

Mapping of Spatial distribution of sectors with underlying attributes in IHRML

GoI-GEF-UNDP
India High Range Mountain Landscape Project, Kerala

Submitted by

Sálim Ali Centre for Ornithology and Natural History
(Ministry of Environment, Forest and Climate Change, GoI)

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Anaikatti, Coimbatore- 641108



Final Report

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Authors

Executive Summary

Spatial mapping is the process of representation of geographic data (where it is on the earth) using a spatial tool platform such as Geographic Information System (GIS). The part of the Western Ghats (one of the global biodiversity hotspots), south of Palghat Gap with high places is one of the major endemic centers in the WG. The High Range Mountain Landscape (hereinafter referred to as HRML) situated in the humid tropical region of the state of Kerala, experiences a highly variable climate. Average annual rainfall in the rain-fed regions ranges from 3,000 to 7,030 mm, and in the rain shadow regions, it is as low as 1,270 mm. Anjanad and the adjoining landscape of the Southern Western Ghats are highly significant in terms of their ecological and cultural diversity, socio-economic profile, and development trajectory. Climate variability, increasing population density, pollution of fresh water, extensive monoculture plantations, heavy agro-chemical inputs in the plantation industry, water-intensive cardamom cultivation, particularly the high yielding varieties, are some of the challenges towards sustainability of this region. This assignment envisages the development of a spatial database with maps using the necessary tools. The project landscape covers 11 Grama Panchayaths and covers an area of 2,066.8 km², which includes six Protected Areas (PAs) with an area of 253.20 km².

The study has been designed to understand the pattern of vegetation in the landscape through fine-scale (high-resolution) satellite data with level V/VI classification and to study the temporal changes in land cover and land use of the HRML to understand the dynamics of the land resources. The major output of the activity will be a high-resolution spatial database (baseline data) for identifying future change detections and for multi-stakeholder management planning. This will also contribute to identifying high priority areas such as habitat for vulnerable species, designating areas for immediate interventions, conducting an inventory of ecological resources, ecosystem types, and facilitating the resource managers to take informed decisions.

The above-mentioned objectives were achieved using both topographic maps published by the Survey of India (preferably 1:25000 scale) and fine resolution (LISS IV; 5.8 m resolution) satellite data procured from the National Remote Sensing Centre (NRSC). Standard GIS protocols and tools were used for mapping and digital image interpretation, supported by ancillary data through ground trothing.

The baseline data for the project landscape was prepared using Survey of India Toposheets (1:25000 & 1:50000 scale) and online resources. The thematic layers such as administrative boundaries, road network, drainage network, slope, aspect, and elevation were prepared. The high-resolution satellite data (LISS IV) was procured from NRSC and mosaicked with the administrative boundaries, and necessary pre-processing analysis was carried out. Object Based Image (OBI) analysis and Support Vector Machine analysis, followed by ground truthing, were carried out to find out the land use and land cover classes of the landscape. A total of 52 landuse/landcover classes, both natural and man-made, were identified in the 11 Grama Panchayaths of the HRML. Among the 52 classes, 34 are natural landcover contributing 1529.68 km² (73.96%) of area and 538.50 km² (26.04%) of man-made landuses. Out of the natural landcover, primary landcover contributes 638 km² (41.7%) and secondary forests and other landcover constitute 891.68 km² (58.3%). Wet evergreen forests of low, medium, and high elevation occupy an area of 406.36 km² and montane evergreen (shola) forests cover 70.47km² of area. Montane grasslands, another unique habitat along with shola forests, spread to an area of 97.40 km². These two formations are largely restricted to Munnar, Devikulam, Kanthalloor, and Vattavada Panchayaths. The dry deciduous forests, the primary formation of the rain shadow area (Anjanad valley), extend to 76.83 km². The moist deciduous and degraded/semi-evergreen forests

contribute more (60.6%) to the secondary landcover of the landscape. They are predominant in Athirappilli and Kuttampuzha Grama Panchayaths.

The extent of man-made landuse, both production and non-production, occupies a significant percentage of the area. Among the plantations, commercial plantations (tea, rubber, oil palm, etc.) occupied an area of 215 km² and forest plantations (teak, eucalyptus, wattle, pine, etc.) spread to an extent of 160.88 km². As mentioned earlier, the teak plantation with luxuriant growth of moist deciduous species (around 86.06 km²) is not included under this. Apart from this, home garden (with houses) is another major (45.20 km²) landuse in the landscape. The built-up category, which included all the buildings, both commercial and associated infrastructures (roads and bridges), occupied an area of 22.21 km². Apart from the government agencies, private companies and individuals also planted extensive eucalyptus plantations in the landscape in Devikulam, Munnar, Kanthalloor, Vattavada and Chinnakanal Grama Panchayaths.

The time series analyses (change detection analysis) were carried out using open-source data on a decadal basis from 1990 to 2020 to understand the change in landuse and resultant land cover of the project landscape. For the year 1990 to 2010, we used Landsat data (30 and 15 m resolution) and for the year 2020, the current high-resolution data (LISS IV) was considered. The historical data was downloaded from open source (<https://earthexplorer.usgs.gov/>). A supervised classification protocol was used for the analysis.

Initially, 30 classes were identified using Landsat data, and later some of the closely related classes were grouped together and simplified to 24 landuse/landcover classes within the project landscape. Among the 24 classes, 19 are natural and five (plantation, tea, home garden, built-up and settlement) are man-made/modified. The natural landcover classes constitute about 75% of the area, whereas the man-made landcover classes are represented by 22.5% of the geographical area. Exposed rocks (rocky outcrops) contribute about 5% of the project landscape area. Among the natural landcovers, evergreen forests of various elevation ranges contribute 23% of the natural vegetation. Among the man-made formations, plantations of commercial and forest contribute 13%, and the remaining are built-up, cultural landscapes of local people and tribal hamlets.

The landuse and landcover of the project area are highly heterogeneous and support rich biological diversity and natural resources. The primary habitats in the landscape did not undergo much alteration over a period of time whereas man-made landuses had been increased in the project landscape. The quality of forest types in Kuttampuzha, Edamalakudy and Mankulam Grama Panchayaths has deteriorated significantly through cardamom plantations and the extraction of resources. Major changes happened in the revenue lands, where large-scale modifications towards built-up areas have been noticed in most of the panchayaths. The skewed ratio of natural vs man-made landuses in certain Panchayaths (e.g., Vattavada, Chinnakanal, etc.) needs strategies to strengthen sustainable development. The degraded formations of various landcover/landuse classes and forest plantations of eucalyptus and wattle may be targeted for restoration activities. Restoration activities would be one of the key strategies for minimising human-wildlife interactions. Since tourism has been recognised as one of the important economic activities of the project landscape, conservation of the structural integrity of the landscape has to be accorded higher priority. The dynamic nature of the landuse pattern in the grama panchayaths needs to be regularly monitored spatially with the support of technical agencies. Such information would help in addressing the sustainable development planning exercise, ensure livelihood security, and also minimise the impact of natural calamities. The

project landscape provides habitats for many threatened (IUCN) and unique species such as Nilgiri tar, tiger, elephant, guar, Nilgiri marten, grizzled giant squirrel, Malabar pied hornbill and Great Indian hornbill, and many other little-known but important species according to conservation and distribution status. The degradation and fragmentation of habitats will be a major detrimental factor for the survival of these species since they depend on critical habitats. The posterity of humankind would be secured in this landscape through sustainable development if adequate thrust had been given to the environmental and natural resources with the help of a well-defined spatial data based decision-making system.

