

**VEGETATION MAPPING AND ANALYSIS OF
CHIMMONY WILDLIFE SANCTUARY
USING REMOTE SENSING TECHNIQUES**

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ABSTRACT

Vegetation mapping of Chimmony Wildlife Sanctuary was done using remote sensing techniques. Maps were prepared in 1:25,000 scale using Black and White aerial photographs and in 1:50,000 scale using IRS 1B Geocoded satellite imagery. A set of supplementary maps viz. physical, digital, drainage, slope maps were also prepared. Vegetation analysis of the area was also done and structural data supplemented.

Key words: Vegetation mapping, Phytosociology, Remote sensing, Photointerpretation, Chimmony Wildlife Sanctuary.

INTRODUCTION

Forest resources in the country are managed by the State Forest Department through Working Plans which are prepared at 10-15 year intervals. At present, the information needed for the preparation of working plans is obtained through ground-based surveys which have several limitations. They tend to be labour intensive, slow and expensive, and data collection from the remote and inaccessible regions is difficult. Remote sensing in combination with ground based studies has proved to be an effective technique to study and monitor changes in natural resources.

Maps are prepared to give basic information about the forest, its type, the density of trees, etc. Vegetation maps represent the vegetation and its geographic distribution. Earlier maps were prepared by conventional ground survey which was tedious. There is a considerable time-lag (10 to 15 years) between their preparation and utilisation. By the time the map is prepared the data becomes obsolete.

After the advent of aerial photographs and satellite imageries, rapid progress was possible in map production and the maps thus produced were also accurate and detailed. In the area of land and natural resource development, there is a constant need for up-to-date information. Periodic monitoring of our forest, which yields timely and accurate forest inventory information is essential for the formulation of regional and national resource management plans as well as information regarding deforestation.

For any ecological study, a quantitative evaluation of its vegetation is prerequisite. The quantitative study on structure of vegetation is called phytosociology, the principle of which is to describe the vegetation, explain or predict its pattern and classify it in a meaningful manner. The qualitative and quantitative descriptions of forest vegetation of Trichur, adjacent to Chimmony WLS (Sasidharan, 1994; Menon and Balasubramanian, 1987 respectively) are already available. Since, Vegetation data of Chimmony Wildlife Sanctuary are not available, the present study was taken up.

The structural information and land cover maps are essential for the management of Wildlife Sanctuaries and National Parks. Even though general reconnaissance maps in small scale are available for different parts of Kerala, no detailed maps in large scale are available, with respect to forest cover classification, vegetation density status, degradation aspects, slope, drainage etc. The lack of comprehensive, detailed vegetation data is a major lacuna in the management operations of Sanctuaries and National Parks in the state.

The present work was undertaken to fill up the lacuna with following objectives:

- i. To map the vegetation in suitable scale.
- ii. To estimate the area of major vegetation types.
- iii. To prepare slope and drainage maps, of the area.
- iv. To study the structure and composition of permanent vegetation
- v. Digital image analysis of the area for land cover classification.

STUDY AREA

LOCATION

Chimmony Wildlife Sanctuary falls between 10°24' to 10°29' N Lat. and 76°25' to 76°30'E Long. and is situated in the Mukundapuram taluk, Chalakudy Forest Division of Trichur district in Kerala State (Fig.

BOUNDARY DESCRIPTION

The territorial boundary of the sanctuary (See Fig. 1) roughly coincides with the watershed boundary of Chimmony river. The boundary line starts from the height point 855 m north east of Mangattukumban hill (810 m) and runs along the inter-taluk boundary of Trichur and Mukundapuram and meets the inter-district boundary of Trichur and Palakkad at Ponmudi (928 m) passing the height points 745 m and 762 m.

From Ponmudi, the boundary continues along the inter-district boundary of Trichur and Palakkad towards east passing the height points 862 m, 928m (Velli Mudi) upto 1020m.

From the height points 1020m the boundary runs towards south along the ridge passing the height points 845m (Karimadam), 772 m upto Pundi Mudi (1116m).

The boundary runs further along the ridge passing the height points 838 m, 759 m, 453 m (Ettakumban Mala), 361 m, 405 m, till it meets the forest boundary at a height point 40 m. Then it runs eastwards along the forest boundary and rubber plantation boundary up to 110 m, the boundary runs further along the eastern boundary of Chimmony rubber estate passing through the western bank of the Chimmony dam. The boundary runs further along the northern boundary of Chimmony estate and ends about 500 m east of Muthalamkappukadu (50 m) and follows the river course along the valley passing the height point 708 m and follows the ridge upto Mangattukumban hill (855 m).

METHODOLOGY

VEGETATION MAPPING

Data used

In the present study, the following data products were used

a. Aerial photographs(1:15,000 scale),procuredfrom NRSA

Black and white aerial photographs of the following details were used

Scale	:	1: 15.000
Camera	:	RMK 15/23
Focal length	:	15.3cm
Date of photograph	:	March, 1987and February, 1990
Format size	:	23 x 23 c m
Nature of the print	:	Glossy and single weight
Overlap : Forward	:	60-80%
: Lateral	:	10-40%
Direction of flight	:	South to North
Film	:	Kodak xx Aerographic Panchromatic B & W 2405
Filter	:	D'124455

b. Satellite data products, procured from NRSA data center

i. IRS - 1A LISS 2 B 2 FCC

Band 2, 3, 4. Scale 1:2,50,000, Dated 6 Feb 1989. Path - 26,Row - 61

ii. IRS -1B LISS 2 B 2 FCC

Band 2, 3, 4; Scale 1:50,000 Geocoded, dated 8 Feb 1993, Path-26, Row-61

iii. COMPUTER COMPATIBLE TAPE (CCT)

IRS LISS 1 Band 2 3 4, dated 26 Jan 1994, Path-26, Row-61

c. Ancillary data

Survey of India Topographic Maps 58 B/7 and 58 B/ 11 of 1:50,000 scale: 58 B/7 NE of 1:2,50,000 scale.

Aerial photointerpretation

Recognition of objects on aerial photographs was done with the help of photo-interpretation key based on photo-elements like tone, shape and size, shadow, texture, pattern and location and association.

Visual interpretation of satellite imagery

Photoelements like tone, colour, texture and site/location, etc. are used as parameters in visual interpretation. By using photoelements described. a photointerpretation key was prepared based on photostratification scheme.

Monoscopic visual interpretation of the satellite imageries was done for identification of different categories of forests, using standard photointerpretation key. In addition, the local knowledge about the terrain contributed considerably in interpretation. Other Auxiliary data like topographical maps, forest maps and other available details were collected and made use of for identification and mapping of land cover classes.

Field checking

The units delineated on the aerial photographs and satellite imageries were compared with ground details at random to verify the accuracy of interpretation and to check the doubtful areas for correction.

Fair Map Preparation and printing

Fair mapping was done on a transparent film. The aerial photo/satellite imagery interpreted details were transferred to the base maps. The transparent fair maps were used for making photocopies or prints.

Area estimation

The area estimation of different land cover classes was carried out using Plank-5000 digital planimeter.

Preparation of drainage map

A drainage map was prepared using 1:15,000 B & W aerial photographs and Survey of India Topographic sheets. All the major and minor rivers were marked from photographs.

Preparation of slope maps

The slope map of the study area was prepared following Wentworth's method. Area under different slope category and their percentage was calculated using planimeter.

DIGITAL IMAGE PROCESSING

The digital analysis was carried out on VAX 11/780 computer system with pericolor image processing system at Regional Remote Sensing Service Center (RRSSC), Bangalore using VIPs-32 software IRS Liss 1 and data acquired on 26 Jan, 1994. A sub-scene of 512x512 pixels was selected for analysis. The data in the form of CCT was procured from NRSA, Hyderabad after preprocessing.

Preprocessing was carried out for eliminating geometric and radiometric distortions and to enhance contrast so that certain features of interest comes out best in photograph. Usually the digital data was generated after geometric and radiometric corrections leaving the enhancement to the users.

PHYTOSOCIOLOGY

The phytosociological analysis of the tree layer (>15 cm girth) was made by Census Quadrat method (Oosting, 1956). Ten quadrats of 10 m x 10 m size was taken from each locality (see Fig.1). Height, and girth at breast height (gbh at 1.37 m above the ground level) of all trees occumng in each quadrat was measured.

PRIMARY ANALYSIS

Primary analysis of the vegetation was carried out to obtain the values of various parameters like density, frequency, abundance, basal area, and importance value index (M) (Gates, 1949, Curtis and Mc-Intosh 1950; Misra and Puri 1954; Curtis, 1951, Phillips 1959; Misra 1969; Muller-Dombois and Ellenberg, 1974) by using the following formula:

$$\text{Density} = \frac{\text{Total No. of Individuals}}{\text{Total No. of quadrats studied}}$$

$$\text{Relative Density} = \frac{\text{No. of Individuals of the species}}{\text{No. of Individuals of all species}} \times 100$$

$$\text{Percentage frequency} = \frac{\text{No. of quadrats in which species occurred}}{\text{Total No. of quadrats studied}} \times 100$$

$$\text{Abundance} = \frac{\text{Total No. of Individuals of the the species}}{\text{Total No. of quadrats of occurrence}}$$

$$\text{Relative Abundance} = \frac{\text{Abundance of individual species}}{\text{Abundance of all species}} \times 100$$

$$\text{Basal Areas} = gbh^2/4 \text{ pi. [pi} = 3.141$$

$$\text{Relative Basal Area} = \frac{\text{Total basal area of the species}}{\text{Total basal area of all species}} \times 100$$

Importance Value Index (IVI) = relative density + relative frequency + relative basal area

A clear picture of the ecological status of a species with respect to the community structure can be obtained only by synthesising the percentage values of relative frequency, relative density and relative basal area or relative dominance. The values when added together give the IVI based on which an association is derived (Phillips, 1959).

SECONDARY ANALYSIS

Maturity Index

The term maturity index (MI) was coined by Pichi-Sermolli (1948) to assess the status of a community in relation to successional stages. It is calculated as:

$$\text{Maturity Index (MI)} = \frac{\text{Total frequency of community}}{\text{Total No. of species present}}$$

Distribution Pattern

Abundance/frequency ratio was worked out to study the nature of distribution of species (Whitford, 1948).

Continuum concept

Gleason (1926) pointed out that there is no absolute boundaries between adjacent plant communities and proposed the 'Continuum concept'. For calculating the continuum index, each species is given a climax adaptation number, based on the important value index (IVI), ranging from 1-10 for species at the other extreme. A high value of adaptation number means better adaptations to all environmental conditions present in terminal strands (Muller-Dombois and Ellenberg, 1974). To assess the position of a single stand the important value indices of different species present in the stand were weighed against their adaptation numbers. The values are added to arrive at the continuum index value for the stand.

Similarity Index/Community Coefficient

In order to compare two plant communities which resemble each other in appearance, the concept of similarity index was put forth by Jaccard (1912). Jaccard's formula has undergone several quantitative (Ellenberg, 1956; Pandeya, 1961; etc.) and qualitative modifications (Sorenson, 1948). Sorenson's modification is widely accepted since it is mathematically more satisfactory in terms of statistical probability.

The 'community coefficient' is expressed in terms of Similarity Index. Sorenson's (1948) formula for Similarity Index is:

$$IS = \frac{C}{1/2 (A+B)} \times 100 \text{ or } \frac{2C}{A + B} \times 100$$

where, 'C' is the no: of species common to two releves

'A' is the total no: of species in releve A

'B' is the total no: of species in releve B

Diversity Index

For calculating 'Shannon Index of General Diversity' Margalefs (1968) formula was used as:

$$H = -\sum \frac{n_i}{N} \log \frac{n_i}{N}$$

where H = Shannon index of general diversity

n_i = No. of individuals of the species

N = No. of individuals of all species

RESULTS AND DISCUSSION

VEGETATION MAPPING

Three different kinds of vegetation maps were prepared as follows.

Small Scale Maps

Map prepared by digital processing (Plate 1) gives an overall idea regarding the distribution of different landcover types. Since the ground resolution of IRS Liss 1 data currently used is of 72.5m only type classification was attempted.

Medium Scale Maps

Map prepared from IRS 1B Geocoded FCC of March 1995 (Fig. 5) in 1:50,000 scale is compatible with Survey of India toposheets. Stratification of cover classes was done in three density levels.

Large Scale Map

Map prepared from 1:15,000 B & W aerial photographs of March 1990 in 1:25,000 scale (Fig. 6). A total of about 16 land cover classes were identified in the map prepared from B & W aerial photographs. Among the natural forests 3 and 5 density classes were identified for semievergreens and moist-deciduous forests, respectively. Man made forests include teak plantation and the mixed teak plantation. This mixed teak plantation has a few *Bombax* (Elavu) trees in addition to teak. In addition, two scrub classes (open and dense), grass, rock, quarry, etc. were also identifiable.

The position of reservoir after completion of the construction of the dam, taken from IRS imagery of March 1995 in 1:50,000 scale was overlaid onto the map. The existing reservoir area was recorded as moist deciduous forest in old working plan records.

Area under different landcover

The study area covers a total area of about 85.067 km². Reservoir occupies an area of about 4.83 km², which is 5.68% of the total area. As per the area statistics generated from photointerpreted maps, semievergreen forests

occupies an area of 35.035 sq. km. (41.19% of the total area) and moist deciduous forest occupies an area of 31.206sq.km. (33.63% of the total area). The estimated area of other minor cover types are tabulated in Table 1 and 2.

Table 1. Area estimates of different land cover types as obtained through 1:15,000 B & W aerial Photographs of 1987-1990

Vegetation Types	Area (km ²)		Percentage of total area	
Semievergreen (SE)				
SE1 (1-20% density)	1.266	35.035	1.49	41.19
SE2 (21-50% density)	2.583		3.04	
SE3 (>50% density)	31.186		36.66	
Moist-deciduous (MD)				
MD1 (1-20% density)	15.525	31.206	18.25	36.63
MD2 (21-40% density)	4.841		5.69	
MD3 (41-60% density)	0.846		0.95	
MD4 (61-80% density)	2.640		3.10	
MD5 (>80% density)	-7.354		8.64	
Scrub (SC)				
Sc (o) open scrub	2.877	6.538	3.38	7.68
Sc (d) dense scrub	3.661		4.30	
Plantation (Pl)				
PIT (teak)	3.552	4.003	4.18	4.71
PIB (mixed teak pl)	0.451		0.53	
Grass (G)	0.041		0.05	
Quarry (Q)	0.008		0.01	
Rock (X)	3.466		4.05	
Reservoir (R)	4.830		5.68	
Total	85.067		100.00	

Drainage map

A detailed drainage map in 1:50,000 scale was prepared. All the perennial and non-perennial rivers were marked. Perennial streams like Virakutodu, Payampara, Marippara, Anaporan, etc drain in to the Chimmony river (Fig.2).

Table 2. Area estimates of different land covers as obtained through IRS IB FCC of 1:50,000 scale of March 1995

Land cover classes	Area (km ²)	Percentage of the total
SE 1 (1-20% Density)	4.275	5.03
SE2 (21-50% Density)	13.810	16.23
SE3 (>50% Density)	27.646	32.65
Moist-deciduous		
MD 1 (1-20% Density)	2.871	3.37
MD2 (21-50% Density)	16.104	18.93
MD3 (>50% Density)	9.908	11.65
SC(0) open scrub	0.875	1.03
Sc (d) dense scrub	0.554	0.65
Teak Plantation (PITI)	3.981	4.68
Grass (G)	0.039	0.05
Quarry (Q)	0.043	0.05
Rock (X)	0.130	0.15
Reservoir (R)	4.830	5.68
Total	85.067	100.00

Slope map

Six slope categories were identified. The slope category below 10° had the minimum area and the slope class 20-25° the minimum area (Fig.3). Based on Survey of India toposheets a contour map of the area was also prepared (Fig. 4).

DIGITAL IMAGE PROCESSING

A hard copy output of digital analysis showing 10 land cover classes of Chimmony and its environs was obtained (Plate 1). The following landcover classes were identified: evergreens, semievergreens, moist deciduous, scrubs, teak plantation, mixed teak plantation, rubber plantation, mixed plantation, agriculture and water body. The accuracy of the classification was worked out using confusion matrices.

PHYTOSOCIOLOGY

The study area has two natural forest types out of the four major types described by Champion and Seth (1968) for Kerala region. They are the West Coast semievergreen forests and the South Indian Moist deciduous forests.

WEST COAST SEMIEVERGREEN FORESTS

Moist-deciduous species such as *Terminalia bellerica*, *Tetrameles nudiflora*, *Bombax ceiba*, *Schleichera oleosa*, *Olea dioica*, etc. are met within semievergreens. Evergreen trees such as *Aporusa lindleyana*, *Artocarpus hirsutus*, *Mesua nagassarium*, *Hopea parviflora*, *Hydnocarpus pentandra*, *Mangifera indica* are also seen.

Small trees like *Bacaurea courtallensis*, *Ixora brachiata*, *Mallotus phillipiensis*, *Memecylon umbellatum*, etc. are also present. Ground vegetation mainly consists of *Barleria* sp., *Dracaena terifolia*, *Strobilanthes*, etc. Climbers commonly present are *Acasia* sp., *Sarcostigma* sp., *Bauhinia scandens* and *Strychnos colubrina*.

SOUTH INDIAN MOIST DECIDUOUS FOREST

Top trees of the top canopy are *Albizia odoratissima*, *Bombax ceiba*, *Dalbergia latifolia*, *Lagerstroemia microcarpa*, *Pterocarpus marsupium*, *Tectona grandis*, *Terminalia paniculata* and *Xylia xylocarpa*. Second tier consists of *Bridelia retusa*, *Careya arborea*, *Cassia fistula*, *Dillenia pentagyna*, *Erythrina stricta* and *Holarrahaena pubescens*. The ground is often covered with *Helecteris isora*, *Strobilanthes* spp., *Lantana camara*. etc. Data on phytosociological analysis of the forests are given in Appendix 1- 10.

PRIMARY ANALYSIS

Percentage frequency

The mean percentage frequency of moist deciduous forests and the percentage frequency of different localities were calculated (Appendix 3- 12).

Density

The species density and relative density values were also worked out (Appendix 1-10).

Abundance

About six species had a mean abundance value above one. The abundance values of species in each locality were calculated (Appendix 1-10).

Basal area

The mean average basal area of moist deciduous forests of Chimmony was 36.784 m.sq./ha. (Appendix 1-10).

Importance value index

The mean importance value index (IVI) studies indicated that the Xylia (51.831), Terminalia (37.6), Lagerstroemia (32.64), Grewia (27.87) and Dillenia (23.24) are the species with maximum mean IVI. A total of about 8 species has M value above 10 (Appendix 1-10).

Distribution pattern (Abundance/frequency ratio)

Mean distribution pattern studies indicated that out of 31 species present only Aporosa had contagious distribution. All the dominant species had either regular (20) or random (10) distribution.

SECONDARY ANALYSIS

Maturity index

Maturity index values of the localities ranged from 24.67 (MD3) to 39.09 (MD2) (Appendix 1-10).

Diversity index

Diversity index values at different localities ranges from 1.8594 (MD1) to 2.3783 (MD3) (Appendix 1-10).

Similarity index

Similarity Index values were between 27.3 to 60.0.

Continuum index

Continuum values of different localities of moist-deciduous forests ranges between 1645.1 (MD1) to 1931.2 (MD5) (Appendix 1-10).

SEMI-EVERGREEN FORESTS

Data on primary analysis of semi-evergreen forests are given in Appendix 6-10.

PRIMARY ANALYSIS

Percentage frequency

The percentage frequency for each locality was worked out separately and the data are given in (Appendix 6- 10).

Density

The mean density studies indicated that not even a single species has a density value above one.

Abundance

Out of 76 species, about 10 species had a mean abundance value of one or above one.

Basal area

The mean basal area studies indicated that species having the maximum mean basal area was *Mesua* (1505.82). followed by *Sclecheria*(1079.55). All other species had a basal area value less than 100.

Importance value index

The species with maximum mean importance value indices were *Mesua* (19.16). *Polyalthia*(18.01), *Bacueria*(12.87), *Myristica* (12.4) and *Elaeocarpus* (12.38). A total of about five species had an IVI value above 10 (Appendix 6-10).

Distribution pattern (Abundance/frequency ratio)

Mean distribution studies indicated that only five species had contiguous distribution and 27 species regular and 44 random distribution.

SECONDARY ANALYSIS

Maturity index

Maturity index value ranged from 18.28 (SE 4) to 21.79 (SE 1) (Appendix 6- 10).

Continuum index

Continuum value of different localities of semi-evergreen ranges between 1352.3 (SE 3) to 1695.3 (SE 5).

Diversity index

Diversity index values of different localities were between 2.7060 (SE 5) to 3.2040 (SE 2) (Appendix 8-12).

Similarity index

Similarity index values ranged between 22.6 to 45.6.

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Appendix 1

VEGETATION ANALYSIS-PAYAMPARA (MD 1)

SPECIES		D	AB	PF	BA	RD	RF	RBA	IVI	ABF
1.	<i>Terminalia paniculata</i>	1.00	2.00	50.00	962.61	16.13	13.89	15.01	45.03	0.04
2.	<i>Xylia xylocarpa</i>	2.50	2.50	100.00	877.09	40.32	27.78	13.67	81.77	0.03
3.	<i>Strychnos nux-vomica</i>	0.70	1.75	40.00	877.09	11.29	11.11	13.67	36.07	0.04
4.	<i>Calycopteris floribunda</i>	0.20	1.00	20.00	71.60	3.23	5.56	1.12	9.91	0.05
5.	<i>Aporosa lindleyana</i>	0.30	1.50	20.00	447.49	4.84	5.56	6.98	17.38	0.07
6.	<i>Dillenia pentagyna</i>	0.60	1.20	50.00	389.82	9.68	13.89	6.08	29.65	0.02
7.	<i>Careyaarborea</i>	0.10	1.00	10.00	49.72	1.61	2.78	0.78	5.17	0.10
8.	<i>Lagerstroemiamicrocarpa</i>	0.50	1.25	40.00	795.54	8.06	11.11	12.40	31.57	0.03
9.	<i>Wrightia tinctoria</i>	0.10	1.00	10.00	17.90	1.61	2.78	0.28	4.67	0.10
10.	<i>Grewia tiliifolia</i>	0.10	1.00	10.00	962.61	1.61	2.78	15.01	19.40	0.10
11.	<i>Ptereospermum rubiginosum</i>	0.10	1.00	10.00	962.61	1.61	2.78	15.01	19.40	0.10

TOTAL BASAL AREA = 6414.08
 MATURITY INDEX = 32.73
 DIVERSITY INDEX = 1.8594

Appendix 2

VEGETATION ANALYSIS-VAVALAM (MD 2)

SPECIES		D	AB	PF	BA	RD	RF	RBA	IVI	ABF
1.	<i>Lagerstroemia microcarpa</i>	0.80	1.00	80.00	2036.60	13.33	18.60	29.10	61.03	0.01
2.	<i>Strychnos nux-vomica</i>	0.60	1.50	40.00	127.29	10.00	9.30	1.82	21.12	0.04
3.	<i>Xylia xylocarpa</i>	1.20	1.71	70.00	286.40	20.00	16.28	4.09	40.37	0.02
4.	<i>Wrightia tinctoria</i>	1.00	1.67	60.00	198.89	16.67	13.95	2.84	33.46	0.03
5.	<i>Aporosa lindleyana</i>	0.50	1.67	30.00	534.92	8.33	6.98	7.64	22.95	0.06
6.	<i>Grewia tiliifolia</i>	0.50	1.25	40.00	389.82	8.33	9.30	5.57	23.20	0.03
7.	<i>Terminalia paniculata</i>	0.60	2.00	30.00	389.82	10.00	6.98	5.57	22.55	0.07
8.	<i>Terminalia crenulata</i>	0.20	1.00	20.00	198.89	3.33	4.65	2.84	10.82	0.05
9.	<i>Dillenia pentagyna</i>	0.40	1.00	40.00	2577.60	6.67	9.30	36.83	52.80	0.03
10.	<i>Holarrhaena pubescens</i>	0.10	1.00	10.00	17.90	1.67	2.33	0.26	4.26	0.10
11.	<i>Pterocarpus marsupium</i>	0.10	1.00	10.00	240.65	1.67	2.33	3.44	7.44	0.10

TOTAL BASAL AREA = 6998.7
 MATURITY INDEX = 39.09
 DIVERSITY INDEX = 2.1942

Appendix 3

VEGETATION ANALYSIS - VALIYAVARA (MD 3)

SPECIES		D	AB	PF	BA	RD	RF	RBA	M	ABF
1.	<i>Grewia tiliifolia</i>	0.70	1.75	40.00	1911.30	12.28	10.81	23.22	46.31	0.04
2.	<i>Aporusa lindleyana</i>	0.40	4.00	10.00	447.49	7.02	2.70	5.44	15.16	0.40
3.	<i>Scleichera oleosa</i>	0.40	1.33	30.00	509.15	7.02	8.11	6.19	21.32	0.04
4.	<i>Wrightia tinctoria</i>	1.10	1.57	70.00	97.45	19.30	18.92	1.18	39.40	0.02
5.	<i>Spondios mangifera</i>	0.10	1.00	10.00	962.61	1.75	2.70	11.69	16.14	0.10
6.	<i>Macaranga peltata</i>	0.50	2.50	20.00	795.54	8.77	5.41	9.66	23.84	0.13
7.	<i>Cycas circinalis</i>	0.10	1.00	10.00	161.10	1.75	2.70	1.96	6.41	0.10
8.	<i>Xylia xylocarpa</i>	1.00	2.50	40.00	509.15	17.54	10.81	6.19	34.54	0.06
9.	<i>Helicteris isora</i>	0.30	1.00	30.00	49.72	5.26	8.11	0.60	13.97	0.03
10.	<i>Cassia fistula</i>	0.10	1.00	10.00	198.89	1.75	2.70	2.42	6.87	0.10

Appendix 3 contd.

Appendix 3 contd.

11	Holarrhaena pubescens	0.10	1.00	10.00	127.29	1.75	2.70	1.55	6.00	0.10
12.	Butea monosperma	0.10	1.00	10.00	286.40	1.75	2.70	3.48	7.93	0.10
13.	Calycopteris floribunda	0.10	1.00	10.00	71.60	1.75	2.70	0.87	5.32	0.10
14.	Terminalia paniculata	0.50	1.00	50.00	1052.10	8.77	13.51	12.78	35.06	0.02
15.	Albizia odorattissima	0.20	1.00	20.00	1052.10	3.51	5.41	12.78	21.70	0.05

TOTAL BASAL AREA = 8231.89

MATURITY INDEX = 24.67

DIVERSITY INDEX = 2.3783

Appendix 4

VEGETATION ANALYSIS-THOTTAPURA (MD 4)

	SPECIES	D	AB	PF	BA	RD	RF	RBA	IVI	ABF
1.	<i>Terminalia paniculata</i>	0.90	1.29	70.00	1052.10	19.15	17.95	11.01	48.11	0.02
2.	<i>Erythrina stricta</i>	0.10	1.00	10.00	1243.00	2.13	2.56	13.00	17.69	0.10
3.	<i>Wrightia tinctoria</i>	0.10	1.00	10.00	71.60	2.13	2.56	0.75	5.44	0.10
4.	<i>Bridelia retusa</i>	0.10	1.00	10.00	97.45	2.13	2.56	1.02	5.71	0.10
5.	<i>Helicteris isora</i>	0.40	1.33	30.00	31.82	8.51	7.69	0.33	16.53	0.04
6.	<i>Grewia tiliifolia</i>	0.20	1.00	20.00	336.12	4.26	5.13	3.52	12.91	0.05
7.	<i>Xylia xylocarpa</i>	1.20	1.71	70.00	717.98	25.53	17.95	7.51	50.99	0.02
8.	<i>Strychnos nux-vomica</i>	0.30	1.00	30.00	1672.60	6.38	7.69	17.50	31.57	0.03
9.	<i>Terminalia bellerica</i>	0.20	1.00	20.00	198.89	4.26	5.13	2.08	11.47	0.05
10.	<i>Sterculia guttata</i>	0.10	1.00	10.00	286.40	2.13	2.56	3.00	7.69	0.10
11.	<i>Aporusa lindleyana</i>	0.30	1.00	30.00	447.49	6.38	7.69	4.68	18.75	0.03
12.	<i>Dillenia pentagyna</i>	0.20	1.00	20.00	161.10	4.26	5.13	1.69	11.08	0.05
13.	<i>Lagerstroemia microcarpa</i>	0.20	1.00	20.00	1449.90	4.26	5.13	15.17	24.56	0.05
14.	<i>Sapindus laurifolia</i>	0.20	1.00	20.00	447.49	4.26	5.13	4.68	14.07	0.05
15.	<i>Stereospermum chelonoides</i>	0.20	1.00	20.00	1344.50	4.26	5.13	14.07	23.46	0.05

TOTAL BASAL AREA = 9558.44
 MATURITY INDEX = 26.00
 DIVERSITY INDEX = 2.3598

Appendix 5

VEGETATION ANALYSIS-VIRAKUTODU (MD 5)

	SPECIES	D	AB	PF	BA	RD	RF	RBA	IVI	ABF
1.	<i>Dillenia pentagyna</i>	0.40	1.00	40.00	198.89	7.55	10.81	4.30	22.66	0.03
2.	<i>Xylia xylocarpa</i>	1.50	3.00	50.00	447.49	28.30	13.51	9.69	51.50	0.06
3.	<i>Milium tomentosum</i>	0.20	1.00	20.00	71.60	3.77	5.41	1.55	10.73	0.05
4.	<i>Terminalia paniculata</i>	0.60	1.20	50.00	574.78	11.32	13.51	12.44	37.27	0.02
5.	<i>Grewia tiliifolia</i>	0.80	1.33	60.00	286.40	15.09	16.22	6.20	37.51	0.02
6.	<i>Tetrameles nudiflora</i>	0.30	1.50	20.00	1145.60	5.66	5.41	24.80	35.87	0.07
7.	<i>Lagerstroemia microcarpa</i>	0.70	1.40	50.00	962.61	13.21	13.51	20.84	47.56	0.03
8.	<i>Holarrhaena pubescens</i>	0.40	1.00	40.00	127.29	7.55	10.81	2.76	21.12	0.03
9.	<i>Cassia fistula</i>	0.30	1.00	30.00	161.10	5.66	8.11	3.49	17.26	0.03
10.	<i>Tectona grandis</i>	0.10	1.00	10.00	644.39	1.89	2.70	13.95	18.54	0.10

TOTAL BASAL AREA = 4620.15
 MATUFUTY INDEX = 37.00
 DIVERSITY INDEX = 2.0704

Appendix 6

VEGETATION ANALYSIS-MANGALAMKAVA (SE 1)

SPECIES		D	AB	PF	BA	RD	RF	RBA	IVI	ABF
1.	<i>Elaeocarpus serratus</i>	0.40	1.00	40.00	484.01	5.56	6.56	2.76	14.88	0.03
2.	<i>Milium tomentosum</i>	0.30	1.00	30.00	717.98	4.17	4.92	4.10	13.19	0.03
3.	<i>Aporosa lindleyana</i>	0.20	1.00	20.00	71.60	2.78	3.28	0.41	6.47	0.05
4.	<i>Knema attenuata</i>	0.40	1.33	30.00	223.47	5.56	4.92	1.27	11.75	0.04
5.	<i>Sterculia guttata</i>	0.20	1.00	20.00	447.49	2.78	3.28	2.55	8.61	0.05
6.	<i>Hopea racophloea</i>	0.30	1.00	30.00	1223.20	4.17	4.92	6.98	16.07	0.03
7.	<i>Polyalthia fragrans</i>	0.30	1.00	30.00	877.09	4.17	4.92	5.00	14.09	0.03
8.	<i>Cyathocalyx zeylanica</i>	0.10	1.00	10.00	4027.40	1.39	1.64	22.98	26.01	0.10
9.	<i>Otonophelium stipulaceum</i>	0.10	1.00	10.00	49.72	1.39	1.64	0.28	3.31	0.10
10.	<i>Hopea parviflora</i>	0.30	1.50	20.00	1604.10	4.17	3.28	9.15	16.60	0.07
11.	<i>Dysoxylum malabaricum</i>	0.20	1.00	20.00	877.09	2.78	3.28	5.00	11.06	0.05
12.	<i>Toona ciliata</i>	0.30	1.50	20.00	161.10	4.17	3.28	0.92	8.37	0.07
13.	<i>Meyna laxiflora</i>	0.10	1.00	10.00	49.72	1.39	1.64	0.28	3.31	0.10
14.	<i>Dimocarpus longan</i>	0.30	3.00	10.00	240.65	4.17	1.64	1.37	7.18	0.30
15.	<i>Scleichera oleosa</i>	0.40	1.00	40.00	97.45	5.56	6.56	0.56	12.68	0.03

Appendix 6 contd..

SPECIES		D	AB	PF	BA	RD	RF	RBA	IVI	ABF
16.	Xanthophyllum arnottianum	0.30	3.00	10.00	114.88	4.17	1.64	0.66	6.47	0.30
17.	Myristica malabarica	0.30	1.50	20.00	1911.30	4.17	3.28	10.90	18.35	0.07
18.	Cinnamomum malabattrum	0.20	1.00	20.00	240.65	2.78	3.28	1.37	7.43	0.05
19.	Scolopia crenata	0.20	1.00	20.00	17.90	2.78	3.28	0.10	6.16	0.05
20.	Syzygium chavaran	0.10	1.00	10.00	717.98	1.39	1.64	4.10	7.13	0.10
21.	Alstonia scholaris	0.20	2.00	10.00	367.86	2.78	1.64	2.10	6.52	0.20
22.	Sterculia villosa	0.10	1.00	10.00	286.40	1.39	1.64	1.63	4.66	0.10
23.	Mesua nagassarium	0.40	1.00	40.00	1911.30	5.56	6.56	10.90	23.02	0.03
24.	Sapindus laurifolia	0.10	1.00	10.00	240.65	1.39	1.64	1.37	4.40	0.10
25.	Dysoxylum beddomei	0.10	1.00	10.00	97.45	1.39	1.64	0.56	3.59	0.10
26.	Hydnocarpus wightiana	0.40	1.33	30.00	198.89	5.56	4.92	1.13	11.61	0.04
27.	Bacaurea courtallensis	0.80	1.14	70.00	71.60	11.11	11.48	0.41	23.00	0.02
28.	Ptereospermum rubiginosum	0.10	1.00	10.00	198.89	1.39	1.64	1.13	4.16	0.10

TOTAL BASAL AREA = 17527.82
 MATURITY INDEX = 21.79
 DIVERSITY INDEX = 3.1788

Appendix 7

VEGETATION ANALYSIS-MARIPPARA (SE 2)

	SPECIES	D	AB	PF	BA	RD	RF	RBA	IVI	ABF
1.	<i>Mitragyne parviflora</i>	0.30	1.50	20.00	305.81	4.76	3.57	1.12	9.45	0.07
2.	<i>Aporusa lindleyana</i>	0.30	1.00	30.00	286.40	4.76	5.36	1.05	11.17	0.03
3.	<i>Ptereospermum rubiginosum</i>	0.50	1.00	50.00	346.54	7.94	8.93	1.27	18.14	0.02
4.	<i>Terminalia bellerica</i>	0.10	1.00	10.00	97.45	1.59	1.79	0.36	3.74	0.10
5.	<i>Persea macrantha</i>	0.20	1.00	20.00	2436.40	3.17	3.57	8.96	15.70	0.05
6.	<i>Holoptelia integrifolia</i>	0.20	1.00	20.00	1303.40	3.17	3.57	4.79	11.53	0.05
7.	<i>Vitex altissima</i>	0.10	1.00	10.00	3508.40	1.59	1.79	12.90	16.28	0.10
8.	<i>Scleichera oleosa</i>	0.20	2.00	10.00	5173.00	3.17	1.79	19.02	23.98	0.20
9.	<i>Lagerstroemia microcarpa</i>	0.10	1.00	10.00	161.10	1.59	1.79	0.59	3.97	0.10
10.	<i>Ixora brachiata</i>	0.40	1.00	40.00	114.88	6.35	7.14	0.42	13.91	0.03
11.	<i>Polyalthia fragrans</i>	0.30	1.00	30.00	748.53	4.76	5.36	2.75	12.87	0.03
12.	<i>Elaeocarpus serratus</i>	0.20	1.00	20.00	223.47	3.17	3.57	0.82	7.56	0.05
13.	<i>Sterculia guttata</i>	0.10	1.00	10.00	97.45	1.59	1.79	0.36	3.74	0.10
14.	<i>Dimocarpus longan</i>	0.20	2.00	10.00	114.88	3.17	1.79	0.42	5.38	0.20
15.	<i>Bacaurea courtallensis</i>	0.30	1.00	30.00	183.29	4.76	5.36	0.67	10.79	0.03

Appendix 7 contd..

	SPECIES	D	AB	PF	BA	RD	RF	RBA	IVI	ABF
16.	<i>Albizia odoratissima</i>	0.10	1.00	10.00	2036.60	1.59	1.79	7.49	10.87	0.10
17.	<i>Tetrameles nudiflora</i>	0.10	1.00	10.00	962.61	1.59	1.79	3.54	6.92	0.10
18.	<i>Syzygium cumuni</i>	0.10	1.00	10.00	2871.90	1.59	1.79	10.56	13.94	0.10
19.	<i>Myristicamalabarica</i>	0.30	1.00	30.00	305.81	4.76	5.36	1.12	11.24	0.03
20.	<i>Hydnocarpus pentandra</i>	0.20	1.00	20.00	962.61	3.17	3.57	3.54	10.28	0.05
21.	<i>Knema attenuata</i>	0.50	1.67	30.00	286.40	7.94	5.36	1.05	14.35	0.06
22.	<i>Cinnamomum verum</i>	0.10	1.00	10.00	286.40	1.59	1.79	1.05	4.43	0.10
23.	<i>Hopea parviflora</i>	0.50	1.67	30.00	644.39	7.94	5.36	2.37	15.67	0.06
24.	<i>Hymenodictyon excelsum</i>	0.10	1.00	10.00	644.39	1.59	1.79	2.37	5.75	0.10
25.	<i>Xanthophyllum arnottianum</i>	0.30	1.00	30.00	240.65	4.76	5.36	0.88	11.00	0.03
26.	<i>Euodia roxburghiana</i>	0.10	1.00	10.00	509.15	1.59	1.79	1.87	5.25	0.10
27.	<i>Anacolosa densiflora</i>	0.20	1.00	20.00	1672.60	3.17	3.57	6.15	12.89	0.05
28.	<i>Polyalthia rufescens</i>	0.10	1.00	10.00	389.82	1.59	1.79	1.43	4.81	0.10
29.	<i>Mesua nagassarium</i>	0.10	1.00	10.00	286.40	1.59	1.79	1.05	4.43	0.10

TOTAL BASAL AREA = 27200.73
MATURITY INDEX = 19.31
DIVERSITY INDEX = 3.2040

Appendix 8

VEGETATION ANALYSIS-ANAPORAN (SE 3)

	SPECIES	D	AB	PF	BA	RD	RF	RBA	IVI	ABF
1.	Syzygium cumuni	0.40	1.00	40.00	1911.30	8.00	8.00	4.57	20.57	0.03
2.	Hopeaparviflora	0.30	1.00	30.00	1911.30	6.00	6.00	4.57	16.57	0.03
3.	Cassia fistula	0.10	1.00	10.00	733.17	2.00	2.00	1.75	5.75	0.10
4.	Vateria indica	0.20	1.00	20.00	1790.00	4.00	4.00	4.28	12.28	0.05
5.	Dipterocarpus indicus	0.20	1.00	20.00	3441.80	4.00	4.00	8.22	16.22	0.05
6.	Mesuanagassarium	0.50	1.00	50.00	3711.70	10.00	10.00	8.87	28.87	0.02
7.	Artocarpus hirtus	0.20	1.00	20.00	1790.00	4.00	4.00	4.28	12.28	0.05
8.	Gmelina arborea	0.10	1.00	10.00	3310.70	2.00	2.00	7.91	11.91	0.10
9.	Euodia roxburghiana	0.30	1.00	30.00	910.82	6.00	6.00	2.18	14.18	0.03
10.	Toona ciliata	0.10	1.00	10.00	644.39	2.00	2.00	1.54	5.54	0.10
11.	Hymenodictyon excelsum	0.20	1.00	20.00	827.68	4.00	4.00	1.98	9.98	0.05
12.	Mangiferaindica	0.30	1.00	30.00	2036.60	6.00	6.00	4.87	16.87	0.03
13.	Polyalthia fragrans	0.40	1.00	40.00	1515.00	8.00	8.00	3.62	19.62	0.03

Appendix 8 contd..

	SPECIES	D	AB	PF	BA	RD	RF	RBA	IVI	ABF
14.	<i>Miliusa tomentosa</i>	0.40	1.00	40.00	1243.00	8.00	8.00	2.97	18.97	0.03
15.	<i>Sterospermum colais</i>	0.20	1.00	20.00	1052.10	4.00	4.00	2.51	10.51	0.05
16.	<i>Tetrameles nudiflora</i>	0.10	1.00	10.00	1015.80	2.00	2.00	2.43	6.43	0.10
17.	<i>Terminalia bellerica</i>	0.20	1.00	20.00	3643.30	4.00	4.00	8.70	16.70	0.05
18.	<i>Myristica malabarica</i>	0.10	1.00	10.00	1015.80	2.00	2.00	2.43	6.43	0.10
19.	<i>Gymnacranthera canarica</i>	0.10	1.00	10.00	717.98	2.00	2.00	1.72	5.72	0.10
20.	<i>Elaeocarpus serratus</i>	0.10	1.00	10.00	945.19	2.00	2.00	2.26	6.26	0.10
21.	<i>Anthocephalus chinensis</i>	0.10	1.00	10.00	484.01	2.00	2.00	1.16	5.16	0.10
22.	<i>Knema attenuata</i>	0.10	1.00	10.00	717.98	2.00	2.00	1.72	5.72	0.10
23.	<i>Cullenia exarillata</i>	0.10	1.00	10.00	3310.70	2.00	2.00	7.91	11.91	0.10
24.	<i>Canarium strictum</i>	0.10	1.00	10.00	484.01	2.00	2.00	1.16	5.16	0.10
25.	<i>Carallia brachiata</i>	0.10	1.00	10.00	2693.40	2.00	2.00	6.43	10.43	0.10

TOTAL BASAL AREA = 41857.73

MATURITY INDEX = 20.00

DIVERSITY INDEX = 3.0543

Appendix 9

VEGETATION ANALYSIS-NJAMPARAKUNNU(SE 4)

SPECIES		D	AB	PF	BA	RD	RF	RBA	IVI	ABF
1.	<i>Ficus exasperata</i>	0.30	1.50	20.00	114.88	3.45	3.77	0.90	8.12	0.07
2.	<i>Aporusa lindleyana</i>	0.30	1.00	30.00	183.29	3.45	5.66	1.44	10.55	0.03
3.	<i>Mesua nagassarium</i>	0.70	2.33	30.00	412.41	8.05	5.66	3.24	16.95	0.08
4.	<i>Polyalthia fragrans</i>	0.60	1.50	40.00	315.75	6.90	7.55	2.48	16.93	0.04
5.	<i>Sterculia guttata</i>	0.10	1.00	10.00	49.72	1.15	1.89	0.39	3.43	0.10
6.	<i>Garcinia gummi-gutta</i>	0.30	1.50	20.00	183.29	3.45	3.77	1.44	8.66	0.07
7.	<i>Mallotus philipiensis</i>	0.10	1.00	10.00	198.89	1.15	1.89	1.56	4.60	0.10
8.	<i>Bambusa arundinaceae</i>	1.80	3.60	50.00	76.45	20.69	9.43	0.60	30.72	0.07
9.	<i>Pterocarpus marsupium</i>	0.10	1.00	10.00	1790.00	1.15	1.89	14.06	17.10	0.10
10.	<i>Hydnocarpus pentandra</i>	0.30	1.50	20.00	161.10	3.45	3.77	1.27	8.49	0.07
11.	<i>Haldina cordifolia</i>	0.10	1.00	10.00	1145.60	1.15	1.89	9.00	12.04	0.10
12.	<i>Cinnamomum malabattrum</i>	0.10	1.00	10.00	389.82	1.15	1.89	3.06	6.10	0.10
13.	<i>Elaeocarpus serratus</i>	0.90	2.25	40.00	367.86	10.34	7.55	2.89	20.78	0.06
14.	<i>Knema attenuata</i>	0.30	1.00	30.00	336.12	3.45	5.66	2.64	11.75	0.03
15.	<i>Anacolosa densiflora</i>	0.70	2.33	30.00	616.07	8.05	5.66	4.84	18.55	0.08

Appendix 9 contd..

Appendix 9 contd..

	SPECIES	D	AB	PF	BA	RD	RF	RBA	IVI	ABF
16.	<i>Dysoxylum malabaricum</i>	0.10	1.00	10.00	49.72	1.15	1.89	0.39	3.43	0.10
17.	<i>Ailanthus malabarica</i>	0.10	1.00	10.00	198.89	1.15	1.89	1.56	4.60	0.10
18.	<i>Myristica malabarica</i>	0.20	1.00	20.00	71.60	2.30	3.77	0.56	6.63	0.05
19.	<i>Macaranga peltata</i>	0.10	1.00	10.00	644.39	1.15	1.89	5.06	8.10	0.10
20.	<i>Hopea racophloea</i>	0.10	1.00	10.00	644.39	1.15	1.89	5.06	8.10	0.10
21.	<i>Diospyros assimilis</i>	0.10	1.00	10.00	161.10	1.15	1.89	1.27	4.31	0.10
22.	<i>Terminalia chebula</i>	0.10	1.00	10.00	97.45	1.15	1.89	0.77	3.81	0.10
23.	<i>Xanthophyllum arnottianum</i>	0.30	1.50	20.00	198.89	3.45	3.77	1.56	8.78	0.07
24.	<i>Diospyros buxifolia</i>	0.10	1.00	10.00	49.72	1.15	1.89	0.39	3.43	0.10
25.	<i>Mangifera indica</i>	0.20	1.00	20.00	2871.90	2.30	3.77	22.56	28.63	0.05
26.	<i>Sterculia urens</i>	0.10	1.00	10.00	31.82	1.15	1.89	0.25	3.29	0.10
27.	<i>Polyalthia rufescens</i>	0.10	1.00	10.00	795.54	1.15	1.89	6.25	9.29	0.10
28.	<i>Scleichera oleosa</i>	0.20	2.00	10.00	127.29	2.30	1.89	1.00	5.19	0.20
29.	<i>Vateria indica</i>	0.20	2.00	10.00	447.49	2.30	1.89	3.51	7.70	0.20

TOTAL BASAL AREA = 12731.44
MATURITY INDEX = 18.28
DIVERSITY INDEX = 2.9129

Appendix 10

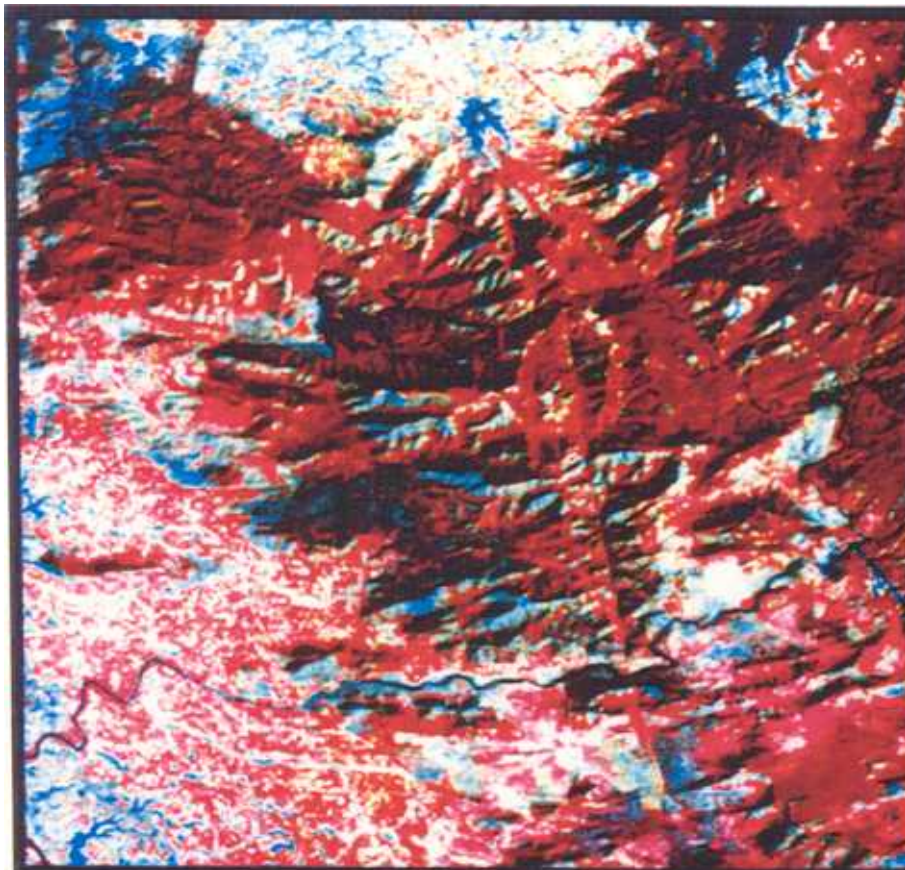
VEGETATION ANALYSIS-THOTTAPURA (SE 5)

SPECIES		D	AB	PF	BA	RD	RF	RBA	M	ABF
1.	<i>Cyathocalyx zeylanica</i>	0.20	1.00	20.00	509.15	2.17	3.51	2.41	8.09	0.05
2.	<i>Olea dioica</i>	0.20	1.00	20.00	389.82	2.17	3.51	1.85	7.53	0.05
3.	<i>Alstonia scholaris</i>	0.10	1.00	10.00	286.40	1.09	1.75	1.36	4.20	0.10
4.	<i>Elaeocarpus serratus</i>	0.40	1.00	40.00	191.01	4.35	7.02	0.91	12.28	0.03
5.	<i>Mesua nagassarium</i>	0.90	2.25	40.00	1203.60	9.78	7.02	5.71	22.51	0.06
6.	<i>Myristica malabarica</i>	0.50	1.00	50.00	1089.00	5.43	8.77	5.16	19.36	0.02
7.	<i>Mallotus tetracoccus</i>	0.10	1.00	10.00	71.60	1.09	1.75	0.34	3.18	0.10
8.	<i>Diospyros crumenata</i>	0.10	1.00	10.00	717.98	1.09	1.75	3.40	6.24	0.10
9.	<i>Bacaurea courtallensis</i>	1.80	3.00	60.00	97.45	19.57	10.53	0.46	130.56	0.05
10.	<i>Hydnocarpus pentandra</i>	0.10	1.00	10.00	389.82	1.09	1.75	1.85	4.69	0.10
11.	<i>Dimocarpus longan</i>	0.30	1.00	30.00	215.12	3.26	5.26	1.02	9.54	0.03
12.	<i>Terminalia bellerica</i>	0.30	4.50	40.00	154.02	19.57	7.02	0.73	27.32	0.11
13.	<i>Aporusa lindleyana</i>	0.80	1.33	30.00	267.62	4.35	5.26	1.27	10.88	0.04
14.	<i>Polyalthia fragrans</i>	0.80	1.33	60.00	1537.10	8.70	10.53	7.29	126.52	0.02
15.	<i>Stereospermum chelonoides</i>	0.10	1.00	10.00	97.45	1.09	1.75	0.46	3.30	0.10

Appendix 10 contd..

	SPECIES	D	AB	PF	BA	RD	RF	RBA	IVI	ABF
16.	<i>Ficus racemosa</i>	0.10	1.00	10.00	2722.80	1.09	1.75	12.91	15.75	0.10
17.	<i>Vitexaltissima</i>	0.20	2.00	10.00	1303.40	2.17	1.75	6.18	10.10	0.20
18.	<i>Mallotus philipiensis</i>	0.10	1.00	10.00	17.90	1.09	1.75	0.08	2.92	0.10
19.	<i>Bridelia retusa</i>	0.10	1.00	10.00	127.29	1.09	1.75	0.60	3.44	0.10
20.	<i>Ixora brachiata</i>	0.10	1.00	10.00	71.60	1.09	1.75	0.34	3.18	0.10
21.	<i>Xylia xylocarpa</i>	0.10	1.00	10.00	17.90	1.09	1.75	0.08	2.92	0.10
22.	<i>Strychnos nux-vomica</i>	0.10	1.00	10.00	3182.20	1.09	1.75	15.09	17.93	0.10
23.	<i>Dillenia pentagyna</i>	0.10	1.00	10.00	17.90	1.09	1.75	0.08	2.92	0.10
24.	<i>Macaranga peltata</i>	0.10	1.00	10.00	240.65	1.09	1.75	1.14	3.98	0.10
25.	<i>Gmelina arborea</i>	0.10	1.00	10.00	31.82	1.09	1.75	0.15	2.99	0.10
26.	<i>Cinnamomum malabatum</i>	0.10	1.00	10.00	161.10	1.09	1.75	0.76	3.60	0.10
27.	<i>Haldina cordifolia</i>	0.10	1.00	10.00	2299.10	1.09	1.75	10.90	13.74	0.10
28.	<i>Lagerstroemia microcarpa</i>	0.10	1.00	10.00	3677.40	1.09	1.75	17.44	20.28	0.10

TOTAL BASAL AREA = 21088.20
= 20.36
DIVERSITY INDEX = 2.7060



CHIMMONY
WILDLIFE
SANCTUARY

FALSE COLOUR
COMPOSITE

IRS LISS-I
26 JAN 1994

KFRI/RRSSC-B



LANDCOVER

CHIMMONY WLS

- EVERGREEN
- S. EVERGREEN
- M. DECIDUOUS
- SCRUB
- TEAK PTN
- TEAK MIXED
- RUBBER PTN
- MIXED PTN
- AGRICULTURE
- WATERBODY

IRS LISS I
26 JAN 1994

KFRI/RRSSC-B

CHIMMONY WILDLIFE SANCTUARY - LOCATION

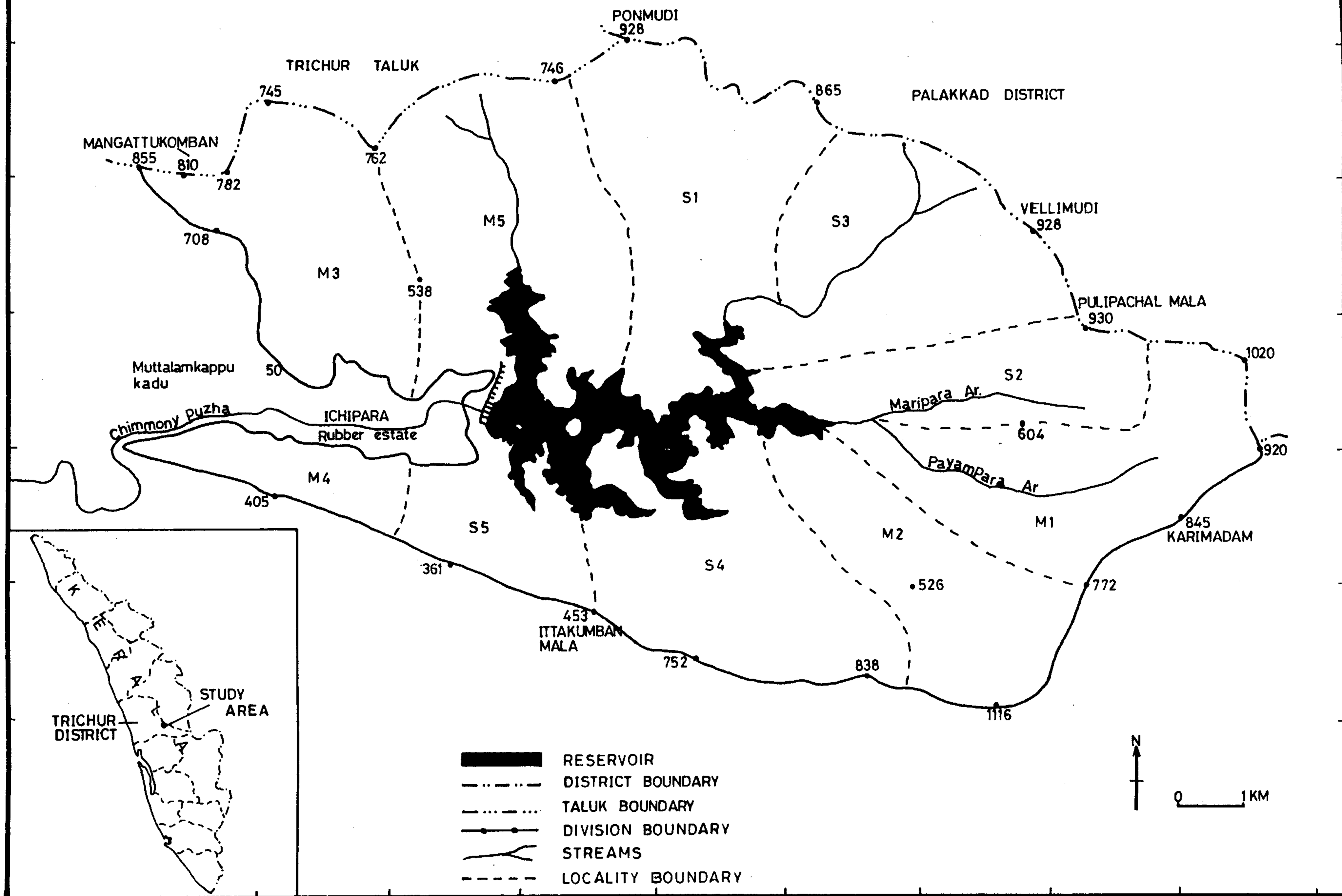


Fig. 1

CHIMMONY WILDLIFE SANCTUARY - DRAINAGE

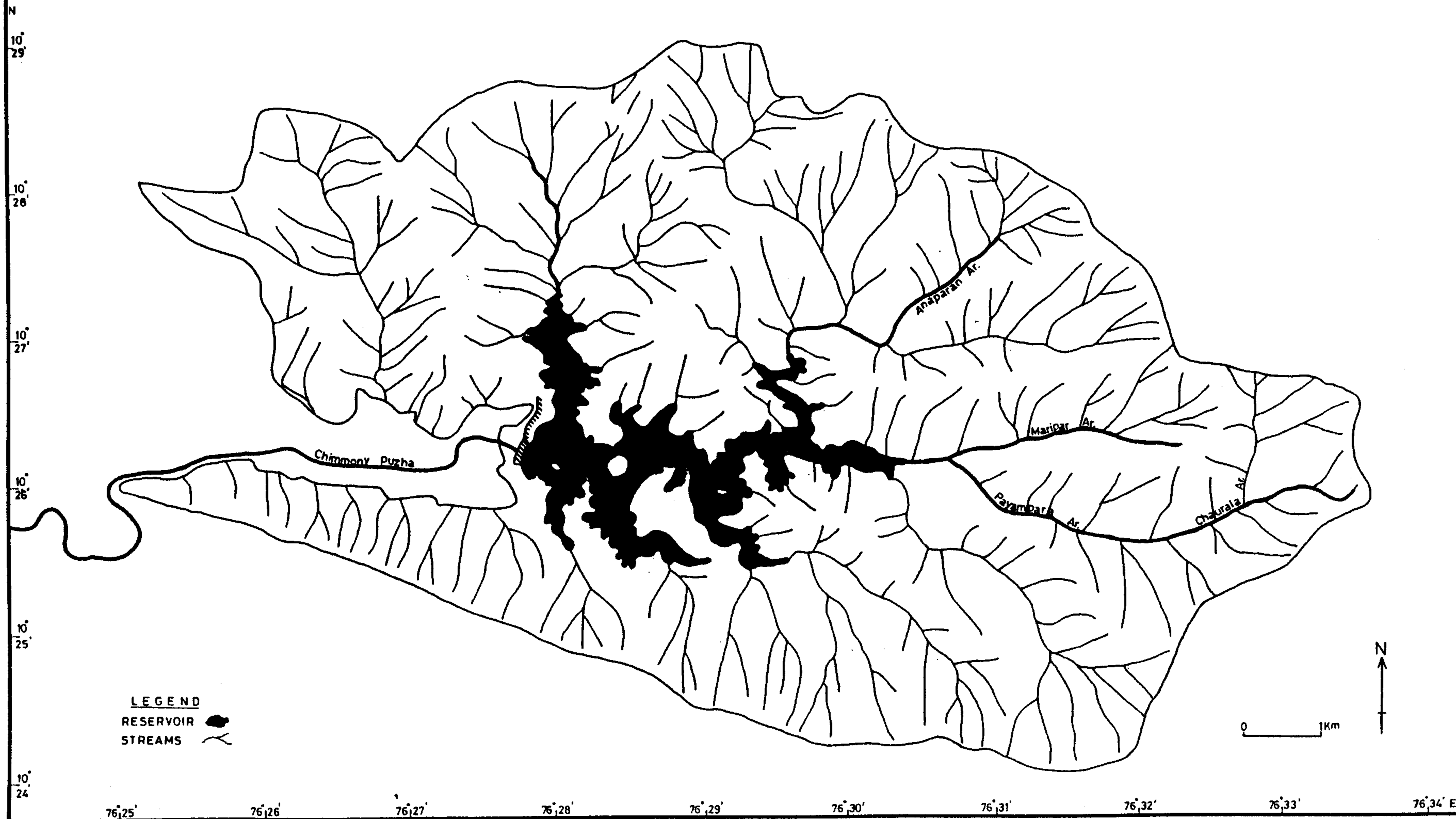


Fig. 2

CHIMMONY WILDLIFE SANCTUARY - SLOPE

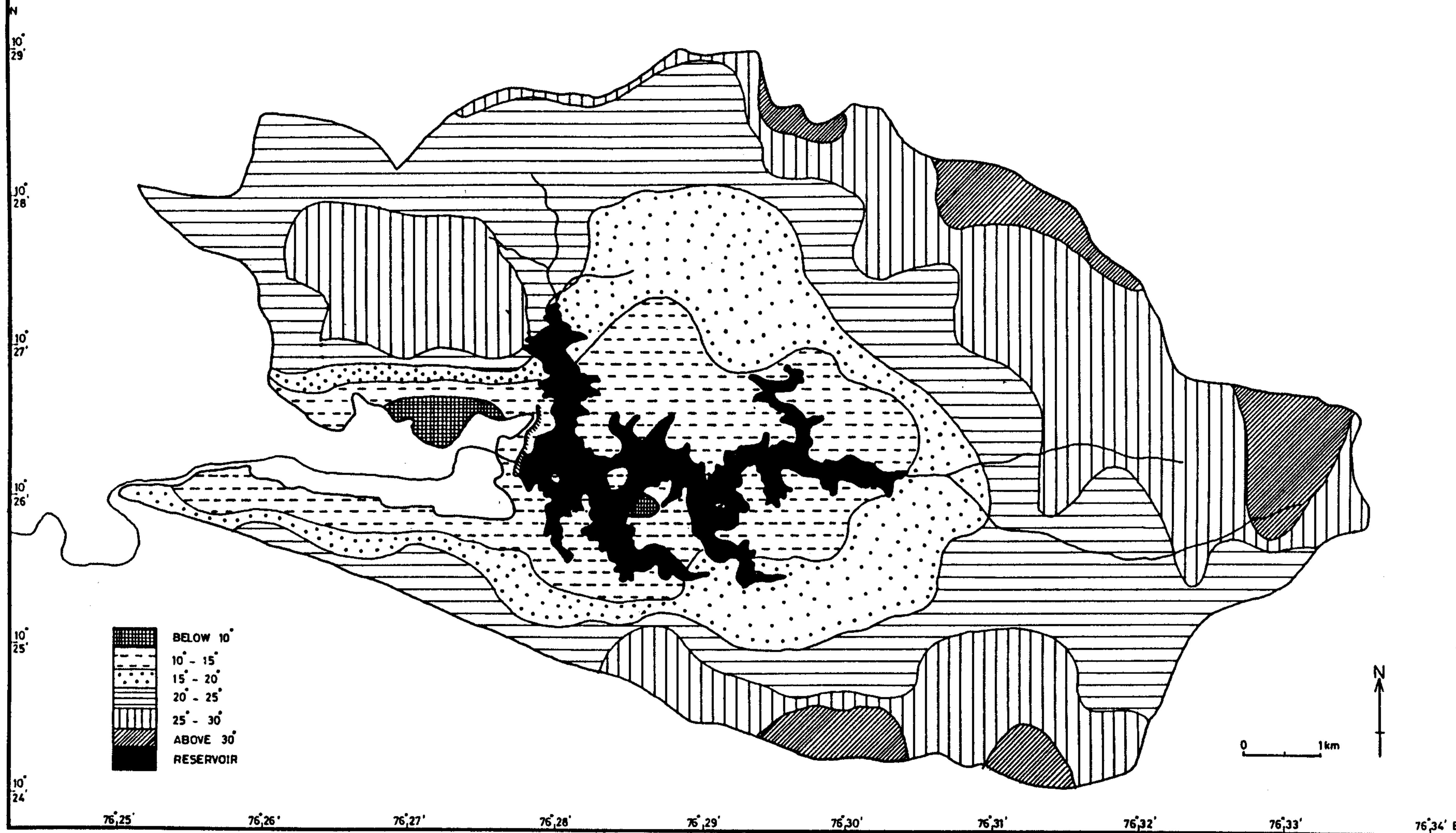


Fig. 3

CHIMMONY WILDLIFE SANCTUARY - CONTOURS

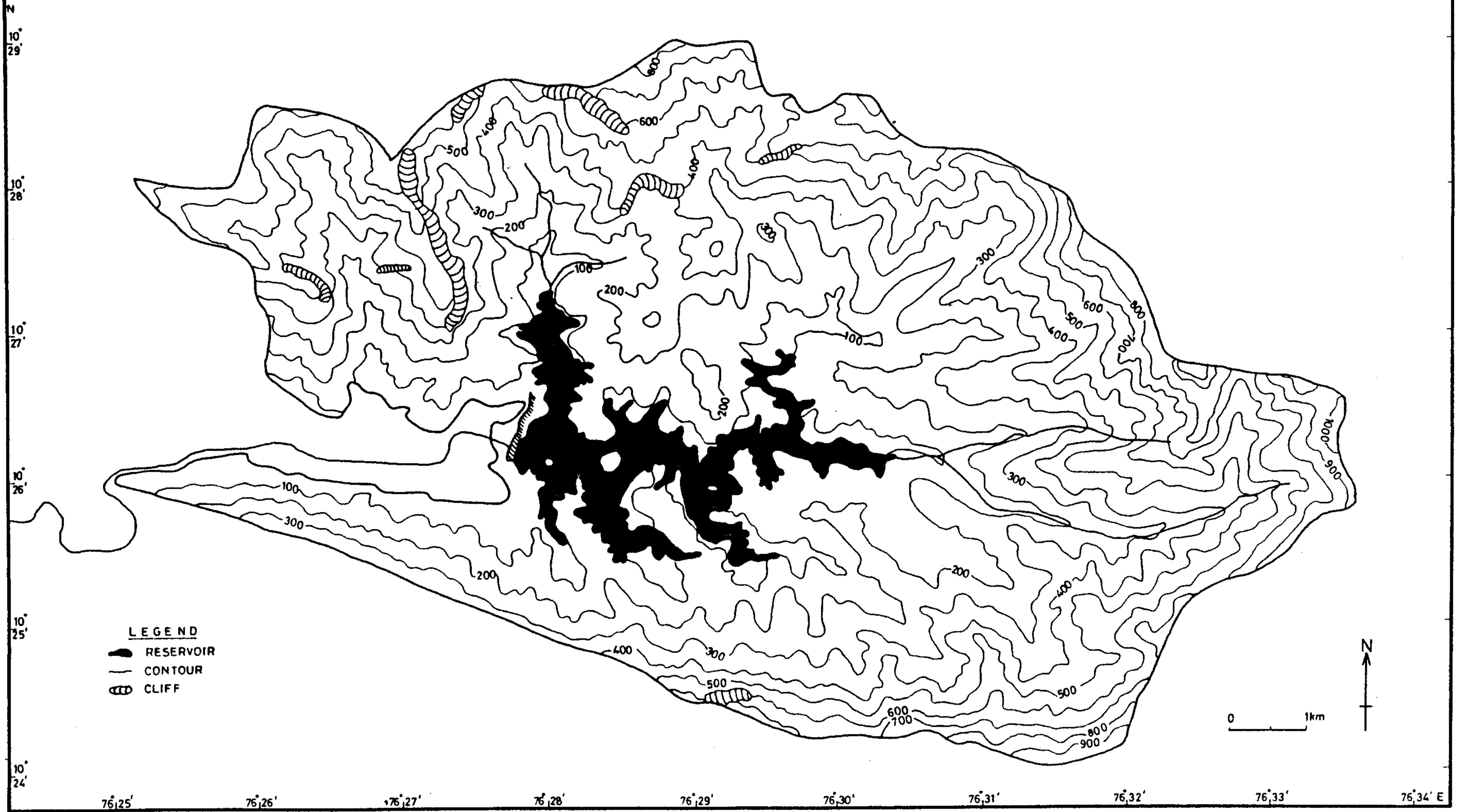


Fig. 4

CHIMMONY WILDLIFE SANCTUARY - LAND COVER

(prepared from IRS 1B(L₂B₂) 1:50,000 geocoded imagery of March 1995)

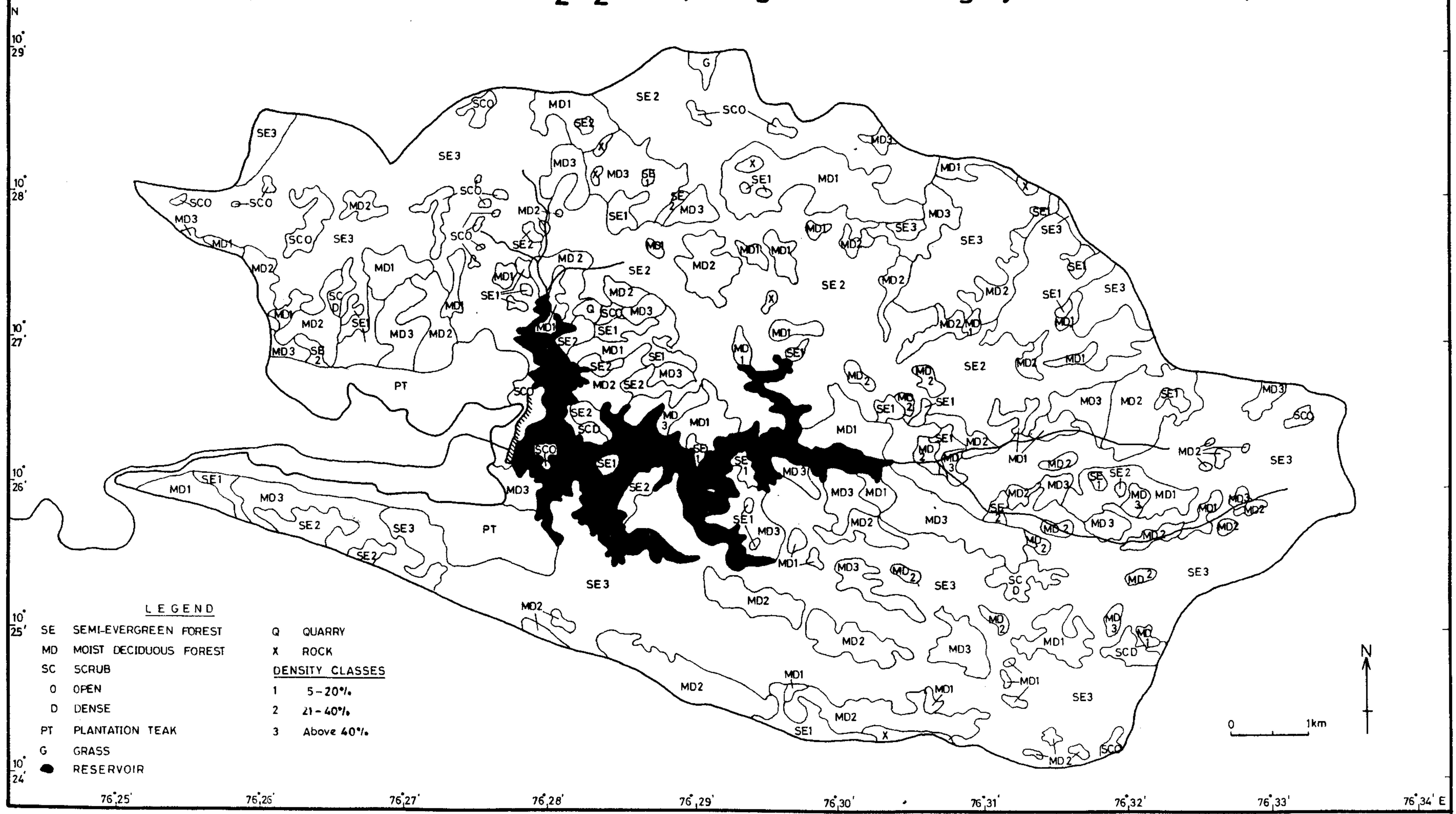


Fig. 5