Tropical Ecology **43**(2): 345-349, 2002 ISSN 0564-3295

Forest type mapping and vegetation analysis in part of Kolli hills, eastern ghats of Tamil Nadu

S. JAYA KUMAR, D.I. AROCKIASAMY* & S. JOHN BRITTO

Centre for Natural Resources Study, St. Joseph's College (Autonomous), Tiruchirapalli – 2, Tamil Nadu, India

Key words: Change detection, Kolli hills, remote sensing, species diversity, vegetation mapping, vegetation analysis.

One of the recent forest cover estimates in Tamil Nadu by Forest Survey of India points out that the TN has a forest area of 2.26 million ha, which constitutes 17.40% of the state. Among them only 1.71 million ha is under actual forest cover, which is 13.10% of the total geographical area. This recent assessment of forest cover status on 1: 250,000 scale revealed that dense forest occupies 0.86 million ha, open forest occupies 0.84 million ha and mangroves occupy 0.002 million ha (FSI 2002). Though there is an increase in the actual forest cover between 1972-95 (1.67 to 1.71 million ha) (Anon. 1983, 1997); the dense forest cover has been decreasing considerably from 1972 – 1999 (1.35 to 0.86 million ha) (Anon. 1983; FSI 2002). These figures pointed out the increasing pressure on forest. In Tamil Nadu the major forest areas are distributed in to western and eastern ghats. When compared western ghats, eastern ghats experiences heavy pressure from all side from the people for fuel wood, fodder, medicinal plants and illicit felling, thereby loosing its forest cover at an unprecedented rate. According to Champion & Seth (1968) the vegetation of eastern ghats comes under Tropical dry deciduous type. However, evergreen and semi-evergreen forests are also occurring in the high altitude of various hills. Though Forest Survey of India estimates forest cover status of entire India for every two years there are some limitations in their assessment. The scale is on 1:250,000 and the classified map will state only the forest density not the types. With reference to phyto-sociological study eastern ghats attain very poor attention from the scientific community. Very few studies reported include Kadavul & Parthasarathy (1993, 1999). Vegetation mapping using remote sensing data has more advantages over conventional ground survey method and it has been well exploited in many studies (Pant *et al.* 1992; Porwal & Pant 1989; Prowal & Roy 1992; Roy *et al.* 1985; Unni *et al.* 1983). Most of these studies had been carried out only for forest mapping and no phyto-sociological studies were carried out which is an inseparable component of the forest ecosystem. The present study was undertaken to map the forest cover status, and the change it has undergone between a period of ten years and to identify the present phyto-sociological status of various forest types in the puliyanjolai reserved forest of Kolli hills, eastern ghats of Tamil Nadu.

Puliyanjolai reserved forest (PRF), located at the eastern aspect of Kolli hills, belongs to Namakkal district, covering an area of about 2806 ha. The geographical coordinates of PRF is between 11°14′18″ to 11°19′00″ N and 78°22′37″ to 78°28′00″ E. Based on the meteorological data maintained in the nearby station at Padasolai the average maximum and minimum temperature is 35 and 18°C respectively. The mean annual rainfall is 1318 mm. The altitude is ranging from 200

* *Corresponding Author*

m at the foothill to 1190 m at the plateau. This reserved forest harbors semi-evergreen forest on top, deciduous forest at the middle elevation, southern thorn and *Euphorbia* scrub forests at the foothill.

In this study, IRS 1C LISS III digital data of 26th February 1999 of Path: 101 and row: 65, Landsat TM digital data of 23 April 1990 of Path: 143 row 52, Survey of India Topo sheets No. 58 I/7 and secondary data were used to prepare the forest type map on 1: 50,000 scale for 1990 and 1999. After necessary radiometric and geometric corrections using *ERDAS IMAGINE 8.3.1* False color composite (FCC_s) were prepared from the digital data of LISS III and TM with the following band combinations 2, 3,4 and 1, 2, 3 in RGB respectively. To avoid misclassification, the PRF is subset from the FCC using the vector boundary. On-screen visual interpretation method was followed to prepare forest type map from 1990 and 1999 FCC_s. Intensive field verification check was carried out and corrections were made. Field check for 1990 classified data was performed mostly on the unchanged area and finalized. Change detection analysis was carried out to quantify the changes in the area of different forest types between 1990 and 1999 using *ERDAS IMAGINE 8.3.1*- GIS module (Figs. 1 & 2).

In order to understand the vegetation status, quadrat study (20 x 20 m size) was carried out in each forest type. A total of 40 randomly distributed quadrats were studied in four forest types (10 quadrats in each forest type) and the present diversity status of different forest types were estimated. The riverain forest was left in the present study because of inaccessibility. In the quadrat study only tree species which are ≥30 cm girth at breast height (gbh) were measured. Voucher specimens for each

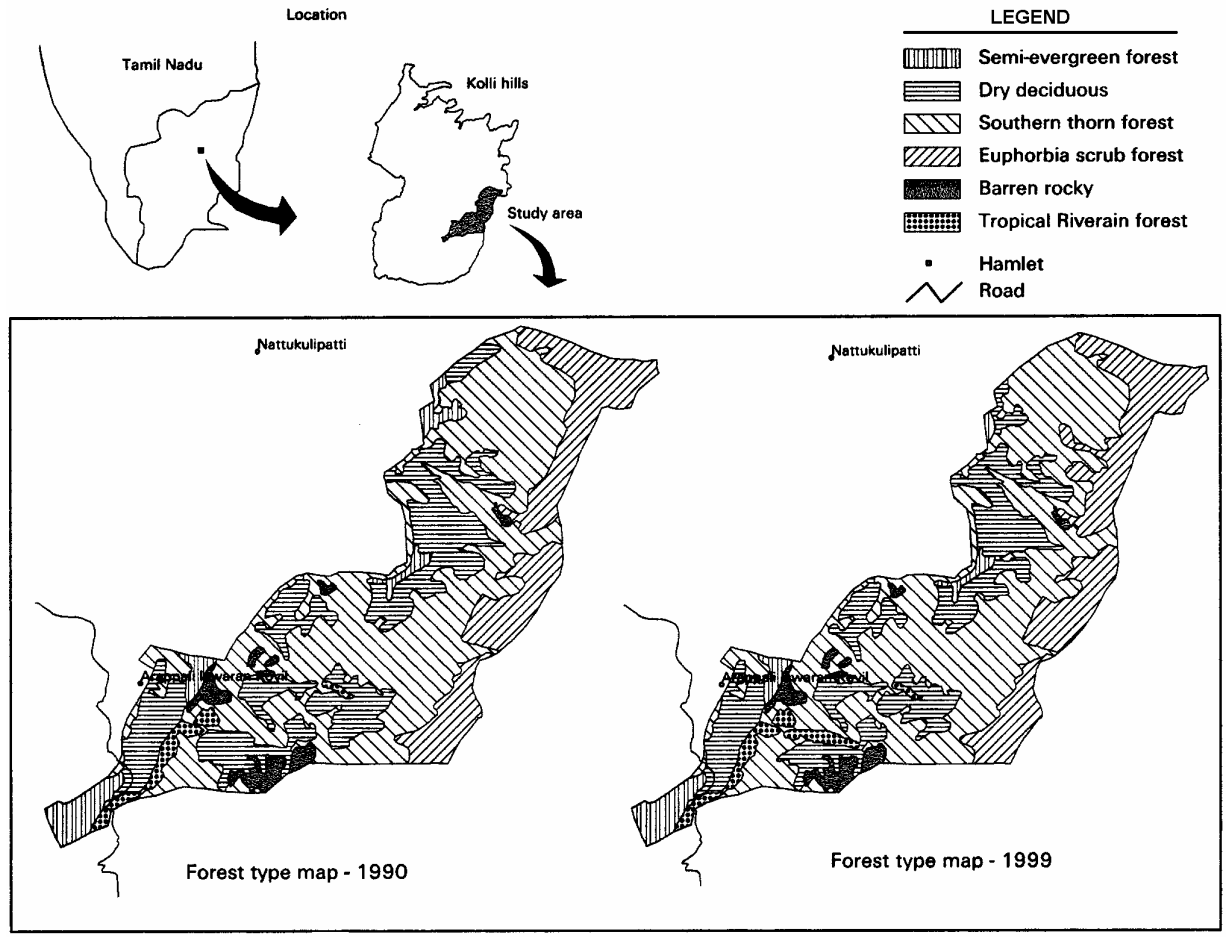

Fig. 1. Forest type map of Puliyanjolai reserved forest – 1990 and 1999.

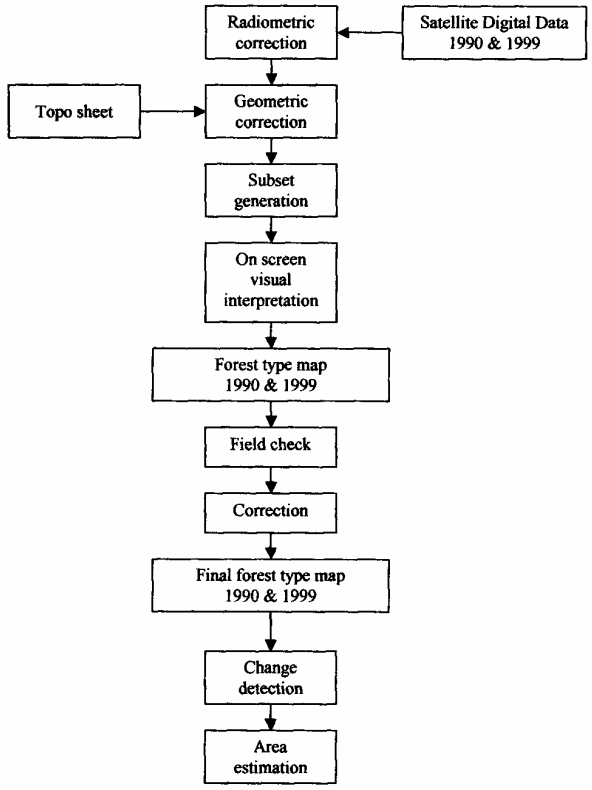

Fig. 2. Paradigm for forest type mapping and change detection.

recorded species were collected for identification. Apart from field identification, the names of species were further confirmed with the Flora of Tamil Nadu Carnatic (Mathew 1983). The standard diversity indices like relative density, relative frequency were calculated according to Balslev *et al.* (1987). Shannon and Weaver index was calculated as per Shannon & Weaver (1949) and Simpson index was calculated as per Magurran (1988).

In the PRF, five forest types could be delineated from the FCC of 1999 and 1990 and the area of each forest type is also estimated. The semi-evergreen forest occupies 113.04 ha during 1999 shows a change of about 20.82 ha when compared to 1990. The total forest cover under deciduous forest during 1999 is 628.24 ha and the net change in this type is the maximum of 49.97 ha (Table 1). The southern thorn and *Euphorbia* scrub forest show increase in their forest area 18.56 and 34.57 ha respectively in 1999 when compared to 1990. The increase in the riverain forest during 1999 is about 19.08 ha. The change detection analysis shows the rate of degradation in semi-evergreen and deciduous forests, which is 2.08 and 4.99 ha per year. The possible reasons that could be attributed to the degradation include to the intensive fuel wood, fodder extraction, clearing forest for agriculture, illicit felling, etc., by the local people. The inaccessibility to riverain forest favors the increase in its forest area considerably. The results of phyto-sociological analysis carried out in all the forest types except riverain forest are shown in Tables 1 & 2. In the semi-evergreen forest 22 tree species have been recorded which belong to 21 genera and 18 families. In the deciduous forest, 19 tree species have been recorded which belong to 18 genera and 17 families. In the southern thorn and *Euphorbia* scrub forest 12 and 4 tree species have been recorded.

Except basal area contribution, other diversity indices between semi-evergreen and deciduous are almost similar (Table 1). In the semi-evergreen forest *Scolopia crenata* contributes maximum stand density (30) followed by *Prunus ceylanica* (15) and *Syzygium cumini* (15). However, *Myrstica dactyloides* contributes maximum basal area (6.165 m^2) than all the other species though it is

Table 1. Forest types and their area in 1990, 1999 and the changes and various diversity indices recorded in the different forest types of Puliyanjolai reserve forest.

Forest types	1990 area (ha)	1999 area (ha)	Change (ha)	Species recorded	Genera recorded	Families recorded	Stand density	Total BA (m^2)	Shannon diversity index	Simpson diversity index
Semi-evergreen	133.86	113.04	– 20.82	22	21	18	136	28.124	2.589	0.1029
Deciduous	678.21	628.24	– 49.97	19	18	17	139	5.1306	2.484	0.1150
Southern thorn	1387.21	1406.42	+ 18.56	12	11	10	59	1.6120	2.188	0.1295
Euphorbia scrub	473.99	506.20	+ 34.57	4	4	4	17	0.2840	0.916	0.5291
Riverain	53.73	72.81	+ 19.08	–	–	–	–	–	–	–
Barren rocky	78.64	79.45	+ 0.81	–	–	–	–	–	–	–

Table 2. Stand density, frequency, basal area and importance value index recorded in some important tree species of different forest types.

Species name	Stand density	Frequency (%)	Basal area (m^2)	Importance value index
Semi-evergreen				
Terminalia paniculata	11	60	2.265	25.97
Myrstica dactyloides	9	20	6.165	31.816
Scolopia crenata	30	70	2.610	40.68
Prunus ceylanica	15	50	3.793	32.71
Syzygium cumini	15	70	1.099	26.41
Deciduous				
Spondias pinnata	32	30	0.961	48.28
Anogeissus latifolia	19	50	1.289	49.66
Albizia amara	10	40	0.522	26.08
Buchanania axillaris	20	30	0.390	28.52
Southern thorn				
Canthium dicoccum	5	30	0.0568	22.34
Commiphora caudata	12	40	0.324	54.25
Moringa oleifera	8	40	0.333	47.86
Albizia amara	7	50	0.155	38.76
Euphorbia scrub				
Euphorbia antiquorum	12	70	0.197	203.59

represented by 9 individuals. *Scolopia crenata* has been recorded in seven quadrats thereby gaining maximum frequency and important value index values. In the case of deciduous forest *Spondias pinnata* contributes the maximum number of individuals (32). *Anogeissus latifolia* has been recorded in 5 quadrats, represented by 19 individuals which contributes maximum basal area (1.289 m^2) and maximum importance value index (49.66). The *Buchanania axillaries* and *Albizia amara* contribute 20 and 10 individuals to the stand density respectively. Though the stand density recorded in deciduous forest is 139 the corresponding basal area contribution by these stems is very poor (5.130 m^2). The gbh value for 132 stems are between 30 and 100 cm which indicates the deciduous forest is in its early succession stage. Though southern thorn forest occupies relatively more area (1406.42 ha) in the PRF it is very poor in terms of species richness and stand density. Only 12 species have been recorded from this forest type. The total stand density is 59 and the total basal area contributed by these stems is 1.612 m^2. In the *Euphorbia* scrub forest 4 species have been recorded. It is very difficult to find trees in this forest type. The total stand density recorded is 17. The Shannon and Simpson diversity indices of semi-evergreen, deciduous, and southern thorn forest types are almost similar stating that the tree diversity in these forest types is low (Table 1).

In the present study forest type maps of 1990 and 1999 and the change detection between these periods (Fig. 1) portrayed the status of different forest types and their rate of change/degradation (Table 1). Among the five forest types semi-evergreen and deciduous forest types experience considerably high pressure from the local people. The deciduous forest is in its early succession stage (gbh mostly 30-100 cm) needs severe protection for further growth and establishment. These pressure not only results in the degradation of these forests but also affects the regeneration potential. Though vegetation mapping in any region on large scale could provide spatial information on forest cover and type it is necessary to conduct the phyto-sociological study in different forest types to understand the diversity and distribution of species, which are very much important for planning conservation strategies.

Acknowledgements

The authors acknowledge the Ministry of Environment and Forests, New Delhi, for funding this study through a research project entitled "Evaluation of Natural Resources and Environment of the Kolli Hill, Tamil Nadu Using Remote Sensing and Geographical Information System". (Sanction No. 13/03/97-EI dt. 31.03.97). We also acknowledge the help received from Tamil Nadu Forest Department.

References

Annon. 1983. *Mapping of Forest Cover in Satellite Imagery 1972-75 and 1980-82*. Summary Report, National Remote Sensing Agency, Department of Space, Govt. of India, Hyderabad.

Annon. 1997. *The State Forest Report 1997*. Forest Survey of India, Ministry of Environment and Forests, Govt. of India.

Balslev, H., J. Luteyn, B. Ollguard & L.B. Holm-Neilson. 1987. Composition and structure of adjacent unflooded and floodplain forest in Amazonian Ecuador. *Opera Botanica* **92**: 37-57.

Champion, H.G. & S.K. Seth. 1968. *A Revised Survey of Forest Types of India*. Govt. of India Press.

Forest Survey of India (FSI). 2002. http//:www.fsiorg.in

Kadavul, K. & N. Parthasarathy. 1993. A quantitative inventory of plant biodiversity in the semi-evergreen forest of Shervaroy hills, Eastern Ghats. Abstract. Proceedings of Annual Session of Academy of Plant Sciences, India. Seminar on *Biodiversity Strategies for Conservation and Future Challenges,* Oct. 1993. Bharathiar University, Coimbatore.

Kadavul, K. & N. Parthasarathy. 1999. Structure and composition of woody species in tropical Semi-evergreen forest of Kalrayan hills, Eastern Ghats, India. *Tropical Ecology* **40**: 247-260.

Magurran, A.E. 1988. *Ecological Diversity and its Measurements*. Princeton University Press, New Jersey.

Matthew, K.M. 1983. *The Flora of the Tamil Nadu Carnatic*. Diocesan Press, Chennai, India.

Pant, D.N., K.K. Das & P.S. Roy. 1992. Mapping of tropical dry deciduous forest and landuse in part of Vindyan range using satellite remote sensing. Photonirvachak, *Journal of the Indian Society of Remote Sensing* **20**: 9-20.

Porwal, M.C. & D.N. Pant. 1989. Forest cover types and land use mapping using landsat thematic mapper false color composite – A case study for Chakrata in western Himalayas, U.P. Photonirvachak, *Journal of the Indian Society of Remote Sensing* **17**: 33-40.

Porwal, M.C. & P.S. Roy. 1992. Vegetation type discrimination of landsat TM data in heterogeneous forested landscape of Western Ghats – Accuracy evaluation from large scale aerial photo maps. Photonirvachak, *Journal of the Indian Society of Remote Sensing* **20**: 21-33.

Roy, P.S., R.N. Kaul, M.R. Sharma & S.S. Garbyal. 1985. Forest type stratification and delineation of shifting cultivation area in eastern part of Arunachal Pradesh using landsat MSS data. *International Journal of Remote Sensing* **6**: 411-418.

Shannon, C.E. & W. Weaver. 1949. *The Mathematical Theory of Communication*. Urbana, Univ. Illinois Press.

Unni, N.V.M., P.S. Roy & V. Parthasarathy. 1983. Feasibility of mapping economically important forest species by landsat data. Photonirvachak, *Journal of the Indian Society of Remote Sensing* **11**: 37.