Forests have had a pervasive influence on the evolution of terrestrial life and continue to provide important feedbacks to the physical environment, notably climate. Forests cover \( \sim 42 \text{ million km}^2 \) in tropical, temperate, and boreal lands occupy \( \sim 30\% \) of the land surface. These forests provide ecological, economic, social, and aesthetic services to natural systems and humankind, including refuges for biodiversity, provision of food, medicinal, and forest products, regulation of the hydrologic cycle, protection of soil resources, recreational uses, spiritual needs and aesthetic values. Additionally, forests influence climate through exchanges of energy, water, carbon dioxide, and other chemical species with the atmosphere. Today, studies of the world’s forests are taking place against a backdrop of unprecedented change, largely resulting either directly or indirectly from human activity.

Forests are decreasing at a rate of 7 million hectares annually, mostly in the tropics. The loss is partially due to a lack of knowledge on their composition and function. Researchers and policy makers point out the need for precise information about compositional and functional attributes of forest to develop adaptive management strategy for the conservation of forest, and thereby maintaining the habitability of the earth. In this context, the present study was taken up to assess the compositional organization of the forest and to appraise the functional aspect in
terms of carbon stock and uptake. In addition, the possible threats to the existing landscape configuration were also evaluated through a change detection analysis. Five specific objectives were formulated and the thesis is organized in such a way that each chapter achieves one objective, in addition to the introduction and conclusion chapters.

**Chapter 1** aims to introduce the general background of the research. The importance of compositional and functional attributes, various threats to the biodiversity, the use of geospatial tools in addressing the above components are described in detail. In addition, this chapter also gives an overview of the study area, research problem identified and the specific objectives formulated. **Chapter 2** explains the major land cover types in the Anamalai hills and assesses its phytodiversity. **Chapter 3** characterizes the vegetation communities in the hills and identifies the most important environmental correlates of species richness. **Chapter 4** deals with the biomass and carbon stock of the area with respect to different vegetation types and the role of geostatistical techniques to predict the carbon stock in unknown areas. **Chapter 5** is an assessment of Light Use Efficiency (LUE) and carbon uptake of different vegetation types in the study area in different seasons. **Chapter 6** assesses the land cover changes in the sanctuary and identifies the proximate and underlying causes of land cover change in the hills. **Chapter 7** provides the conclusion of the present research work.