CHAPTER – 6
Chapter 6
Summary and Conclusions

6.1 Thesis Summary

The present study is an attempt to understand the affinity of certain diseases to geographical locations, through analysis of temporal data on the incidence of selected diseases recorded in different regions and the possible geographical factors that prevail in such regions that might be favourable for the prevalence of the diseases there. For this purpose, the case studies of malaria in Visakhapatnam and Vizianagaram; Filaria in Vizianagaram; and Fluorosis in Nalgonda districts of Andhra Pradesh State in India were taken up.

Data on number of cases of these diseases recorded over a period of time in the respective districts were collected from various sources. Data on various geographical features and phenomena have been generated using the moderate techniques of remote sensing and geographical information system, coupled with the conventional sources of climatic, census and such related records.

The thesis is structured into six chapters beginning with an introduction to the topic in Chapter 1, where an attempt was made to establish the significance of medical geography or geography of health through a review of literature and case studies which indicated how the spread of certain diseases have
geographical patterns. The chapter also defines the aim of the present study; selection of malaria, filaria and fluorosis in selected districts in Andhra Pradesh State; and various sources of data and overall methodology employed for processing the data to establish links between the prevalence of a disease in certain areas.

Chapter 2 is devoted to the spatial distribution of malaria in Visakhapatnam district. Initially, a detailed account of the history of research on the causes of malaria, the types of parasites and vector mosquitoes are provided, followed by a brief description on the distribution of malaria in different parts of the world, India and Andhra Pradesh State. Taking Visakhapatnam district as a case study, the spread of malaria in different revenue ‘mandals’ of the district are analyzed based on the available data on malaria incidence during 1999 – 2011. Considering the two major physiographic divisions, namely the Coastal Plain and Hilly Area of the district, the regional, mandal and annual variations in the malaria incidence are discussed. Further, variations in the malaria intensity over the period based on the type of the parasite such as PF and PV are also described. Taking the number of malaria cases vis-a-vis the total population into consideration, location quotient method is used to assess the malaria risk of different mandals of the district. After identifying the various levels of malaria risk of the mandals, the landscape epidemiology of malaria in the district is analyzed by comparing the malaria risk level of the area with geographical phenomena such as relief, forest cover, drainage, soils and rainfall conditions of the district.
More or less, a similar approach was adopted in Chapter 3 to assess the malaria risk assessment of different parts of the neighbouring Vizianagaram district in the northeastern coastal part of Andhra Pradesh State in southern India. Taking malaria incidence in the Hilly, Urban and Plain areas of the district into consideration, the location quotient and landscape epidemiology analyses are carried out to identification of the malaria risk zones in the district.

Chapter 4 deals with filariasis, which is a permanently crippling disease spread through mosquito bites. Taking the same Vizianagaram district which was selected for malaria risk analysis (Chapter 3), an attempt is made in this Chapter for identifying the spatial patterns of filariasis and its possible link with the geographical factors of the respective areas. Further, the age-wise and gender-wise intensity of the disease are also analyzed. Considering the fact that Vizianagaram town had the maximum prevalence of filariasis and that there has been a temporal variation in its incidence, a detailed analysis is made for the town area as well. For this purpose, temporal changes in the state of various water bodies which act as major mosquito breeding zones have been brought out using the multi-date topographic maps and satellite images in conjunction with the field data and observations, which helped to understanding how the changes in filariasis intensity in the town are related to the state of the water bodies.

Chapter 5 is devoted to the problem of fluorosis disease in Nalgonda district. Fluorosis impacts the bones in the human body due to imbalance of the
fluorine intake and thereby weakens the skeletal structure with a crippling affect. Data on fluorine content in groundwater in different parts of Nalgonda district, especially in the Nalgonda revenue division were collected from several sources including the analysis of groundwater samples collected in this study at selected locations where no data are available. Similarly, data on the number of dental caries and skeletal fluorosis cases are collected from the available records. The fluoride levels in the groundwater in many parts of the district are found to be at higher than acceptable limits for human consumption. A comparison of spatial distribution maps prepared for the fluoride content in groundwater, vis-à-vis the fluorosis cases in Nalgonda district, especially in the Nalgonda revenue division indicated a very good correlation between the two. Based on this, not only the endemic zones of fluorosis could be identified, but also the fluorosis prone zones in the region are identified.

6.2 Major Conclusions

The analysis of malaria incidence in both the adjacent districts of Visakhapatnam and Vizianagaram indicated that the disease caused by the PF parasite is more in number while the type of malaria caused by PV. The maximum number of malaria incidence was reported during the months of June, July, and August, which come under southwest monsoon season. The Coastal plain of Visakhapatnam district, especially Visakhapatnam Urban mandal is highly vulnerable to PV type malaria rather than that of PF type, because of the degraded environment caused by human activities.
Of the two major physiographic zones the Hilly area (comprising the Eastern Ghats) and the Plain area closer to the coastal parts in both the districts, the former experienced higher rates of malaria incidence, as revealed by the location quotient analysis. Further, the landscape epidemiology analysis indicated that the thick vegetation, pressure of dense network of water bodies, higher annual rainfall, moist weather and moderate temperature in the Hilly regions of both these districts are more suitable for the breeding and proliferation of the mosquitoes which act as the malaria vectors. Probably, poor sanitation and malnutrition that characterize the tribal communities that largely inhabit the Hilly areas exacerbate the problem of malaria in the region.

The study on filariasis in Vizianagaram district revealed that the disease is predominant in the Plain area including the Vizianagaram town. This may be due to the fact that the entire Plain area has thousands of irrigations ponds and village tanks, which act as breeding zones for vector mosquitoes. Apparently the female patients are more in number than their male counterparts. Of all the body parts, legs are more commonly affected by the diseases, resulting in swollen legs even to the extent of crippling the person from being able to walk. Such a condition of filariasis is called elephantiasis. Further the study revealed that among all the age-groups, people in their 30 – 60 years of age have the disease predominantly manifested. Another significant inference that could be drawn from this study is from the temporal analysis of filaria cases and the state of water bodies in Vizianagaram town. There has been a steady increase in filariasis cases in Vizianagaram town from about 84 – 186 cases in the early 1990s to more than 400 cases per
year during the late 1990s and early 2000s. However, there has been a steady decrease in the number of cases reported annually from 2004 onwards. The initial growth of the disease from early 1990s to early 2000s may be attributed to the deterioration in number of large water bodies (for which the Vizianagaram town is known) due to increased urban sewage and garbage being let into them by the growing population in the town. Thus the water bodies are rendered as excellent breeding grounds for the vector mosquitoes which spread the disease. However, despite the continued population growth and increased generation of urban pollutants in the town, the sudden decrease in the incidence of filaria since 2004 can be attributed to the cleaning up of all the major water bodies in the town beginning from 2004 which resulted in reduced mosquito growth and hence the decline in filaria incidence.

Analysis of data on number of cases of fluorosis affected persons in Nalgonda district, especially in the Nalgonda revenue division within the district indicated the severity of the disease in this highly drought prone and extremely groundwater dependent region in the southern Telangana in Andhra Pradesh. The groundwater in the region contains higher levels of fluorine at more than permissible levels for human consumption. A comparison of the spatial distribution of fluorine content in groundwater Vs fluorosis cases recorded in the area indicated a good correlation between the two with more number of cases in the areas where the fluorine content in groundwater is higher. The study revealed that Nalgonda division is endemic to fluorosis. The variation in
the severity of the disease in different revenue mandals serves as a guide to take up remedial measures in the region.

The study, on the whole, highlights the significance of a geographical perspective in understanding the prevalence of certain diseases such as malaria, filaria and fluorosis in different parts of Andhra Pradesh State in India. The modern techniques of remote sensing and GIS are found to be useful in generating data on various geographical features and phenomena as well as their role in the occurrence and endemicity of diseases in different regions. Needless to mention, information on the spatial patterns of diseases and the physical factors that are responsible for the persistence of some diseases in certain geographical locations would be an important input to disease eradication programs. ****