CHAPTER - 7

Conclusion

Forest ecosystems are highly complex systems that play a significant role in regularizing and stabilizing the climate, biogeochemical cycles and biological diversity. Forests store ~45% of terrestrial carbon, contribute ~50% of terrestrial net primary production, and can sequester large amounts of carbon annually. Carbon uptake by forests contributed to a “residual” 2.6 Pg C/year terrestrial carbon sink in 1990s, ~33% of anthropogenic carbon emission from fossil fuel and land use change. Despite the wide importance, forest is degrading at an alarming rate both compositionally and functionally. This affects the habitability of the earth
by upsetting the climatic balance, radiation equilibrium and biogeochemical cycles. The process modelling of such cause-response relationship requires high technological inputs. Analysis with conventional tools has practical limitations in the model development and this has accelerated the scientific community to evolve new techniques. Geoinformatics, which evolved in the last few decades, has overwhelmed most of the other techniques due to its ability to provide location based analysis and inferences. However, most of these studies have been carried out in the Neotropics, with very little on the Old-World tropics. Similarly, there is an overrepresentation of studies in tropical humid forests and underrepresentation of information on other tropical formations. Clearly, these patterns reflect the biases that characterize tropical biology. Therefore the present study was taken up to characterize the compositional and functional attributes of tropical forests and to identify the vulnerable areas of land cover change in an Old World biodiversity hotspot with the help of advanced modeling tools.

The area selected for the study was the Anamalai hills in the Western Ghats biodiversity hotspot where the ecological setting is a representation of the diverse climatic and topographic gradients existing in peninsular India. Land use / land cover mapping using satellite remote sensing data showed that the area is dominated by deciduous forest followed by evergreen forest. Phytodiversity assessment at ground level indicated that species richness is high at evergreen forest while stand density is high at shola forest. Characterization of vegetation communities using Canonical Correspondence Analysis (CCA) identified six major
vegetation communities in the area. Precipitation was the highest correlate of diversity. This was in agreement with the observations in the Neotropics that the rainier areas maintain higher species diversity.

Biomass and carbon stock assessment using empirically derived allometric equations and carbon conversion coefficients indicated highest carbon stock in evergreen forest and the lowest in thorny scrub forest. Spatial interpolation of carbon stock revealed that Ordinary Kriging performs better than IDW (Inverse Distance Weighted) and Polynomial interpolations. Carbon uptake modelling using light use efficiency (LUE) models indicated that low elevation tropical wet evergreen forest uptake carbon at higher levels. The lowest rate of carbon assimilation was observed in grasslands. Tropical deciduous and thorny scrub forests showed a higher assimilation rate in wet season than in dry season.

Two divergent trends were observed in the identification of vulnerable areas of land cover change. A dominant degradational trend could be attributed to agricultural expansion and infrastructure development, while a successional trend due to protection of the area indicated the resilience of the system after prolonged disturbances. The sanctuary appears susceptible to continuing disturbances under the current management regime but at lower rates than in surrounding unprotected areas. The study also demonstrates how remote sensing based land cover assessments help in monitoring the land use pattern and conservation strategies.