpsum	1.00	1.00	0.00	0.00	0.00	2.00
	Dialogue with cattle/estate owners through a social scientist	One person on contract @ Rs. 15000/ per month	1.80	1.80	1.80	1.80	1.80	9.00
	Audio-visual equipments (LCD projector, computer etc.)	Lumpsum	3.00	0.25	0.50	0.25	0.50	4.50
		Sub Total	11.05	8.55	5.55	5.05	6.05	40.25
Staff development and Capacity building								
	Training in use of specialized equipments	Lumpsum	0.50	0.00	0.50	0.00	0.50	1.50
	Exposure visit to other tahr areas	Lumpsum	0.50	0.00	0.50	0.00	0.50	1.50
		Sub Total	1.00	0.00	1.00	0.00	1.00	3.00
Staff Welfare activities								
	Staff amenities fund for welfare measures	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
		Sub Total	1.00	1.00	1.00	1.00	1.00	5.00
Wildlife Veterinary care								
	Veterinary support	Lumpsum	0.50	1.00	0.50	0.50	0.50	3.00
		Sub Total	0.50	1.00	0.50	0.50	0.50	3.00

Theni Forest Division								
	Anti-poaching Activities							
	Engaging Watchers for protection	12 Nos. @Rs. 3000/ per month per person	4.32	4.32	4.32	4.32	4.32	21.60
	Ration provision	Four camps @ 2000/ per camp with minimal annual increase	0.08	0.10	0.12	0.14	0.16	0.60
	Secret fund	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
		Sub Total	4.90	4.92	4.94	4.96	4.98	24.70
	Habitat Improvement							
	Additional watchers for fire management	12 watchers @ Rs. 3000/ per month for six months	2.16	2.16	2.16	2.16	2.16	10.80
		Sub Total	2.16	2.16	2.16	2.16	2.16	10.80
	Infrastructure strengthening							
	Arms and ammunitions	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Field gears and camping equipments for staff and field watchers	Lumpsum	1.00	0.00	1.00	0.00	1.00	3.00
	Binoculars/ spotting scope/camera/GPS	Lumpsum	1.50	0.00	0.50	0.00	0.50	2.50
	Communication network	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
		Sub Total	4.50	2.00	3.50	2.00	3.50	15.50

Wildlife Research, Education and Nature Awareness								
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	0.50	0.50	0.50	0.75	0.75	3.00
	Awareness programme for public	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Awareness materials/ publications/films	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
	Mapping of tahr habitats – Research	Lumpsum	2.00	0.50	0.00	0.00	0.00	2.50
	Habitat assessment and monitoring for impact of cattle, pilgrimage and fire management – Research	Lumpsum	3.00	2.00	0.50	0.00	0.00	5.50
	Assessment of dependence on tahr areas by the communities – Research	Lumpsum	1.00	1.00	0.00	0.00	0.00	2.00
	Audio-visual equipments (LCD projector, computer etc.)	Lumpsum	2.00	0.25	0.50	0.25	0.50	3.50
		Sub Total	10.00	5.75	3.00	2.50	2.75	24.00
Staff development and Capacity building								
	Training in use of specialized equipments	Lumpsum	0.50	0.00	0.50	0.00	0.50	1.50

	Exposure visit to other tahr areas	Lumpsum	0.25	0.00	0.00	0.50	0.00	0.75
		Sub Total	0.75	0.00	0.50	0.50	0.50	2.25
Staff Welfare activities								
	Staff amenities fund for welfare measures	Lumpsum	0.50	0.50	0.50	1.00	1.00	3.50
		Sub Total	0.50	0.50	0.50	1.00	1.00	3.50
Wildlife Veterinary care								
	Veterinary support	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
		Sub Total	0.50	0.50	0.50	0.50	0.50	2.50
		Total						
Anamalai Tiger Reserve								
Anti-poaching Activities								
	Engaging Watchers for protection	25 Nos. @Rs. 3000/ per month per person	9.00	9.00	9.00	9.00	9.00	45.00
	Ration provision	Four camps @ 2000/ per camp with minimal annual increase	0.08	0.10	0.12	0.14	0.16	0.60
		Sub Total	9.08	9.10	9.12	9.14	9.16	45.60
Habitat Improvement								
	Additional watchers for fire management	Fifteen watchers @ Rs. 3000/- per month per person for 6 months	2.70	2.70	2.70	2.70	2.70	13.50

	Removal of Alien Invasive plants	Lumpsum	0.50	1.00	0.50	1.00	0.50	3.50
		Sub Total	3.20	3.70	3.20	3.70	3.20	17.00
Infrastructure strengthening								
	Field gears and camping equipments for staff and field watchers	Lumpsum	1.00	0.50	1.00	0.50	1.00	4.00
	Binoculars/ spotting scope/camera	Lumpsum	1.50	0.00	0.50	0.00	0.50	2.50
	Communication network	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
		Sub Total	3.00	1.00	2.00	1.00	2.00	9.00
Wildlife Research, Education and Nature Awareness								
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	1.50	1.50	1.50	1.50	1.50	7.50
	Awareness programme for public	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Awareness programme for media	Lumpsum	0.50	0.00	0.50	0.00	0.50	1.50
	Awareness materials/ publications/films	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
	Mapping of tahr habitats – Research	Lumpsum	2.00	0.50	0.00	0.00	0.00	2.50
	Habitat assessment and monitoring for impact of fire management – Research	Lumpsum	3.00	2.00	0.50	0.00	0.00	5.50

	Research - ecology, wildlife health	Lumpsum	3.00	3.00	3.00	3.00	3.00	15.00
	Assessment of dependence on tahr areas by the communities – Research	Lumpsum	1.00	1.00	0.00	0.00	0.00	2.00
	Interpretation Centre	Lumpsum	3.00	10.00	2.00	2.00	2.00	19.00
	Audio-visual equipments (LCD projector, computer etc.)	Lumpsum	2.00	0.25	0.50	0.25	0.50	3.50
	Interpretation Expert on contract	One person @ Rs. 10000/ per month with annual increment of Rs. 250/ -	1.20	1.23	1.26	1.29	1.32	6.30
		Sub Total	18.70	20.98	10.76	9.54	10.32	70.30
Staff development and Capacity building								
	Training in use of specialized equipments	Lumpsum	0.50	0.00	0.50	0.00	0.50	1.50
	Exposure visit to other tahr areas	Lumpsum	0.50	0.00	0.00	0.50	0.00	1.00
		Sub Total	1.00	0.00	0.50	0.50	0.50	2.50
Staff Welfare activities								
	Staff amenities fund for welfare measures	Lumpsum	0.50	0.50	0.50	1.00	1.00	3.50
		Sub Total	0.50	0.50	0.50	1.00	1.00	3.50
Wildlife Veterinary care								
	Veterinary support	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50

		Sub Total	0.50	0.50	0.50	0.50	0.50	2.50
		Total						
Coimbatore Forest Division								
Anti-poaching Activities								
	Engaging Watchers for protection	10 Nos. @Rs. 3000/ per month per person	3.60	3.60	3.60	3.60	3.60	18.00
	Ration provision	Lumpsum	0.08	0.10	0.12	0.14	0.16	0.60
		Sub Total	3.68	3.70	3.72	3.74	3.76	18.60
Habitat Improvement								
	Additional watchers for fire management	Ten watchers @ Rs. 3000/- per month per person for 6 months	1.80	1.80	1.80	1.80	1.80	9.00
		Sub Total	1.80	1.80	1.80	1.80	1.80	9.00
Infrastructure strengthening								
	Field gears and camping equipments for staff and field watchers	Lumpsum	0.75	0.00	0.75	0.00	0.75	2.25
	Binoculars/ spotting scope/camera	Lumpsum	1.50	0.00	0.50	0.00	0.50	2.50
	Communication network	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
		Sub Total	2.75	0.50	1.75	0.50	1.75	7.25
Wildlife Research, Education and Nature Awareness								
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00

	Awareness programme for public	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Awareness programme for media	Lumpsum	0.50	0.00	0.50	0.00	0.50	1.50
	Awareness materials/ publications/films	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
	Mapping of tahr habitats – Research	Lumpsum	1.50	0.50	0.00	0.00	0.00	2.00
	Habitat assessment and monitoring for impact of fire management – Research	Lumpsum	2.00	2.00	0.50	0.00	0.00	4.50
	Assessment of dependence on tahr areas by the communities – Research	Lumpsum	1.00	1.00	0.00	0.00	0.00	2.00
	Audio-visual equipments (LCD projector, computer etc.)	Lumpsum	2.00	0.25	0.50	0.25	0.50	3.50
		Sub Total	9.50	6.25	4.00	2.75	3.50	26.00
Staff development and Capacity building								
	Training in use of specialized equipments	Lumpsum	0.25	0.00	0.25	0.00	0.25	0.75
	Exposure visit to other tahr areas	Lumpsum	0.50	0.00	0.00	0.50	0.00	1.00
		Sub Total	0.75	0.00	0.25	0.50	0.25	1.75
Staff Welfare activities								
	Staff amenities fund for welfare measures	Lumpsum	0.50	0.50	0.50	1.00	1.00	3.50

		Sub Total	0.50	0.50	0.50	1.00	1.00	3.50
	Wildlife Veterinary care							
	Veterinary support	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
		Sub Total	0.50	0.50	0.50	0.50	0.50	2.50
Nilgiris (South and Wildlife)								
	Anti-poaching Activities							
	Engaging Watchers for protection	20 Nos. @Rs. 3000/ per month per person	7.20	7.20	7.20	7.20	7.20	36.00
	Ration provision	Four camps @ 2000/ per camp with minimal annual increase	0.08	0.10	0.12	0.14	0.16	0.60
	Secret fund	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
	Trek path maintenance	Lumpsum	1.00	0.50	1.00	0.50	1.00	4.00
		Sub Total	8.78	8.30	8.82	8.34	8.86	43.10
	Habitat Improvement							
	Additional watchers for fire management	Fifteen watchers @ Rs. 3000/- per month per person for 6 months	2.70	2.70	2.70	2.70	2.70	13.50
	Removal of Alien Invasive plants	50 ha/year @ Rs. 6000/ per ha	3.00	3.00	3.00	3.00	3.00	15.00
		Sub Total	5.70	5.70	5.70	5.70	5.70	28.50
	Infrastructure strengthening							

	Anti poaching camps maintenance	Three camps	1.50	0.00	1.50	0.00	1.50	4.50
	Interpretation Centre	Lumpsum	10.00	10.00	0.00	0.00	0.00	20.00
	Field gears for patrolling and camping equipments	Lumpsum	1.50	0.50	1.00	0.50	1.00	4.50
	Night vision binoculars	Lumpsum	2.00	0.00	1.00	0.00	1.00	4.00
	Binoculars/ spotting scope/camera/GPS	Lumpsum	5.00	0.00	1.00	0.00	1.00	7.00
	Arms and ammunitions	Lumpsum	1.00	0.50	1.00	0.50	1.00	4.00
	Communication network	Lumpsum	1.00	0.50	0.50	0.50	0.50	3.00
		Sub Total	22.00	11.50	6.00	1.50	6.00	47.00
	Wildlife Research, Education and Nature Awareness							
	Audio-visual equipments (LCD projector, computer etc.)	Lumpsum	3.00	0.25	0.50	0.25	0.50	4.50
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Awareness programme for public	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Awareness programme for media	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
	Awareness material publications	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00

	Mapping of tahr habitats – Research	Lumpsum	1.00	0.50	0.00	0.00	0.00	1.50
	Habitat assessment – Research	Lumpsum	5.00	2.00	0.00	0.00	0.00	7.00
	Research support staff (Field Assistant)	One @ Rs.5000/ per month with annual increment of Rs. 100	0.60	0.72	0.84	0.96	1.08	4.20
	Laptop, printer, camera and accessories for Research	Lumpsum	3.00	0.50	0.50	0.50	0.50	5.00
		Sub Total	16.10	7.47	5.34	5.21	5.58	39.70
Staff development and Capacity building								
	Training in use of specialized equipments	Lumpsum	0.25	0.00	0.25	0.00	0.50	1.00
	Exposure visit to other tahr areas	Lumpsum	0.50	0.00	0.00	1.00	0.00	1.50
		Sub Total	0.75	0.00	0.25	1.00	0.50	2.50
Wildlife Veterinary care								
	Veterinary support	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
		Sub Total	1.00	1.00	1.00	1.00	1.00	5.00
Kodaikanal Forest Division								
Anti-poaching Activities								
	Engaging Watchers for protection	20 Nos. @Rs. 3000/ per month per person	7.20	7.20	7.20	7.20	7.20	36.00

	Ration provision	Four camps @ 2000/ per camp with minimal annual increase	0.08	0.10	0.12	0.14	0.16	0.60
	Secret fund	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
	Trek path maintenance	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
		Sub Total	8.28	8.30	8.32	8.34	8.36	41.60
Habitat Improvement								
	Additional watchers for fire management	Fifteen watchers @ Rs. 3000/- per month per person for 6 months	2.70	2.70	2.70	2.70	2.70	13.50
	Removal of Alien Invasive plants	50 ha/year @ Rs. 6000/ per ha	3.00	3.00	3.00	3.00	3.00	15.00
		Sub Total	5.70	5.70	5.70	5.70	5.70	28.50
Infrastructure strengthening								
	Anti poaching camps maintenance	Three camps	1.50	0.00	1.50	0.00	1.50	4.50
	Interpretation Centre	Lumpsum	10.00	10.00	0.00	0.00	0.00	20.00
	Field gears for patrolling and camping equipments	Lumpsum	1.50	0.50	1.00	0.50	1.00	4.50
	Binoculars/ spotting scope/camera/GPS	Lumpsum	2.50	0.00	1.00	0.00	0.00	3.50
	Arms and ammunitions	Lumpsum	1.00	0.50	1.00	0.50	1.00	4.00
	LCD Projector, Computer, GPS	Lumpsum	2.50	0.50	1.00	0.50	0.50	5.00

	Communication network	Lumpsum	1.00	0.50	0.50	0.50	0.50	3.00
		Sub Total	20.00	12.00	6.00	2.00	4.50	44.50
Wildlife Research, Education and Nature Awareness								
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Awareness programme for public	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Awareness material publications	Lumpsum	1.00	0.50	1.00	0.50	1.00	4.00
	Mapping of tahr habitats – Research	Lumpsum	1.00	0.50	0.00	0.00	0.00	1.50
	Research - Enclosure and population monitoring	Lumpsum	5.00	3.00	3.00	2.00	1.00	14.00
	Habitat assessment – Research	Lumpsum	5.00	2.00	0.00	0.00	0.00	7.00
		Sub Total	14.00	8.00	6.00	4.50	4.00	36.50
Staff development and Capacity building								
	Training in use of specialized equipments	Lumpsum	0.25	0.00	0.25	0.00	0.50	1.00
	Exposure visit to other tahr areas	Lumpsum	0.25	0.00	0.25	0.00	0.50	1.00
		Sub Total	0.50	0.00	0.50	0.00	1.00	2.00
Wildlife Veterinary care								
	Veterinary support	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
		Sub Total	1.00	1.00	1.00	1.00	1.00	5.00

KERALA								
	Trivandrum Wildlife							
	Anti-poaching Activities							
	Engaging Watchers for protection	6 Nos. @Rs. 3000/ per month per person	2.16	2.16	2.16	2.16	2.16	10.80
	Ration provision	Two camps @ 2000/ per camp with minimal annual increase	0.48	0.50	0.52	0.54	0.56	2.60
	Secret fund	Lumpsum	0.25	0.25	0.25	0.25	0.25	1.25
		Sub Total	2.89	2.91	2.93	2.95	2.97	14.65
	Habitat Improvement							
	Additional watchers for fire management	Ten watchers @ Rs. 3000/- per month per person for 6 months	1.80	1.80	1.80	1.80	1.80	9.00
	Removal of Alien Invasive plants	Lumpsum	0.30	0.30	0.30	0.30	0.30	1.50
		Sub Total	2.10	2.10	2.10	2.10	2.10	10.50
	Infrastructure strengthening							
	Anti poaching camps	One camp	3.00	0.00	0.00	0.00	0.00	3.00
	Field gears for patrolling and camping equipments	Lumpsum	0.50	0.00	0.50	0.00	0.50	1.50
	Binoculars/ spotting scope/camera/GPS	Lumpsum	1.00	0.00	0.50	0.00	0.50	2.00
	Arms and ammunitions	Lumpsum	1.00	0.50	0.50	0.50	0.50	3.00

	Communication network	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
		Sub Total	6.00	1.00	2.00	1.00	2.00	12.00
Wildlife Research, Education and Nature Awareness								
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	0.75	0.75	0.75	0.75	0.75	3.75
	Awareness programme for public	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Awareness programme for media	Lumpsum	0.50	0.00	0.50	0.00	0.50	1.50
	Habitat assessment – Research	Lumpsum	3.00	1.00	0.00	0.00	0.00	4.00
		Sub Total	5.25	2.75	2.25	1.75	2.25	14.25
Staff development and Capacity building								
	Training in use of specialized equipments	Lumpsum	0.25	0.00	0.50	0.00	0.50	1.25
	Exposure visit to other tahr areas	Lumpsum	0.50	0.00	0.00	0.50	0.00	1.00
		Sub Total	0.75	0.00	0.50	0.50	0.50	2.25
Wildlife Veterinary care								
	Veterinary support	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
Trivandrum Territorial								
Anti-poaching Activities								
	Engaging Watchers for protection	6 Nos. @Rs. 3000/ per month per person	2.16	2.16	2.16	2.16	2.16	10.80

	Ration provision	Two camps @ 2000/ per camp with minimal annual increase	0.48	0.50	0.52	0.54	0.56	2.60
	Secret fund	Lumpsum	0.25	0.25	0.25	0.25	0.25	1.25
		Sub Total	2.89	2.91	2.93	2.95	2.97	14.65
Habitat Improvement								
	Additional watchers for fire management	Six watchers @ Rs. 3000/- per month per person for 6 months	2.16	2.16	2.16	2.16	2.16	10.80
	Removal of Alien Invasive plants	Lumpsum	0.30	0.30	0.30	0.30	0.30	1.50
		Sub Total	2.46	2.46	2.46	2.46	2.46	12.30
Infrastructure strengthening								
	Anti poaching camps	One camp	3.00	0.00	0.00	0.00	0.00	3.00
	Field gears for patrolling and camping equipments	Lumpsum	0.50	0.00	0.50	0.00	0.50	1.50
	Binoculars/GPS/Spotting scope	Lumpsum	1.00	0.00	0.00	0.00	0.00	1.00
	Arms and ammunitions	Lumpsum	1.00	0.50	0.50	0.50	0.50	3.00
	Communication network	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
		Sub Total	6.00	1.00	1.50	1.00	1.50	11.00
Wildlife Research, Education and Nature Awareness								
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50

	Awareness programme for public	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Habitat assessment – Research	Lumpsum	3.00	1.00	0.00	0.00	0.00	4.00
		Sub Total	4.50	2.50	1.50	1.50	1.50	11.50
Staff development and Capacity building								
	Training in use of specialized equipments	Lumpsum	0.25	0.00	0.25	0.00	0.25	0.75
	Exposure visit to other tahr areas	Lumpsum	0.50	0.00	0.00	0.50	0.00	1.00
		Sub Total	0.75	0.00	0.25	0.50	0.25	1.75
Wildlife Veterinary care								
	Veterinary support	Lumpsum	0.25	0.25	0.25	0.25	0.25	1.25
Periyar Tiger Reserve including Kochu Pamba								
Anti-poaching Activities								
	Engaging Watchers for protection	4 Nos. @Rs. 3000/ per month per person	1.44	1.44	1.44	1.44	1.44	7.20
	Secret fund	Lumpsum	0.25	0.25	0.25	0.25	0.25	1.25
		Sub Total	1.69	1.69	1.69	1.69	1.69	8.45
Habitat Improvement								
	Additional watchers for fire management	Four watchers @ Rs. 3000/- per month per person for 6 months	0.72	0.72	0.72	0.72	0.72	3.60

	Removal of Alien Invasive plants	Lumpsum	0.30	0.30	0.30	0.30	0.30	1.50
		Sub Total	1.02	1.02	1.02	1.02	1.02	5.10
Infrastructure strengthening								
	Field gears for patrolling and camping equipments	Lumpsum	0.50	0.00	0.50	0.00	0.50	1.50
	Binoculars/ spotting scope/camera/GPS	Lumpsum	0.50	0.00	0.50	0.00	0.50	1.50
		Sub Total	1.00	0.00	1.00	0.00	1.00	3.00
Wildlife Research, Education and Nature Awareness								
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	0.75	0.75	0.75	0.75	0.75	3.75
	Habitat assessment – Research	Lumpsum	2.00	1.00	0.00	0.00	0.00	3.00
		Sub Total	2.75	1.75	0.75	0.75	0.75	6.75
Staff development and Capacity building								
	Exposure visit to other tahr areas	Lumpsum	0.25	0.00	0.00	0.50	0.00	0.75
		Sub Total	0.25	0.00	0.00	0.50	0.00	0.75
Munnar Territorial and Wildlife Division								
Anti-poaching Activities								
	Engaging Watchers for protection	20 Nos. @Rs. 3000/ per month per person	7.20	7.20	7.20	7.20	7.20	36.00

	Ration provision	6 camps @ 2000/ per camp with minimal annual increase	1.44	1.46	1.48	1.50	1.52	7.40
	Secret fund	Lumpsum	0.25	0.25	0.25	0.25	0.25	1.25
	Trek path maintenance	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
		Sub Total	9.89	9.91	9.93	9.95	9.97	49.65
Habitat Improvement								
	Additional watchers for fire management	Fifteen watchers @ Rs. 3000/- per month per person for 6 months	2.70	2.70	2.70	2.70	2.70	13.50
	Removal of Alien Invasive plants	Lumpsum	1.00	0.50	1.00	0.50	1.00	4.00
		Sub Total	3.70	3.20	3.70	3.20	3.70	17.50
Infrastructure strengthening								
	Anti poaching camps	Two camps @ 3 lakhs	6.00	0.00	0.00	0.00	0.00	6.00
	Field gears for patrolling and camping equipments	Lumpsum	2.00	0.00	2.00	0.00	2.00	6.00
	Binoculars/ spotting scope/camera/GPS	Lumpsum	1.50	0.00	0.50	0.00	0.50	2.50
	Arms and ammunitions	Lumpsum	1.00	0.50	0.50	0.50	0.50	3.00
	Communication network	Lumpsum	0.50	0.00	0.50	0.00	0.50	1.50
		Sub Total	11.00	0.50	3.50	0.50	3.50	19.00
Wildlife Research, Education and Nature Awareness								
	Audio-visual equipments (LCD projector, computer etc.)	Lumpsum	1.50	0.25	0.25	0.25	0.25	2.50

	Periodic population estimation, monitoring and analyses – Research	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Awareness programme for public	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Awareness programme for media	Lumpsum	0.50	0.00	0.50	0.00	0.50	1.50
	Awareness material publications	Lumpsum	1.00	0.50	1.00	0.50	1.00	4.00
	Mapping of tahr habitats – Research	Lumpsum	1.00	0.25	0.00	0.00	0.00	1.25
	Habitat assessment – Research	Lumpsum	1.00	0.50	0.00	0.00	0.00	1.50
	Field Research - ecological, behavioural, wildlife health	Lumpsum	5.00	3.00	3.00	4.00	2.00	17.00
		Sub Total	12.00	6.50	6.75	6.75	5.75	37.75
Staff development and Capacity building								
	Training in use of specialized equipments	Lumpsum	0.25	0.00	0.50	0.00	0.50	1.25
		Sub Total	0.25	0.00	0.50	0.00	0.50	1.25
Staff Welfare activities								
	Staff amenities fund for welfare measures	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
Wildlife Veterinary care								
	Veterinary support	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50

Malayattur Division								
	Anti-poaching Activities							
	Engaging Watchers for protection	3 Nos. @Rs. 3000/ per month per person	1.08	1.08	1.08	1.08	1.08	5.40
		Sub Total	1.08	1.08	1.08	1.08	1.08	5.40
	Habitat Improvement							
	Additional watchers for fire management	Two watchers @ Rs. 3000/- per month per person for 6 months	0.36	0.36	0.36	0.36	0.36	1.80
		Sub Total	0.36	0.36	0.36	0.36	0.36	1.80
	Infrastructure strengthening							
	Field gears for patrolling and camping equipments	Lumpsum	0.30	0.00	0.30	0.00	0.30	0.90
	Binoculars	Lumpsum	0.20	0.00	0.00	0.00	0.20	0.40
	Arms and ammunitions	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
	Communication network	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
		Sub Total	1.50	1.00	1.30	1.00	1.50	6.30
	Wildlife Research, Education and Nature Awareness							
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
	Habitat assessment – Research	Lumpsum	1.00	1.00	0.00	0.00	0.00	2.00
		Sub Total	1.50	1.50	0.50	0.50	0.50	4.50

Chalakkudy Division								
	Anti-poaching Activities							
	Engaging Watchers for protection	2 Nos. @Rs. 3000/ per month per person	0.72	0.72	0.72	0.72	0.72	3.60
		Sub Total	0.72	0.72	0.72	0.72	0.72	3.60
	Habitat Improvement							
	Additional watchers for fire management	Two watchers @ Rs. 3000/- per month per person for 6 months	0.36	0.36	0.36	0.36	0.36	1.80
		Sub Total	0.36	0.36	0.36	0.36	0.36	1.80
	Infrastructure strengthening							
	Field gears for patrolling and camping equipments	Lumpsum	0.30	0.00	0.30	0.00	0.30	0.90
	Binoculars	Lumpsum	0.20	0.00	0.00	0.00	0.20	0.40
	Arms and ammunitions	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
	Communication network	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
		Sub Total	1.50	1.00	1.30	1.00	1.50	6.30
	Wildlife Research, Education and Nature Awareness							
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	0.30	0.30	0.30	0.30	0.30	1.50
	Habitat assessment – Research	Lumpsum	0.50	1.00	0.00	0.00	0.00	1.50
		Sub Total	0.80	1.30	0.30	0.30	0.30	3.00

Parambikulam - Nelliampathis								
	Anti-poaching Activities							
	Engaging Watchers for protection	6 Nos. @Rs. 3000/ per month per person	2.16	2.16	2.16	2.16	2.16	10.80
		Sub Total	2.16	2.16	2.16	2.16	2.16	10.80
	Habitat Improvement							
	Additional watchers for fire management	Two watchers @ Rs. 3000/- per month per person for 6 months	0.36	0.36	0.36	0.36	0.36	1.80
		Sub Total	0.36	0.36	0.36	0.36	0.36	1.80
	Infrastructure strengthening							
	Field gears for patrolling and camping equipments	Lumpsum	0.30	0.00	0.30	0.00	0.30	0.90
	Binoculars	Lumpsum	0.20	0.00	0.00	0.00	0.20	0.40
		Sub Total	0.50	0.00	0.30	0.00	0.50	1.30
	Wildlife Research, Education and Nature Awareness							
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Habitat assessment – Research	Lumpsum	0.50	1.00	0.00	0.00	0.00	1.50
		Sub Total	1.50	2.00	1.00	1.00	1.00	6.50
Palakad Division								
	Anti-poaching Activities							
	Engaging Watchers for protection	2 Nos. @Rs. 3000/ per month per person	0.72	0.72	0.72	0.72	0.72	3.60

		Sub Total	0.72	0.72	0.72	0.72	0.72	3.60
	Habitat Improvement							
	Additional watchers for fire management	Two watchers @ Rs. 3000/- per month per person for 6 months	0.36	0.36	0.36	0.36	0.36	1.80
		Sub Total	0.36	0.36	0.36	0.36	0.36	1.80
	Infrastructure strengthening							
	Field gears for patrolling and camping equipments	Lumpsum	0.30	0.00	0.30	0.00	0.30	0.90
	Binoculars	Lumpsum	0.20	0.00	0.00	0.00	0.20	0.40
	Arms and ammunitions	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
	Communication network	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
		Sub Total	1.50	1.00	1.30	1.00	1.50	6.30
	Wildlife Research, Education and Nature Awareness							
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	0.30	0.30	0.30	0.30	0.30	1.50
	Habitat assessment – Research	Lumpsum	0.50	1.00	0.00	0.00	0.00	1.50
		Sub Total	0.80	1.30	0.30	0.30	0.30	3.00
	Research - Ecology	Lumpsum	3.00	3.00	3.00	2.00	2.00	13.00
	Research - Enclosure and population monitoring	Lumpsum	5.00	3.00	3.00	2.00	1.00	14.00
	Habitat assessment – Research	Lumpsum	1.00	1.00	0.00	0.00	0.00	2.00
		Sub Total	9.80	8.30	6.30	4.30	3.30	32.00

	Wildlife Veterinary care							
	Veterinary support	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
		Sub Total	0.50	0.50	0.50	0.50	0.50	2.50
Mannarkad Division								
	Anti-poaching Activities							
	Engaging Watchers for protection	6 Nos. @Rs. 3000/ per month per person	2.16	2.16	2.16	2.16	2.16	10.80
		Sub Total	2.16	2.16	2.16	2.16	2.16	10.80
	Habitat Improvement							
	Additional watchers for fire management	Six watchers @ Rs. 3000/- per month per person for 6 months	1.08	1.08	1.08	1.08	1.08	5.40
		Sub Total	1.08	1.08	1.08	1.08	1.08	5.40
	Infrastructure strengthening							
	Anti poaching camps	One @ Rs. 3 lakh	3.00	0.00	0.00	0.00	0.00	3.00
	Field gears for patrolling and camping equipments	Lumpsum	0.50	0.00	0.50	0.00	0.50	1.50
	Binoculars	Lumpsum	0.20	0.00	0.00	0.00	0.20	0.40
	Arms and ammunitions	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
	Communication network	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
		Sub Total	1.70	1.00	1.50	1.00	1.70	6.90
	Wildlife Research, Education and Nature Awareness							
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50

	Habitat assessment – Research	Lumpsum	1.00	1.00	0.00	0.00	0.00	2.00
		Sub Total	1.50	1.50	0.50	0.50	0.50	4.50
Silent Valley								
Anti-poaching Activities								
	Engaging Watchers for protection	6 Nos. @Rs. 3000/ per month per person	2.16	2.16	2.16	2.16	2.16	10.80
	Ration provision	2 camps @ 2000/ per camp with minimal annual increase	0.48	0.50	0.52	0.54	0.56	2.60
		Sub Total	2.64	2.66	2.68	2.70	2.72	13.40
Habitat Improvement								
	Additional watchers for fire management	Twelve watchers @ Rs. 3000/- per month per person for 6 months	2.16	2.16	2.16	2.16	2.16	10.80
	Removal of Alien Invasive plants	Lumpsum	1.00	0.50	1.00	0.50	1.00	4.00
		Sub Total	3.16	2.66	3.16	2.66	3.16	14.80
Infrastructure strengthening								
	Anti poaching camps	Two camps @ 3 lakhs	6.00	0.00	0.00	0.00	0.00	6.00
	Field gears for patrolling and camping equipments	Lumpsum	2.00	0.00	2.00	0.00	2.00	6.00

	Binoculars/ spotting scope/camera/GPS	Lumpsum	1.50	0.00	0.50	0.00	0.50	2.50
	Arms and ammunitions	Lumpsum	1.00	0.50	0.50	0.50	0.50	3.00
	Communication network	Lumpsum	0.50	0.00	0.50	0.00	0.50	1.50
		Sub Total	11.00	0.50	3.50	0.50	3.50	19.00
Wildlife Research, Education and Nature Awareness								
	Audio-visual equipments (LCD projector, computer etc.)	Lumpsum	1.50	0.25	0.25	0.25	0.25	2.50
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Awareness programme for public	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Awareness programme for media	Lumpsum	0.50	0.00	0.50	0.00	0.50	1.50
	Awareness material publications	Lumpsum	1.00	0.50	1.00	0.50	1.00	4.00
	Mapping of tahr habitats – Research	Lumpsum	1.00	0.25	0.00	0.00	0.00	1.25
	Habitat assessment – Research	Lumpsum	1.00	0.50	0.00	0.00	0.00	1.50
	Field Research - ecological, behavioural, wildlife health	Lumpsum	5.00	3.00	3.00	4.00	2.00	17.00
		Sub Total	12.00	6.50	6.75	6.75	5.75	37.75
Staff development and Capacity building								
	Training in use of specialized equipments	Lumpsum	0.25	0.00	0.50	0.00	0.50	1.25
		Sub Total	0.25	0.00	0.50	0.00	0.50	1.25

	Staff Welfare activities							
	Staff amenities fund for welfare measures	Lumpsum	1.00	1.00	1.00	1.00	1.00	5.00
	Wildlife Veterinary care							
	Veterinary support	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
Nilambur South Division								
	Anti-poaching Activities							
	Engaging Watchers for protection	6 Nos. @Rs. 3000/ per month per person	2.16	2.16	2.16	2.16	2.16	10.80
		Sub Total	2.16	2.16	2.16	2.16	2.16	10.80
	Habitat Improvement							
	Additional watchers for fire management	Two watchers @ Rs. 3000/- per month per person for 6 months	0.36	0.36	0.36	0.36	0.36	1.80
		Sub Total	0.36	0.36	0.36	0.36	0.36	1.80
	Infrastructure strengthening							
	Anti poaching camps	One @ Rs. 3 lakh	3.00	0.00	0.00	0.00	0.00	3.00
	Field gears for patrolling and camping equipments	Lumpsum	0.50	0.00	0.50	0.00	0.50	1.50
	Binoculars	Lumpsum	0.20	0.00	0.00	0.00	0.20	0.40
	Arms and ammunitions	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
	Communication network	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
		Sub Total	1.70	1.00	1.50	1.00	1.70	6.90

Wildlife Research, Education and Nature Awareness								
	Periodic population estimation, monitoring and analyses – Research	Lumpsum	0.50	0.50	0.50	0.50	0.50	2.50
	Habitat assessment – Research	Lumpsum	1.00	1.00	0.00	0.00	0.00	2.00
		Sub Total	1.50	1.50	0.50	0.50	0.50	4.50

