HABITAT PREFERENCE OF FIVE HERBIVORES IN THE CHIMMONY WILDLIFE SANCTUARY

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Introduction

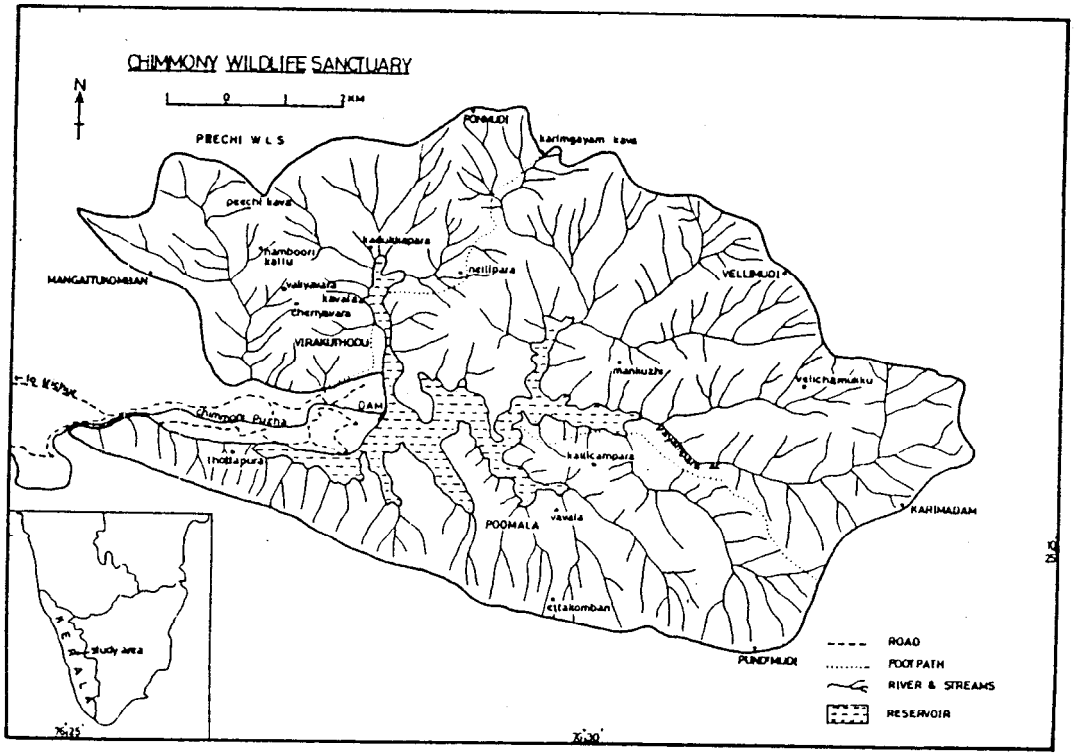
Information on the habitat preference of wild herbivores is necessary for the scientific management of protected areas. When habitats are used disproportionately to their availability, such use can be considered as selective (Johnson, 1980). In many of the protected areas in the Western Ghats of South India, herbivores use habitats selectively. Even though many studies have been carried out earlier on the habitat use of mammals (Balakrishnan and Easa, 1986; Nair and Jayson, 1988; Jayson and Ramachandran, 1996), no attempt has been made to elucidate the selective habitat use by the herbivores in the different vegetation types of Chimmony Wildlife Sanctuary.

Recently, status and distribution of larger mammals of Chimmony Wildlife Sanctuary were reported (Jayson, 1997). Apart from these, no other information is available on the herbivores from this protected area. Many studies have been conducted in North America on the habitat use of wild herbivores. Habitat use of Columbian White-tailed Deer has been reported by Suring and Vohs (1979). Mule Deer (*Odocoileus hemionus*) habitat selection patterns in North Central Washington was described by Carson and Peek (1987). Summer habitat use of Mountain sheep was reported by Gionfriddo and Krausman (1986). Similarly, home range and habitat use of adult female Moose was studied by Cederlund and Okarma (1988). Study designs and tests for comparing resource use and availability have been reviewed by Thomas and Taylor (1990). Relative habitat preference of herbivorous mammals, namely Indian Porcupine (*Hystrix indica*), Blacknaped Hare (*Lepus nigricollis*), Asian Elephant (*Elephas maximus*), Sambar (*Cervus unicolor*) and Wild Boar (*Sus scrofa*) to their availability is discussed in this paper. Along with this, seasonal difference in habitat use during summer and monsoon months were also reported.

Study Area and Methods

Study area : The Sanctuary is situated in Thrissur District of Kerala State, India (between 10° 22' - 10° 26'N Lat. 76° 31' - 76° 39'E Long.) on the Western slopes of Nelliampathy forest. The extent of this Sanctuary is about 90 km^2 and is contiguous with Parambikulam Wildlife Sanctuary on the East and Peechi-Vazhani Wildlife Sanctuary on the West (Fig. 1). Elevation varies from 1126 m to 2500 m above MSL. Detailed description on the location and topography of the Sanctuary is given in Jayson (1997). The mean annual rainfall varied from 2500mm to 3000mm. Maximum

Fig. 1



Study Area showing important places

precipitation is obtained from the South-West monsoon during June to September. Temperature ranged between a maximum of 36°C to a minimum of 24°C. The area consists of semi-evergreen forests 41.19%, moist deciduous forests 36.63%, scrub 7.68%, Teak (*Tectona grandis*) plantations 4.71%, grass 0.05%, quarry 0.01%, rock 4.05% and reservoir 5.68% (Menon, 1997).

Vegetation : The vegetation of the sanctuary consists of west coast tropical wet evergreen forests, west coast semi-evergreen forests, South Indian moist deciduous forests (Champion and Seth, 1969) and Teak (30 years) plantations. Evergreen forest is composed of species like *Palaquium ellipticum, Calophyllam tomentosum, Cullenia exarillata, Dipterocarpus indicus, Artocarpus hirsuta, Bombax ceiba* and *Syzygium cumini*. Lower canopy consists of species like *Cinnamomum zeylanicum, Mallotus phillipensis* and *Zanthoxylum flavescens*. Undergrowth is mainly of *Laportea crenulata, Ixora* sp. and *Calamus travancoricus*. Most of the area in the sanctuary harbour moist deciduous forest, which merge with semi-evergreen at higher elevations. *Tectona grandis, Dillenia pentagyna, Largerstroemia microcarpa* and *Terminalia paniculata* dominate the top canopy. The lower canopy mainly consists of *Bridelia retusa, Cassia fistula* and *Dillenia pentagyna*.

Methods of study : Initially, the whole area was traversed on foot for reconnaissance survey. Whenever an animal was sighted,

species, herd size, number of males, females, sub-adults, young ones, habitat and activity were recorded. Indirect evidences like pugmarks, pellets, dung, spoor and foot prints were also recorded and identified. Apart from the general survey, systematic plots studies were also carried out as described below. Pellets or dung of various animals were searched in line transects of 30 m length in three different habitats viz. semi-evergreen, moist deciduous and *Tectona grandis* habitats. These data were collected in two period from November 1992 to August 1993 and also from July 1994 to March 1995. On an average, 60 samples were made from each habitat in every month. But during monsoon months, only 20 samples were collected. Altogether 1760 samples were taken. Percentage of pellet/ dung in each month for three different habitats were derived from this pooled data.

Relative Preference Indices (RPI) were calculated using the following equation (Stinnett and Klebenow, 1986) :

$$\text{Relative Preference Index (RPI)} = \frac{\text{Percentage utilization}}{\text{Percentage availability of the habitat}} - 1$$

Positive values indicate preference, negative values between 0 and -1 indicate no preference and -1 indicates no use. Area estimates of different vegetation types obtained from 1:15,000 B&W aerial photographs of 1987-1990 were used to calculate percentage availability of habitats (Menon, 1997).

The data were analysed using one way ANOVA to find out the significant differences in habitat use. The difference in habitat use between the monsoon (June to August) and summer (September to May) seasons were analysed using 't' test in each habitat. The seasonal differences in habitat use was also verified using, the pooled data for the three habitats.

Habitat structure

Girth class distribution of trees : To characterise the vegetation types, the structure of trees in moist deciduous and semi-evergreen forests were analysed. Trees above 10 cm girth at breast height (gbh) were enumerated using the point-centred quarter method. Distance to the 4 nearest trees in four quardrats were measured from the centre. Like this, 50 plots were measured in two most prominent vegetation types i.e. semi-evergreen and moist deciduous forest.

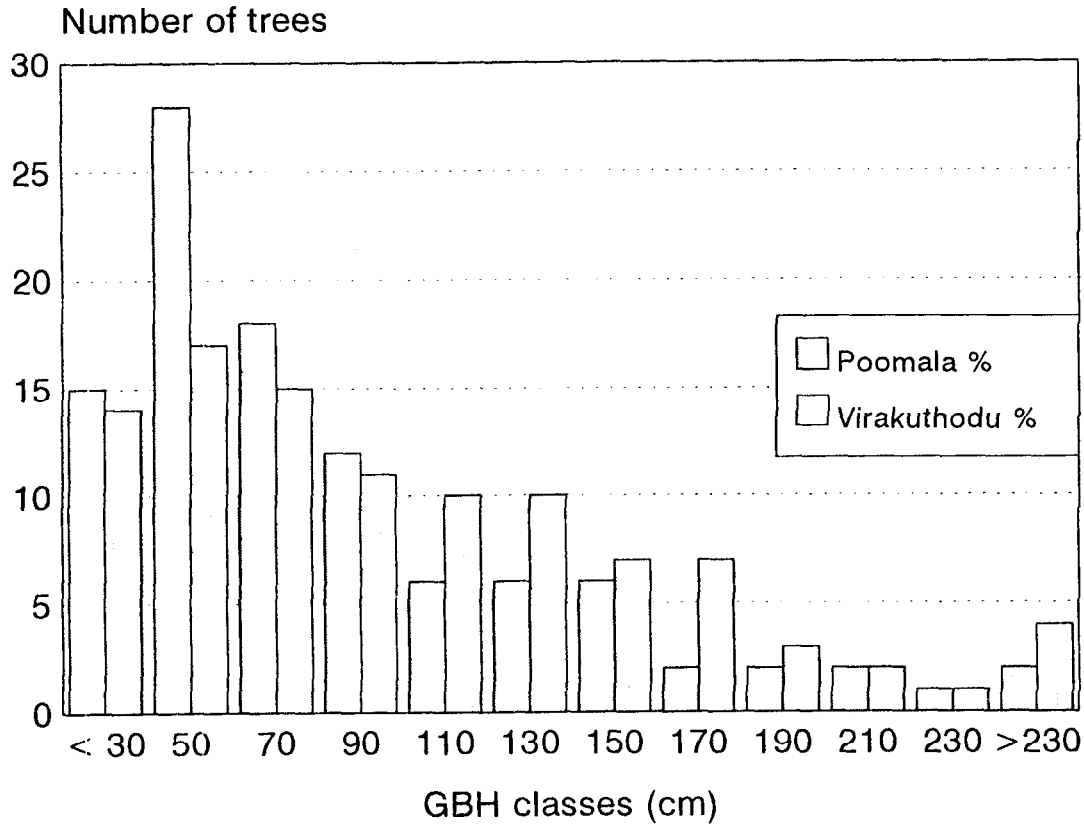
Results

Habitat structure : Vegetation of an area has great influence on the distribution and occurrence of fauna. Girth class distribution of trees was collected from two vegetation types namely moist deciduous forest and semi-evergreen forest. For the moist deciduous forest, data was collected from the Virakuthodu and for the semi-evergreen forest, it was gathered from Poomala region.

In both the vegetation types studied, trees coming in the range of 31 cm to 50 cm of gbh were in majority, which was followed by 51 cm to 70 cm category (Fig. 2) Trees with higher gbh were only of low percentage. Teak plantations were not studied in detail, because the structural details of different class of Teak plantations is already available (Nair and Jayson, 1988).

Habitat preference : The population status and distribution of herbivores in the sanctuary is described in a previous paper

Fig. 2



Frequency distribution of GBH of trees at Poomala and Virakuthodu

(Jayson, 1997). Habitat preference of five herbivores is described below.

Indian Porcupine (*Hystrix indica*)

Indian Porcupine is found in most of the sanctuaries and also in the Reserve forests of Kerala. Number of pellet groups recorded from the three habitats in various months is give in the Table 1. Maximum pellet groups were recorded from the semi evergreen forest ($\bar{x}$=43.14). But there was no significant difference in the use of the habitats by this animal, namely the Teak plantations, moist deciduous and semi-evergreen forests (F = 1.57; P = 0.22). Relative Preference Index showed that Indian Porcupine preferred Teak plantations (RPI = 0.79) followed by semi-evergreen and moist deciduous forests in the Sanctuary.

Analysis was also carried out to find the difference in the habitat use in summer and monsoon seasons. Significantly high habitat use was observed during summer in the moist deciduous forests ('t'=3.03; p=0.01), where as in the semi-evergreen forest no such significant difference was found. Analysis was carried out combining

Table 1

Pellets of Indian Porcupine recorded from different habitats at Chimmony Wildlife Sanctuary (N=1760)

Months	Habitats					
	Teak plantation(%)	RPI	Moist deciduous forest (%)	RPI	Semi-evergreen forest (%)	RPI
January	28.57	5.07	42.86	0.17	28.57	-0.31
February	28.57	5.07	71.43	0.95	0.00	-1
March	0.00	-1	66.67	0.82	33.37	-0.19
April	0.00	-1	0.00	-1	100.00	1.43
May	0.00	-1	50.00	0.37	50.00	0.21
June	0.00	-1	0.00	-1	0.00	-1
July	0.00	-1	0.00	-1	-	-
August	0.00	-1	0.00	-1	-	-
September	0.00	-1	0.00	-1	0.00	-1
October	0.00	-1	0.00	-1	100.00	1.43
November	0.00	-1	25.00	-0.32	75.00	0.82
December	44.44	8.44	11.12	-0.69	44.44	0.07
Mean	8.47	0.79	22.26	-0.39	43.14	0.04

- = No data collected; RPI = Relative Preference Index

all the three habitats to find the difference in habitat use during two seasons. It was revealed that significantly higher habitat use during summer than during the monsoon season ('t'=4.25; p=0.002, Table 7).

Blacknaped Hare (*Lepus nigricollis*)

The Blacknaped Hare preferred Teak plantations, compared to the moist deciduous forest and semi-evergreen forest is the least preferred (Table 2). Significant difference was obtained in the habitat use between these habitats (ANOVA, F=6.46, P=0.005). Pellets of Blacknaped Hare was not recorded from semi-evergreen forests except in the month of October. During the months of monsoon only few pellets of these species were observed in the field. When seasonal difference in habitat use was compared, significant difference was obtained in the use of Teak plantations between monsoon and summer seasons. In other two habitats no pellets were recorded during the months of monsoon and these habitats were used only in the months of summer. Similarly, no significantly different habitat use was recorded between summer and monsoon seasons when the pooled data of all the habitats were analysed using the 't' test (Table 7).

Asian Elephant (*Elephas maximus*)

Direct sightings of Elephants were rare in the Sanctuary. Maximum occurrence of Elephant dung was seen in the moist deciduous forests, followed by semi-evergreen. Relative Preference Index showed that Elephants preferred Teak plantation (RPI=0.77), followed by moist deciduous and semi-evergreen forests

(Table 3). But no significant difference was obtained in the habitat use from the one way ANOVA. No seasonal difference in habitat use was noticed in moist deciduous and semi evergreen vegetation types ('t' test). Analysis was not done in the case of Teak plantation as this habitat was visited only once, which was in monsoon season. Similarly, no significant difference in habitat use was found during summer and monsoon seasons when the pooled data of all the habitats were analysed (Table 7).

Sambar (*Cervus unicolor*)

This is the Deer commonly found in the Sanctuary and was recorded in all the months. Distribution of Sambar is ubiquitous and the Deer was sighted from most of the places. Sambar was utilising Teak plantations (RPI = 7.02) maximum, followed by moist deciduous and semi-evergreen forests (Table 4). But no significant difference was obtained in habitat use when the three habitats were compared using the one way ANOVA. When seasonal difference in habitat use was compared no significant difference was obtained during summer and monsoon seasons in the Teak plantations. Where as significantly high habitat use was obtained in summer season in the semi-evergreen forests (t=3.98; p=0.0041). In moist deciduous forest there was no habitat use during monsoon season. Significant difference in habitat use was also observed between monsoon and summer when the pooled data was analysed using the 't' test ('t'=3.82; p=0.0006) (Table 7).

Table 2

Pellets of Blacknaped Hare recorded from different habitats at Chimmony Wildlife Sanctuary (N=1760)

Months	Habitats					
	Teak plantation(%)	RPI	Moist deciduous forest (%)	RPI	Semi-evergreen forest (%)	RPI
January	100.00	20.23	0.00	-1	0.00	-1
February	92.31	18-59	7.69	-0.79	0.00	-1
March	42.86	8.09	57.14	0.55	0.00	-1
April	100.00	20.23	0.00	-1	0.00	-1
May	100.00	20.23	0.00	-1	0.00	-1
June	100.00	20.23	0.00	-1	0.00	-1
July	0.00	-1	0.00	-1	-	-
August	0.00	-1	0.00	-1	-	-
September	0.00	-1	0.00	-1	0.00	-1
October	0.00	-1	0.00	-1	100.00	1.42
November	0.00	-1	0.00	-1	0.00	-1
December	100.00	20.23	0.00	-1	0.00	-1
Mean	52.93	10.23	5.40	-0.85	10.00	-0.63

- = No data collected; RPI = Relative Preference Index

Table 3

Percentage of Elephant dung recorded from different habitats at Chimmony Wildlife Sanctuary (N=1760)

Months	Habitats					
	Teak plantation(%)	RPI	Moist deciduous forest (%)	RPI	Semi-evergreen forest (%)	RPI
January	0.00	-1	20.00	-0.45	80.00	0.94
February	0.00	-1	50.00	0.36	50.00	0.21
March	0.00	-1	50.00	0.36	50.00	0.21
April	0.00	-1	0.00	-1	0.00	-1
May	0.00	-1	0.00	-1	0.00	-1
June	0.00	-1	0.00	-1	0.00	-1
July	100.00	20.23	0.00	-1	-	-
August	0.00	-1	0.00	-1	-	-
September	0.00	-1	100.00	1.73	0.00	-1
October	0.00	-1	100.00	1.73	0.00	-1
November	0.00	-1	20.00	-0.45	80.00	0.94
December	0.00	-1	0.00	-1	100.00	1.42
Mean	8.33	0.77	28.33	-0.22	36.00	-0.13

- = No data collected; RPI = Relative preference Index

Table 4

Pellets of Sambar recorded from different habitats of Chimmony Wildlife Sanctuary (N=1760)

Months	Habitats					
	Teak plantation(%)	RPI	Moist deciduous forest (%)	RPI	Semi-evergreen forest (%)	RPI
January	60.42	11.82	27.08	-0.26	12.50	-0.69
February	60.65	11.87	22.95	-0.37	16.39	-0.60
March	60.87	11.92	18.84	-0.48	20.29	-0.50
April	4.76	0.01	59.52	-0.62	35.71	-0.13
May	16.67	2.53	41.67	0.13	41.67	0.01
June	0.00	-1	0.00	-1	0.00	-1
July	100.00	20.23	0.00	-1	-	-
August	100.00	20.23	0.00	-1	-	-
September	0.00	-1	0.00	-1	0.00	-1
October	0.00	-1	0.00	-1	0.00	-1
November	50.00	9.61	0.00	-1	50.00	0.21
December	0.00	-1	59.09	0.61	40.91	-6.79
Mean	37.78	7.02	19.09	0.48	21.74	-0.96

- = No data collected; RPI = Relative Preference Index

Table 5

Pellets of Wild Boar recorded from different habitats at Chimmony Wildlife Sanctuary (N=1760)

Months	Habitats					
	Teak plantation(%)	RPI	Moist deciduous forest (%)	RPI	Semi evergreen forest (%)	RPI
January	100.00	20.23	0.00	-1	0.00	-1
February	80.00	15.98	0.00	-1	20.00	-0.51
March	57.14	11.13	35.71	-0.02	7.15	-0.82
April	16.67	2.50	83.33	1.27	0.00	-1
May	0.00	-1	0.00	-1	0.00	-1
June	0.00	-1	0.00	-1	0.00	-1
July	0.00	-1	0.00	-1	-	-
August	0.00	-1	0.00	-1	-	-
September	0.00	-1	0.00	-1	0.00	-1
October	0.00	-1	0.00	-1	0.00	-1
November	0.00	-1	0.00	-1	0.00	-1
December	100.00	20.23	0.00	-1	0.00	-1
Mean	29.48	5.26	9.92	-0.73	2.72	-0.93

- = No data collected; RPI = Relative Preference Index

Table 6

Relative habitat preference of five herbivores in Chimmony Wildlife Sanctuary based RPI on analysis

Species	Teak plantation	Moist deciduous forest	Semi-evergreen forest
Indian Porcupine	Highly preferred	Least preferred	Preferred
Blacknaped Hare	Highly preferred	Preferred	Least preferred
Asian Elephant	Highly preferred	Preferred	Least preferred
Sambar	Highly preferred	Preferred	Least preferred
Wild Boar	Highly preferred	Least preferred	Preferred

Wild boar (*Sus scrofa*)

Even though the indirect evidences of Wild Boar were common, direct sighting at day time was less. Relative Preference Index showed, highest preference to Teak plantations (RPI= 5.26) followed by semi evergreen and moist deciduous forests. Only few indirect signs of Wild Boar were recorded during the rainy months (Table 5) and no significant difference was obtained in habitat use (ANOVA).

Discussion and Conclusions

Habitat preference : Even though no significant difference in habitat use was revealed in the case of Indian Porcupine, a clear preference for Teak plantations emerged from the RPI analysis. Similarly

Table 7

Seasonal difference in the habitat use of five herbivores Chimmony Wildlife Sanctuary

Species	Monsoon	Summer season
Indian Porcupine	0.004 (± 0.01)	0.036 (± 0.03)*
Blacknaped Hare	0.021 (± 0.08)	0.044 (± 0.08)
Asian Elephant	0.02 (± 0.05)	0.008 (± 0.01)
Sambar	0.04 (± 0.08)	0.16 (± 0.11)*

Standard deviation in brackets 't' - test: * = Significant difference

Blacknaped Hare, Asian Elephant, Sambar and Wild Boar showed preference for Teak plantations (Table 6). Teak plantations with open canopy provided more fodder to the herbivores compared to the moist deciduous and semi-evergreen forests. So, it is only natural that the animals preferred the Teak plantations.

Seasonal difference in habitat use : Indian Porcupine and Wild Boar showed significantly high habitat use during summer in Teak plantations. No significant difference among the summer and monsoon months were obtained in the case of Blacknaped Hare and Sambar. In the case of Asian Elephant this analysis was not attempted since the Elephants rarely used Teak plantation in both the seasons.

Sambar, Wild Boar and Blacknaped Hare showed significantly high habitat use of moist deciduous forest during summer months. But no significant difference was obtained in habitat use by Indian Porcupine and Asian Elephant during summer and monsoon.

Only Sambar and Wild Boar showed high utilization of semi-evergreen forests during summer. In the case of Indian Porcupine and Asian Elephant no difference was found. Blacknaped Hare rarely used semi-evergreen in either of these seasons.

An increased habitat use during summer season was recorded in the case of Indian Porcupine and Sambar. As the study mostly depended on the method of pellet count to quantify the habitat use, the probability of detecting a pellet during monsoon and summer might have affected the study. Due to the high growth of vegetation during monsoon season, the probability of detecting a pellet during monsoon is less than in the summer season. Washing out and disappearance of pellets during the heavy South-West monsoon rains might have influenced the study.

Due to lack of sufficient protection, before the establishment of the Sanctuary, population of Sambar is not dense. Felling and logging operations carried out in the sanctuary had also an adverse effect on the herbivore population. Girth class distribution of trees showed that most of the natural habitats are disturbed. The study indicates that Teak plantations can be maintained in the protected areas without adversely affecting the species studied. Habitat improvement programmes can take this fact also into consideration in the management of protected areas.

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SUMMARY

Habitat preference of five herbivores in Chimmony Wildlife Sanctuary, situated in the Western Ghats of South India, was studied during the years 1992 to 1995. Indian Porcupine (*Hystrix indica*), Blacknaped Hare (*Lepus nigricollis*), Asian Elephant (*Elephas maximus*), Sambar (*Cervus unicolor*) and Wild Boar (*Sus scrofa*) showed preference for Teak plantations when compared to moist deciduous and evergreen forests. Among the herbivores studied, only Porcupine and Sambar showed significant difference in habitat use during summer and monsoon season. Possible reasons for the difference in habitat use of herbivores is discussed.

चिम्मोनी वन्य प्राणियों अभयारण्य में पांच शाकभोजियों का प्राकृतावास प्रवरण

ई०ए० जैसन

सारांश

दक्षिण भारत के पश्चिमी घाट क्षेत्र में स्थित चिम्मोनी वन्य प्राणि अभयारण्य के पांच शाक भोजियों के प्राकृतावास प्रवरण का अध्ययन 1992 से 1995 के वर्षों में किया गया । भारतीय सेही (*हायस्ट्रिक्स इण्डिका*), कृष्णाकन्धर शशक (*लेपुस नाइग्रिकोलिस*), एशियाई हाथी (*एलिफस मैक्सिमस*), सांभर (*सेर्वुस युनिकलर*), जंगली सुअर (*सुस स्क्रोफा*) आर्द्र प्रर्णपाती और सदाहरित वनों की अपेक्षा सागौन रोपवनों का प्रवरण प्रदर्शित किया । अधीत शाकभोजियों में केवल सेही और सांभर में ही गर्मियों और मानसून मौसमों में उनके प्राकृतावास उपयोग में सार्थक अन्तर पाया गया । शाकभोजियों द्वारा किए प्राकृतावास उपयोग के संभावित कारणों का विवेचन भी किया गया है ।

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