



Astronaut picture of western Tibet and the Himalaya looking west (space shuttle visible at the top). Photo: NASA.

(Images are available for viewing and downloading from the NASA website: <http://eol.jsc.nasa.gov/sseop/>).

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Vegetation Types of the Endangered Eastern Ghats Mountain Ecosystem in Southern Andhra Pradesh and Tamil Nadu, India.

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Vegetation and land cover information have been generally recognised as the basis for planning and management and for detailed habitat inventories. The design and execution of these comprehensive inventories of natural resources, coupled with scientific assessments using Remote Sensing and GIS tools, have often led to a clear definition of management priorities. Vegetation management depends upon several factors including classification of habitats and the regular monitoring of these habitats permits the detection of change in vegetation components and immediate surroundings. The present study was conceived with a view to studying the land use/land cover of the southern parts of the Eastern Ghats in Andhra Pradesh and Tamil Nadu using Remote Sensing and Geographic Information Systems.

The primary objectives of this study was to prepare thematic maps and mapping of the existing vegetation of the region with a focus on land use and land cover and to study land use patterns in and around the natural forest patches.

The Eastern Ghats constitute an important biogeographic region in the Indian region and has been identified as a major centre of plant diversity with a unique floral diversity. Ranging from Orissa, Andhra Pradesh to Karnataka and Tamil Nadu the Eastern Ghats are spread over an area of about 75,000 square kilometres through a chain of fragmented and disjunct hill ranges. The scope of this project encompassed southern parts of the eastern ghats, particularly the Seshachalam-Chittoor hill ranges, in the Chittoor district and covering the Palamaner forest division in Andhra Pradesh. In Tamil Nadu, the study area primarily covered the Tiruvannamalai, Vellore, Villupuram, Salem (Yercaud) hill ranges and to some extent also the Dharmapuri and Nilgiris district where the Eastern Ghats converge with the Western Ghats evergreen ecosystems. The fragmented nature of the Eastern Ghats mountain ecosystem limited the extent of area that was included in the study and only some of the major hill ranges were covered for satellite interpretation. The Ghats have a rich assemblage of floral, faunal wealth including many endangered and endemic species. An estimated 3,000 species of flowering plants constitute the entire flora of the Eastern Ghats out of which at least 100 species are known to be endemic to the region. The overall vegetation structure of these hill ranges comprises several forest vegetation types including tropical dry deciduous, mixed dry deciduous, dry evergreen forests, scrub or thorn forests, riverine forests and small patches of evergreen forests.

The methodology for the present study was carried out through a combination of different field techniques which included field surveys, satellite data processing and GIS data analysis.

The land use and land cover information of the Eastern Ghats within the study area covered an area of 153,934 square kilometres. The data analysis included assessment of the forest cover and land use distribution pattern across 17 different thematic elements, relevant to the landscape of the region. Dry deciduous forests, thorn forests and scrub vegetation constituted 38 percent of the forest cover. Dry deciduous forest constituted a substantial part covering an area of 14,967 square kilometres (10 percent). In the Chittoor district of Andhra Pradesh these forests occupied 1,518 square kilometres mainly in the Seshachalam hills and the Palamaner forest ranges apart from reserve forests. Including other deciduous forest types and scrub, these constitute over 6,600 square kilometres in the district. These hills also harbour endemic floristic elements like *Shorea tumbuggaia*, *Boswellia ovalifolia*, *Pterocarpus santalinus*, *Terminalia pallida*, *Pimpinella tirupatensis*, *Cycas beddomi* and faunal assemblages like *Golden Gecko*, *Slender Loris* *Loris tardigradus*. In Tamil Nadu, as per the surveyed area dry deciduous forests were largely recorded in Vellore, Villupuram, Tiruvannamalai, Salem (Yercaud), Dharmapuri and Nilgiris districts

Mixed dry deciduous forests accounted for 18,514 square kilometres (12 percent) according to the satellite data. These non teak-bearing forest patches occur in the Seshachalam ranges in the Chittoor districts, Andhra Pradesh and in Vellore. Only 2,482 square kilometres (1.6 percent) of dry evergreen forests were recorded through our analysis. The presence of these forests is characterised by low and dense forest thickets, at times impenetrable, with distinct thorny elements. The vegetation has typical elements like *Manilkara hexandra*, *Memecylon umbellatum*, *Syzygium cumini*, *Albizia amara*, *Albizia lebbek*, *Strychnos nux-vomica*. Increased economic activities along coastal regions have led to exploitation of these unique forest ecosystems for fuelwood and fodder purposes.



Dry deciduous forest. Photo: G Areendran.

Scrub vegetation classified as scrub forests constituted nine percent or 14,040 square kilometres of the study area according to satellite data interpretation. The increasing use of existing natural lands has shown that about 43,416 square kilometres (28 percent) of the landscape is being converted for human use, particularly for irrigation and cultivation.

The loss and decline of native vegetation can have serious implications on the biodiversity of the landscape. The Eastern Ghats have long been recognised as a major centre of plant diversity with several species of rare and endangered floral and faunal elements. Several floral species of this landscape have a narrow distributional range and any adverse impact on their habitats can lead to serious decline in the native populations of these species. The use of Remote Sensing as a tool has brought out the salient features of the present status and distribution of some of the forest types as well as the overall land use pattern of the southern part of the Eastern Ghats. We suggest a more detailed assessment and analysis at a higher scale of the rare and endangered biological diversity, using modern technology for future conservation planning in a region which is facing increasing pressures from economic and developmental activities.

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To Meet Climate Change: Strategies for Promoting Resilience in Protected Areas (What the PA Manager can do)

Lawrence S Hamilton

- Inventory taxa surveys to know what you have. Be alert for unusual sites/communities, refugia.
- Sustain the slow variables (e.g. soil resources and the species pool) that accumulate slowly and provide buffers.
- Sustain both ecological legacies (e.g. old growth forest, woody debris) and cultural legacies (e.g. peoples' connection to the land).
- Relieve the stresses that drive change (e.g. pests, invasives, pollution).
- Increase the effective size of the protected area where and when possible (e.g. enlarged core protection zone, enlarged buffer zone of nature-friendly land use).
- Protect altitudinal gradients.
- Restore or facilitate recovery of missing keystone species (e.g. wolf, beaver)
- Build linkages across multiple scales from hedgerows to landscape-scale connectivity corridors. Stepping-stones may also be valuable.
- In connection with connectivity, think big-bioregionally, even at continental scale.
- Cooperate to develop common approaches with adjacent or nearby protected areas. Transborder cooperation is especially important.
- Increase interchange with and education of stakeholders about planned interventions.
- Develop flexibility and ability to move in new directions as scenarios change. Employ adaptive management. Treat crises as an opportunity for constructive change.
- Think outside the box.

A "take-home" summary of paper presented for the German-French Biosphere Reserves Transboundary Workshop, October 22, 2008.



Solukhumbu flora, Nepal. Photo: Marianne Heredge.