Summary

Forest covers approximately a third of the planet's land area, and range from undisturbed primary forests to forests managed and used for a variety of purposes. Forests provide a number of goods and services, which are essential for civilizations and crucial for economic development. They offer access to water, agricultural productivity, energy, soil conservation, and flood control. Forests are also home to at least 80 per cent of terrestrial biodiversity, and are a major carbon sink for regulating global climate. These resources have a history of being exploited either adequately or abusively. Today efforts are made towards their use, and their value is periodically realized at both global and country levels. Applications related to the monitoring of forest management requires updated and accurate inventories summarizing knowledge of landuse changes related to forest, including the rates and patterns of deforestation and afforestation. This information must be more precise and detail at both regional and local scale for its utility and planning. Remote sensing can play a crucial role in providing information across these scales. It allows for the frequent measurement and monitoring of the world's forests on a continuous basis. Passive optical RS applications for forestry inventories are based on the sensitivity of optical radiation to the chlorophyllian content of the stands. However, several factors can interfere such as the optical properties of the soil background, illumination and viewing geometries and many on. Microwave signals, in contrast to optical wavelengths, are unaffected by atmospheric conditions, including clouds, because the wavelength of the radiation is several orders of magnitude larger than the atmospheric particles There has been growing interest in the capabilities of microwave remote sensing, particularly in the form of SAR instruments, for the estimation of forest biophysical

parameters. Microwave systems provide information on woody biomass and forest structure.

Keeping this in mind the present work was carried out using both optical and microwave remote sensing data. The highlights of the entire work are as follows:

- Species Diversity was estimated and different diversity indices were calculated. GIS Interpolation technique gave a good result in estimating the Shannon diversity index with an accuracy of 60%.
- Tree phenology was assessed using ground survey and correlation of tree phenology with backscatter was carried out. When phenology was analyzed for the past 16 years, shifts in the phenological events were observed for the most of the species. The phenophase exhibited variation with climatic variables, such as temperature. With the increase in temperature, flowering, fruiting and leaf flush in tree species also increased.
- DBH was estimated for different forest area of Dediapada Taluka. Out of five different species assessed for its DBH, it was seen that *Terminalia crenulata* had largest girth among the five species. The Total tree Height (TH) in fourteen different villages of Dediapada ranged from 4.65 m to 33m.
- The crown cover spread in fourteen different villages evaluated ranged from 0.03 m to 8.03 m. *Butea monosperma* had the maximum crown cover in the Dediapada Taluka
- Regression equation developed between DBH, tree height and crown cover revealed a close relationship amongst them. Thus, indirectly such parameters can be ascertained without removing or destructing the trees. It is a simple and practical method and easy to apply. The formulae are valid for the entity they represent and applicable to the areas under study. Therefore, it is worthwhile to develop equations on local or regional levels.

- In stressed tree species of Dediapada taluka, both biochemical and biophysical parameter i.e. chlorophyll and relative water content respectively, were found to be decreased. In case of *Dalbergia sisoo,* water content was found to be high during the stress condition.
- Vegetation indices i.e. NDVI and NDMI were analyzed for the Dediapada Taluka, The NDVI reflects the vegetation health status, a decreased in this index was observed in the present study for the year 1990-2005. Similarly, moisture content obtained from the NDMI was found to be decreased. Indicating the health status of tree species was decreased in the present study area.
- Biomass map from optical data was generated using regression equation developed from ground survey. Multi-temporal microwave data were found to be useful in analyzing biomass with backscatter value. The Multiple regression equation developed using the ENVISAT-ASAR data and ground survey data helped in preparing the biomass map.
- Different classification techniques were used. Optical data gave a good accuracy in forest classification, whereas microwave data highlighted the degraded forest areas more accurately.
- In the present study different fusion techniques such as the modified IHS, Ehler and the Brovey fusion technique were applied using microwave and optical data. The Brovey technique is found to be the best in forest classification with a good accuracy.