

Landscape level floral biodiversity characterisation and estimation in shendurney wildlife sanctuary using remote sensing and gis techniques

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SUMMARY : Shendurney Wildlife Sanctuary, part of Agasthyamalai Biosphere Reserve is one of the richest areas of biodiversity in the Western Ghats, the biotic richness and distinct biographic features making it an ideal gene pool reserve. Shendurney Wildlife Sanctuary has substantial natural vegetation ranging from the southern secondary moist mixed deciduous forest to southern subtropical hill forest. Remote sensing, with its advantage of spatial, spectral and temporal availability of data covering large and inaccessible area within short time has made it a very rapid and cost effective tool in assessing, monitoring and conserving our natural resources. With an aim of assessing the floral biodiversity of the sanctuary at the landscape (vegetation class) level, remote sensing based supervised classification technique was carried out on IRS P6 LISS III digital imagery. Quantification of each vegetation class was then carried out on the classified image using the tool of GIS which was substantiated with extensive ground survey. The results indicated that more than 40% of the vegetation in Shendurney Wildlife sanctuary falls under the semi-evergreen category followed by evergreen vegetation which comes to 30 % of the total area. Other classes identified include reed brake (3.37 %), grass land (3.30 %) and water-bodies (10.22 %). A fraction of 0.1 % and 2.3 % of the area depicted cloud cover and shadow regions in the imagery, respectively. A Kappa analysis was also performed to estimate the thematic accuracy of the classified image, using the Kappa co-efficient, which is a measure of agreement between classification and verification.

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Natural forests are home to a plethora of biological resources on which the man kind depend, for their basic existence and sustainable development. Conservation of natural forests involves wise and careful management of resources to obtain maximum possible social benefits for present and future generations. Appropriate use of modern technologies like Geographic Information System (GIS) and Remote Sensing, in mapping, monitoring and modelling of forest resources, aids in the effective planning and management of a forest area (World Bank, 1997). The Western Ghats is one of the 25 global biodiversity hotspots and lying towards its southern tip is the Agasthyamalai region, of which,

the Shendurney Wildlife Sanctuary is a component. This study aims to estimate the floral biodiversity in the sanctuary at the landscape (vegetation class) level using the tools of remote sensing and GIS, the results of which can be made use of in formulating conservation measures in the sanctuary.

The study area :

Shendurney Wildlife Sanctuary, part of Agasthyamalai Biosphere Reserve is one of the richest areas of biodiversity in the Western Ghats, the biotic richness and distinct biographic features making it an ideal gene pool reserve. The etymological meaning of the name Shendurney is

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derived from a tree locally called Chenkurinjy (*Gluta travancorica*) which is an endemic tree confined to this tract. The area lies between 76° 59' 30" and 77° 16' 30" East longitude and 8° 44' and 9° 14' North latitude in the western slope of Western Ghats in the taluk of Pathanapuram in Kollam revenue district (Fig. A). Shendurney Wildlife Sanctuary has substantial natural vegetation ranging from the southern secondary moist mixed deciduous forest to southern subtropical hill forest. The tract is drained by a good number of rivers and tributaries; the main river being Shendurney and its tributaries Umayar, Parappar, and Uruliyar. The boundary of the sanctuary roughly coincides with the watershed boundary of Kallada reservoir in North, East and South faces.

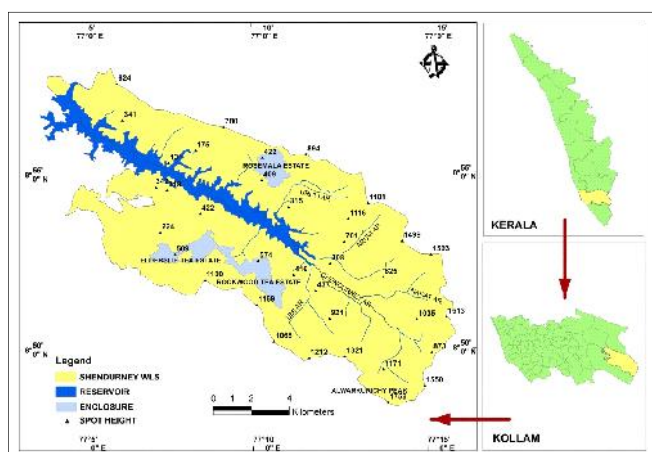


Fig. A : Location of the study area

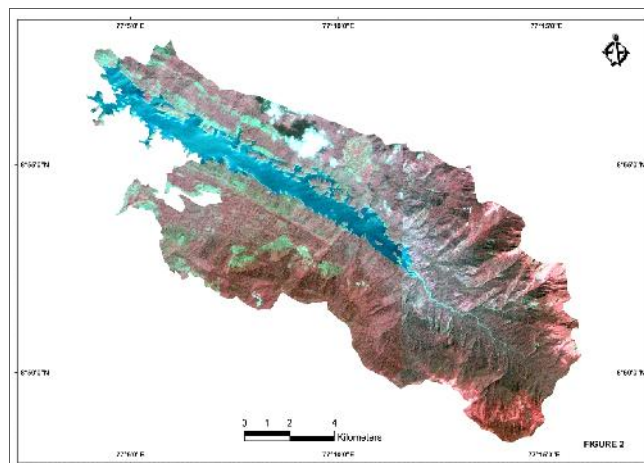


Fig. B : IRS P6 LISS IV Image of Shendurney wildlife sanctuary

for the study. The hardware used was Workstation Arc INFO with the required configurations.

In order to achieve a quantitative estimation of the vegetation in the sanctuary, the digital data was subjected to supervised classification technique wherein individual pixels are assigned to specific classes based on the known spectral characteristics of the vegetation. Three basic steps involved in supervised classification process. In the first step, the training areas are identified in the imagery and a numerical description of the spectral attributes of the class or land cover type is developed. In the second step, each pixel is categorized into land cover class to which it closely resembles. If the pixel is not similar to the training data, then it is labelled as unknown. Finally, to estimate the thematic accuracy of any map, sample areas representing different categories of mapping units were selected randomly (Congalton *et al.*, 1983). Then these points were verified in the field and a one-to-one comparison of the categories mapped from all the datasets and ground truth were made. Accuracy of the classification of each dataset was expressed as an error matrix from which, the overall accuracy,

EXPERIMENTAL METHODOLOGY

The digital data used for the study purpose was IRS P6 LISS III digital image (Fig. B). The softwares used for the study included Erdas IMAGINE ver 9.2 and Arc GIS ver 9.3. Survey of India Toposheets of No. 58 H1 and H5 in 1: 50,000 scale were used for the generation of the base layers required

Table 1 : Accuracy estimation for supervised classification

Class name	Reference totals	Classified totals	Number correct	Producers accuracy	Users accuracy
Shadow	1	1	1	100.00%	100.00%
Cloud	1	1	1	100.00%	100.00%
Water	4	4	4	100.00%	100.00%
Reed brake	2	2	2	100.00%	100.00%
Hill top evergreen	4	6	4	100.00%	66.67%
Grassland	5	6	5	100.00%	83.33%
Semi evergreen	19	18	18	94.74%	100.00%
Moist deciduous	5	4	4	80.00%	100.00%
River channel	0	0	0	—	—
Evergreen	9	8	7	77.78%	87.50%
Totals	50	50	46		

Overall classification accuracy = 92.00% (Kappa (K[^]) Statistics = 0.8995)

Table 2 : Area-wise details of vegetation classes in Shendurney WLS

Sr. No.	Vegetation class	Area (sq.km.)	% to the total area
1.	Evergreen (including hilltop)	52.20	30.56
2.	Semi-evergreen	68.39	40.04
3.	Moist deciduous	17.04	9.97
4.	Reed brake	5.77	3.37
5.	Grassland	5.65	3.30
6.	Water	17.47	10.22
7.	Cloud	0.24	0.14
8.	Shadow	4.03	2.35
Total		170.79	100

the user’s accuracy and the producer’s accuracy were calculated (Congalton, 1991).

EXPERIMENTAL FINDINGS AND DISCUSSION

The supervised classification of image was done by assigning values to pixels based on the reflectance characteristics of different vegetations and the resultant supervised classification image of Shendurney is shown in

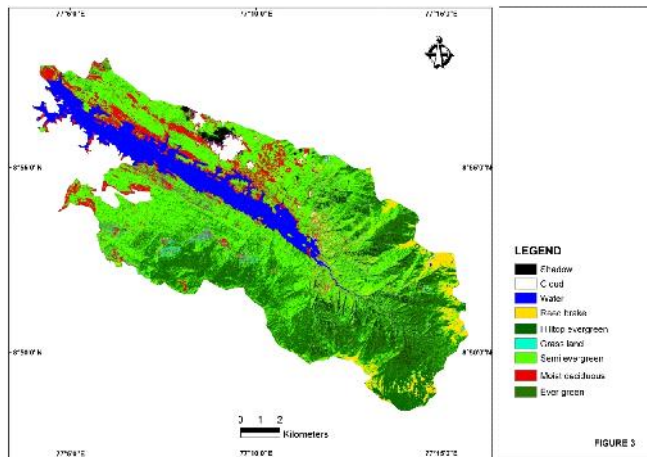


Fig. 1 : Mixed culture bacterial colonies growing on nutrient agar obtained from sampling of indoor air

Fig. 1. The results of the accuracy estimation by comparing the categories on the classified images with the areas of known identity on the ground are given in Table 1.

The classified image was then brought to the GIS platform for quantification of area of each class assigned in the digital image and the details are given in Table 2.

The results indicated that more than 40% of the vegetation in Shendurney Wildlife sanctuary falls under the semi-evergreen category followed by evergreen vegetation

which comes to 30 % of the total area. Other classes identified include reed brake (3.37 %), grass land (3.30 %) and water-bodies (10.22 %). A fraction of 0.1 % and 2.3 % of the area depicted cloud cover and shadow regions in the imagery, respectively.

Conclusion :

Remote sensing technique was utilized for the quantitative estimation of vegetation classes in Shendurney WLS for which supervised image classification methodologies were employed, wherein valuable data on the existing field conditions were obtained even in remote and inaccessible forest areas. The sanctuary was found to harbour luxuriant semi-evergreen vegetation in more than 40 % of the total area, followed by ever-green vegetation in more than 30 % of the area. The kappa accuracy test was carried out for the supervised image which indicated good results with an overall accuracy of 92 %. The modern tools of remote sensing and GIS, coupled with field studies, thus proves to be highly effective in the field of forestry and biodiversity studies.

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