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SURVEY OF REPTILES AND AMPHIBIANS IN KERALA PART OF NILGIRI BIOSPHERE RESERVE

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ABSTRACT

A survey was conducted in the Kerala part of Nilgiri Biosphere Reserve for documenting the reptiles and amphibians. Random survey was conducted in summer and the two rainy seasons covering the entire study area to document the species diversity. To estimate the species abundance, Broad Quadrat Sampling method was employed using plots of 8 x 8 m size, in all habitat types. Parameters such as temperature, humidity, altitude, distance to water source, humus depth, canopy cover, plant species, number of logs and microhabitat of the species were also recorded.

Thirty three species of amphibians and 62 species of reptiles were documented. The reptiles, *Mabuya allapallensis* and *Aspideretes leithi* are new records to Kerala. The amphibians, *Ansonia rubigina, Micrixalus thampii* and the reptile *Uraeoptyphlus menonii* were documented from new areas. *Ansonia rubigina* was recorded from Wayanad and the other two from Nilambur. A comparison of the diversity and abundance between habitats, *viz.* Evergreen, semi evergreen, deciduous, grassland and plantation showed the following. The highest diversity of both amphibians and reptiles was found in deciduous forests. Amphibians were most abundant in plantation and reptiles in deciduous. Leaf litter was the most preferred microhabitat of amphibians. Reptiles had a preference for tree trunk. However, there were species specific variations. Only a few environmental parameters had positive correlation with species abundance. Nilambur was the richest for both the groups, among the areas. The species were more or less evenly distributed in the study area.

1. INTRODUCTION

Recent thrust on biodiversity conservation necessitates a comprehensive knowledge of the fauna, their distribution and abundance that are important pre-requisites for the management of an area, especially the wildlife sanctuaries and national parks. The Western Ghat mountain range in India has received considerable attention due to its faunistic and floristic diversity and high degree of endemism. In India, Western Ghats and Eastern Himalayas are rich in amphibian fauna. So far 216 amphibians are reported from India (Dutta, 1992 and 1997). Among these, 112 species occur in the Western Ghats, 88 species being endemic to the region (Swengel, 1990 and 1993). Of nearly 500 species of reptiles in India, Western Ghats harbour about 156 species (Murthy, 1992) and about 93 of them are considered to be endemic to the area (Swengel, 1990 and 1993). Aengals (1996) mentions 12 species of reptiles as endangered.

Studies on Indian herpetofauna are comparatively few. The fauna volumes of Boulenger (1890), Guenther (1864 and 1875) and Smith (1933, 1935 and 1943) still remain the authentic records of the herpetofauna of Kerala. Most of the studies on the amphibians and reptiles are limited to surveys and new descriptions. The outstanding works of Ferguson (1904) in Travancore region and Myers (1942a) in Anamalai hills were probably the earlier works on amphibians requiring special mention. Later works in Ponmudi (Inger *et al.*, 1984a and b), Silent Valley (Pillai, 1986; Pillai and Pattabiraman, 1981a), Sabarigiri (Pillai and Pattabiraman, 1981 b), Pooyamkutty (George, 1995 and 1996), Aralam, (Radhakrishnan, 1996a) Parambikulam (Radhakrishnan, 1996b) and Kuttanad (George *et al.*, 1992) contributed to the knowledge on this group. Most of the systematic studies were by Pillai (1978, 1981 and 1986) who described several new species of amphibians from Wayanad and Silent Valley.

The earlier works on reptiles include those of Wall (1906 and 1918) in Cannanore and Wayanad areas. Studies by Vijaya (1982), Murthy (1981,1983a and b and 1986), Inger *et al.,* (1984b), Radhakrishnan (1996c) and others added to the information. A brief review of the published works on amphibians and reptiles in Kerala are summarised in Tables 1 and 2.

Table 1. Amphibian studies in Kerala - Review of Literature

Author/s	Year	Study area	Type of Work
Andrews	1979	Travancore	Biology
Annandale	1918	Travancore	New description
Boulenger	1892	Travancore	New description
Daniel	1963a&b, 1975	Western India	Distribution
Daniel & Sekar	1989	Western India	Distribution
Ferguson	1904	Travancore	Survey
George	1995	Pooyamkutty	Survey
George	1996	Pooyamkutty	Survey
George & Leelamma	1995	Kerala	New record
George *et. al.*	1992	Kuttanad	Survey
Inger *et. al.*	1984	Ponmudi	Survey
Inger *et. al.*	1984	Ponmudi	Survey
Myers	1942a	Travancore	New description
Myers	1942b	Anamalai hills	Survey
Pillai	1978	Wayanad	New description
Pillai	1981	Silent Valley	New descriptions
Pillai	1986	Silent Valley	Survey
Pillai &Pattabiraman	1981a	Silent Valley	New description
Pillai & Pattabiraman	1981b	Sabarigiri	Survey
Radhakrishnan	1996 a b	Aralam Parambikulam	Survey Survey
Zacharias & Bhardwaj	1996	Periyar Tiger Reserve	Survey

The literature review points to the lack of information on the herpetofauna of the region. Hence, the present work was carried out in Kerala part of Nilgiri Biosphere Reserve from July, 1994 to September, 1997. The objectives were to

document the herpetofauna in the area, to study the microhabitat of the species and to suggest management strategies

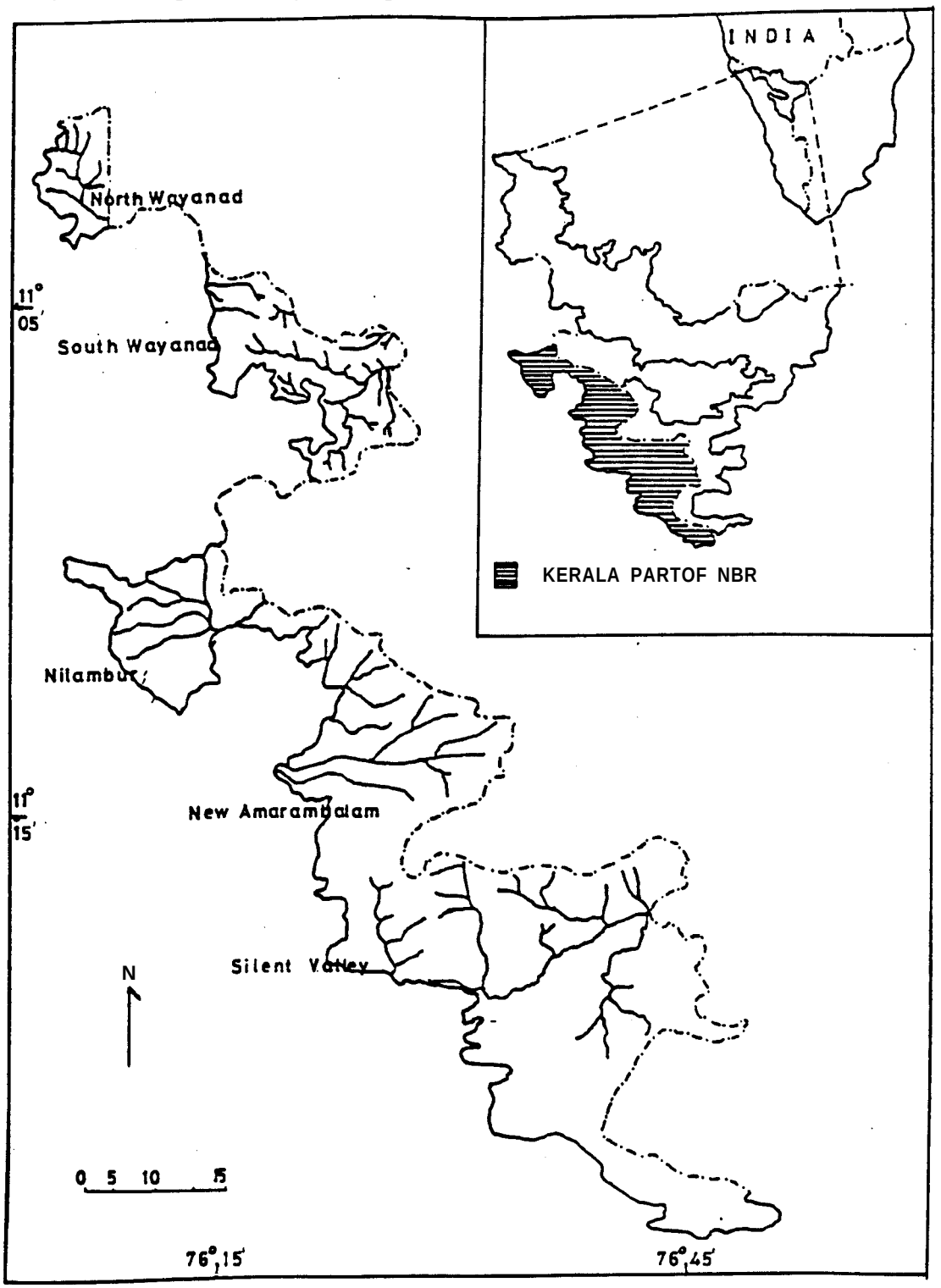
Table 2. Reptile Studies in Kerala - Review of Literature

Author/s	Year	Study area	Type of Work
Beddome	1863,1876 & 1962	Kerala	Description &distribution
Boulenger	1890	Kerala, India	Taxonomy & distribution
Chandrasekhar	1987	Idukki	Survey
Daniel	1983	Kerala, India	General description
Ferguson	1895 &1903	Travancore	Survey & new description
Guenther	1864	Kerala, India	
Inger *et.al*	1984	Ponmudi	Survey
Mukherjee	1986	Periyar	Range extension
Murthy	1972	Anamalais & Cardamom hills	Survey of snakes
Murthy	1978	New Amarambalam	New sub-species
Murthy	1980	South Indian hills	Uropeltid-ecology
Murthy	1981&1986	New Amarambalam & Silent Valley	Survey
Murthy	1983 a &b	Western Ghats	Snakes & lizards
Murthy	1991	NBR	Rare snake
Murthy	1994	India	Reptile list
Radhakrishnan	1996c	Parambikulam	Survey
Rajendran	1977	Western Ghats	Uropeltid survey
Smith	1933, 1935 & 1943	South India	New description & Systematics
Vijaya	1982	Chalakudy	Rediscovery
Wall	1906	Cannanore	Survey
Wall	1918	Nilgiri & Wayanad	Survey

2. STUDY AREA

Biosphere Reserves are constituted to conserve representative ecosystems. Areas around the Nilgiri mountain and adjoining hills of Western Ghats, which

Fig. 1 Kerala part of Nilgiri Biosphere Reserve



include two of the bio-geographic provinces namely Malabar rain forests and the Deccan thorn forests were declared as Nilgiri Biosphere Reserve in 1986.

Nilgiri Biosphere Reserve is located in the south west portion of Western Ghats (North of Palghat gap) between 10^{o} 45' and 12^{o} 5' N. and between 76^{o} 10' and 77^{o} 10' E. and is about 5500 km^2 in extent. Topographic variations ranging from low lying valleys in the west to mountains over 200m and flat elevated table land of nearly 800-1000m above the sea level in the east have resulted in diverse climatic zones. This leads to diverse habitats like tropical wet evergreen forests, semi evergreen forests, montane sholas with associated grass lands and dry deciduous forests.

The northern part is formed by the Wayanad, Mysore, Sigur and Talamalai plateau with associated hills at a general elevation of 700-1000m. The west slopes constitute Nilambur, New Amarambalam and Silent Valley Reserves descending to 250 m in Kozhikode plains. To the south, Attapadi plateau, Siruvani and Bolampatti hills show their own diverse topography from 1800 to 150m in Palghat gap. In the east, Nilgiri slopes down to 250m in the Coimbatore plains.

Kerala part of Nilgiri Biosphere Reserve extends over an area of 1455 km^2 and include Wayanad Wildlife Division, Silent Valley national park. Mannarkkad, Nilambur North and South Forest Divisions (Fig. 1). The core zone forms about 240 km^2, the forestry zone about 870 km^2, the tourism zone 100 km^2 and the restoration zone 246 km^2 (Anonymous,l992- 1993). Natural vegetation types in the area are tropical wet evergreen forests, tropical montane shola and grass lands, tropical semi-evergreen forests, and tropical dry deciduous forests.

2.1 Wayanad

Wayanad is contiguous with Bandipur Tiger Reserve and Rajiv Ghandhi (Nagarhole) national park of Karnataka and Mudumalai Wildlife Sanctuary of Tamil

Fig. 2 Wayanad

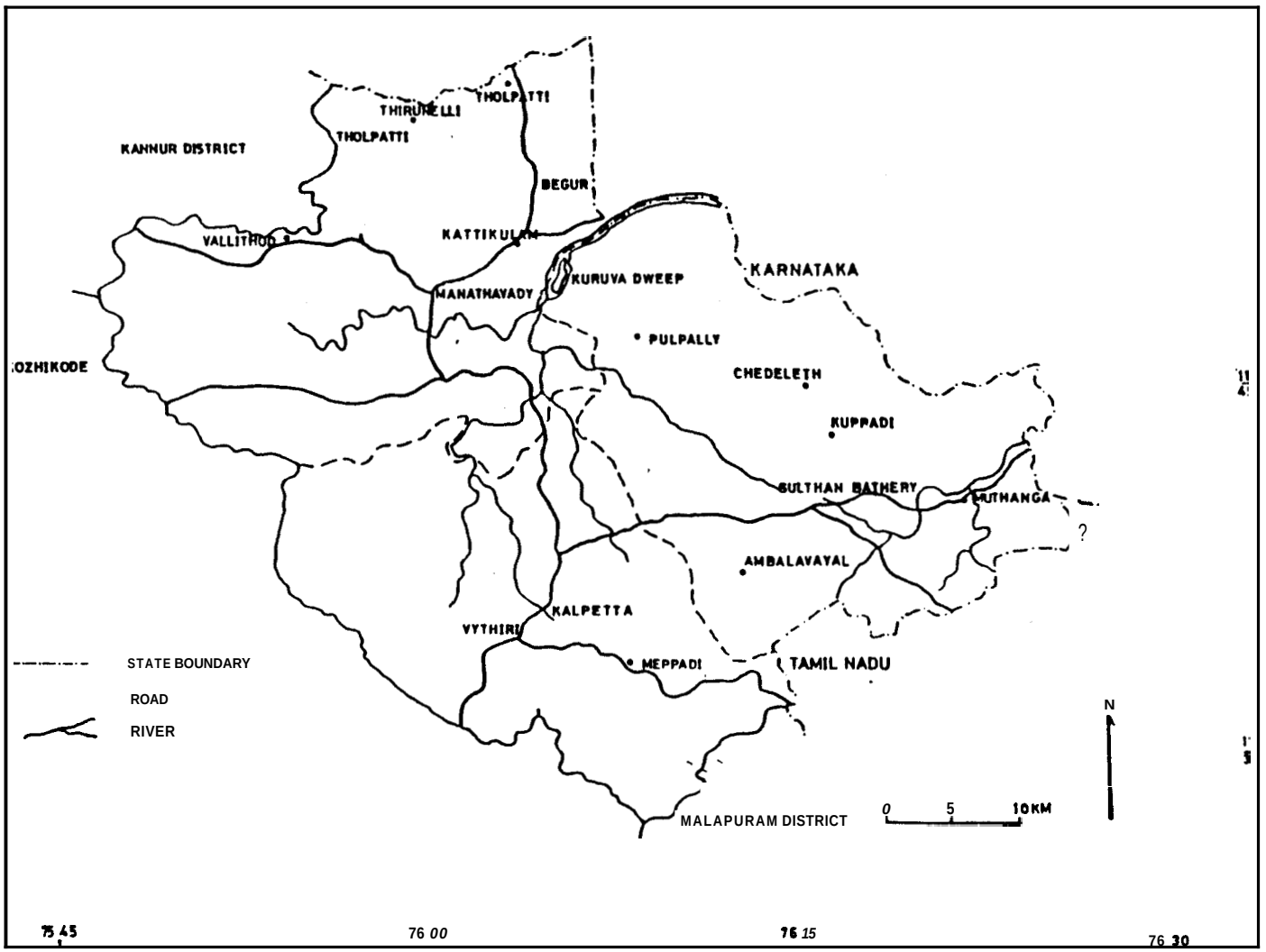


Fig. 3 Nilambur Reserve Forests

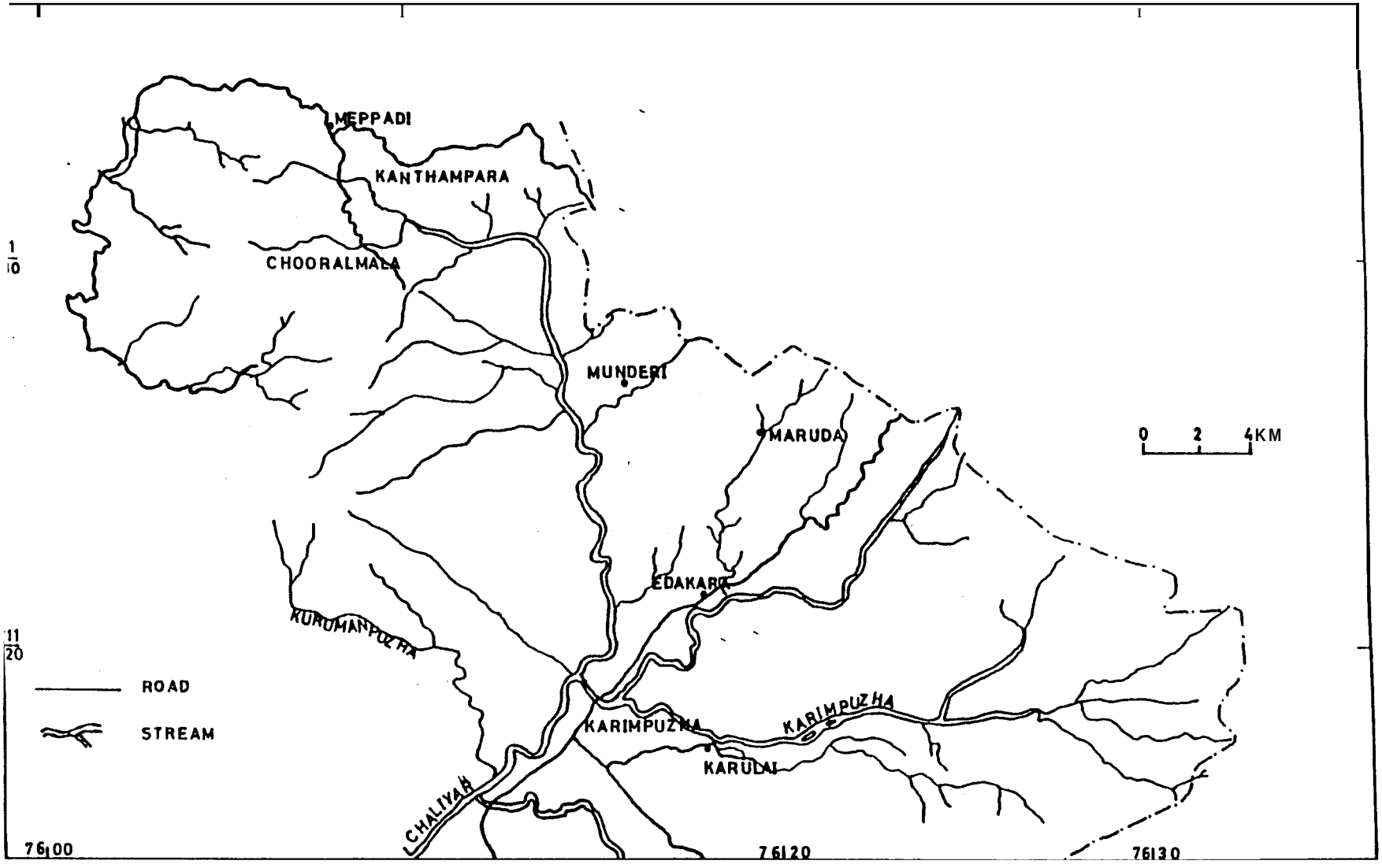
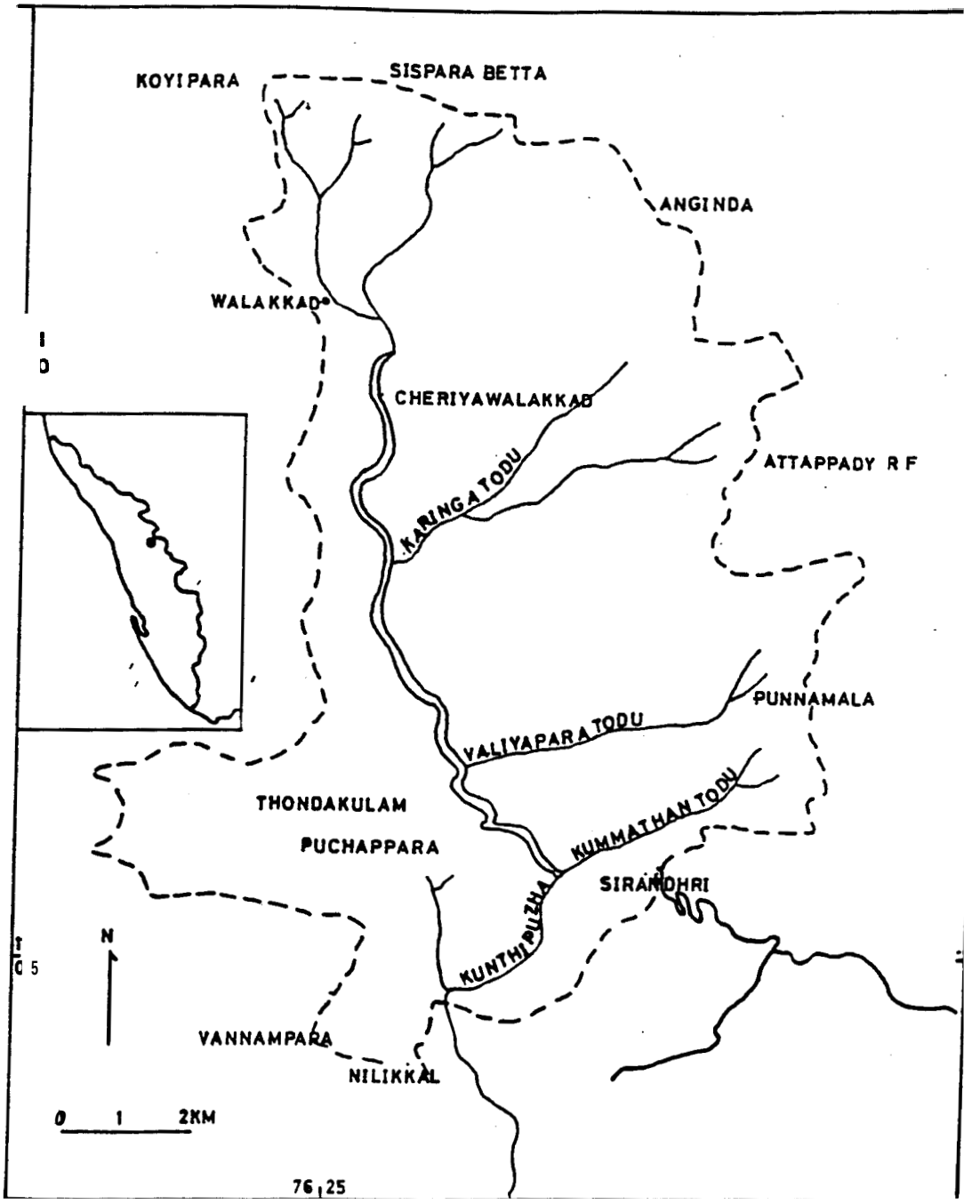


Fig. 4 Silent Valley National Park



Nadu (Fig.2). The total extent is about 1200 km^2, of which 344 km^2 forms the Wayanad Wildlife Sanctuary. The eastern and western plateau of Wayanad differ in topography and climate. The Wayanad plateau is at an elevation of 900-1600m. The northern part with an elevation of 700-1600m differs from the southwestern slope of uneven peaks ranging from 1000-2000m. The plateau is comparatively drier. The hottest period is between March and June. Temperature varies from 13°C to 32°C. Southwest monsoon is the active one bringing in more rainfall. The average rainfall is 2000mm. Vegetation types include wet evergreen forests confined to the northern part and deciduous forests in the areas bordering adjacent States. Natural forests are intervened with bamboo thickets and plantations of teak and eucalypts. The area is drained by a number of tributaries of Kabini river flowing to the east.

2.2 Nilambur Reserve Forest

Nilambur reserved forest is located in Malappuram district of Kerala (between 11° 16' and 11° 34' N. and between 76° 3' and 76° 13' E.) (Fig.3). Temperature ranges from 17° C to 39° C. Southwest monsoon is the active one and annual average rainfall varies from 2032 to 2556mm. The reserve consists of wet evergreen and deciduous forests intervened with bamboo thickets. Teak plantations occur in areas close to the periphery. Chaliyar and its tributaries form the drainage system in the area.

2.3 Silent Valley National Park

Silent Valley national park, with an extent of about 90 km^2 is located in the Palakkad district of Kerala (between 11° 4' and 11° 13' N. and between 76° 24' and 76° 29' E.). It is bounded by the Nilgiris and forests of Nilambur along the north and Attappadi forests in the south (Fig. 4). There is considerable variation in climate due to the undulating terrain. Temperature varies from 10° C to 30° C.

Intensity of rainfall varies across the area. Annual rainfall is about 4543 mm. Sirendhri being at a lower elevation receives an annual rainfall of about 3180 mm. Vegetation is highly complex with a number of types represented. Major vegetation types consist of wet evergreen forests, montane grasslands and shola forests. Kunthipuzha and its tributaries drain the area.

2.4 Attapadi Reserve

Attapadi valley is situated in Palakkad district (between 10^{o} 55' and between 11^{o} 14' N. and between 76^{o} 27' and 76^{o} 48' E.) The area is bordered in the north by Nilgiri district of Tamil Nadu, in the west by Malappuram district, in the south by Palakkad district and in the east by Coimbatore district. The valley is about 765 km^2 in extent. Three major regions of the valley are the valley proper, Nilgiri range along the northern side of the valley and Vellingiri range (Muthikkulam Reserve) on the southern side. The entire valley is rugged and elevation ranges from about 250-1700m except for the eastern side where it is comparatively less undulating and gently sloping.

Malleswara malai (1664m) is the highest peak in the valley region. Nilgiri region has steep slopes and cliffs with the elevation ranging from 1600-2300 m. The altitude varies from 750-2100 m in the Vellingiri range consisting largely of broken hills. Climatic conditions vary considerably in different part of the forests. The considerable difference in elevation behveen the plains and the ghat is responsible for such a condition. Greater part of the precipitation over most of the area is during the south-west monsoon. The heaviest fall is in July and August. The north-east monsoon brings some rain in October and November. The annual rainfall is about 2300-2800 mm. Vegetation is dominated by deciduous forests followed by wet evergreen forests. The east flowing river and its tributaries drain the area.

2.5 Muthikkulam-Siruvani Reserve Forests

Muthikkulam Reserve (between 10° 55' to 11° 33' N. and between 76° 35' to 76° 41' E.) is situated on the Siruvani plateau of Palghat district and covers an area of about 64 km^2. This reserve is almost cut off from the north, east and west. Wet evergreen forests form the major vegetation. Tributaries of Bhavani drain the area (Fig. 5).

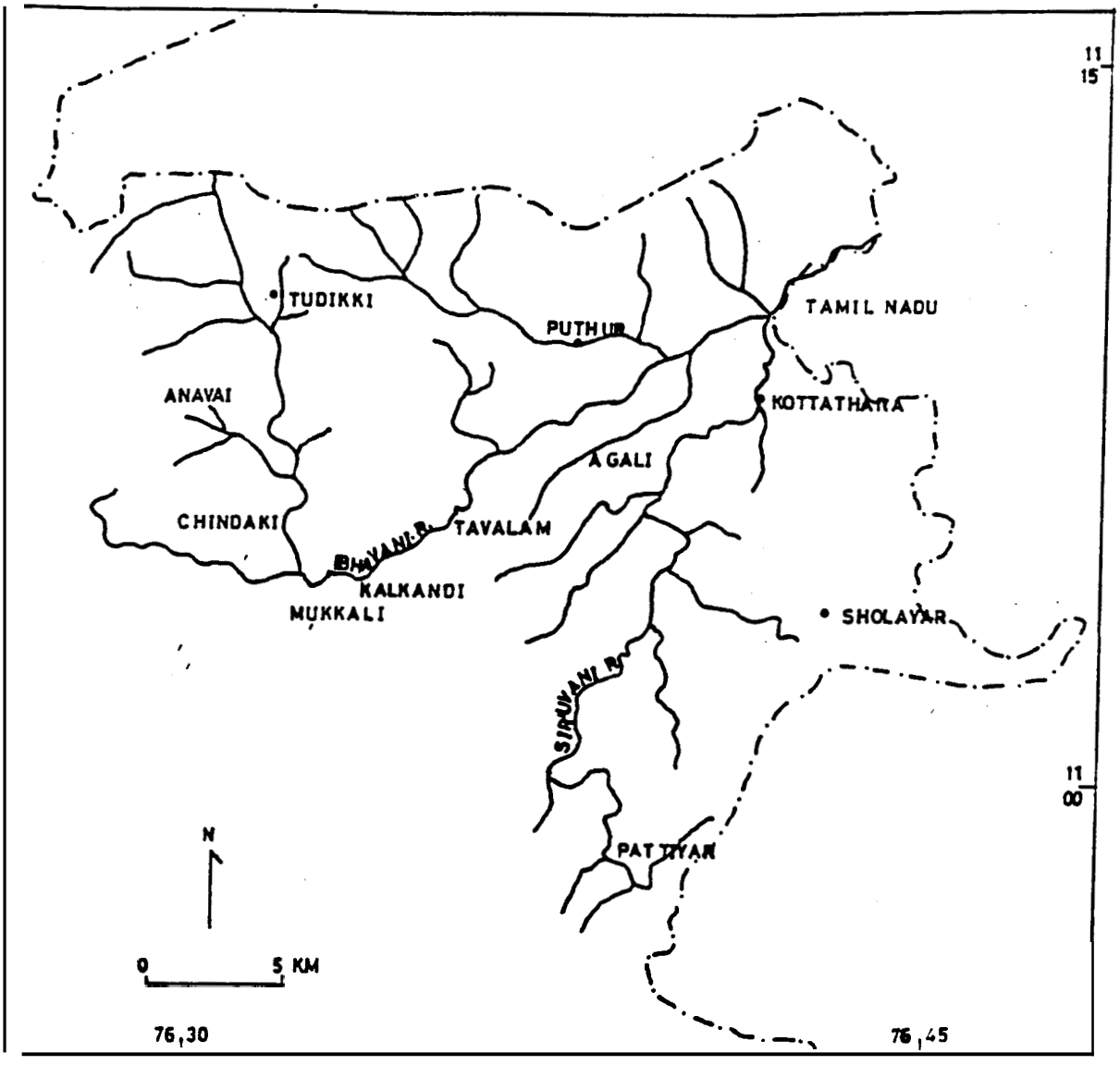
3. METHODS

3.1. Inventory

Random surveys were conducted in almost all parts of the study area to document the amphibian and reptile species. The streams, rivers and marshy areas were specially surveyed for amphibians. The calls during the night time helped to locate and collect several amphibian species like *Philautus* and *Ramanella.* Diurnal forms were collected between dawn and mid day. Usually hand picking was employed for the collection of specimens and pitfall traps were tried rarely in some places like Silent Valley and Nilambur. Night observations were made wherever possible. Collected specimens were preserved in 10% formaldehyde solution. The specimens were identified referring to the manuals (Boulenger, 1890; Smith, 1933, 1935 and 1943; Daniel, 1963a and b, 1975; Daniel and Sekar, 1989; Tikader *et al.,* 1992).

Quadrat sampling method was used for estimating abundance and diversity indices. Plots of 8 x 8m size were laid at random, ensuring adequate representations of all habitat types and altitudes. These plots were thoroughly searched by a team of three persons *(Heyer, et al.,* 1984). Adequate time was spent in each plot to search the area completely. Amphibians and reptiles in the plot were identified in the field itself as far as possible. Various ecological parameters like temperature, pH, altitude, distance to water source, humidity, number of logs, number of trees, herbs, shrubs and grass clums, nature of humus, depth of humus,

Fig. 5 Muthikkulam- Siruvani Reserve Forests



microhabitat and canopy value were recorded for each quadrat. The study area was covered three seasons viz.the summer (February-May), the rainy (June-August) and post rainy (September –January).

3.2. Analyses

3.2.1 Habitat Preference

Observations from different quadrats were pooled to estimate the habitat preference of reptiles and amphibians. Further, an Abundance Index was worked out by taking the proportion of number of individuals observed in each habitat and the number of plots sampled in each. Thus

$$\text{Abundance Index in habitat 'A'} = \frac{\text{No. of individuals observed in habitat A}}{\text{No. plots sampled in habitat 'A'}}$$

3.2.2 Microhabitat preferences

Amphibian microhabitats were broadly classified into grass, water, leaf litter, shrub, bare ground, tree trunk, under boulder and under log. Two more microhabitats *viz.* near water and on rock were identified in the case of reptiles. The microhabitit, water was deleted in this case. Data from both the random and plot surveys were pooled for the analyses.

Analysis was also done for micro-habitat preference of selected amphibians *viz. Bufo melanostictus* , *Rana beddomii, Micrixals nudis* and *Rana temporalis.* These were selected based on the number of observations made. The reptiles *Mabuya macularius, M. carinata, Cnemaspis kandianus C. wynadensis Calotes rouxi, Ristella beddomii* and *Trimeresurus malabaricus* were selcted for anlyses of microhabitat preference.

Frequency of occurrence of amphibians and reptiles in various collection locations were correlated with the ecological parameters collected from the sites.

3.2.3. Richness Evenness and Diversity Indices

The data collected were analysed for diversity, richness and evenness indices using the computer program SPDIVERS of STATECOL (Ludwig and Reynolds, 1988). Two diversity indices, Shanon-Weiner's and Simpson's and the two richness indices, Margalef (R_1) and Menhenick's (R_2) were estimated. The most commonly used five evenness indices E_1, E_2, E_3, E_4, and E_5 were also computed.

4. RESULTS AND DISCUSSION

4.1 Inventory

4.1.1 Amphibians: A total of 33 species of amphibians were recorded (Table 3), consisting of 4 species of caecilians, 5 bufonids, 16 ranids and 8 rhacophorids. Wyanad area had 27 species, Silent Valley 14, Nilambur 21 and Muthikkulam 15. Of these, *Ansonia rubigina, Bufo silentvalleyensis, B. parietalis, Ramanella montana, R triangularis, Micrixalus nudis, M. saxicola, M. thampii, Nyctibatrachus major, Rana curtipes, Philautus pulcherrimus, Rhacophorus malabaricus* and *Uraeotyphlus menoni* are endemic to Western Ghats (Swengel, 1990).

Information on the distribution of caecilians are rather scanty (Daniel, 1963 a). Among the four species of caecilians recorded, *Icthyophis longicephalus* was described from Silent Valley national park by Pillai (1986) and is endemic to the area. The present survey indicates its abundance in the streams of Panthanthodu and Kunthipuzha at Walakkad. *Uraeotyphlus menoni* was originally recorded from Cochin (Daniel, 1963 a) and information regarding its distribution is rather few. The present observation of the species from Nilambur extends its range further north. *Ichthyophis beddomii,* a widely distributed caecilian was recorded from the paddy fields in Wayanad and rivulets in Muthikkulam and Nilambur Reserves.

Among the ranids, *Rana tigerina, R. curtipes, R. verrucosa* and *R. hexaductyla* were the most abundant ones. These species were observed mostly near the streams and other water source mostly during night time. *Rana keralensis* was earlier considered endemic to Kerala. But this was later reported from Jalpaiguri district in West Bengal (Sarkar *et al.,* 1992). Recent reports from lower elevations of Tamil Nadu, Maharashtra, Goa and Gujarat (Deuti and Goswami, 1995) indicate its wider distribution. *Rana malabarica,* one of the rare ranids, was seen only in Moolepadam in Nilambur, near a human habitation. *Nyctibatrachus major,* a Western Ghat endemic, was one of the abundant species observed frequently under the submerged boulders in streams and rivulets throughout the area.

Among the Bufonids, *Ansonia rubigina* was reported from Silent Valley (Pillai and Pattabiraman, 1981a). The species was collected from a small rivulet passing through Banasuramala in Wayanad during the present study. This is the second report of the species and shows its range of extension further north. However, population was very low in both the places. *Bufo silentvalleyensis,* a species described from Silent Valley (Pillai, 1981a) was abundant in the type locality. *Bufo parietalis, B. melanostictus* and *B. microtympanum* were widely distributed and abundant throughout.

Pillai (1978) described *Micrixalus nudis* from Kurichiat in Wayand. Later this was reported from Silent Valley also (Pillai, 1986). The present survey indicates its distribution in Nilambur and New Amarambalam areas. *M. thampii,* described by Pillai (1981) from Silent Valley was found to be abundant in the marshes of Nilambur and most of the places in Wayanad. The present observations indicate its range of extension further north. *M saxicola,* described from' Travancore region was later reported from Silent Valley (Pillai, 1986). This species was observed to be abundant in Nilambur and Silent Valley and inhabited the

crevices of boulders in the streams. All the species of *Micrixalus* collected during the survey are endemic to Kerala.

Table 3. List of Amphibians recorded from Kerala Part of NBR

Name of species	Wayanad	Nilambur	Silent Valley	Muthikkulam-Siruvani
I Family :Ichthyophidae				
1. *Ichthyophis beddomii* Peters	+	+		+
2. *I. Longicephalus*			+	
II Family :Uraeotyphlidae				
3. *Uraeotyphlus menoni* Annandale		+		
4. *Uraeotyphlus* sp	+			
III Family :Bufonidae				
5. *Bufo parietalis* Boulenger	+	+	+	+
6. *Bufo melanostictus* Schneider	+	+	+	+
7. *Bufo microiympanum* Boulenger	+	+	+	+
8. *Bufo silentvalleyensis* Pillai			+	-
9. *Ansonia rubigina* (Pillai and Pttabiraman)	+			
IV Family :Ranidae				
10. *Rana tigerina* (Daudin)	+	+		+
11. *Rana hexadactyla* (Lesson)	+	+		+
12. *Rana curtipes* Jerdon	+			
13. *Rana cyandphlyctis* Schneider	+	+		+
14. *Rana temporalis* (Fuenther)	+	+	+	+
15. *Rana beddomii* (Guenther)	+	+	+	+
16. *Rana verrucosa*	+	+		+
17. *Rana Keralensis* (Dubis)	+	+		
18. *Rana malabarica* Tscudi		+		
19. *Micrixalus nudis* Pillai	+	+		+
20. *Micrixalus thampii* Pillai	+	+	+	
21. *Micrixalus saxicola* Jerdon	+	+	+	
22. *Nyctibatrachus major* Boulenger	+	+	+	+
VFamily: Microhylidae				
23. *Microhyla ornata* (Dumeril and Bibron)	+			

Name of species	Wayanad	Nilambur	Silent Valley	Muthikkulam-Siruvani
24. *Microhyla rubra* Jerdon	+			
25. *Ramanella montana* (Jerdon)	+			
26. *Ramanella triangularis* Guenther			+	
V I Family : Rhacophoridae				
27. *Rhacophorus malabaricus* Jerdon	+	+		
28. *Polypedates maculatus* (Gray)	+	+		+
29. *Philautus leucorhinus* (Lich. And Martens)	+	+		
30. *Philautus pulcherrimus* Ah1			+	+
31. *Philautus nasutus* Jerdon	+	+	+	
32. *Philautus variabilis* (Guenther)		+	+	+
33. *Philautus sp.*	+			

+ Sighted/located - Not sighted/located

Among the seventeen microhylids reported from India. only four species viz, *Microhyla ornata. M rubra, Ramanella montana* and ***R triangularis*** are represented in the area. The first-two species were abundantly seen in the ploughed paddy fields in the midst of forests in Wayanad. *Ramanella rnontana* and ***R triangularis*** were recorded from Wayanad and Silent Valley respectively. Both the species were very rare in their localities. The former was collected from a termite mound during night and the latter from the hole in a tree trunk in Silent Valley.

Rhacophorids are represented by three genera *viz, Rhacophorus. Polypedates* and *Philautus.* The first two are represented by single species each and the latter by five species. *Rhacophorus malabaricus,* the Malabar gliding frog, was fairly well distributed in the study area. They were seen in amplexus in an abandoned well in Wayanad. Most of the species were observed on bamboo stems or leaves. *Polypedates maculatus* showed an affinity to habitations. The genus *Philautus* is represented by five species and one of them is yet to be identified. *P. pulcherimus* was confined to Silent Valley and was mostly observed on twigs. *P. nasutus* and *P. Ieucorhinus* have a wider distribution. *P. pulcherrimus* is reported to be endemic to Kerala (Dutta, 1992).

A few of the earlier reported species could not be located during the present survey. *Pedostibes tuberculosus* which was originally described by Guenther (1875) from Malabar was later rediscovered by Pillai (1986) from Mukkali after about 105 years. One of the rarest toad, *Nannobatrachus beddomii* was rediscovered for the first time by Pillai (1986) after its original description by Boulenger (1882). It was known to occur in Malabar and Thinneveli. These could not be located during the present survey, may be due to their rarity.

4.1.2 Reptiles : Sixty two species of reptiles were recorded from the Kerala part of the Nilgiri Biosphere Reserve during the present survey (Table 4). These include one species of crocodile, four species of turtles, eight species of geckos. nine species of agamids, one species of chamaeleon, seven species of scincids, one species of monitor lizard and thirty one species of snakes. ,Eighteen of them *(Indotestudo forsteni, Cnemaspis beddomei, Cnemaspis wynadensis, Calotes ellioti, C. grandisquamis, C. rouxi, Draco dussumieri, Salea horsfieldii, Scincella laterimaculatum, S. travancoricum, Ristella beddoniii, Rhinophis sanguineus, Teretrurus sanguineus, Ahaetulla perroteti, Amphiesma beddomei, A. monticola* and *Calliophis bibroni)* are endemic to Western Ghats (Swengel, 1990 and 1993).

Marsh Crocodile *(Crocodylus palustris)* was recorded only from Kabini river and its tributary Nulpuzha. The four species of turtles recorded were Indian pond terrapin *(Melanochelys trijuga),* Travancore tortoise *(Indotestudo forsteni)* Leith's soft shell turtle *(Aspideretes leithi)* and the Indian flapshell turtle *(Lissemys punctata).* Indian pond terrapin was common and widely distributed in the rivers and ponds in the study area. Travancore tortoise was recorded only from Nilambur area. Its young ones were common during the rainy season. Bhupathy and Choudhury (1995) reported the occurrence of Travancore tortoise in New Amarambalam reserve forest. Leith's softshell turtle was collected from Chaliyar river at Edavanna in Nilambur. This is the first record of its

occurrence in Kerala. (Thomas *et al.,1997).* The Indian flap shell turtle was recorded only from Wayanad.

Eight species of geckos were recorded during the present study. Two of them *(Cnemaspis beddomei* and *C.wynadensis)* are endemic to Western Ghats (Swengel, *1990). Cnemaspis beddomei* and *Geckoella collegalensis* are considered rare. *Cnemaspis wynadensis* and *Geckoella collegalensis* were observed mainly under loose stones. *C. kandiana,* the common forest dwelling gecko was usually seen on tree barks. *Hemidactylus brooki, H frenatus* and *H. triedrus* were seen both in the interior forests as well as in the buildings in the forest fringes. However, their population in the forest seem to be low as evident from the few sightings.

Nine species of Agamids were recorded from the study area. Of these. five species are endemic to Western Ghats (Swengel. *1990). Calotes grandisquamiis,* a rare agamid was collected from the evergreen forest in Thirunelli, Wayanad. *Salea horsfieldii* was located at Sispara in Silent Valley national park. *Calotes rouxi,* the commonest agamid occurred in almost all terrestrial habitats in the forest. *C. versicolor* was not very common in the forest. *Calotes ellioti* and *C. nemoricola* were frequently seen in the wet evergreen forests of Nilambur. *Drnco dussumieri,* an arboreal Agamid, was seen on tree trunks in various habitats.

Psammophilus blanfordianus was seen in plenty in rocky regions. Sightings of C. *calotes* were few compared to other species, but it was seen in almost all areas. Chamaeleon *(Chamaeleo zeylanicus)* and Monitor lizard *bengalensis)* were rarely sighted during the present survey. However, enquiries with the local people confirm its presence in all the areas.

Table 4. List of Reptiles recorded from Kerala part of NBR

Name of species	Wayanad	Nilambur	Silent Valley	Muthikkulam-Siruvani
Family: Crocodylidae				
1. *Crocodylus palustris* Lesson	+			
Family: Emydidae				
2. *Melanochelys trijuga* (Schweigger)	+	+		+
Family: Testudinidae				
3. *Indotestudo forsteni* (Schlegel & Muller)	-		+	
Family: Trionychidae				
4. *Aspideretes leithi* (Gray)		+		
5. *Lissemys punctata* (Bonnaterre)	+			
Family: Geckonidae				
6. *Geckoella collegalensis* (Beddome)				
7. *Cnemaspis beddomei* (Theobald)	+			
8. *C. gracilis* (Beddome)	+			
9. *C. kandianus* (Kelaart)		+	+	+
10. *C. wynadensis* (Beddome)	+	+	+	+
11. *Hemidactylus brooki* (Gray)	+	+	+	
12. *H. frenatus* Du.& Bibr	+	+	+	+
13. *H. triedrus* (Daudin)	+			
Family: Agamidae				
14. *Calotes calotes* (Linn.)	+	+	-	
15. *C. nemoricola* Jerdon	+	+	-	
16. *C. grandisquamis* Guenther	+	-	-	
17. *C. versicolor* (Daudin)	+	+	+	+
18. *C. ellioti* Guenther		+	+	+
19. *C. rouxi* Dum. & Bibr.	+	+	+	+
20. *Psammophilus blanfordianus* (Sto1iczka)	-	+	+	
21. *Salea horsfieldii* Gray		-	+	
22. *Draco dussumieri* Dum. & Bibr.	+	+	+	
Family: Chamaeleonidae				
23. *Chamaeleo zeylanicus* Lautrenti	+			
Family: Scincidae				
24. *Mabuya carinata* (Schneider)	+	+	+	+
25. M *macularius* (Blyth)	+	+	+	+

Name of species	Wayanad	Nilambur	Silent Valley	Muthikkulam-Siruvani
26. *M. allapallensis* Schmidt	+			
27. *Ristella beddomii* Boulenger	+	+	+	+
28. *Scincella travancoricum* (Beddome)			+	
29. *S. laterimaculatum* (Boulenger)	+			
30. *Riopa punctata* (Gmelin)	+	+		
Family: Varanidae				
31. *Varanus bengalensis* (Daudin)	+		+	
Family: Typhlopidae				
32. *Ramphotyphlops braminus* (Daudin)	+	+		-
33. *Typhlops acutus* (Dum&Bibr)		+		-
Family: Uropeltidae				
34. *Rhinophis sanguineus* Beddome	+			
35. *Uropeltisphipsonii* (Mason)			+	
36. *U. ceylanicus* Cuvier				+
37. *Teretrurus sanguineus* Beddome			+	
Family: Boidae				
38. *Python molurus* (Linn.)	+			
39. *Eryx conicus* (Sbhneider)	+			-
Family: Colubridae				
40. *Ahaetulla nasutus* Anderson	+	+	+	+
41. *A. perroteti* (Dum.& Bibr.)			+	
42. *Amphiesma beddomei* (Guenther)			+	
43. *A.stolata* (Linn.)	+	+		
44. *A. monticola* (Jerdon)	+			
45. *Boiga ceylonensis* (Guenther)		+		
46. *B. trigonata* (Schneider)	+	+		
47. *Chrysopelea ornata* (Shaw)	+			
48. *Coluber mucosus* (Linn.)	+	+		
49. *Dendrelaphis tristis* (Daudin)	+	+		
50. *Elaphe helena* (Daudin)		+		
51. *Lycodon aulicus* (Linn.)	+			
52. *L. travancoricus* (Beddome)		+	+	
53. *Xenochrophis piscator(* Schneider)	+	+		
54. *Oligodon taeniolatus* (Guenther)	+		+	
Family: Elapidae				
55 .*Bungarus caeruleus* (Schneider)	+	+		
56. *Calliophis bibroni* (Jan)	+			

Name of species	Wayanad	Nilambur	Silent Valley	Muthikkulam-Siruvani	
57. C. nigrescens Guenther				+	
58. Naju naja (Linn.)	+	+			
59. *Ophiophagus hannah* (Cantor)	+				
Family: Viperidae					
60. Trimeresurus malabaricus(Jerdon)	+	+	+	+	
61. Hypnale hypnale (Merrem)		+			
62. Viperarusselli (Shaw & Nodder)	+				

+ Sighted/located - Not sighted/located

Seven species of skinks were recorded. Among these, *Scincella laterimaculatum, S. travancoricum* and *Ristella beddoinii* are endemic to Western Ghats. *Mabuya macularius* was the common, widely distributed forest skink, sighted in almost all habitats. *Mabuya carinata* was seen mainly near habitations. *Mabuya allapallensis* was recorded only from Nalloor vayal near Muthanga in Wayanad, and is a new record to Kerala. *Scincella laterimaculatum,* a rare species, was collected from an evergreen forest patch in Wayanad. Three specimens of *S. travancorium* were collected from Silent Valley. *Riopapunctata* and *Ristella beddomii* have more or less even abundance.

Thirty one species of snakes were recorded from the study area. These include two species of blind snakes, four shield-tails, two boas, fifteen colubrids. five elapids and three viperids. Of the above, *Rhinophis sanguineus, Teretrurus sanguineus, Ahaetulla perroteti, Amphiesma beddomei, A. monticola* and *Calliophis bibroni* are endemic to Western Ghats. The worm snakes were represented by *Ramphotyphlops braminus* and *Typhlops acutus.* The former was common in Wayanad and the latter was recorded only from Nilambur. The Uropeltids or shield-tails collected *(Rhinophis sanguineus, Teretrurus sanguineus, Uropeltis ceylanicus* and *U. phipsoni)* were from loose moist soils. *Eryx conicus* was commonly observed during rainy seasons. Python was rarely sighted. *Ahaetulla nasutus, Boiga ceylonensis, B. trigonata, Dendrelaphis*

tristis and *Chrysopelea ornata* are arboreal snakes observed mostly on bushes and tree branches. *Ahaetulla nasutus* was the commonest among them. *Ahaetulla perroteti* was frequented mainly in grass lands of Sispara in Silent Valley. *Amphiesma beddomei, A. monticola, A. stolata,* and *Xenochrophis piscator* were found to have a strong preference for riparian vegetation.

Coluber mucosus was the commonest among the snakes collected /sighted throughout the study area. *Elaphe helena* was recorded only once from Nilambur. The decayed fallen logs, heap of stones and decayed leaves were the abodes of Wolf snakes *(Lycodon* spp.). Kukri snake *(Oligodon taeniolatus)* was seen in Wayanad and Silent Valley under loose stones in rocky regions.

Krait *(Bungarus caeruleus),* Cobra *(Naja naja)* and Viper *(Vipera russelli)* were not sighted in the field,, but dead specimens brought by the locals revealed the occurrence of these in the area. Coral snake *(Calliophis bibroni)* was located in a rocky region in Wayanad. Murthy (1993) considered this as rare. *Calliophis nigrescens* was collected from Silent Valley national park and was a colour variant (Thomas and Easa, 1997b).

A King cobra was caught by the Forest Department from Wayanad but was not sighted in any other place, though it was said to be common in Silent Valley, Nilambur and Muthikkulam. The hump-nosed pit viper, *Hypnale hypnale* was commonly associated with plantations and deciduous forests in Nilambur. Majority of the sightings of Malabar rock pit viper *(Trimeresurus malabaricus)* were near streams in various localities.

Beddome (1962) described a new species of gecko from Silent Valley. Murthy (1981 and 1986) documented 24 species of reptiles from this region. Thomas and Easa (1997 a) published an additional list of eleven species of reptiles from this area. Present survey documented hventy four species. Twelve species reported earlier from Silent Valley were not seen during this study. These

are *Cnemaspis sisparensis, Calotes calotes, Sphenomorphus dussumieri, Mabuya beddomii, Coluber mucosus, Melanophidium punctatum, Dendrelaphis grandoculis, Lycodon aulicus, Macropisthodon plumbicolor, Xenochrophis piscator, Bungarus caeruleus* and *Trimeresurus strigatus.*

Murthy (1978) reported the occurrence of a new sub species of tree lizard in the New Amarambalam area. Murthy (1981 and 1983b) mentioned the occurrence of twenty two species of reptiles in Nilambur. Present surveys documented thirty three species of reptiles from Nilambur. We could not find a few of the species reported by Murthy (1981). *Chrysopelea ornata, Ahaetulla pulverulenta, Lycodon aulicus, Dendralaphis grandoculis, C. indica, C. sisparensis, C. littoralis* and *Sphenomorphus dussumieri* were the missing ones in the area probably due to their rarity and hiding nature.

Beddome (1863 and 1876) reported three new Uropeltids from Wayanad. Wall (1918) listed 43 species of snakes from Nilgiri - Wayanad area. Most of these were very common in the area as evident from the number of specimens he had collected. Present survey in Wayanad documented forty four species of reptiles. We could not document twenty species of snakes documented by Wall (1918) as common. The rarity of the species may be due to the increase in the number of settlements and human disturbances leading to loss of their habitats.

4.2 Habitat preference

Deciduous forests had the highest frequency of both the amphibians and reptiles (33.33% and 48.21% respectively). This was followed by evergreen forests with a frequency of 22.22% for amphibians and 21.43% for reptiles (Tables 5 and 6).

Table 5. Percentage frequency of occurrence of amphibians in different habitats

Habitat	Percentage N=84
Evergreen	21.43
Deciduous	32.14
Semi-evergreen	19.05
Plantation	20.24
Grassland	7.14

Table 6. Percentage frequency of occurrence of reptiles in different habitats

Habitat	Percentage N=56
Evergreen	21.43
Deciduous	48.21
Semi-evergreen	14.29
Plantation	10.71
Grassland	5.36

The Abundance Index for amphibians in different habitats indicate a high value in plantations followed by semi-evergreen forests. (Table 7). Evergreen and deciduous forests had more or less equal abundance. The higher index values in plantations could be due to the higher number of plots in vayals (marshy areas) which are mostly located in the midst of plantations in Wayanad. The plots in the plantations in Manchery in New Amarambalam. with a lot of under growth also must have contribute to this. Reptile abundance was high in deciduous forests followed by evergreens.

Table 7 Abundance index for reptiles and amphibians in different habitats

Habitat	AMPHIBIANS	REPTILES
Evergreen	1.90	0.60
Deciduous	1.96	1.00
Semi-evergreen	2.96	0.33
Plantation	3.30	0.30
Grassland	0.50	

4.3 Microhabitat preferences

The preferred microhabitats of amphibians were the leaf litter (39.96%), followed by the grass (21%). Most of the species, especially the ranids showed a high affinity to water. The results are presented in Table 8.

Table 8. Percentage frequency of occurrence of amphibians in different micro habitats

Microhabitat	Amphibians N=538	Reptiles N=577
Leaf litter	39.96	23.05
Under boulder	15.80	01.92
Shrub	03.90	10.57
Bare ground	02.05	14.73
Tree trunk	01.30	26.00
Under log	04.46	05.89
Grass	21.00	02.25
Water	11.53	--
Near Water	--	09.53
On rock	--	06.06

The Chi square test conducted indicated that the values are for different microhabitats are highly significant. ($\chi 2$= 521.4796, P<0.01) for amphibians and for reptiles ($\chi 2$=309.4454,p<0.01)

Table 9. Percentage frequency of occurrence of selected amphibians in different microhabitats

Species	LL	Grass	UL	BG	OR	W	UB
Bufo melanostictus	69.07	26.92	03.86	-	-	-	-
Rana beddommii	62.90	14.52	11.29	04.84	06.45	-	-
Rana temporalis	54.76	15.48	-	-	-	17.86	11.90
Micrixalus nudis	58.33	08.33	-	-	-	16.67	16.67

LL-Leaf litter, UL-Under log, BG-Bare ground, OR-On rock.
W-Water. UB- Under boulder, - No sightings

Bufo melanostictus, Rana beddotnii, Micrixalus nudis and *Rana temporalis* had a high preference for leaf litter (Table 9). Reptiles had a high preference for tree trunk followed by leaf litter (Table 8). *Calotes rouxi* and *Cnemaspis kandianus* preferred the tree bark. C. *wynadensis* was observed more on the emerged rocks in the streams. Leaf litter was preferred by *Mabuya carinata, M.macularius* and *Ristella beddoinii.* The pit viper *(T malabaricus)* showed high affinity to the boulders and rocks in\near the stream (Table 10).

Table 10. Percentage frequency of occurrence of selected reptiles in different inicrohabitats

Species	LL	BG	UL	OR	NW	TT	Shrub	UB
M.macularius	79.07	09.30	03.49	04.65	00.00	00.00	03.49	00.00
M.carinata	47.06	23.53	02.94	17.65	00.00	02.94	02.94	02.94
Cnemaspis kandianus	08.00	02.67	13.32	00.00	08.00	62.67	02.67	02.67
C. wynadensis	00.00	00.00	34.79	00.00	47.83	08.69	00.00	08.69
Calotes rouxi	11.24	00.00	02.61	00.00	00.00	65.80	20.35	00.00
Ristella beddomii	56.25	06.25	10.42	08.33	00.00	00.00	16.67	02.08
Trimeresurus malabaricus	00.00	03.57	00.00	0.00	60.71	32.14	03.57	00.00

LL-Leaf litter, BG-Bare ground,UL-Under log, OR-On rock NW - Near Water
TT, Tree trunk,UB- Under boulder, - No sightings

4.4 Richness, evenness and diversity

Ludwig and Reynolds (1988) have discussed different methods for computing various indices of species richness, diversity and evenness. Krebs (1989) has discussed the applications and limitations of these methods in detail.

Analyses for the richness indices for amphibians indicated that deciduous forest was rich with more number of amphibians in terms of species and individuals. Evergreen and semi evergreen forests were more or less equally rich (Table 11). The diversity indices also indicate deciduous forest as the most diverse habitat followed by semi-evergreen forest. Lambda value followed the same pattern. which decreases with increasing diversity (Table 12). Deciduous forest was also

rich with more number of abundant species as evident from the high N_1 and N_2 values.

Table 11. Richness indices of Amphibians in different habitats

Habitat	Indices	
	R_1	R_2
Evergreen	1.996	1.213
Semi evergreen	1.870	1.060
Deciduous	2.738	1.453
Plantation	0.868	0.948

Habitat	Indices			
	λ	H_1	N_1	N_2
Evergreen	0.215	1.736	5.678	4.638
Semi evergreen	0.190	1.842	6.309	5,256
Deciduous	0.128	2.160	8.671	7.803
Plantation	0.444	0.801	2.229	2.250

The area wise analyses for richness (Table 13) of amphibians indicated that Nilambur had high value followed by Muthikkulam and Siruvani. All the remaining study sites had more or less equal value. The diversity indices followed the same pattern (Table 14). In the case of reptiles, deciduous habitat was found to be rich (Table 15) and diverse (Table 16).

Table 13. Amphibian Richness indices in different areas

Area	Indices	
	R_1	R_2
Wayanad	1.795	0.970
Silent Valley	1.271	0.846
Muthikulam	1.970	1.527
Nilambur	6.469	1.293

Table 14. Diversity indices of Amphibians in different Areas

Area	Indices			
	λ	H1	N1	N2
Wayanad	0.181	1.860	6.424	5.521
Silent Valley	0.446	11.120	3.067	2.246
Muthikulam	0.185	1.699	5.470	5.384
Nilambur	0.135	2.143	8.525	7.368

Table 15. Reptile richness in different Habitats

Habitat	Indices	
	R1	R2
Evergreen	2.037	1.605
Semi evergreen	1.820	1.4I4
Deciduous	2.518	2.510
Plantation	1.442	1.414

Table 16. Diversity indices of Reptiles in different habitats

Habitat	Indices			
	λ	H_1	N_1	N_2
Evergreen	0.333	1.410	4.090	3.000
Semi evergreen	0.194	1.427	4.166	5.142
Deciduous	0.137	2.096	8.137	7.291
Plantation	0.357	1.073	2.925	2.800

area wise analyses for richness (Table 17) and diversity (Table 18) indices for reptiles indicated that Nilambur was the richest followed by Silent Valley national park. Wayanad also had more or less same richness value.

However, Silent Valley had more very abundant species as indicated by the high value of N2.

Table 17. Reptile richness in different Areas

Habitat	Indices	
	R_1	R_2
Wayanad	2.164	1.750
Silent Valley	2.817	2.309
Muthikulam	1.027	1.133
Nilambur	3.290	1.941

Table 18. Diversity indices of Reptiles in different Areas

Habitat	Indices			
	λ	H_1	N_1	N_2
Wayanad	0.208	1.628	5.096	4.800
Silent Valley	0.106	1.907	6.734	9.428
Muthikulam	0.476	0.796	2.217	2.100
Nilambur	0.164	2.111	8.263	6.082

The evenness values are more difficult to interpret (Ludwig and Reynolds, 1988). The most appropriate index among the five are Hill's ratio (E_4) and modified Hill's ratio (E_5). In plantation, dominance of certain species were observed where as in all other habitats the amphibians were more or less equally distributed (Table 19). In the case of reptiles. E_4 and E_5 showed the dominance of certain species in semi evergreen forests(Table 20).

Table 19. Evenness indices of Amphibians in different habitats

Habitat	Indices				
	E_1	E_2	E_3	E_4	E_5
Evergreen	0.790	0.630	0.584	0.816	0.777
Semi evergreen	0.838	0.701	0.663	0.833	0.801
Deciduous	0.842	0.667	0.639	0.899	0.886
Plantation	0.729	0.743	0.614	1.009	1.016

Table 20. Evenness indices of Reptiles in different habitats

Habitat	Indices				
	E1	E2	E3	E4	E5
Evergreen	0.724	0.585	0.516	0.732	0.645
Semi evergreen	0.886	0.833	0.791	1.234	1.308
Deciduous	0.874	0.739	0.713	0.895	0.881
Plantation	0.774	0.731	0.641	0.957	0.934

Table 21. Evenness indices of Amphibians in different Areas

Area	Indices				
	E_1	E_2	E_3	E_4	E_5
Wayanad	0.846	0.713	0.678	0.859	0.833
Silent Valley	0.625	0.511	0.413	0.730	0.600
Muthikulam	0.873	0.781	0.745	0.984	0.980
Nilambur	0.862	0.710	0.684	0.864	0.846

TabIe 22. Evenness indices of Reptiles in different Areas

Area	Indices				
	El	E2	E3	E4	E5
Wayanad	0.836	0.728	0.682	0.941	0.927
Silent Valley	0.170	0.841	0.811	1.399	1.469
Muthikulam	0.724	0.739	0.608	0.947	0.903
Nilambur	0.800	0.590	0.558	0.736	0.699

The area wise analyses for evenness indicated that the amphibians (Table 21) showed an even distribution in all study sites. In the case of reptiles. certain species dominated in Silent Valley national park (Table 22). The reptiles were evenly distributed in all the other areas.

4.5 Correlation with environmental parameters

In the case of amphibians, abundance is negatively correlated with altitude. canopy, distance to water source, humus nature, number of shrubs. trees, temperature and slope. Number of logs, humidity, number of grass clumps and number of herbs have a positive correlation with the abundance (Table 23).Altitude,

Table 23. Correlation matrix of amphibians with environmental parameters

	NOOFSP	ALTITU	CANOPY	DTWATE	HUMIDI	HUMONS	NOGRAS	NOHERB	NOSHRU	NOLOGS	NOTREE	SLOPE
NOOFSP	1.0000											
ALTITU	-0.1879'	1.0000										
CANOPY	-0.0817	0.1346	1.0000									
DTWATE	-0.0444	0.1719	-0.1544	1.0000								
HUMIDI	0.0568	-0.0629	0.1370	-0.1665	1.0000							
HUMONS	-0.1218	0.0190	0.0095	-0.1035	0.1479	1.0000						
NOGRAS	0.0123	-0.2569**	-0.2007'	0.1122	-0.0475	-0.0676	1.0000					
NOHERB	0.1240	-0.0351	0.0554	-0.0511	0.1418	-0.0136	-0.0020	1.0000				
NOSHRU	-0.1392	-0.1474	0.2024*	-0.0942	0.0998	0.0068	0.1553	-0.0860	1.0000			
NOLOGS	0.1650'	-0.0348	-0.0985	-0.0146	0.0963	-0.0572	-0.0422	0.5595**	-0.0607	1.0000		
NOTREE	-0.1108	0.3580**	0.3184**	0.1026	-0.0700	-0.0772	-0.1956*	-0.0831	0.0477	-0.0535	1.0000	
SLOPE	-0.0325	-0.2919**	0.1588	-0.1074	0.0507	-0.1343	-0.0206	-0.0013	0.0274	-0.0766	0.0327	1.0000
TEMPER	-0.0061	-0.0949	-0.1447	-0.0164	-0.1839*	-0.0134	0.0626	0.0889	-0.2141'	-0.0299	0.0647	-0.0607

Table 24. Correlation matrix of reptiles with environmental parameters

	NOOFSP	ALTITU	CANOPY	DTWATE	HUMIDI	HUMONS	NOGRAS	NOHERB	NOSHRU	NOLOGS	NOTREE	SLOPE
NOOFSP	1.0000											
ALTITU	-0.2488**	1.0000										
CANOPY	0.0326	0.1346	1.0000									
DTWATE	0.0421	0.1719	-0.1544	1.0000								
HUMIDI	-0.0089	-0.0629	0.1370	-0.1665	1.0000							
HUMONS	-0.0047	0.0190	0.0095	-0.1035	0.1479	1.0000						
NOGRAS	-0.1191	-0.2569''	-0.2007*	0.1122	-0.0475	-0.0676	1.0000					
NOHERB	0.1889'	-0.0351	0.0554	-0.0511	0.1418	-0.0136	-0.0020	1.0000				
NOSHRU	-0.0670	-0.1474	0.2024*	-0.0942	0.0998	0.0068	0.1553	-0.0860	1.0000			
NOLOGS	0.3090**	-0.0348	-0.0985	-0.0146	0.0963	-0.0572	-0.0422	0.5595**	-0.0607	1.0000		
NOTREE	-0.0505	0.3580**	0.3184**	0.1026	-0.0700	-0.0772	-0.1956'	-0.0831	0.0477	-0.0535	1.0000	
SLOPE	0.2393**	-0.2919**	0.1588	-0.1074	0.0507	-0.1343	-0.0206	-0.0013	0.0214	-0.0766	0.0327	1.000
TEMPER	0.0150	-0.0949	-0.1447	-0.0164	-0.1839'	-0.0134	0.0626	0.0889	-0.2141*	-0.0299	0.0647	-0.060

* - Signif 1.13 05 ** - Signif LE 01 (2-tailed)

humidity, humus nature, number of shrubs and number of trees are negatively correlated with the abundance in the case of reptiles. Species abundance is positively correlated with temperature, slope, number of logs, number of herbs, distance to water and canopy value (Table 24).

5. MANAGEMENT STRATEGIES

The study indicates the richness and diversity of herpetofauna in the study area. The microhabitat preferences of both the reptiles and amphibians for leaf litter. dead and decayed logs, and the tree trunk/bark point to the importance of conserving these to ensure the survival of the species. The dead and fallen trees should not be removed for any purpose. Special emphasis should also be given to conserve the vayals (marshy lands), which is the abode of herpetofauna ensuring complete protection from fire and other biotic disturbance. The drying up of the streams is another threat to the amphibians. The people residing in the fringes of the forest frequently kill even non-poisonous snakes due to their ignorance. An awareness programme would be beneficial to the people and these lower forms.

Some of the species recorded earlier could not be located in the present survey indicating either its total absence or rarity. It would be ideal to develop a system for monitoring these lower vertebrates. The Management Plans/Working Plans developed for the area should include programmes for the protection of the group by conserving the microhabitats.

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