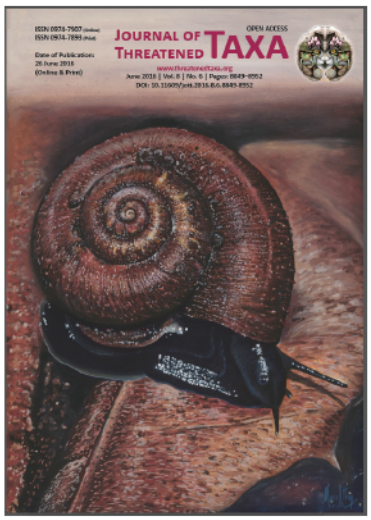

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COMMUNICATION

THE NILGIRI TAHR (MAMMALIA: CETARTIODACTYLA: BOVIDAE: *NILGIRITRAGUS HYLOCRIUS* OGILBY, 1838) IN THE AGASTYAMALAI RANGE, WESTERN GHATS, INDIA: POPULATION STATUS AND THREATS

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The Nilgiri Tahr (Mammalia: Cetartiodactyla: Bovidae: *Nilgiritragus hylocrius* Ogilby, 1838) in the Agastyamalai range, Western Ghats, India: population status and threats

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Abstract: The Nilgiri Tahr (*Nilgiritragus hylocrius* Ogilby, 1838) has not been comprehensively surveyed in the southern Western Ghats, India. Here we present results of a survey conducted in 2012 and 2013 in 25 sites where Nilgiri Tahr was reported in Agastyamalai range south of the Shencottah gap. The objectives of the survey were to assess population status; evaluate threats and propose conservation measures. In each site the geographical coordinates were noted. If Nilgiri Tahr (=Tahr) were sighted, the number and herd structure were recorded. Indirect signs of Tahr presence such as faecal pellets and feedback from local informants were noted in sites with no direct sightings of Tahr. The total sightings were 247 Tahr in 10 sites, and indication of Tahr presence in seven sites. Only two populations viz. Kalamalai-Varraiattumudi and Muthukulivayal-Balamore were large (>30 individuals). Tahr were not present in eight sites: of which four had earlier records of Tahr presence, and the other four had no prior data. There was a significant positive association between percentage of young (kids and yearlings) and number of Tahr sighted. Illegal hunting was widespread in the past, and continues to be a serious threat. Loss of Tahr grazing habitat to successional processes resulting in increased tree cover, is a long term threat that could increase with climate change. A landscape level management plan to reconnect small populations, rehabilitate Tahr in sites where they have disappeared, use fire to restore short grass habitats, and stringent curb on illegal hunting is required for the long term viability of the Nilgiri Tahr in this region.

Keywords: Endangered, Kalakad-Mundanthurai Tiger Reserve, Kanyakumari Wildlife Sanctuary, India, Tahr population status, threats, Western Ghats.

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Author Details: P. Hopeland is a biodiversity research consultant with an interest in species distribution, movement ecology and population biology. Dr. Jean-Philippe Puyravaud is scientist at Sigur Nature Trust and is interested in conservation planning at the landscape level for endangered species. Dr. Priya Davidar is a professor at Pondicherry Univeristy and is an ecologist and conservation biologist presently working on endangered species like the Nilgiri Tahr and Asian Elephant.

Author Contribution: All authors jointly designed the study. PH carried out the field work. All authors contributed to the literature review and writing. J-PP prepared the map.

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INTRODUCTION

An endangered species is vulnerable to extinction due to small population size, declining numbers, habitat changes and overexploitation (Mace & Lande 1991). A recovery plan for an endangered species should be based on population monitoring, improving habitat quality and controlling threats (Campbell et al. 2002).

The Nilgiri Tahr (*Nilgiritragus hylocrius* Ogilby, 1838), called hereafter 'Tahr', is a mountain ungulate endemic to the Western Ghats of India. The Tahr is classified as 'Endangered' due to its restricted geographical distribution and declining population (Alempath & Rice 2008). Its present population is estimated to be around 3,000 (Schaller 1970; Davidar 1978; Predit et al. 2015). The geographical range of the Tahr extended to the state of Karnataka over 50 years ago. It was last reported in Agumbe Ghat at around $13^{0}30'$N latitude in 1954 (Davidar 1978). At present, Its northernmost range limit is the Nilgiri Mountains, at around $11^{0}30'$N latitude. The largest population of around 800 animals, is found in the Eravikulam National Park, Kerala (Abraham et al. 2006). The Nilgiri population has been annihilated by hunting since the early 20th century (Fletcher 1911) and only a few hundred animals remain in the southwestern region in the Mukurthi National Park (Davidar 1978; Madappa 2012).

The increasing fragmentation and isolation of Tahr population is a cause for concern (Davidar 1978; Rice 1984; Mishra & Johnsingh 1998; Vergis 2011) as small isolated populations have greater risk of extinction due to stochastic factors (Soulé 1987). Rice (1984) indicated that 15 of the 17 sites with Tahr populations held fewer than 100 animals. There were no signs of the Tahr in six of 20 sites (30%) (Mishra & Johnsingh 1998; Vergis et al. 2011) where they had been documented earlier (Davidar 1978; Abraham et al. 2006). Loss of these small populations will result in genetic homogenization and further endanger the long term survival of the species.

Small isolated populations can help maintain the metapopulation structure of the species, if gene flow is restored through habitat connectivity or genetic rescue. Therefore it is important to document the status of smaller, isolated population of Nilgiri Tahr for conservation planning.

The southern Western Ghats south of the Shencottah Gap, termed the Agastyamalai range, has been relatively less investigated for the presence of Tahr. The early documentation of the species was by Webb-Peploe (1946–47) in and around the Naraikadu estate in Kalakad, where he recorded around 40 individuals. Later surveys by Daniel (1970), Davidar (1978), Daniel (1987), Lal Mohan et al. (1998) and Vergis et al. (2011), were not extensive, but indicated that many of these populations were small, and hunted.

Threats to Tahr in this region are several. Illegal hunting (Daniel 1987; Davidar 1978) was the most direct and obvious cause for the decline of this species. More insidious but permanent threats emerged such as human disturbance, roads and other obstructions (Davidar 1978). Strict protection against fire promoted tall grass succession which reduces availability of short grasses favoured by herbivores (Sankaran 2005). Livestock grazing reduces forage availability for wild herbivores (Davidar 1978; Madhusudan 2004) and could be agents for diseases such as rinderpest (Schaller 1970).

In order to check the status of the Tahr in this region, we conducted surveys during the dry seasons of 2012 and 2013. The objective of this study was to (i) identify sites where Tahr is present south of the Shencottah Gap, (ii) see whether the recruitment rate as indicated by the proportion of young Tahr is related to its population size, and (iii) qualitatively evaluate threats in the context of its present status. We tested the null hypothesis that small populations of the Tahr have not changed over the years.

Study area

This study was conducted over several sites south of the Shencottah gap in the Ashambu Hills and Kadayam ranges in Tirunelveli District, and in Kodayar in Kanyakumari District of Tamil Nadu. This region is generally termed the Agastyamalai range. This is the southernmost range of the species, and has extensive cliffs, undulating grasslands, steep gradients and deep gorges favourable to the Tahr. The largest population is along the western flank of the Agastyamalai adjoining Kerala (Vergis 2011; Hopeland 2012).

This region receives rainfall from the south-west and north-east monsoons, and rainfall decreases from the western crest of the Ghats towards the east. The topographical diversity and varied climate supports rich and diverse vegetation ranging from tropical wet evergreen forests, dry deciduous forests, savannah woodlands and grasslands (Roy et al. 2015).

METHODS AND MATERIALS

The survey was carried out in the dry season (January-June) of 2012 and 2013 in Kalakad-Mundanthurai Tiger Reserve (KMTR) and Kanyakumari Wildlife Sanctuary

(KWS), covering an area of 1,220km^2. We included the results of an earlier survey in 2009–2010 in the Ponmudi range of Kerala which is part of the Agastyamalai range (Vergis et al. 2011). A total of 24 sites known to support populations of Tahr, including sites surveyed at different times by various investigators (Daniel 1970; Davidar 1978; Daniel 1987; Mohan et al. 1998) were surveyed on foot.

In each site, transects were walked along the ridge or cliffs, where several vantage points were chosen which gave a good perspective on the landscape. The habitats surrounding these vantage points were thoroughly surveyed between 0600 to 1800 hours with an Olympus 10 x 50DPS I binoculars and a Celestron C 70 Mini Mac spotting scope with 90X magnification.

The surveys were carried out over consecutive days within a short period of time. Time taken to cover a site was considered a session. Each effort day had a minimum of one session and a maximum of two depending on the size of the site. The number of effort days per site ranged from one to five. This was replicated at every site possible over two seasons.

A Nikon D200 SLR camera with 55–300 mm lens was used to photograph Tahr whenever sighted. Detailed perusal of photographs can aid in enumerating animals in larger herds, avoiding double counts, and classifying animals by sex and age. Notes on location, time of sighting and herd structure, together with photographic database helped avoid recounts of individuals. Data were omitted where there were possibilities of double count of individuals or herds. After these precautions, the highest number sighted in a site in any single session was taken as the final count.

The geographical coordinates and elevation (amsl) of each site were recorded using a global positioning system. Signs of Tahr such as fresh faecal pellets were noted and indicated on the map (Fig. 1). In some sites where only Tahr faecal pellets were available, the pellets were compared with those of sympatric ungulates such as the Sambar *Rusa unicolor* and Barking Deer *Muntiacus vaginalis* for similarity. Tahr faecal pellets can be distinguished as they are smooth, compact and slightly elongated or elliptical shape as opposed to coarse, dark and larger pellets of the Sambar and the latrine type defecation piles of Barking Deer (Jayson & Easa 1997). In addition, the habitat in which the pellets are found, i.e., rocky outcrops are indicative of Tahr presence. However, there are possibilities of error and therefore only definitive records are included.

In addition to Tahr sightings, past estimates for each site were obtained from literature if available, and by discussion with local informants familiar with the study area. The sightings and estimates were tabulated. The population was designated as "large" if the sightings were over 30 and "small" if lesser than 30 animals.

The animals were classified as pre-reproductive (kids less than one year old and yearlings between one and two years old) and reproductive, based on size. Kids were from the present breeding season and yearlings from the previous breeding season. Larger animals approximately 80cm at the shoulder were classified as adults (Rice 1984). We correlated the number of sightings in each site with the proportion of young animals using Spearman's rank correlation to see whether larger populations had proportionately more young than smaller populations.

In each site the major threats were noted from personal observations and discussions with local people. Present threats were illegal hunting, livestock grazing, tall grass cover and human disturbance through noise, harvesting of forest products, tourism, feral dogs, mining and other activities. Information on past threats was obtained from informal and open-ended interviews with local people particularly elders who had a good knowledge of the area. The threats were categorised qualitatively as being present or absent.

We mapped the sites with currently observed populations and all other sites formerly surveyed and resurveyed by us, with or without evidence of Tahr present using ASTER-GDEM satellite data, a product of NASA and METI. We compared our sightings to estimates provided in literature. We correlated the number of sightings with percentage of young (kids and yearlings) using a Spearman rank correlation.

RESULTS

A total of 247 Tahr was sighted in 10 of the 25 sites surveyed and faecal pellets were recorded in seven additional sites. There was no Tahr in four sites where they had been reported earlier. Fourteen sites had no clear published information on presence of Tahr, and of these four had no current evidence of Tahr (Table 1, Fig. 1).

Thirty and more individuals were sighted in only two sites: Kalamalai-Varraiattumudi and Muthukulivayal-Balamore in Kodayar. The rest of the sites held fewer than 30 animals (Table 1, Fig. 1).

Totally there were 49 young animals in six sites which constituted 20% of the population. The highest proportion of young was in the Tiruvanamalai mottai

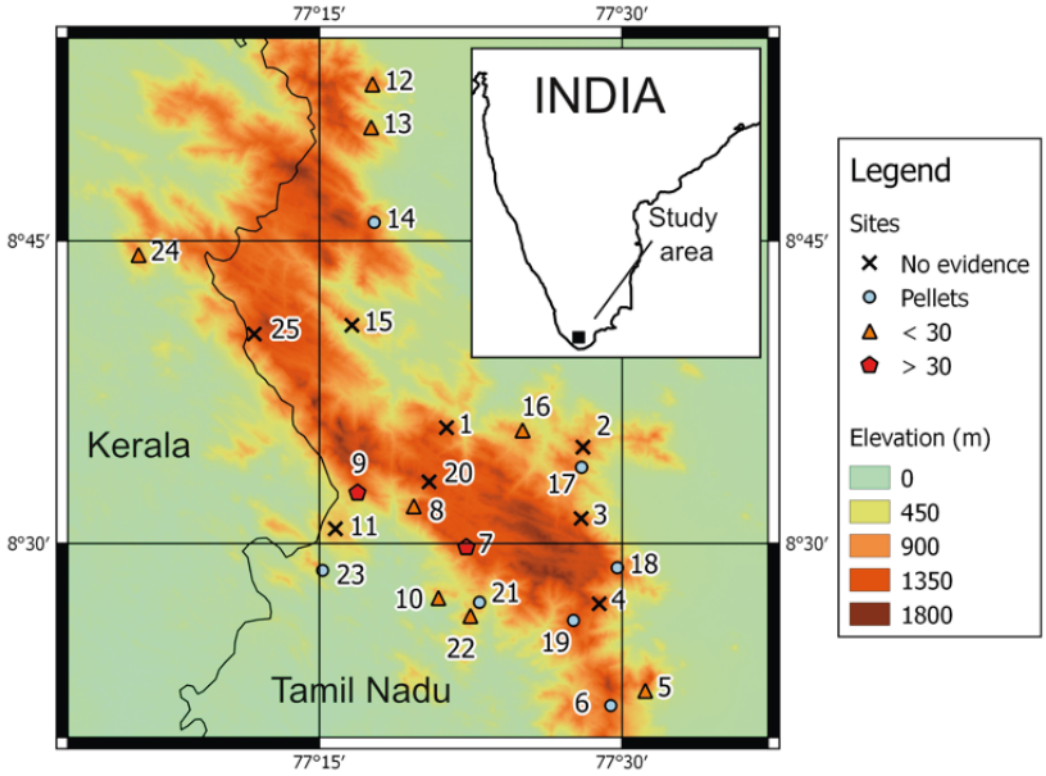

Figure 1. The study region with location of Nilgiri Tahr sites, indicating presence, indirect evidence and absence. The same numbering of sites is followed in Table 1 and Fig. 1 facilitating cross reference.

Table 1. Summary table with list of study sites. Serial numbers are same for Figure 1. Tahr sightings or faecal pellets (p) are indicated. Threats are: tall grass cover (G), illegal hunting (H), human disturbance including noise, plant harvesting and barriers (D) and livestock grazing (L). Not available (NA).

	Site	Sightings or pellets	Threats	Earlier estimates
1	Kudiraivetti Cliffs	NA	HDGL	NA: local informants
2	Panchanthangi, Vellimalai	NA	G	6: Davidar (1978), estimated 20
3	Kulirattimottai	NA	G	6: Davidar (1978)
4	Kottanguthati-Kanuni	NA	Nil	40: Webb-Peploe (1946)
5	Tiruvanamalai mottai	11	HDG	40: Davidar (1978)
6	Mahendragiri peaks, Manjathatai	P	HDGL	NA
7	Muthukulivayal-Balamore	58	HD	15: Mohan et al. 1998
8	Peechiparai Cliffs Winch station	14	HD	12: Daniel 1970. 14: Davidar (1978) 15: Mohan et al. (1998)
9	Kalamalai-Varraiattu mudi	103	HG	25 (Davidar 1978) 15: Mohan et al. 1998 76: Vergis (2011) Neyyar Wildlife Sanctuary, Kerala
10	Thatchanpotrai	23	HDGL	30–35: Daniel 1987 10: Mohan et al. 1998
11	Modiramalai-Perinjavial-Noolmudi-Kalamala	NA	HDGL	30: Mohan et al. 1998

	Site	Sightings or pellets	Threats	Earlier estimates
12	Eetiaathupudavu-Kudiraitheri	6	HDG	NA
13	Varraiattumottai	1	G	NA
14	Chinnapul-Noolpalam	P	G	NA
15	Pandian Kottai	NA	DG	NA
16	Kuuvathati mottai/ Varraiattu mottai	8	HDG	3: Davidar (1978) in 1960's
17	Nandoothu-Venkalaparai	P	G	NA
18	Panierandam Pirapu-Vistara mottai	P	G	NA
19	Nalikal-Mayamparambu-Vanamutti	P	G	NA
20	Manjanamparai	NA	HDG	NA: local informants
21	Maramalai	P	HDG	NA
22	Periamaramalai	12	HDG	NA
23	Kalamala II	P	HDL	NA
24	Ponmudi	11	HDGL	18: Abraham et al. (2006) survey in 2000–2001. 11: Vergis (2011)
25	Chemmunji peaks	NA	HD	NA

(36%) and Muthukulivayal-Balamore (26%). Young animals were not recorded in four sites with fewer than 30 Tahr. There was a significant positive association between the total number of sightings and percentage of young Tahr (Spearman rank correlation = 0.73, n=9, p <0.05).

The major threats were tall grass cover in 20 sites (80%), illegal hunting of wildlife in 16 (64%) including all sites with Tahr presence, and human disturbance in 16 (64%) sites (Table 1). Livestock grazing was prevalent in 6 (24%) sites. No threats were reported from Kottanguthati and Kanuni (Table 1).

DISCUSSION

This study represents the first comprehensive survey of the Tahr in its southernmost range in the Western Ghats. Our surveys recorded Tahr in only ten out of 25 sites. Thirty and more individuals were sighted in only two sites: Kalamalai-Varraiattumudi and Muthukulivayal-Balamore in Kodayar. The former is contiguous with Neyyar Wildlife Sanctuary in Kerala, where Vergis et al. (2011) recorded 76 individuals in 2010 and 103 in the present survey. The remaining eight sites had small numbers consisting mostly of a single herd.

This historically widespread population in the Agastyamalai landscape is now isolated forming four clusters with the Ponmudi range in the north-west, the Kadayam range in the north-east, Kodayar range in the south-west and Tiruvanamalai Peaks in the south-east.

We could not find any evidence of Tahr in four sites where they had been reported earlier, which includes Kottanguthati and Kanuni (Webb-Peploe 1946–47), where pellets were observed but no definitive presence as local residents had not sighted any Tahr there for decades (P. Davidar pers. obs.). Hence it was included among sites with no Tahr presence. The loss of Tahr in many sites could be because of several reasons: Hunting was widely prevalent in the past (Davidar 1978; Daniel 1987) and was also reported in 16 (64%) out of 25 sites by local informants. There are eyewitness reports of illegal hunting of Tahr in this region in the past (Daniel 1970; Davidar 1978; Mohan et al. 1998) and could be among the reasons for its absence in certain sites. Illegal hunting is a major threat to Tahr over its range (Davidar 1978; Mishra & Johnsingh 1998; Vergis et al. 2011). Unless stringent steps are taken to curb illegal hunting, many small populations will be decimated.

The Tahr in the Agastyamalai landscape occurs from an elevation of 650–1,400 m. Larger populations seem to thrive at elevations above 1000m where there are extensive grasslands, cliffs and protection from low elevation habitats. This suggests that inaccessibility protects populations from threats such as poaching and other human caused disturbances. Loss of short grassland habitats due to successional processes has been previously reported (Vergis et al. 2011). In regions with high rainfall, forests can replace grasslands in about 20–30 years in the absence of fire (Bond & Parr 2010). This process can make the habitat unsuitable for Tahr due to lack of forage and increased susceptibility to ambush predators such as the tiger and leopard. Sankaran (2009) has found that tall grass communities were least used by herbivores at all elevations in KMTR. *Cymbopogon flexuosus,* the dominant tall grass species is highly resistant to burning and can recover quickly to its original state if herbivore grazing pressure is low (Sankaran 2005). The low densities of wild grazing herbivores in KMTR are probably another reason for the dominance of tall grasses (Sankaran 2005). However, tall grass cover can be controlled with fire management.

Livestock grazing was extensive in the past, although has considerably declined. Livestock could have transmitted diseases like rinderpest and foot and mouth to wild ungulates (Sankar 2008). However, evidence is lacking.

In conclusion, Tahr was sighted in only 10 of 25 sites over the course of this study, and eight of these populations were very small. Pellets were noted in some sites, but here again it is not a definitive indicator of Tahr presence. Illegal hunting appears to be the major cause for decimation of the Tahr, and continues to be a threat to remnant populations.

Landscape level planning using scientific tools and models can help identify areas where corridors can be placed with minimum impacts, and sites where Tahr could be reintroduced to maintain metapopulation dynamics at the landscape scale.

REFERENCES

Abraham, S.K., P.S. Easa & M. Sivaram (2006). Status and distribution of Nilgiri Tahr *Hemitragus hylocrius* in Kerala part of the Western Ghats. *Zoos' Print Journal* 21(9): 2379–2385; http://dx.doi.org/10.11609/JoTT.ZPJ.1517.2379-85

Alempath, M. & C. Rice (2008). *Nilgiritragus hylocrius*. The IUCN Red List of Threatened Species 2008: e.T9917A13026736. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T9917A13026736.en

Bond, W.J. & C. L. Parr (2010). Beyond the forest edge: ecology, diversity and conservation of the grassy biomes. *Biological Conservation* 143: 2395–2404: http://dx.doi.org/10.1016/j.biocon.2009.12.012

Campbell, S.P., J.A. Clark, L.H. Crampton, A.D. Guerry, L.T. Hatch, P.R. Hosseini, J.J. Lawler & R.J. O'Connor (2002). An

assessment of monitoring efforts in endangered species recovery plans. *Ecological Applications* 12: 674–681; http://dx.doi.org/10.1890/1051-0761(2002)012[0674:AAOMEI]2.0.CO;2

Daniel, J. C. (1970). The Nilgiri Tahr (*Hemitragus hylocrius* Ogilby), in the High Range, Kerala and the southern hills of the Western Ghats. *Journal of the Bombay Natural History Society* 67: 535–542.

Daniel, M. (1987). A short note on a new found group of Tahr. *Journal of the Bombay Natural History Society* 84: 673–674.

Davidar, E.R.C. (1978). Distribution and status of the Nilgiri Tahr (*Hemitragus hylocrius*) 1975-1978. *Journal of the Bombay Natural History Society 75*: 815–844.

Fletcher, F.W.F. (1911). *Sport in the Nilgiris and in the Wynaad*. MacMillan & Co. Ltd, London.

Hopeland, P. (2012). A study on isolated populations of Nilgiri Tahr in Kalakad-Mundanthurai Tiger Reserve and Kanyakumari Wildlife Sanctuary and their conservation status. Unpublished M. Sc. Dissertation, Pondicherry University.

Jayson E.A. & P.S. Easa (1997). *A Field Guide to Animal Signs*. KFRI. Handbook; N 4, KFRI, Peechi, Kerala, 56pp.

Mace, G.M. & R. Lande (1991). Assessing extinction threats: toward a reevaluation of IUCN threatened species categories. *Conservation Biology 5:* 148–157; http://dx.doi.org/10.1111/j.1523-1739.1991.tb00119.x

Madappa, D. (2012). Population estimation and distribution of Nilgiri Tahr in Mukurthi National Park using GIS and remote sensing. Unpublished M.Sc. dissertation, Pondicherry University.

Madhusudan, M.D. (2004). Recovery of wild large herbivores following livestock decline in a tropical Indian wildlife reserve. *Journal of Applied Ecology* 41: 858–869; http://dx.doi.org/10.1111/j.0021-8901.2004.00950.x

Mishra, C. & A.J.T. Johnsingh (1998). Population and conservation status of the Nilgiri Tahr *Hemitragus hylocrius* in Anamalai Hills, south India. *Biological Conservation* 86: 199–206; http://dx.doi.org/10.1016/S0006-3207(98)00004-4

Mohan, R.S.L., J. Dharmasingh, J. Jeyaseelan & D. Daniel (1998). Nilgiri Tahr (*Hemitragus hylocrius*) of Kanyakumari District. *Zoos Print* XIII(2): 48–49.

Rice, C. (1984). *Behavior and ecology of Nilgiri Tahr (Hemitragus hylocrius)* Ph.D. Dissertation. Texas A & M University, College Station, Texas.

Roy, P.S., M.D. Behera, M.S.R. Murthy, A. Roy, S. Singh, S.P.S Kushwaha & S. Gupta (2015). New vegetation type map of India prepared using satellite remote sensing: Comparison with global vegetation maps and utilities. *International Journal of Applied Earth Observation and Geoinformation* 39: 142–159; http://dx.doi.org/10.1016/j.jag.2015.03.003

Sankar, R.L. (2008). Forest administration in Tirunelveli District 1950 to 1995. PhD Dissertation, Manonmaniam Sundaranar University, Tirunelveli, India; http://shodhganga.inflibnet.ac.in/handle/10603/15704

Sankaran, M. (2005). Fire, grazing and the dynamics of tall-grass savannas in the Kalakad-Mundanthurai Tiger Reserve, south India. *Conservation and Society* 3: 425.

Sankaran, M. (2009). Diversity patterns in savanna grassland communities: implications for conservation strategies in a biodiversity hotspot. *Biodiversity and Conservation* 18: 1099–1115; http://dx.doi.org/10.1007/s10531-008-9519-9

Soulé, M.E. (1987). *Viable Populations for Conservation*. Cambridge University Press.

Schaller, G.B. (1970). Observations on Nilgiri Tahr (*Hemitragus hylocrius* Ogilby, 1838). *Journal of the Bombay Natural History Society* 67: 365–389.

Vergis, S., J.P. Puyravaud, P.C. Mammen & P. Davidar (2011). Survey of isolated populations of the Nilgiri Tahr *Nilgiritragus hylocrius* (Ogilby) in Kerala, India. *Journal of the Bombay Natural History Society* 108: 8–11.

Webb-Peploe, C.G. (1946–47). Field notes on the mammals of South Tinnevelly, south India. *Journal of the Bombay Natural History Society* 46: 629–644.

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