

**MAJOR DISEASES OF MEGHALAYA: A SPATIAL
ANALYSIS**

ABSTRACT

**SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT OF THE
DEGREE OF DOCTOR OF PHILOSOPHY IN GEOGRAPHY**

BY

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The present work was conceived with an idea of understanding the inherent characteristics of the wide range of diseases prevalent among the people of Meghalaya. The aspects of health, at the present day perspective, are immensely important and hence this field demands to be studied by social scientists in addition to the practitioners of medicine. The spatial and social aspects of human disease are not being taken up seriously and regularly by the professional in medical sciences. While preparing the proposal for this particular thesis the researcher found it as a pity that there is hardly any remarkable contribution in this field from social scientists of this part of India. Baring a few notable contributions in the field of bio-anthropology and ethno medicine the field of human health has not been touched from a North East India perspective. Prevalence of diseases has a spatial dimension too which when viewed in its environmental and social context brings the issue closer to a geographical scrutiny for the benefit of better management, preventive as well as curative, of health of the people at large. Geographers unlike in the past are becoming increasingly aware of the practical importance of their discipline which can contribute to the welfare of the society by way of identifying the spatial patterning inherent in the distribution of social phenomena and thereby calling for intervention by social action and social planning. Health of the people is an extremely important aspect of social planning and the present study is devoted to an in-depth understanding of the patterns in the prevalence of major diseases in the study area with a view to understanding the locational, ecological and cultural attributes of the disease prevalence so that it leads to better management of health of the people. Problems of health and health care demands particular attention in view of the specific disease ecology and constraints involved in providing adequate health care. Furthermore, statistics available at aggregate levels often

conceal the true picture while evaluating achievement levels with reference to normative goals. It is imperative therefore to scrutinize data at smaller spatial units and for peoples socially and culturally distinguished so as to arrive at a meaningful evaluation of health standards achieved after decades of strenuous efforts and to influence public policy for further improvement.

The problems of health care in Meghalaya, a region in India's north-east, characterized by difficult terrain conditions and dominated by communicable diseases are too many. The state has a special responsibility in looking after the health of the people in a state like Meghalaya, where the poor, rural tribal people are largely unaware of the benefits of modern health care. Unfortunately the health care delivery in Meghalaya leaves much to be desired as over 42 per cent of the rural people are yet to be covered under any institutional health care network. Much of the health care facility is confined to the urban areas only. The more glaring aspect however is not so much the inadequacy of health infrastructure, but the disparity in whatever is available. A second area of concern remains at the level of utilisation of this facility. There are structural constraints in utilising the health care facility, which may not be confined only to accessibility factor.

The whole of North East India and Meghalaya in particular provides a wide array of disease environment owing to the anthropo-geographical variations. An important aspect of the geographical reality of the North-East India in general and Meghalaya in particular is that the region subsumes within itself a sizeable proportion of tribal people who have been exposed to modernisation only recently, particularly since the Colonial times. Though the Missionary efforts in the region achieved spectacular success in areas of education and health, yet the people suffer most from a wide range of communicable

diseases. Partly the reason lies in the extended contacts of the relatively isolated tribes to the outside world and partly it is due to unavailability of modern health care to most people living in rural areas and also due to ignorance of the people. The region also suffers greatly from lack of transport and communication facility aggravating the problem of health. The main aim of the present research is however not related to look into these problems, but to get an insight into the prevalence pattern of some of the major diseases. Infrastructure undoubtedly influences the prevalence. It is contended that a geographical perspective to the problem of the prevalence of major diseases would reveal the spatial dimension of the problem-an aspect which is generally ignored while planning health.

With this perspective in mind, the present study considered Meghalaya as an appropriate study area where the prevalence pattern of major diseases have been examined. Meghalaya represents North-east in several ways, both physically and in terms of its population which consists largely of tribes. The communicable diseases predominate and the state has a wide variety of disease environments due largely to extraordinary variation in almost all attributes of physiography, terrain, soil, climate vegetation and above all cultural practices.

Accepting the above mentioned problems to be dealt with within the span of this thesis the objectives placed before the research were to identify the major diseases prevalent in the State; analyse the pattern of distribution of those major diseases; find the associated macro and micro environmental factors, natural and cultural, of those major diseases; evaluate the impact of available health care facilities as well as the level of awareness on health and to propose suitable measures for improving the prevailing health situation in Meghalaya.

In course of this study the major questions have been attempted to answer whether there are discernible spatial patterns in the prevalence of diseases, if so to what extent does the natural environment determine the prevalence of these diseases? What are particular demographic and economic characteristics of the people reporting the major diseases? Are there any cultural habits associated with those diseases and also what is the level of availability and acceptance of the different health care facilities before the people of Meghalaya?

The relevant data and information, on the study area required was not readily available. Both secondary and primary sources of data have been tapped from different libraries, offices and institutions. The data on disease morbidity over the spatial unit or the epidemiological data on disease was collected directly from major health centres and hospitals of all the seven districts. The basic data on reported disease were gathered from all the 85 Government Health Centres spread all over Meghalaya distributed among 30 Community Development Blocks in seven districts. Field survey was also required to collect the household level morbidity data from five villages selected purposively from different ethno-geographic as well as risk zones in Meghalaya.

It must be noted here that serious problems were faced to organize the raw data and to make those compatible and uniform. Instead of good efforts certain data gaps due to poor quality and irregularity of recording could not be overcome.

All the reported diseases were ranked as per the number of cases recorded in the state as a whole so as to determine the empirically major and most important categories of human morbidity. In this process 21 different diseases were recorded including the miscellaneous group where both minor and undiagnosed diseases are clubbed together.

Within the limit of the present research the most prevalent diseases were dealt with at different levels of details.

The morbidity data were tabulated and mapped for the purpose of depicting spatial and seasonal variations in occurrence of each disease category. Taking the Blocks as the lowest administrative unit disease ranking, percentage share of each disease category and disease incidence per thousand populations were computed and mapped. The most important explanatory variables considered to have significant bearing on disease prevalence included such factors as absolute altitude above mean sea level mean annual rainfall, mean annual temperature, percentage of forest cover, density of population per square kilometre, general literacy rate, female literacy rate, percentage of villages having educational facility, percentage of villages having medical facility and percentage of villages having drinking water facility.

The entire analysis has been presented in five broad chapters preceding the present one. The first chapter provides details pertaining to the basic research design including the statement of the problem, definitions and concepts, relevance of the study, a brief note on the selection of the study area, state of health in Meghalaya, broad objectives placed before the research, important research questions, methodology and database, data analysis and presentation, an overview of relevant literatures and the chapter design. It may be pointed out again that no relevant and substantive work could be found for similar subject on Meghalaya to be referred here. The second chapter is devoted to an understanding of the environmental and socio-economic background of Meghalaya. In this chapter the study area has been introduced in relation to those attributes which have a direct bearing on the disease distribution pattern of the region. The aspects chosen for description include

location, relief and drainage, climatic character, extent of forest cover, distribution of Population, literacy rate, availability of educational facility, availability of drinking water facility and availability of medical facility. Each of those aspects has been presented through maps and charts for a better understanding of geographical variations of those. Distribution Pattern of prevalent diseases in Meghalaya is the major concern for analysis in the third chapter. First the statistically major diseases have been sorted out from total 21 diseases recorded during the index year. Thereafter, an attempt has been made in this chapter to identify the spatial pattern in the distribution of major diseases in the study area through block level maps of each disease and graphs presenting the seasonal variation of those. The next chapter i.e., Chapter IV is devoted to an understanding of the environmental attributes of the major diseases prevalent in Meghalaya. The chapter includes a detailed analysis of six major diseases and their relation with environmental attributes; both physical as well as socio-cultural. There are in all 49 tables comparing six major diseases against all the selected attributes along with short interpretations.

An explanation of the micro level data collected from the household of five selected villages have been done in the fifth chapter to cross examine and complement the already found correlation between different environmental attributes and the disease pattern at macro level in previous chapters. First the sample villages have been described in details giving the geographical, demographic and socio-economic characteristics. Thereafter, the pattern of disease morbidity of each household has been compared with the variables which are likely to have impact on the disease environment at the village level.

Major findings of the research may be outlined as below:

From the first chapter it was understood that Meghalaya as an unique North-east Indian state provides immense scope for conducting research on health in general and geography of health in specific. There are gaps in the recording of data making temporal analysis a hazardous exercise. No standard classification procedure for the diseases has been followed making it exceedingly difficult in classifying morbidity pattern.

Environmental and socio-economic background of Meghalaya provided the much needed geographical basis to understand the disease environment prevalent in the state. However, only the most important aspects of the physical environment and socio-economic background of the study area were discussed. It was noted that the state of Meghalaya has its own physiographic uniqueness in terms of its plateau landscape receiving world's highest rainfall under the impact of tropical monsoon climate. There are tangible variations in altitude, rainfall, temperature and forest cover within the state. Moreover, it is a relatively small but important tribal state in the north eastern India. Dominantly rural in population composition, the state is experiencing a relatively higher decennial growth rate. Nevertheless the density of population is relatively low except in a few towns. Literacy rate is relatively higher in the Khasi Hills compared to the Garo Hills region though overall level of literacy is at higher level compared to national average. the study area enjoys a relatively better level of both educational and drinking water facility but is constrained with insufficient medical facility according to the present norms. In fact it is evident that availability of medical vis-à-vis health care facility in the state is low by any standard and certainly a matter of serious concern.

The analysis of the prevailing distribution pattern of the major diseases of Meghalaya has been presented as the main objective of the thesis. Diseases like

respiratory infections, diarrhoea, probable cases of malaria fever, skin infections; peptic ulcer syndrome and malaria are found as statistically major diseases during the index year. In fact the first three diseases together shared three fourths of all the 21 disease categories recorded. Prominent spatial variations were found in distribution pattern of all the major diseases. The diseases of respiratory infections dominated at the first rank followed by diarrhoeal diseases. Malaria and pyrexia of unknown origin were treated successively and was found interrelated. It is important to note that incidence of respiratory infections were more over the high altitude areas whereas diarrhoea cases are found in middle and lower altitude belts of the Meghalaya plateau. The huge dominance of the three top order diseases was also in the computed results of disease combination. Moreover, it is also observed that four disease combinations are present mainly in the thickly populated border blocks of Garo Hills and Ri Bhoi districts. On the other hand in two higher altitude blocks viz. Khliehriat and Mawryngkheng, extreme dominance of Ri and Dd has resulted in two disease combination. Higher altitude and higher rainfall areas were seen associated with Ri diseases which occur mostly during pre-monsoon and early winter seasons. The Dd on the other hand prevailed relatively more over the Khasi Hills than in Garo Hills, probably be due to differences in availability and quality of drinking water and level of personal hygiene. Malaria was found presenting a controlled spatial distribution directly related to factors like altitude, temperature and rainfall. The low valley and foothill zones of the districts like WGH, EGH, SGH and WKH remains highly malaria infested where more than 90 per cent is *P. falciparum* species. The highest part of the central plateau ridge of JH, EKH and WKH, roughly above the 1350 m contour line, is recorded as the malaria free zone. The hottest and wettest seasons had maximum positive cases of malaria in

Meghalaya. The undetected fever cases grouped as Po were revealed largely as the probable cases of malaria by nature of occurrence. By and large both spatial and seasonal distribution pattern conform to that of malaria. In general skin diseases were present higher among the people of Garo Hills region compared to the other half of the state viz. Khasi Hills and Jaintia Hills indicating that the disease is associated with over all physio-cultural character of the region and not merely with any of the specific environmental precursors. The seasonality pattern of skin diseases was found obscured due to gaps and incompatibility in data. The peptic ulcer syndrome, a disease caused by certain food habits and addictions etc, was found to have emerged as an important disease in the state. The spatial variation is quite high which may also be due to faulty and under reporting from several blocks. There is one contiguous zone of high Po cases but seems not related to any of the parameters used in this study.

In course of interpretation and analysis of the correspondence between distribution of the six major diseases and the associated factors it was observed that, excepting a few, most of the variables are related to normal trends though not significantly. In certain cases the statistical trend was found to be just opposite of the accepted or normal one. Diseases of Respiratory infections are closely associated with altitude, air temperature and educational facilities. Diarrhoeal diseases were found related to drinking water and availability of medical facilities. Variation in rainfall is significant attribute to malaria occurrence whereas Pyrexia of unknown origin was observed closely associated to altitude, air temperature, forest cover, educational and medical facilities. Finally, diseases of skin were found related to altitudinal variations. Altitude, air temperature and literacy rates played important roles for occurrence of peptic ulcer syndrome.

One of the most significant findings was that the economic conditions along with all its related components like house type, presence of separate kitchen and privy etc have statistically emerged as the main determinant of disease morbidity in all the five villages as emerged during the micro level explanations of the disease attributes. But education as such did not depict a direct implication on general disease morbidity pattern. This is contrary to expectation as literacy is always cited as an important factor in making people aware about disease occurrence. This does not hold true in the case of Meghalaya, where the general literacy level is high, but is possibly not accompanied by health education. It may be suggested that the state should take special care in health education among the people through special campaigns and through school curriculum. Household size also was found not associated logically to variations in disease occurrence except in the case of villages Umden Khasi and Langumshing, representing two less privileged ones. Occupation such as agriculture, both *jhum* and settled forms, was found to enhance more exposure to the prevalent disease environment. In the village Demdema cultivators were found suffering from more diseases compared to those in non- agricultural occupations. Wage labourers, the major occupational group in Denchynrum, reported greater morbidity from almost all diseases and those in agriculture get gastric and malaria in particular. Majority of the households of Umden Khasi practicing *jhum* cultivation reported all the major diseases like gastric, malaria and diarrhoea. Most of the communicable diseases of infectious nature seemed to affect more to the people going for open air defecation as well as using open pit privy. It was also noted that a very low proportion of households having sanitary toilets were not statistically reflected in the results. Malaria, the most dreaded and significant parasitic disease did not show any differential spread over the different

categories of people practicing different levels of household hygiene. Finally, it was observed that villages from different eco-cultural zones possess different disease attributes as reflected from the comparison between villages. In general economic parameters and occupation remained the common explanatory variables in all the villages.

In a nut shell, the observed distribution pattern of major diseases in Meghalaya is mostly unique to each disease. The extent of spatial variations in individual as well as in different diseases is remarkable in the state owing to the prevailing diversities in environmental and cultural aspects and this very fact is extremely important for the researchers in the field of health geography and the practitioners of medicine alike.

The present piece of research, instead of being limited within its own extent, has highlighted certain hitherto unknown dimensions of the disease and environment relation existing in this small and less studied tribal state located at a far corner of India. In the absence of any noticeable background information, either in form of database or published material, this seemingly initial attempt is expected to raise more relevant questions to the students and researchers of an important universal issue – human health.

In fact human health remains to be one of the most neglected subjects in the developing countries in particular which has immense impact on the development economy of any country. The targets set on ‘Health for all...’programme by the Government of India is constantly being rescheduled due to several serious lacuna in health care delivery system which is otherwise related to the health information and knowledge base. Therefore, it is hoped that this attempt to understand the salient features of the problems related to health of the people of Meghalaya will be helpful to the planners and managers of the much important health policy.

It may be noted that the study has been limited to only one calendar year though it is expected that the intricate nature of diseases needs to be examined in a much broader perspective and preferably on long term basis using time series data for a sufficiently long period. Follow up studies are needed where infectious diseases are at rampant. On the other hand the nature and extent information required for such studies are immensely scanty in Meghalaya due mainly to inaccessibility of the risk areas and less awareness about the importance of such information among the health workers and even medical practitioners in some cases. Moreover, several other equally important parameters to be considered for better understanding of the disease causatives.

Therefore, it is important to propose that a concrete and comprehensive epidemiological data base is to be developed at the earliest using the available network of both state and private sector health institutions in the state. Preventive measures, as already in practise, needs to be revamped and implemented up to the lowest level.

Public awareness needs to be generated against over congestion of houses and proper ventilation to prevent incidence of respiratory diseases, the most important of all diseases in Meghalaya. Adequate preventive measures need to be taken from both government and public to destroy the mosquito habitats and simultaneously people in the endemic belts to be made aware to regularly using mosquito nets, the only proven prevention from mosquito bites.

In a region with high proportion of rural population dispersed in villages scattered all over the state characterised by difficult terrain conditions and poor road facility doubly constrained with very low health care coverage with only one hospital bed per thousand

population a Better health care network with a sound regional coverage, removing the strong urban bias present in the state, is an urgent necessity.

The paradoxical situation of acute water crisis even in the world's highest rainfall zone may only be overcome through better and appropriate rural water management. Supply of safe piped water to all villages has to be ensured in effective manner, for which rain water harvesting system has a bright prospect in this rainiest state in the world. Even if supply of piped water is not feasible for economic reason, the campaign for clean drinking water through traditional methods of boiling and filtering can be effective. The NGOs have a particularly important role to play in this regard.

Utilising the already available NIC net connection in all development blocks, sudden onset of the disease can be monitored closely and emergency services can be provided at the time of need.

As a primary barrier of transmission of organisms causing diarrhoea, the system of safe disposal of excreta is emphasised e.g. its collection, transportation, treatment and disposal. On the other hand, improvement of awareness of water sanitation behaviour will result in prevention of diarrhoeal epidemic.

It may be noted here that these recommendations are based on the particular research and does not take into consideration the cost aspect. Some of these recommendations may be easily implemented as they are already emphasised by Government policy. In such cases emphasis needs to be placed on their effective implementation. In other cases however, more fundamental research is required for methods that are economically sound. At research level, the Geographical Information System (GIS) can be profitably used for understanding disease patterning in their

composite occurrence and the future research in this area requires GIS techniques to be used for not only identifying the pattern but also to suggest measures to combat them more effectively.

The present research is a humble beginning in this direction and was handicapped by less than expected research in this area and for the region as a whole. Nevertheless within the scope of the research, the study made an attempt at answering some of the questions pertaining to the topic of research while leaving many more partially answered or totally unanswered and making one aware about new questions that emerged.

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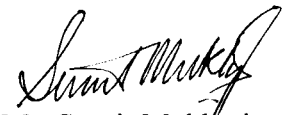
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I, Mr. Sumit Mukherjee, do hereby declare that the subject matter of the thesis is the record of work done by me, that the content of this thesis did not form basis of the award of any previous degree to me or to the best of my knowledge to anybody else, and that the thesis has not been submitted by me for any research degree in any other University/ Institute.

This is being submitted to the North Eastern Hill University for the Degree of Doctor of Philosophy in Geography.



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PREFACE

At the juncture of presenting this thesis to the examiners I take this opportunity to remember the circumstances which prompted me to undertake this challenging study way back in an autumnal afternoon of 1996. I gratefully acknowledge the outcome of a discussion in an informal gathering where Prof. A. K. Ghosh of the Department of Anthropology, N. E. H. U. coaxed me to take up a topic in the field of geography of health as this area of research was scantily trodden in this part of India. In fact the work could never have ever been initiated without his inspirations and valuable suggestions in formulating the project. It was again he who acted as the bridge between Prof. D. K. Nayak, my supervisor and me. And so, for me, it was a unique experience with a person of all-great human qualities and scholarly attitudes. In course of this research work we even crossed the usual boundaries between the teacher and student and I am blessed to find a good friend and philosopher in Prof. Nayak. It was not easy for me to cope up with varied duties and jobs starting from those in my office in Shillong to the family affairs in Kolkata without the persistent help and guidance from him. Nothing less I owe my indebtedness to my wife, son and daughter who silently sacrificed a chunk of their happiness and have born with me during my hectic days of doing the research.

I wish to make a special mention of the then Director of Anthropological Survey of India and the Head of Office and several colleagues of the NERC office in Shillong who were singly and collectively instrumental in getting a project entitled 'Ecology of Disease

and Indigenous Health Practices in Meghalaya' sanctioned and in conducting it successfully under the banner of the Survey. Working for the project provided me with the necessary insights and strength to continue my endeavours at the Ph.D work.

The challenge of covering the whole state of Meghalaya single handily seemed awesome to me till Dr. Mrs. T. Laloo, the then Director of Health Services, Government of Meghalaya, extended her valuable help in officially introducing me to all the doctors and medical officers spread over her jurisdiction. I owe my heartiest gratitude to her as she made the most difficult job of collecting the huge volume of data look immensely easy. Dr. Lakiang, Dy. Director, and Dr. S. M. Lyngdoh, Entomologist of N.M.E.P., Meghalaya were extremely helpful in providing me with the classified data on malaria. I place on record my sincere gratitude to both of them for their ungrudging and timely help. Several doctors, health workers, language interpreters and anonymous villagers extended their full support and warm hospitality throughout my tour among the unfamiliar language groups and under difficult and often hostile terrain conditions.

I recall with gratitude the encouragement that I received from Swami Yogatmananda, the then Secretary of the Ramakrishna Mission, Shillong who took extraordinary interest on my study and invited me to present the first hand observations on rural health in Meghalaya at the prestigious Centenary Workshop of the Mission held during 1997. The occasion provided me with a rare opportunity to productive interactions with informed people belonging to personalities from nearly all walks of life towards a fruitful interpretation of the collected data.

Dr. B. R. Mondal, with whom I not only shared a room but also academics, acted as conscience keeper to drive me achieving this target in time. He was the one who came

forward to help me whenever he felt that I was in need of it. I can hardly forget his words of consolation and positive attitude to life particularly in moments of helplessness and despair. There were several others like Dr. Sarit Chaudhuri and Dr. Mrs. Sucheta Sen Chaudhuri of Arunachal University, Prof. T. B. Subba and Prof. R. Khongsdier of NEHU, who all helped both academically and otherwise and kept my hopes alive for a successful completion of the research work. I owe a deep gratitude to all of them. I am indebted to Dr. Mrs. R.R. Gowloog of Anthropological Survey of India, Shillong for all his help during the long and tedious journey towards the completion of the present study.

I am also grateful to the present Head of the Department of Geography, NEHU Prof. B. S. Mipun who provided me with all the administrative facilities for completion and submission of this thesis. I thankfully remember the help received from Dr. N.P. Goel of NEHU who made the most difficult task of computerization of the primary data look very easy.


It would be injustice for me if I miss acknowledging the efforts of Sri Aparesh Patra of the Department of Geography, NEHU, who took the pains of doing computer formatting and printouts of this volume.

Before closing this preface I may please be excused if I have unintentionally omitted mentioning certain persons to whom I remain indebted for their help in course of these long seven years.

Let this humble effort serve as a foundation for more advanced studies in this line in future.

Shillong,

27th October, 2004



(Sumit Mukherjee)

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CHAPTER I

INTRODUCTION

1. 1 Introductory Statement

The human ecosystem in its broader sense includes, in addition to natural environment, all the dimensions of man-made environment-physical, chemical, biological and psychological; in short our culture and all its products (Leavell and Clark: 1965 cited by Park, K: 1997). Therefore, from an ecological point of view, as the theme in historical continuity, health is a dynamic equilibrium between human organism and his environment, and disease maladjustment between those. The fact that endemic diseases maintain themselves in dynamic equilibrium over time is consonant with the idea of disease as an agent-host-environment interaction (Hunter and Akhtar, 1991), hence, for the purpose of the present study that part of human ecology has been taken into consideration, which relates to the human health involving a more comprehensive concept of disease causation that synthesizes the basic factors of agent-host-environment relation.

Jaques May, the founder of the theory of disease ecology in 1958, may be quoted from his comments on the Red River delta in Vietnam:

“...from the waters the people get their food, also their cholera, their dysenteries, their typhoid fever, their malaria; from the earth they get their hookworm; from the crowded villages they get their tuberculosis and their yaws; from the type of housing they have been forced to adopt they get their plague and typhus; and from the food which earth, temperature and rain produce, their protein deficiencies and their beriberi” (May, 1959).

There are several geographical factors, which have serious and established bearings on human health. The land, air, water flora and fauna and all elements of the natural environment determine the resource base for the human habitation and healthy living of human population. The culture of the people, by far the most serious

determinant of health, is partly the outcome of man and environment interaction as well.

Thus, a comprehensive study of disease must involve a study of the inter relationship between pathological factors causing the disease and the geographical factors giving rise to the pathological factors. In short it is difficult to attribute a single factor as the causative factor of a disease. Sometimes, two or more factors join together for its incidence. Hence, identification of a particular factor as a causative factor may reflect a partial analysis of the problem (Pacholi, 1993).

1. 2 Statement of the Problem

Health is a multi-dimensional aspect which, for the purpose of this research is viewed in terms of the presence or absence of ill-health manifested by disease. Hence, an attempt has been made to depict the patterning of disease prevalence over the geographical space of Meghalaya in terms of environmental and socio-cultural conditions that have probable impact on prevailing diseases. Therefore, out of the wide range of diseases occurring in the state only those statistically significant and culturally relevant are only considered. As for example the incidence of water born communicable diseases like diarrhoea may give pattern of distribution which would match the topographical character as well as the quality of the drinking water available. So, physiographic and climatic factors like altitude, slope, rainfall, temperature, etc. on the one hand and community character of the people, literacy, density of population, etc. on the other are considered as probable controlling factors of the pattern of disease prevalence. Moreover, in the predominantly rural state of Meghalaya availability of health care delivery too is considered as one of the relevant factors in combating disease.

1.3 Definitions and Concepts

Compact Oxford Reference Dictionary defines disease as “a disorder in a human, animal or plant, caused by infection, diet, or by faulty functioning of a process”. The book refers to the origin of the word ‘disease’ from old French term *desaise* meaning ‘lack of ease’. Webster defined it as “a condition in which body health is impaired, a departure from a state of health, an alteration of the human body interrupting the performance of the vital functions.” From ecological point of view, disease is defined as “a maladjustment of the human organism to the environment” (Gregg, 1956 cited by Park, K: 1997). From sociological point of view, disease is considered a social phenomenon, occurring in all societies (Suchman, 1963 cited by Park, K: 1997) and defined and fought in terms of the particular cultural forces prevalent in the society. The simplest definition is of course that the disease is just the opposite of health which is comprehensively defined by the World Health Organization in the preamble to its constitution (WHO, 1948) as “Health is a state of complete physical, mental and social well-being and not merely an absence of disease or infirmity” and also include the ability to lead a “socially and economically productive life” (WHO, 1978 cited by Park, K: 1997). But WHO has not yet defined disease in a single compact phrase probably because it has a broader spectrum.

Susser (1971), in making distinction between three most commonly used words to denote ill-health, has suggested that “disease is a physiological/psychological dysfunction; illness is a subjective state of the person who feels aware of not being well and sickness is a social dysfunction, i.e., a role that an individual assumes when ill.

Since the discovery of microbiological organisms the concept of disease (causation) has evolved a world of change. The limitations of the famous germ theory

of disease lead to develop the basic factors of agent, host and environment – a model called epidemiological triad.

1.4 Relevance of the Study

Issues pertaining to health and diseases cannot be and should not be left to the medical practitioners alone. Social scientists have a particularly important role in understanding the problem of diseases among socially and environmentally differentiated people – an area of study not usually taken seriously by doctors and practitioners of medicine. Prevalence of diseases has a spatial dimension too which when viewed in its environmental and social context brings the issue closer to a geographical scrutiny for the benefit of better management, preventive as well as curative, of health of the people at large.

The present day medical geography, a scientific discipline combining geography and medicine, ventures in understanding the influence of geographical factors on health of human populations with the aim to recognize the law of the geographical distribution of human diseases. Since the completion of the Moscow IGU in 1976 ‘Medical Geography’ is being termed as ‘Geography of Health’. A group of geographers at present are in search of the factors behind the spatial pattern of occurrence and incidence of certain diseases.

1.5 Study Area

It seems obvious that in a region like North East India and particularly in Meghalaya, with wide variations in geographical and anthropological conditions, rich cultural traditions and a vast range of disease occurrence one has boundless scope for the study of geography of health. Therefore, the Meghalaya plateau (fig. 1.1), as a compact and unique geographical as well as administrative unit has been chosen as the study area (fig. 1.2). The state is bounded on the west, north and the east by the Brahmaputra river valley with the exception of the Mikir Hills on its north east corner.

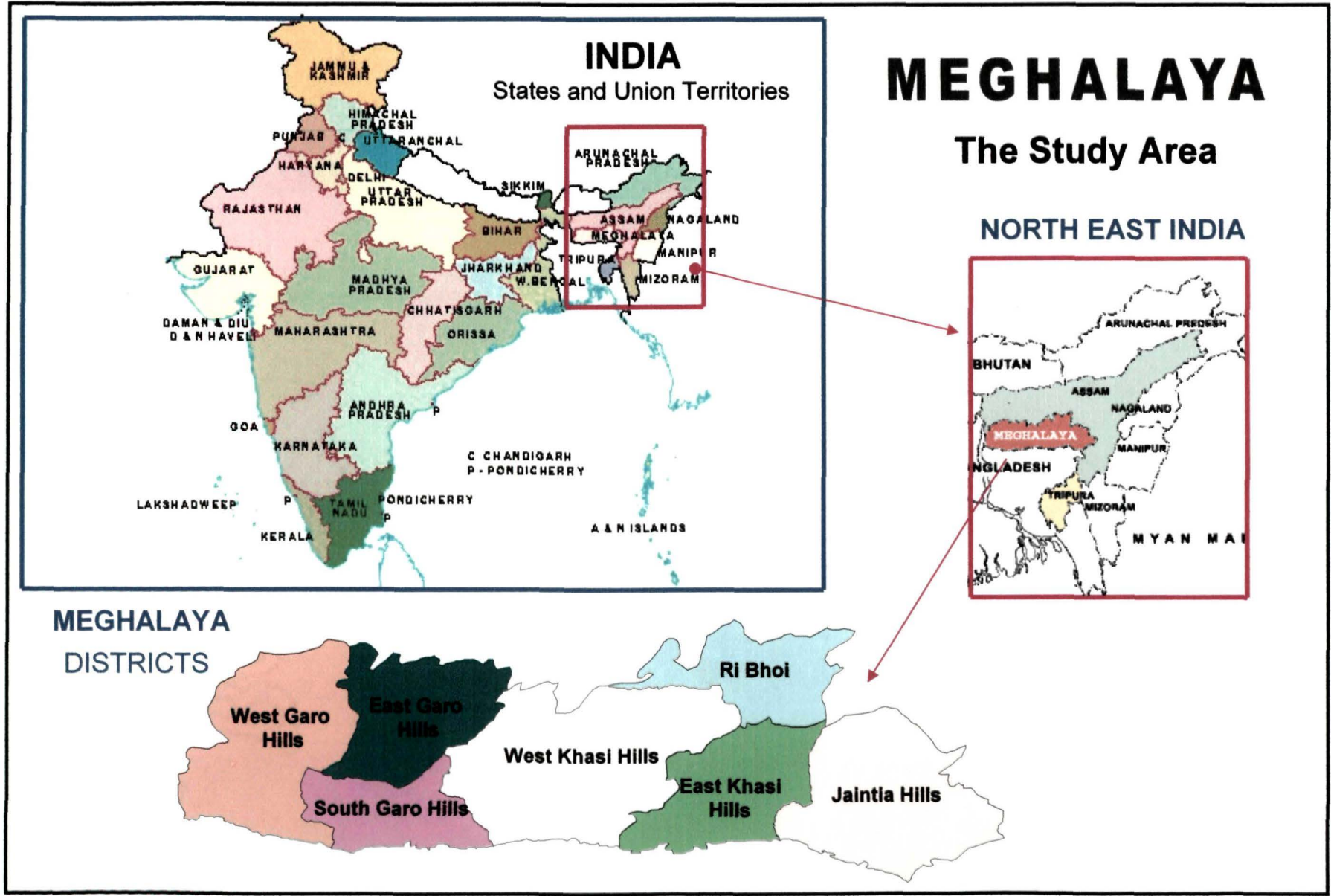


Figure – 1.1

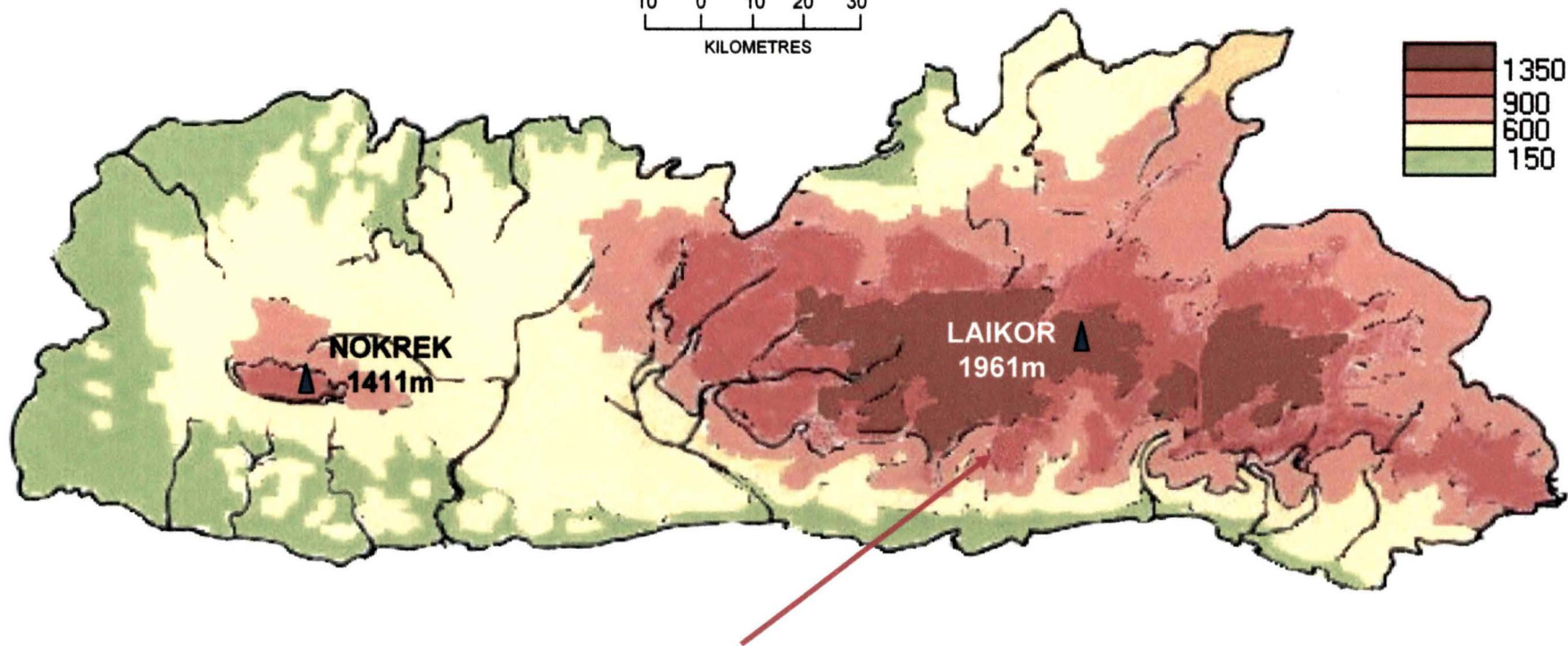
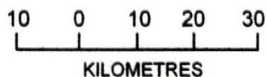
The state shares a long international boundary with Bangladesh on its south, a predominantly flat valley plain of Shylhet and Mymensingh districts. Perceptible variations in altitude, rainfall, temperature, etc help developing a wide range of disease environment. In addition, it's predominantly rural population mainly consists of three major tribal groups (86 per cent) namely the Garo, Khasi and Jaintia. These people are still partially dependent on the primitive mode of agriculture – the *Jhum* or shifting cultivation. The higher growth rate of population i.e. 32.9 per cent against national average of 23.9 per cent in the year 1991 exerts extra pressure on the already degraded and deforested slopes in absence of good arable plain land.

1. 6 State of Health in Meghalaya

From the available data and the information gathered at macro (state) and micro (village) levels, the primary causes of morbidity and mortality of the people of Meghalaya are grouped as follow:

1. Diseases due to different environmental precursors:
 - a) Unsafe water, poor sanitation: Diarrhoea and gastroenteritis, hepatitis, worm infection.
 - b) Hill climate, poor housing etc: Diseases of respiratory systems, pneumonia, pulmonary tuberculosis, cough, etc.
 - c) Prevalence of pests: Malaria.
 - d) Vehicular accidents and trauma.
2. Diseases related to specific population groups and different occupational activities:
 - a) New born and schoolchildren: Diphtheria, whooping cough, measles, etc.
 - b) Specific diseases - Leprosy, peptic ulcer, influenza.
 - c) Nutritional deficiency: Anaemia (related to diarrhoea, Malaria and maternal causes.)
 - d) Alcohol related: Cardiac and liver diseases, cancer, etc.

MEGHALAYA THE AREA IN FOCUS



Mawsynram: World's highest Rainfall Zone (10,000mm+)

**Area: 22,429 Sq. Km,
Population: 2,306,069
Growth Rate: 29.94%**

**Population Density: 103/sq.Km
Sex Ratio: 975 Literacy: 63.31**

**Rural Population: 81%
Tribal Population: 86%
Major Tribes: Khasi, Garo, Jaintia**

Figure – 1.2

e) Emerging problems of HIV infections.

The Executive Summary Report 1994, of the Directorate of Health Services, Government of Meghalaya showed that diseases related to natural environment (mainly water born) as well as diseases of communicable nature dominated (35.68 per cent) in the state compared to all India rate (20.80 per cent). Diseases of respiratory tract infections (including pneumonia) and intestinal infectious diseases like diarrhoea, dysentery, gastroenteritis, etc. are the two main groups of diseases prevalent all over Meghalaya. Deficiency diseases like anaemia and blindness are also of great importance followed by skin diseases and dental problems. On the other hand Meghalaya, particularly Garo Hills and Jaintia Hills are Malaria endemic zones. At present malaria, especially *P. Falciparum* has emerged as the most concerned causes of health hazards throughout the state except only the highest altitude areas. As per the N.F.H.S. data malaria incidences was highest in Meghalaya among all the N. E. States in 1991-92. The diseases of lower age group e.g. Whooping cough and measles are still a matter of serious concern.

With such a wide range of disease prevalence Meghalaya certainly has a very tough road ahead towards achieving the targets of the national health policy. The Executive Summary Report 1994 showed that only half (42.3 per cent) of the rural population is covered under the institutional health care network. Considering the available health care delivery the state has one of the poorest conditions in N.E. India with only one hospital bed per thousand population and one government doctor per 5337 people. In total there are nine hospitals including four private and five district Civil Hospitals. In addition there are 82 Primary Health Centre, 323 Sub Centres, 9 Community Health Centres and 23 State Dispensaries. Further the strong urban bias in health care is prominent as urban people are enjoying 75 per cent of the total bed

capacity with a share of only 18.6 per cent of the total population. Only 10 per cent of all the children are fully vaccinated when 55 per cent dose not get any. Thus the rural health infrastructure is lying well below the norms set by the governments. Moreover certain stringent traditional customs and beliefs prevent the predominantly rural tribal people from availing of the benefits of modern medicine. On the other hand due to large scale deforestation and destruction of the fragile hill ecosystem both the natural hygiene and sources of herbal medicine are becoming a thing of past.

1.7 Objectives

The following broad objectives have been placed before the research

1. To identify the major diseases prevalent in the State.
2. To analyse the pattern of distribution of those major diseases.
3. To find the associated macro and micro environmental factors, natural and cultural, of those major diseases.
4. To evaluate the impact of available health care facilities as well as the level of awareness on health.
5. To propose suitable measures for improving the prevailing health situation in Meghalaya.

1.8 Research Questions

Accepting the hypothetical concept that human health is a function of both external or macro environmental and internal or micro environmental elements/factors, the present study have been conducted to answer the following research questions:

1. Are there discernible spatial patterns in the prevalence of diseases?
2. To what extent does the natural environment determine the prevalence of these diseases?
3. What are the important diseases associated with particular demographic and economic characteristics of the people?
4. Is prevalence of certain diseases associated with cultural habits of the people?

5. What is the level of availability and acceptance of different health care facilities among the general people of Meghalaya?

1. 9. Methodology and Database

The State of Meghalaya, as defined in terms of its administrative boundaries and as a distinct eco-cultural region, has been taken up as the study area. A time span of continuous twelve months i.e. the calendar year of 1996 has been taken as the index period. Human morbidity data on all major diseases have been collected in order to assess the spatial and temporal distribution in relation to the related diseases environment.

1. 9.1. Data Source

The present study is based on both secondary and primary sources of data related to human disease morbidity and their basic environmental attributes. Here, disease morbidity has been measured from the recorded cases of ill health as reported by the people at the institutional level i.e. the State run Primary Health Centres (PHC) and Community Health Centres (CHC) under the Directorate of Health Services, Government of Meghalaya. In fact data has been gathered from 85 such Centres spread all over the geographical space of Meghalaya and distributed among 30 Community Development Blocks (hereafter referred to as Blocks) in seven districts.

Several published and unpublished records, reports and maps have been studied and worked with to generate the database on physiographic and demographic variables affecting these diseases.

To complement the macro level facts a micro level study was conducted in five villages purposively chosen from different eco-cultural zones having a critical disease environment. With the help of a village survey schedule along with the house hold questionnaire all the households present at the time of visit were interviewed to assess primarily the morbid conditions (both diseases suffered and illness), for six months

preceding the survey, in the light of demographic, socio-economic, community hygiene as well as available health care delivery system at the village and its environ.

1.9.2. Field Work

In all, three months of field investigations preceded by one month for preparatory data collection in Shillong have been carried out in two phases between October 1996 and April 1997. Primarily the study was conducted as a part of the national project designed and undertaken solely by the researcher on behalf of the North Eastern Regional Office of the Anthropological Survey of India, Shillong.

1.9.3. Classification of Data

The reported diseases have been categorised as per the World Health Organisation standardisation. The basic morbidity records are then tabulated moth wise and disease wise for each health centre. For the purpose of the data organisation and mapping, those morbidity figures have been grouped at the Block level (Annexure-III-I), taken as the lowest unit, combining the data of the group of health centres located in each Block (fig.1.3). Thereafter, proportion of each disease/disease group to all reported cases during the index year has been calculated for each administrative unit, i.e. Block. Next, the incidence rate of each disease per thousand populations is also worked out against the interpolated mid-census population (i. e. for the index year 1996).

Similarly the data on physiographic and demographic attributes viz. absolute altitude above mean sea level, mean annual rainfall, mean annual temperature, percentage of forest cove (for the year 1991), density of population per square kilometre (against computed mid-census population), literacy rate, female literacy rate, percentage of villages having educational facility, percentage of villages having

MEGHALAYA

ADMINISTRATIVE DIVISIONS 1996

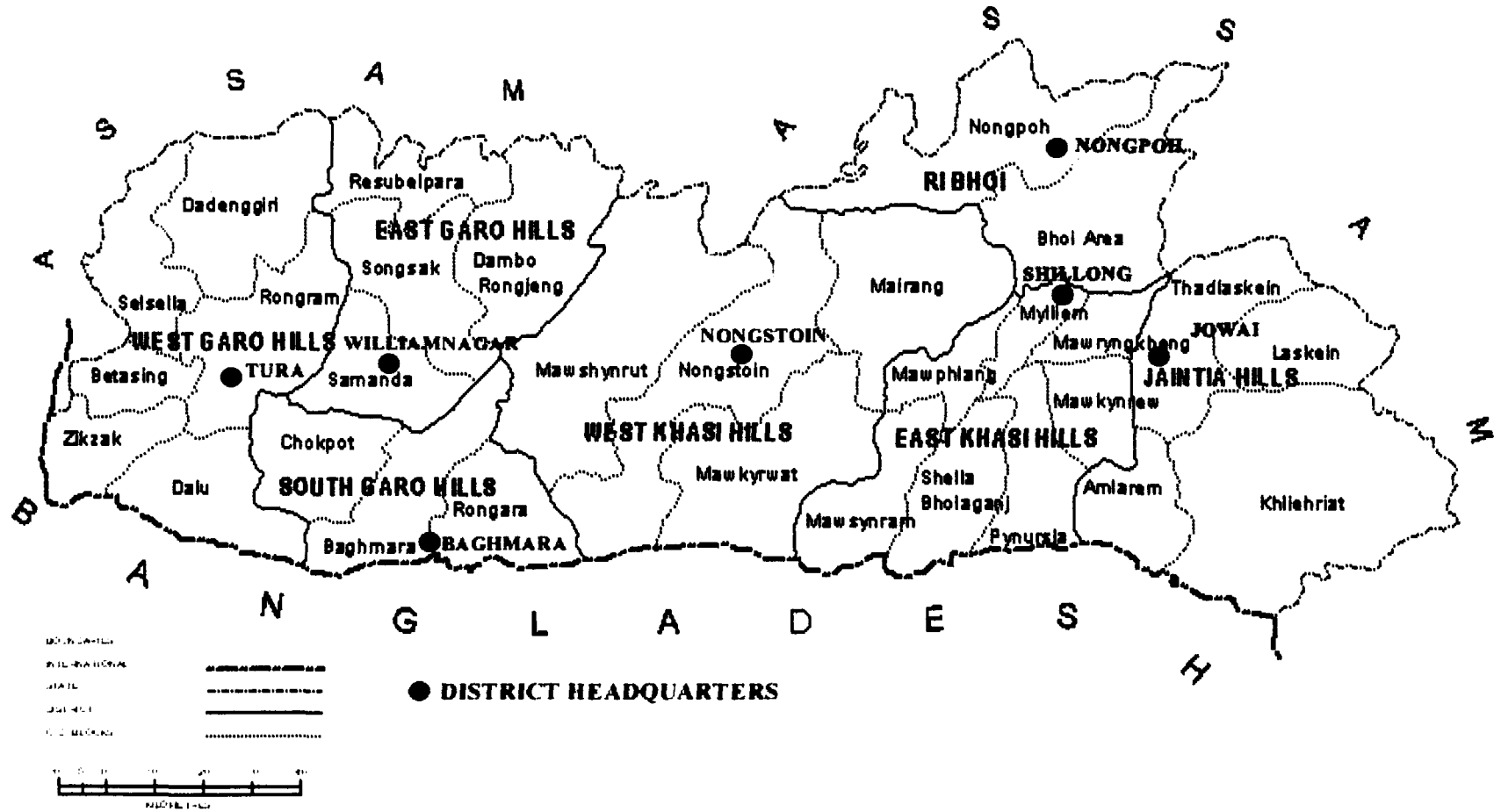


Figure- 1.3

medical facility, percentage of villages having drinking water facility was also worked out and tabulated against each of those 30 Blocks of the State.

Table-1.1
Classification of Major Diseases Prevalent in Meghalaya (as per International Classification of Diseases Adopted by World Health Organization)

Sl. No.	Major Diseases By Rank	International Classification of Diseases (ICD)	ICD Code
1	Respiratory Infections	Diseases of respiratory system	J00 – J99
2	Diarrhoeal diseases,	Diseases of digestive system	K00 – K94
3	Pyrexia of Unknown origin	Symptoms, signs and abnormal clinical and laboratory findings not elsewhere classified	R00 – R99
4	Skin diseases	Diseases of skin and subcutaneous tissues	L00 – L99
5	Peptic ulcer syndrome	Diseases of digestive system	K00 – K93
6	Malaria	Certain infectious and parasitic diseases	A00 – B99
7	Viral hepatitis	Endocrine, nutritional and metabolic disorder	K00 – K93
8	Infection of worm	Certain infectious and parasitic diseases	A00 – B99
9	Anaemia	Endocrine, nutritional and metabolic disorder	E00 – E90
10	Diseases of oral cavity	Diseases of digestive system	K00 – K93
11	Diseases of eye	Diseases of eye and adnexa	H00 – H59
12	Diseases of urinary track	Diseases of genitor urinary system	N00 – N99
13	Pulmonary tuberculosis	Diseases of respiratory system	J00 – J99
14	Diseases of ear	Diseases of ear and mastoid process	H00 – H95

1. 10. Data Analysis and Presentation

All the reported diseases have been ranked as per the number of cases recorded in the State as a whole so as to determine the empirically major and most important categories of human morbidity. In this process 21 different diseases were recorded including the miscellaneous group where both minor and undiagnosed diseases are clubbed together. Within the limit of the present research, as many as 11 high ranking diseases have been dealt with at different levels of details.

The morbidity data have been tabulated and mapped employing manual, Microsoft Excel Spreadsheet and Arc View GIS software to show the spatial and seasonal variations in occurrence of each disease category. Taking the Blocks as the

lowest administrative unit disease ranking, percentage share of each disease category and disease incidence per thousand populations (against mid-census population for the year 1996) have been computed and mapped. Moreover, Rafiullah's Maximum Positive deviation Method used for crop combination has been profitably employed in order to workout a combination pattern of the major diseases for each of the Blocks as well as for the districts.

Rafiullah's Maximum Positive Deviation Method :

$$\text{dev}^2 = \frac{D^2/p - D^2/n}{N^2}$$

Thus:-

$$\begin{aligned} 1. \text{ Mono-disease} &= \frac{(X1-50)^2}{(1)^2} \\ 2. \text{ Duo-disease} &= \frac{(X1-25)^2 - (X2-25)^2}{(2)^2} \\ 3. \text{ Tri-disease} &= \frac{(X1-16.7)^2 + (X2-16.7)^2 - (X3-16.7)^2}{(3)^2} \\ 4. \text{ Quadri-disease} &= \frac{(X1-12.5)^2 + (X2-12.5)^2 - (X3-12.5)^2 - (X4-12.5)^2}{(4)^2} \end{aligned}$$

In case of malaria, the method of diagnosis is that of microscopic detection of parasite in the blood sample of the diseased person done at those PHCs having malaria detection laboratory. The parameters used for measurement of malaria positivity are parasitological in nature and are expressed as follows:

$$\text{API (Annual Parasite Incidence)} = \frac{\text{Positive cases during one year}}{\text{Population under surveillance}} \times 1000$$

$$\text{AFI (Annual Falciparum Incidence)} = \frac{\text{Positive falciparum cases during one year}}{\text{Population under surveillance}} \times 1000$$

$$\text{PF\% (Plasmodium Falciparum Percent)} = \frac{\text{No. of PF cases}}{\text{No. of total malaria cases}} \times 100$$

$$\text{PV\% (Plasmodium Vivax Percent)} = \frac{\text{No. of PF cases}}{\text{No. of total malaria cases}} \times 100$$

As many as ten attributes have been selected as those having significant influence on the prevalence pattern. These include; absolute altitude above mean sea level (in metre), mean annual rainfall (in millimetres), mean annual temperature (in degree Celsius), percentage of forest cover (for the year 1991), density of population per square kilometre (against computed mid-census population), literacy rate, female literacy rate, percentage of villages having educational facility, percentage of villages having medical facility and percentage of villages having drinking water facility. These have been computed as the mean occurrence within the areal extent of each Block of Meghalaya. Both spatial and statistical association of these attributes with the major diseases have been assessed through representation on maps and simple statistical methods. The statistical software SPSS 7.5 and the ESRI mapping software Arc View GIS have been employed for this purpose.

1 11 Review of Literature

Among several disciplines which study the human health in one form or another, geography is one. These two most classical disciplines, i.e., geography and medical science, have found their common fields of interest since around the start of this century. Medical geography is defined as a distinct “branch of bio-geography has been evolved out of a systematic study of the spatial distribution of diseases, health and ill-health and the causes thereof” (Misra, 1970). This definition may restrict the much important environmental approach to health and disease. On the other hand the impact of changing socio cultural and economic attributes provides another perspective to the subject.

Although ‘medical geography’ is a fairly recent term, E. J. L. Corwin (1949) found the concept of geographical medicine is not essentially new. The connection between the environment in which we live and diseases from which we suffer was

known to the Indians and Chinese even in 1000 B.C. and among the Greeks since the time of Hippocrates (5th and 6th Century B.C.) and Lucretius (1st Century B. C.). Ancient Indian scholars of Ayurvedic medicine like Susruta (1500–1000 B.C.), Charak (1000 B.C.), Bhel (700 A.D.), and others have described the regional patterns of various diseases. Hippocrates was perhaps the first medical geographer who analysed the spatial pattern of diseases in a temporal framework, taking into account the factors such as climate, locality and human behaviour. He also pioneered the generic classification of diseases into ‘endemic’ and ‘epidemic’ types (Agnihotri, 1995).

In modern times the serious study of geographical medicine began with a three volume work by a German writer, Finke, published in 1795. Many similar systematic studies appeared during the Nineteenth century; of that ‘Handbook of Geographical and Historical Pathology’ by Hirsch is the most famous. World War II stimulated new interest in this subject. In course of the war two sets of disease survey reports have been brought out are ‘Global Epidemiology’ by Simmons and others, based on surveys made for the United States Army Medical Department, and the *Sauchen Atlas* or ‘Atlas of Epidemic Diseases’, issued by the German Army Sanitary Corps (Corwin, 1949).

Thus the study on this particular discipline was initiated by non-geographers. Primarily the countries shown interest in the subject were U. S. A. (May), Britain (Learmonth, Geddes, Howe, Waddy), Germany (Jusatz), and particularly U. S. S. R. where not only the spatial distribution of diseases have been taken into consideration, but more stress is laid on geophysical and geo-medical causative factors of human diseases with reference to environmental conditions. Thus the concept of ‘medical landscape’ has been developed by the Soviet geographers.

The works done between the Hippocratic era and the nineteenth century have been classified by Howe into two timescales– the early period before 1848 A.D. when

direct physical aspects in generalized form were more emphasized and the later part looking into the special aspects aided with representation over the maps.

The term 'medical geography' was first coined in Britain by Alfred Haviland in his work 'Geographical Distribution of Disease in Great Britain'¹⁶ and thus in late nineteenth century the subject got its modern origin. By the end of 1949, the subject was recognised by I.G.U. and a new commission was formed in Lisbon. Later in 1968 at New Delhi, India, medical geography was given a permanent status. Instead of its' root in the historical past, a systematic development was not initiated until the fifties with the works of Jacques May.

During 1950s, American geographers prepared a series of maps on a regional and global scale on regional heterogeneity of environmental conditions in prevalence and distribution of diseases. A milestone was laid in the field of medical geography with the publication of the Learmonth's regional study of survival, mortality and disease in Indo-Pakistan zone. He narrated the social and geographical relationship with malnutrition in underdeveloped areas.

By early 1960s Howe made a remarkable contribution by publishing the maps of mortality distribution in Britain. New demographic mapping techniques have been adopted to present the regional pattern of standard mortality rate. Jusatz (1961) in Germany set another landmark in medical geography through his 'World Atlas of Epidemic Diseases'. In Belgium as well various studies by geographers like Picheral (1969), Charlier (1969), etc dealt with the spatial distribution of mortality. Stamp (1964) insisted on micro level mapping of causal factors in disease association.

In Britain Howe continued his contributions during the seventies by employing modern cartographic techniques to portray the pattern of mortality over maps. The ecological approach to the study of spatial distribution of diseases and their possible

causes remained the main trend till mid 1970's along with some attention on spatial aspects of health care delivery, their planning and health behaviour. Belgians contributed much to the study of tropical diseases during 1970s. More attention was paid on diseases like malaria, schistosomiasis, meningitis and syphilis. At the same time studies on epidemiological geography were given importance in U. S. A. and Britain. Hunter and Young (1971) contributed new lights on the spread of influenza in England and Wales.

During the next two decades increasing emphasis has been laid on the spatial pattern analysis of disease occurrence, through both macro and micro ecosystem approach and on cartographic presentation of those using modern software. Hinz (1983) from Germany published a synoptic geo-medical map for a section of Africa comprising Nigeria and western Cameroon. Further progress in the same direction was observed in Belgium and France. The applied aspects of the subject were systematically chaptered in the book 'Applied Medical Geography' written by Gerald F. Pyle (1979) from the University of Akron, U.S.A. A group of medical geographers emerged in Japan as evident from the 'Geography of Health Care' edited by Andrew Learmonth (1981) containing selected papers from the 24th International Geographical Congress held in Tokyo.

1.11.1. Indian Perspective

Indian health situation has been and still is attracting researchers from all over the world since the advent of the subject. According to Akhtar (1985) probably the first scientific attempt to identify the regional factor of disease prevalence in India was made by McClelland in 1859. In fact, up to the end of 19th century most of the works has been restricted within descriptive studies of disease distribution vis-à-vis other geographical aspects corresponding to certain diseases in India. Macnamara, F. N.

(1880) studied some geographical aspects corresponding to certain diseases in India. J. and A. Chudchill (1880), Moore (1880), Fayrer (1882), Chevers (1886), Adams (1889) and Hamoston (1905) are the other initial contributors focussing on the climatic control and distribution of diseases in different parts of India.

By the turn of this century medical geography in India practically has set its modern trend with the studies made by A.M.V. Histerlow (1929) on possible environmental factors and diseases in south India. Up to the end of the colonial period researches had been centred on studying and combating the most common dreaded diseases i.e. malaria. Works of several foreign researchers like Benley (1925), Christopher (1912), Gill (1923) and several others may be cited in this context.

In independent India a large group of medical geographers emerged who worked with a much wider perspective. Consequently several sub-fields have been identified where important contributions have been made in India. Notable among those are Geography of nutrition; Disease ecology, Socio cultural aspects of health, Health behaviour and traditional medicine and. Health care geography, etc.

Among the pioneers, Andrew T. A. Learmonth's efforts in promoting and developing the subject in India is noteworthy. His early works on regional geography of malaria in India and Pakistan (1957) and 'Medical geography in Indo-Pakistan (1958)' made a great impact. On his foot steps, the contributions by Chakrabarty (1954), Covell (1955) and Sen (1957) on cholera and malaria worth special mention. With Basu (1969), Nair and Samnotra (1969) publishing micro level studies on cholera and malaria the main emphasis was still on incidence and distribution of disease in India during 1960s and 1970s. Major diseases like trachoma, malaria, goitre, cholera and dengue have been studied most. As an exception the Aligarh school of medical geography concentrated on nutrition and deficiency diseases.

Finally the 21st International Geographical Union, Commission on Medical Geography held in New Delhi in 1968 opened up the avenue for systematic studies among the Indian geographers. Consequently the first book of 'Medical Geography of India' was presented by R.P.Misra in 1970. Mention is proper for the important works like mortality study in Rajasthan by Tewari (1973), in Orissa by Ahmed (1974) and the map of malaria in India by Christopher and Sinton (1978) and malaria parasite index by Learmonth and Akhtar (1979).

Among the current researchers, study on incidence of malaria in Terai region by Akhtar (1982) and Hyma (1980), on cancer by Akhtar (1983) and Hazra (1984) on infectious hepatitis by De and Gollerkeri (1984) etc are important. D. Banerjee's works on socio cultural aspects of disease (1981), B. Banerjee and J. Hazra's studies on Geocology of Leprosy and cholera in West Bengal (1974-82), S. Pacholi's contribution on Medical Geography of Malaria in Madhya Pradesh (1993) etc may also be mentioned here. R.C. Agnihotri (1995) presented a comprehensive study on geo-medical perspective of a culture zone in Madhya Pradesh, giving a detailed special pattern of disease and health care facilities. Kondrachine (1997) has presented a valuable overview of malaria focussing the post resurgence scenario on a global scale with special reference of Indian subcontinent.

More recently Sinha and Srivastava (2001) have analysed the changing morbidity pattern at a macro level by using available records at state level. An inter state comparison in morbidity pattern in India studied by the authors revealed high prevalence of infectious diseases and nutritional disorders along with increasing incidence of degenerative diseases. Hazra (2000) concludes from a study of Kolkata that incidence of morbidity in this metropolitan city is far more man induced and that the city is experiencing evolution of new disease pattern. Another study (Sinha, 2001-2)

on the disease pattern across age and social classes reveals substantial variation across these social groups. Diffusion of AIDS has been mapped by Mukhopadhyaya and Dutt (2004) in a cross cultural perspective.

De (1998) provided a very interesting review of the works on geography of Health in India and lamented limited attention paid to the utilisation aspect in most geographical studies on health which end up as cartographic representation of a selected disease prevalence. The International Conference on Changing Patterns of Health in Developing Countries (De: 1998) addressed itself to diverse themes on medical Geography, but here too, the papers contributed on social aspects of availability and utilisation of health care were few.

Interest on medical geography research in Meghalaya is largely confined to understanding of the spread and diffusion of malaria. Notable Geographical contribution in this field has come only in recent years from Nandini et. al. (1996) on use of contraceptive, Unisa Sayeed and Murty (1996) on fertility, Mukherjee (1997) on indigenous health practices, Nayak and Mukherjee (1999) on prevalence pattern of major diseases. In a recent study Hazra (2002) found little impact of urban life style on the disease pattern in Mizoram. A notable contribution has come from an M.Phil dissertation on availability and utilization of health services in Meghalaya (Warjri: 2005). The study laments the irrational location of health facilities and attributes this fact to poor utilization of health services in the state as, contrary to popular belief, the tribal people in this area utilize the Government run health institutions very frequently if they are located in close proximity. Needless to mention, in-depth studies based on fieldwork remains a much-felt need to supplement these studies based on secondary sources. As already pointed out, most of the studies on health aspect pay little attention to constraints on utilization.

1. 12 Organisation of the Manuscript

The manuscript of this thesis is organised into the following broad chapters:

Chapter I provides details pertaining to the basic research design including the statement of the problem, definitions and concepts, relevance of the study, a brief note on the selection of the study area, state of health in Meghalaya, broad objectives placed before the research, important research questions, methodology and database, data analysis and presentation, an overview of relevant literatures and the chapter design.

The second chapter is devoted to an understanding of the environmental and socio-economic background of Meghalaya. In this chapter the study area is introduced in relation to those attributes which have a direct bearing on the disease ecology of the region. The aspects chosen for description include location, relief and drainage, climatic character, extent of forest cover, distribution of Population, literacy rate, availability of educational facility, availability of drinking water facility and availability of medical facility.

Distribution Pattern of prevalent diseases in Meghalaya is the major concern for analysis in the third chapter. An attempt has been made in this chapter to identify the spatial pattern in the distribution of major diseases in the study area.

Chapter 4 is devoted to an understanding of the environmental attributes of the major diseases prevalent in Meghalaya. The chapter includes a detail analysis six major diseases and their relation with environmental attributes; both physical as well as socio-cultural.

The fifth chapter analyses the data collected at village and household level to attempt at an explanation of the disease pattern at micro level.

The last chapter provides a summary of the major findings and provides a series of policy recommendations based on both macro and micro level understanding.

1. 13 Concluding Statement

This chapter introduces the thesis giving a general background of the subject, the data base, methodology and techniques adopted for analysing the data. Medical Geography or more aptly and recently named as Geography of Health, which the present study deals with, is a relatively new field in geography particularly in India and more so in the academic landscape of the North East India. Meghalaya, as a distinct geographical and administrative unit, possesses remarkable anthropo-geographical variations and a wide range of diseases environment as well. Both primary and secondary data have been collected through field investigation and supplemented by library study. Only the statistically important diseases are considered for detail study on the distribution pattern to understand the probable environmental and socio-economic causative factors of those diseases. A brief overview of literature is given at the end of the chapter where the researcher could not mention any available reference of study in this part of India which can be compared to this.

The major limitation of the study flows from the macro level data which were collected from health records maintained by hospitals, health centres, dispensaries etc. and were found to be inadequate, incomplete and in a few cases notoriously unreliable. There are gaps in the recording of data making temporal analysis a hazardous exercise. The quality of recording too varies from one institution to another. No standard classification procedure for the diseases has been followed making it exceedingly difficult in classifying morbidity pattern. Moreover, the data collected are only the reported cases whereas there are plenty of cases which go unreported. Attempts have been made to overcome some of the difficulties following standard procedures, but many of the difficulties could not be overcome which remained as inherent problem of the research.

CHAPTER II

ENVIRONMENTAL AND SOCIO-ECONOMIC BACKGROUND OF MEGHALAYA

2.1 Introductory Statement

Needless to emphasise, prevailing environmental conditions in any given area are responsible for occurrence of certain diseases. Likewise, certain socio-cultural practice and economic conditions of the people too are important determinants in creating favourable conditions for emergence of new diseases or are responsible for spread of diseases which are environmentally induced. In short, both natural and socio-economic conditions are important factors in creating specific disease ecology. In this chapter an attempt has been made to describe the general personality of the study area, i.e. Meghalaya, in the context of those crucial physiographic and demographic factors, which have probable bearing on the prevailing disease distribution. In addition to the general description of altitude, rainfall, temperature, forest cover, density of population, literacy rates, availability of medical, educational and drinking water facilities etc. spatial variation of each aspect have been mapped showing different zones based on suitable ranges.

2.2 Location and Administrative Set-up

The state of Meghalaya (the abode of clouds) is located at the north eastern part of India within the geographic latitudes of 25°02' N to 26°06' N and longitudes of 89°48' E to 92°47' E. The state has a total geographical area of 22,429 square kilometres. It was carved out of Assam as a new state in January 1972. Meghalaya is bounded by the Rangpur, Goalpara and Kamrup districts of Assam state on the west and the north, North Kachar Hills and Karbi Anglong districts of Assam on the east,

while the whole of its southern limit forms the international boundary between Bangladesh and India (see chapter-I, fig. 1.1).

Formerly Meghalaya had only five districts. Since 1992 two more districts have been added to the total number of districts by way of administrative reorganisation of districts and at present there are seven districts in the state, namely Jaintia Hills, East Khasi Hills, West Khasi Hills, Ri Bhoi (new), East Garo Hills, West Garo Hills and South Garo Hills (new). These districts are divided into thirty Community Development Blocks as the lowest administrative unit of the state. The revenue villages as demarcated in the census are not clearly defined with boundaries in this state. There were 4,902 census villages and 12 towns as per the records of the Census, 1991. The picturesque city of Shillong, located just north of the highest peak- Laitkor in the East Khasi Hills district, is the administrative capital of the state.

2.3 Relief and Drainage

Physiographically, the whole of Meghalaya is said to represent a remnant of an ancient plateau of Pre-Cambrian age of Indian peninsula uplifted to the present height of 600-1800 metres above the mean sea level. Shillong Peak is the highest tower over neighbouring plateaux at a height of about 1961 meters above the mean sea level. The region has been described as an irregular parallelogram and a tableland (Geological Survey of India, 1974).

Meghalaya Plateau includes the major portion i.e. the Garo, Khasi and the Jaintia Hills of the Meghalaya-Mikir plateau region, an extension of the ancient Gondwanaland land in north-east India. Hence the whole state has a typical plateau landscape with flat skyline bounded almost on all sides by the 150 m contour line. The central axis of the plateau landscape which runs east-west direction raises up to 1900 m above mean sea level (Fig. 2.1).

MEGHALAYA RELIEF AND DRAINAGE

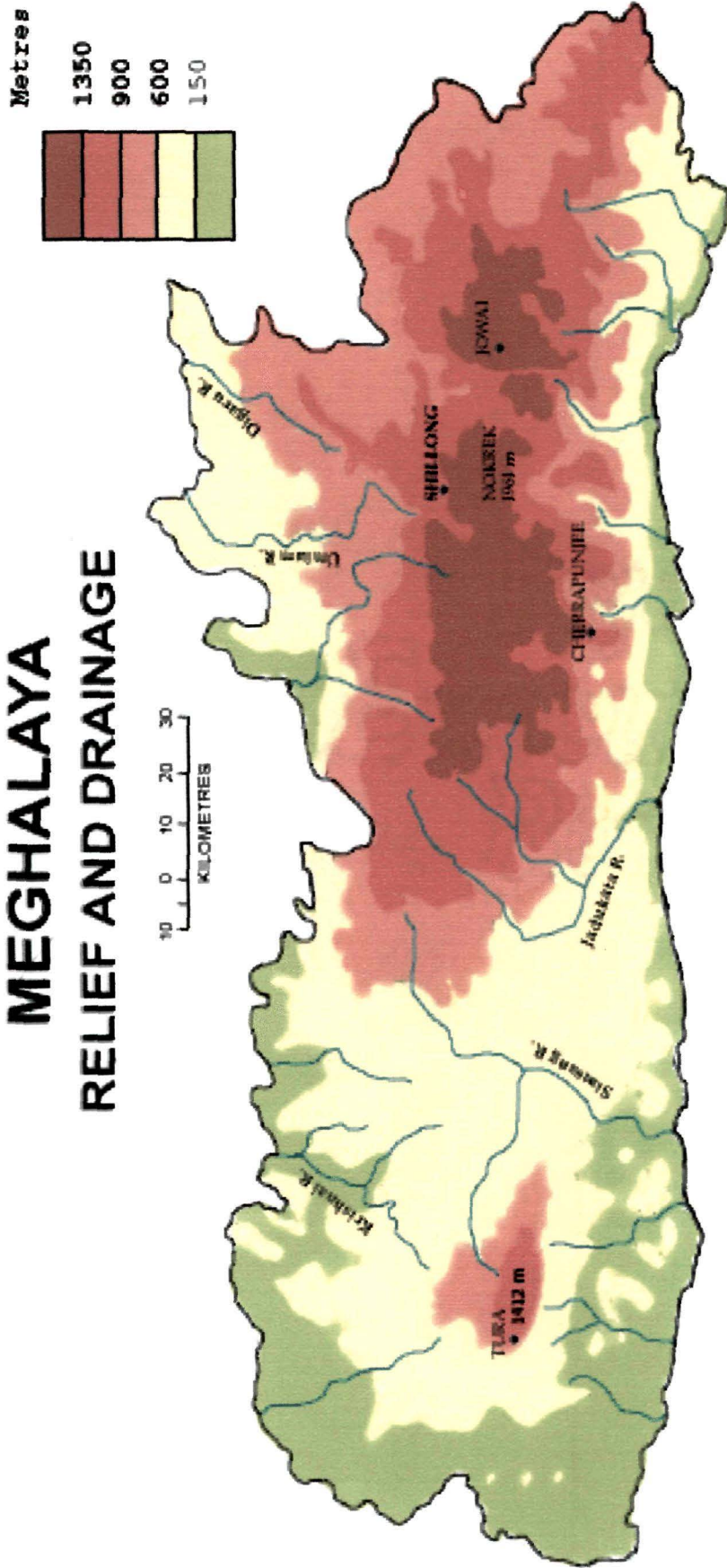


Figure – 2.1

There are two distinct physiographical divisions viz. i). the Khasi Hills or the Eastern Meghalaya covering almost 60% of the total area and four out of seven districts of the state namely Jaintia Hills, East Khasi Hills, Ri Bhoi and West Khasi Hills; and ii) the Western Meghalaya or the Garo Hills consisting of all three Garo Hill districts (Singh, 1971).

The Khasi Hills region contains the central plateau axis with an average altitude 1400 m. with its highest point at Shillong Peak or Laitkor (1,961m). The typical senile plateau landscape is conspicuous with at least three different surfaces merging stepwise down to the Brahmaputra Plain in the north. This northern part is traditionally called the Ri Bhoi (the *Bhoi* country). In the south, the central plateau ridge descends by 150 – 200 m. to the Cherrapunjee Platform. Several structural platforms made of sandstone and limestone of late Mesozoic period. Hence this part is more rugged and dissected carved by the swift flowing rivers with various waterfalls and limestone caves in the world's highest rainfall zone locally known as Ri War (the War country). The plateau axis gradually lowers down into the Jaintia Hills further east and finally merges with the Barak plains of Assam. The central axis acts as the main water divide between the Brahmaputra system in the north and the river system in the Shylhet plain of Bangladesh on south. Several major rivers in the Khasi and Jaintia hills radiate from the central ridge like the Umiam, Umtrew, Umngi, Umngot, Kynshi, Mytndu, Kopili, etc.

The Garo Hills or Western Meghalaya has a lower average altitude with low rounded hills and intermittent plains with an average altitude of 600 m. The Garo Plateau rises to a distinct east-west range known as Kailash or Tura range. The central plateau ridge culminates here reaching the Nokrek peak (1411 m.) near Tura. Another relatively lower range runs north-south between Maheshkhola and Adokkgre separating the western and central parts of the Garo Plateau. Its western and northern parts along

the left bank of Brahmaputra River are characterised by low hills and limited plain areas drained by the Dudhnoi, Krishnai and the Jinjiram rivers. The Simsang is the longest river in the region draining towards the south and entering Bangladesh as Someswari. The Mahadeo and the Mahes Khola are the other two south flowing rivers which flow through deeply cut valleys in the South Garo Hills (Taher and Ahmed, 1998).

All the physio-cultural parameters elected for this study have been calculated and tabulated at block level for the state (Annexure-II). These numerical values are mapped at the block level and also compared with the corresponding disease morbidity figures of each block in the fourth chapter.

2.3.1 Altitudinal Zones

The State of Meghalaya has been divided into four altitudinal zones as per the existing physiographic character of the plateau (Fig. 2.2). The lowest zone up to 350 m. above the mean sea level has been considered as the *Foot Hills Zone* which covers the western fringe of Meghalaya consisting of six bordering blocks of the East and the West Garo Hills districts. The *Low Plateau Zone*, within an altitudinal extent of 351 m. to 800 m, includes the Ri Bhoi district on the north and most parts of the East and South Garo Hills. An extensive part of the West Khasi Hills, Jaintia Hills, some parts of East Khasi Hills and Rongram block of the West Garo Hills districts come under the *High Plateau Zone* within the altitudinal extent of 801m. to 1250 m. whereas the remaining part of the state lying above 1250 m. located on the highest part of the state form the *High Ridge Zone* consisting mainly of the Shillong and Cherrapunjee plateau and the adjoining areas.

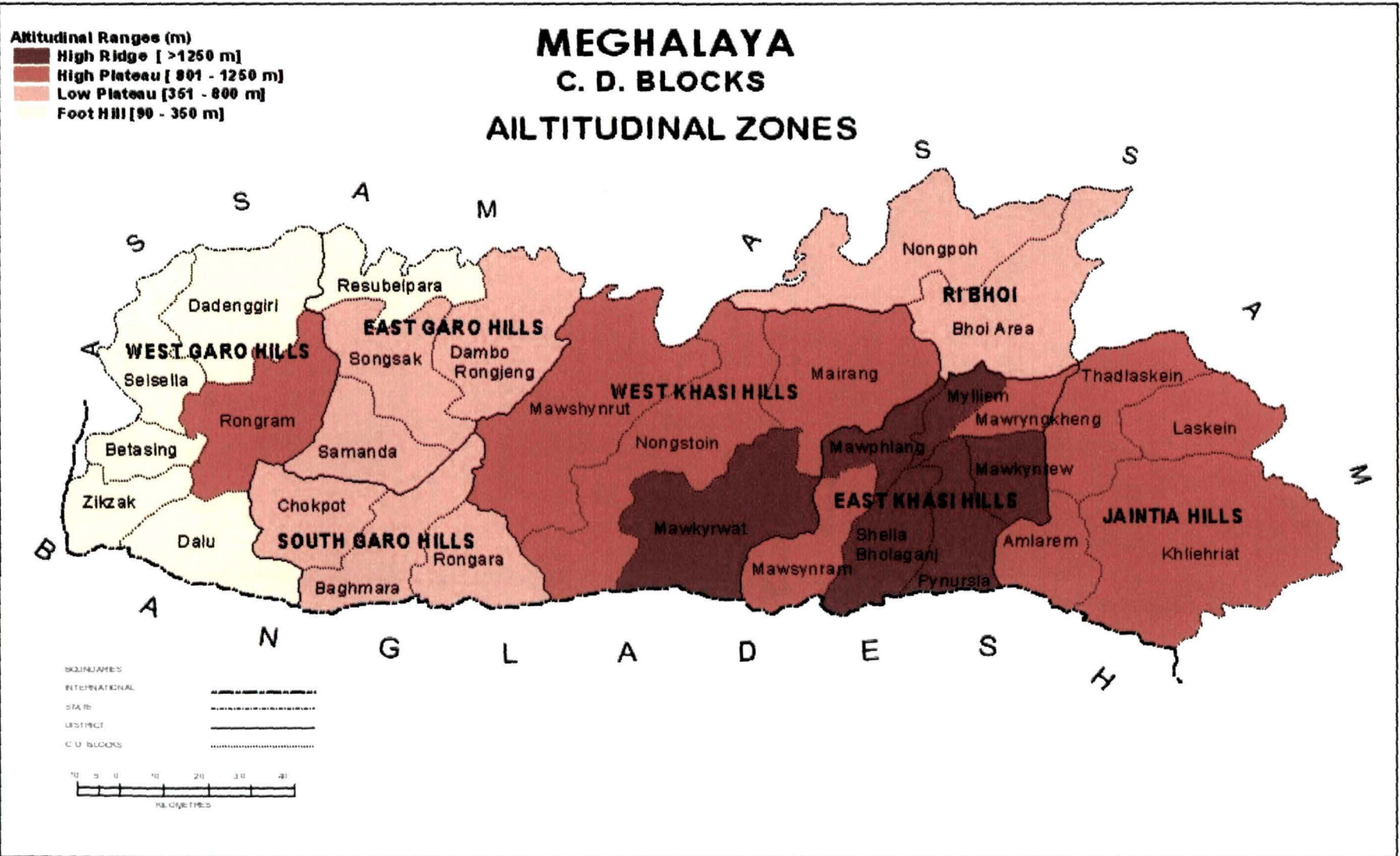


Figure - 2.2

2.4 Climatic Character

In general, Meghalaya enjoys a sub-tropical monsoon climate. Remarkable variation in temperature and rainfall is observed due to orographic prominence and the maritime air mass from the Bay of Bengal on the south. As per the normal weather conditions, the year in Meghalaya can be divided into four distinct seasons viz. cold season, hot season, rainy season and cool season (Bhakta, 1992). The rainy season is the most conspicuous and includes five months from May to September when the south west monsoon stream from Bay of Bengal produce very heavy rainfall. During October – November the weather cools down after the rains and a short cool autumn season prevails. The real cold winter begins in December and continues till the end of February. The mean minimum temperature dips as low as 3.6°C. The next two months, March and April, are the hot season when highest temperature is recorded.

The Garo Hills or the Western Meghalaya with relatively lower altitude enjoys a fairly higher air temperature for major part of the year (February to October). April is the hottest month with mean minimum and maximum temperatures of 33°C and 22°C respectively. January is the coldest month and the mean temperature varies from 24°C to 12°C. The average annual rainfall is also lower (3300 mm) in the Western Meghalaya and winter is particularly dry. The amount of rainfall decreases from south to north as the south-west monsoon wind gets obstructed by the Tura range and cause heavy orographic rainfall on the southern slopes (fig.-2.3).

The Khasi Hills or the Eastern Meghalaya shows a remarkable variation in climatic conditions due to variations in altitude and slope. The central upland or the areas around Shillong experience chilled winter temperature as low as 1.7°C. The mean maximum temperature does not exceed 24°C during the year. In the Cherrapunjee-Mawsynram area in the south, the temperature is still milder on the higher platforms

MEGHALAYA

SEASONAL VARIATION OF RAINFALL AND TEMPERATURE AT THREE STATIONS OF

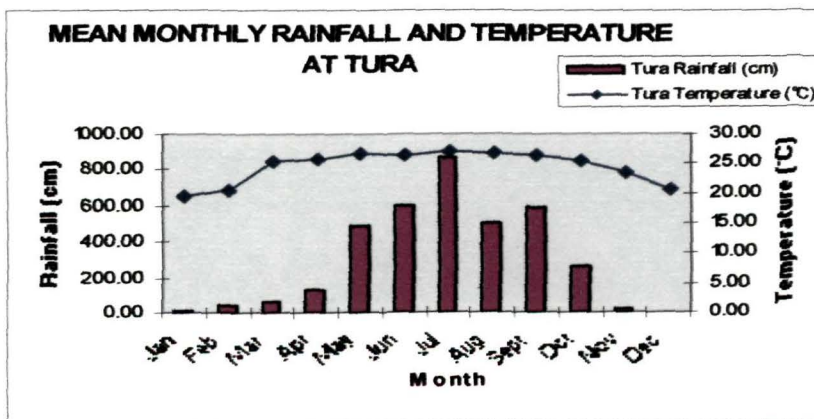
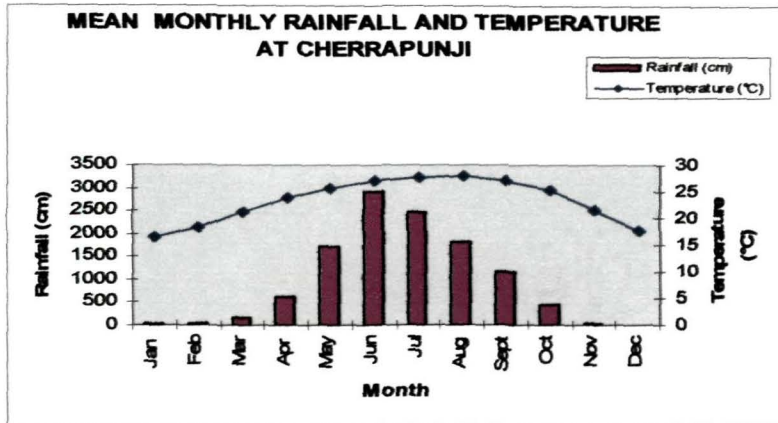
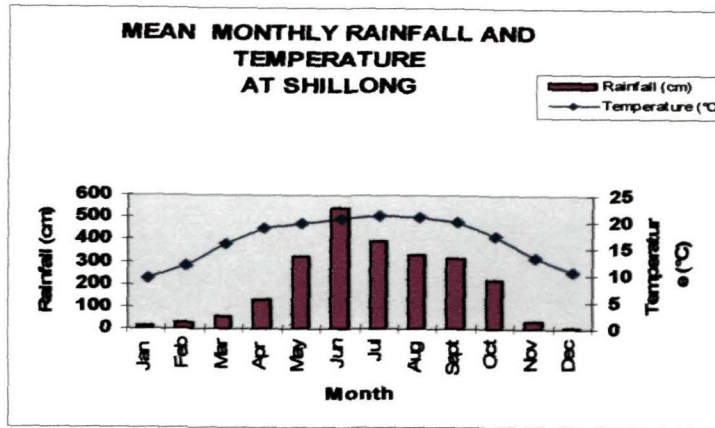


Figure – 2.3

but warm and humid in the deep valleys and low lands. This is the area receiving world's highest rainfall in a year with average annual rainfall of above 12,000 mm. owing to the abruptly rising central plateau ridge forming sudden obstruction to the heavily moisture laden south-west monsoon stream from south. A sharp decrease of rainfall on the northern slope forms a clear rain-shadow zone. Thus the northern and eastern foot hills are more humid and warm though with less rainfall (around 2000mm).

2.4.1. Rainfall Zones

The entire study area has been divided into four major rainfall zones taking the average annual rainfall in each Block into consideration. The zone receiving average annual rainfall below 2000 mm. is the *Moderate Rainfall Zone* which occupies the three blocks north of Shillong plateau broadly corresponding to the rain shadow zone. Major parts of East and West Garo Hills, eastern blocks of Jaintia Hills and some parts of Khasi Hills receiving 2001 mm. to 5000 mm. of annual rainfall are included in the *Moderately High Rainfall zone*. The *High Rainfall Zone* receiving 5001 mm. to 8000 mm. covers a considerably large tract of South Garo Hills, West Khasi Hills. The *Very High Rainfall Zone* consists of those four blocks on the southern plateau slope which receives the world's highest rainfall where the average annual rainfall remains above 8000 mm (Fig. 2.4).

2.4.2 Temperature zones

All the blocks have been grouped into four temperature zones in the state based on the mean annual air temperature (Fig. 2.5). The *Hot Zone* with a mean temperature of 23 degrees Celsius and more is found all along the foot hills zone covering the bordering areas of the Garo Hills and the Ri Bhoi district. The mean temperature varies between 22°C and 23°C in the *Warm Zone* which roughly corresponds to the low plateau belt of Jaintia Hills, some blocks of Garo Hills and the West Khasi Hills

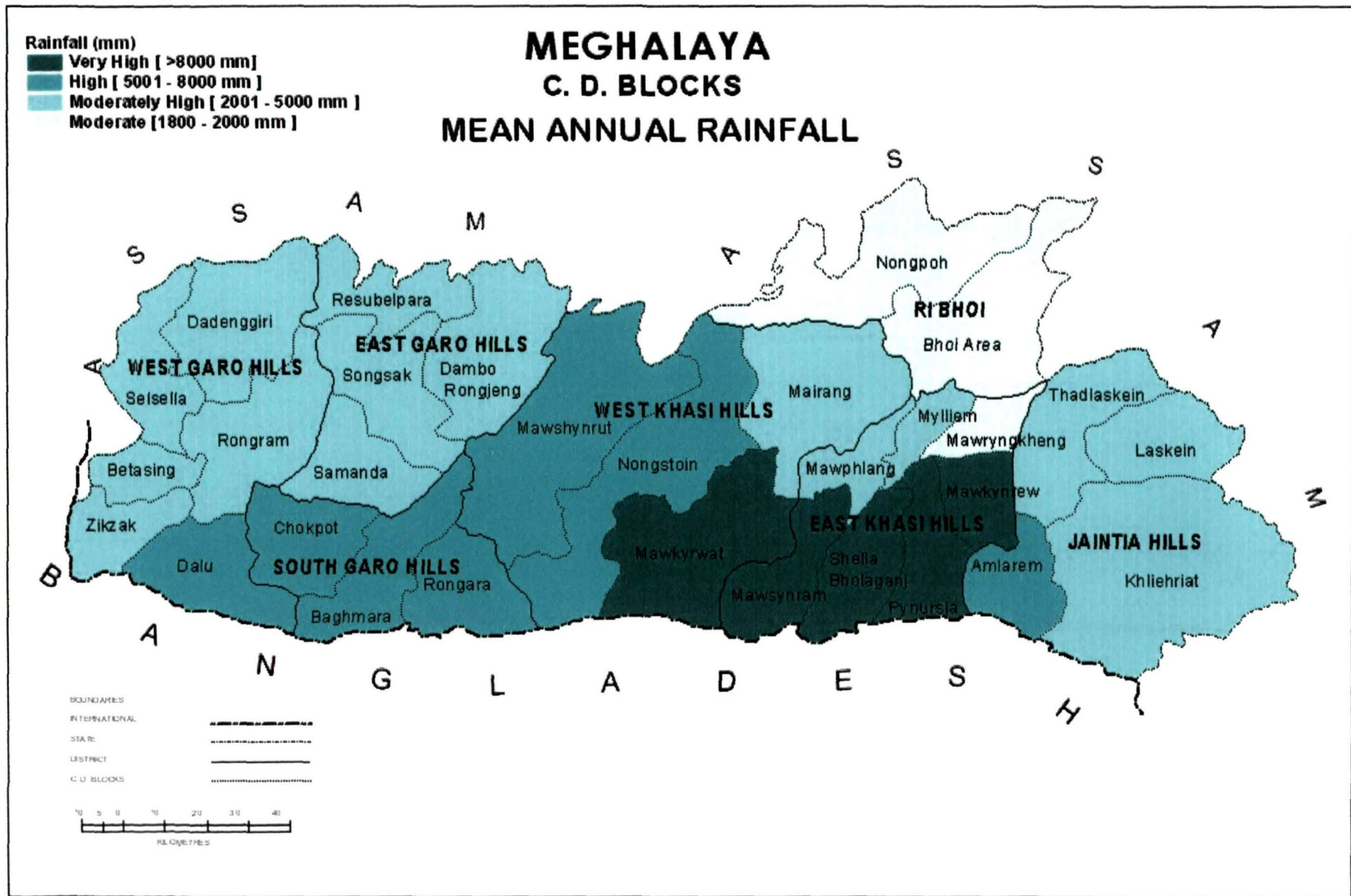


Figure – 2.4

districts. The *Cool Zone* has been delineated with a temperature variation between 19°C to 21°C which covers the higher altitude zone excepting those blocks in the *Cold Zone* enjoying a mean annual temperature of below 19°C.

2.5 Forest Cover

Excessive rainfall and wet climate has endowed the region with thick cover of sub-tropical rain forest, rich in species diversity. The natural vegetation of Meghalaya varies from sub-tropical pine forest over the higher altitude zone to the dense mixed tropical wet evergreen type in areas with moderate altitude but receiving high rainfall. On the other hand tropical moist deciduous forest cover is widely found in the lower hills and valleys of the Garo Hills districts. The vegetal cover of Meghalaya was estimated at 69.70 per cent of its total geographical area based on imagery data (FSI, 1999) but as per legally notified area under forest, the cover was only 37.80 per cent (NEC, 1995). It is important to notice that there has been a loss of 110 square kilometres of forest cover during a short span of two years in 1991-1993 only due mainly to shifting (*jhum*) cultivation and commercial exploitation in the dominantly private forests. In fact around 90 per cent of the total forest area is under private individual or clan ownership in this tribal state under the provisions of the Sixth Schedule of the Indian constitution.

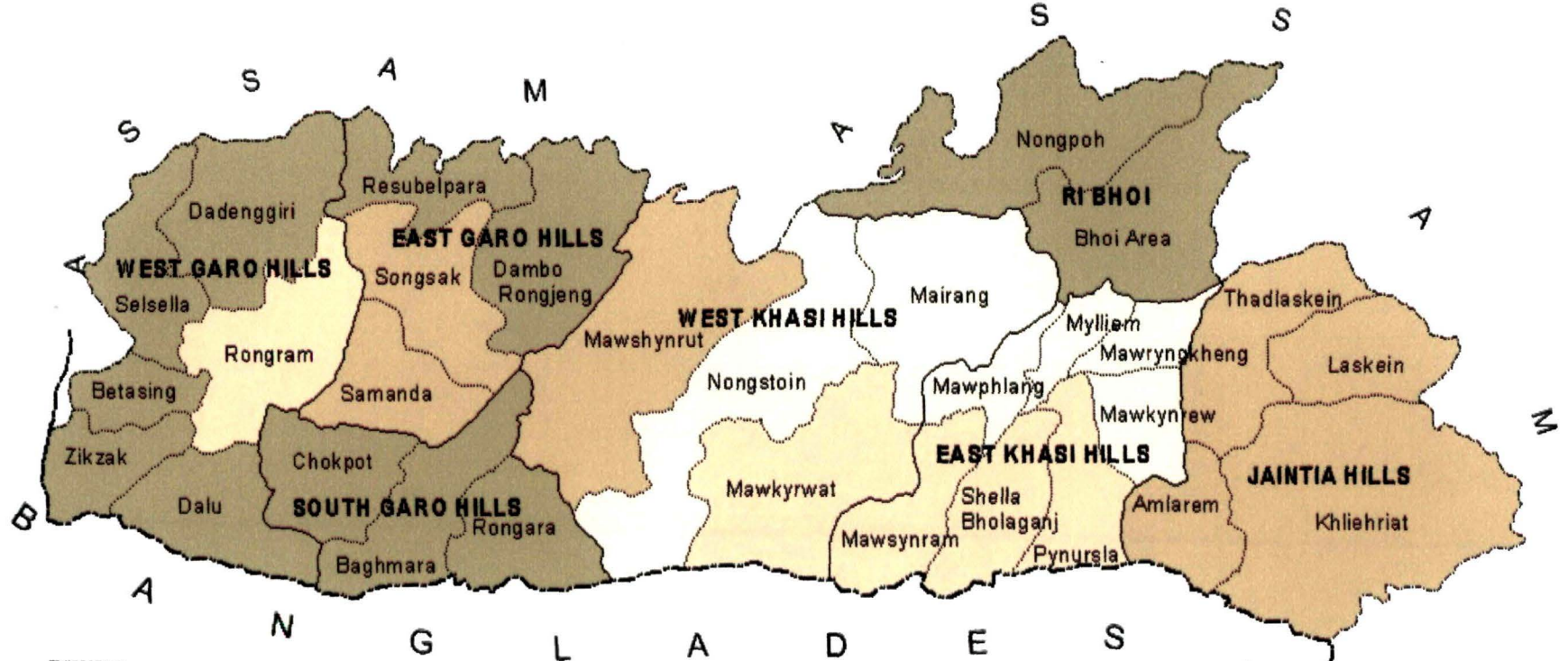
The region is sparsely populated due to its rugged terrain and inhospitable environment. The state had a population of 1,774,778 with density of 79 persons per square kilometres as per 1991 census. The settlement pattern of the tribal communities in the rural areas is the unique ridge top settlement. The predominantly rural (82 per cent) population of Meghalaya is still dependent on agriculture and among them about 23 per cent practice shifting cultivation. Only 9 per cent area is under settled cultivation

MEGHALAYA

C. D. BLOCKS

MEAN ANNUAL TEMPERATURE

- Temperature (°C)
- Hot [>22 Degree Celsius]
 - Warm [22 - 23]
 - Cool [19 - 21]
 - Cold [15 - 18]



NO UNBARRIC
 INTERNATIONAL
 STATE
 DISTRICT
 C. D. BLOCKS



and another 1.5 per cent in horticulture producing potato, ginger, turmeric, bay leaf, broom stick, orange, lemon, areca nut, etc (NEC,1996).

2.5.1. Forest Cover Zones

The Study area has been divided into three different zones considering the percentage of land under forest cover in each block in 1991 as per the data available from the state Forest Department. The distribution of forest cover zones are as follows. The *Low Forest Cover Zone* extends over those blocks which contain less than 40.01 percent of area under forest cover. There are twelve such blocks in the Khasi Hills region compared to just three in the Garo Hills. The *Moderate Forest Cover Zone* is characterised by a forest cover ranging between 40.01 per cent and 48.00 per cent. This zone extends over the remaining five blocks in Khasi Hills and three in Garo Hills. The *High Forest Cover zone* (with a forest cover of over 48.00 per cent) is found only in the Garo Hills area comprising as many as seven blocks, five of which are in the South and East Garo Hills (Fig. 2.6).

2.6 Distribution of Population

The state as a whole is relatively sparsely populated due largely to rugged terrain conditions that permit agriculture to be practised only in limited areas confined to small river valleys and in manageable slopes. The state had a total population of 1,774,778 persons with a crude density of 79 persons per square kilometres but with a relatively higher decadal growth rate of 32.86 percent as per 1991 census. The predominantly rural (82 per cent) population of Meghalaya is still dependent on agriculture and among them about 23 per cent practice shifting cultivation popularly known as *jhum*. Only 9 per cent area is under settled cultivation and another 1.5 per cent under horticulture producing potato, ginger turmeric, bay leaf, broom stick, orange, lemon, areca nut, etc (NEC,1996).

MEGHALAYA

C. D. BLOCKS

FOREST COVER

1991

Forest Cover Zones
 High [>48.00 %]
 Moderate [40.01 - 48.00 %]
 Low [< 40.01 %]

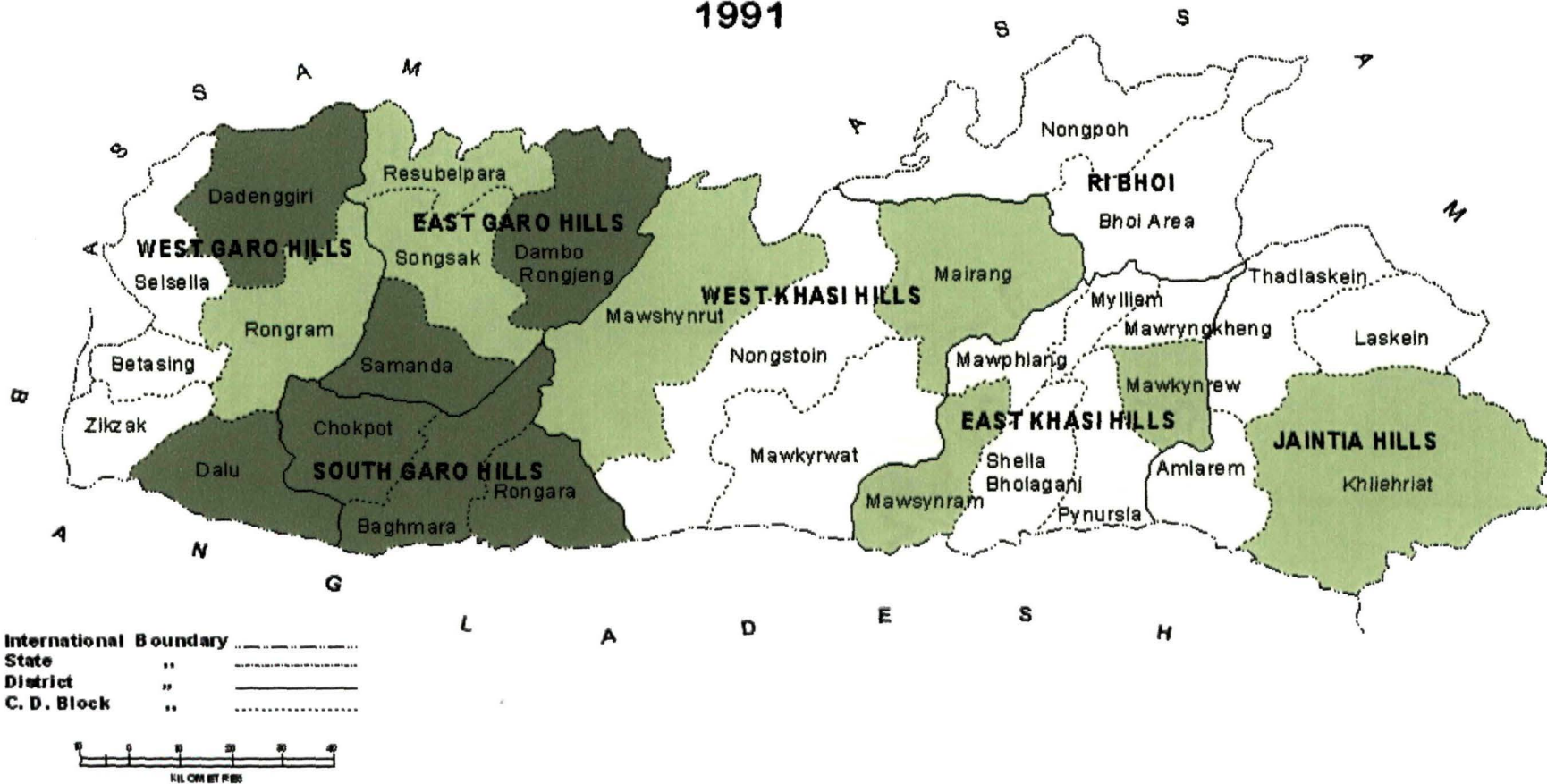


Figure - 2.6

The Garo (5, 46,734), Khasi and the Jaintia (combined 8, 70,322) are the three main scheduled tribes accounting for nearly 85 per cent of the total population (Census, 1991). In fact Khasi is a generic term for different endogamous territorial tribal groups who inhabit different parts of the Khasi and the Jaintia Hills. The Pnar or Synteng or Jaintia occupy the whole of the Jaintia Hills in the east while the Lyngam are concentrated in the westernmost part of the Khasi Hills. Likewise the Ri Bhoi district on the north is the traditional territory of the Bhoi group and the rugged and rainiest southern part is the habitat of the War Khasi group. The highest central plateau is the home for the Khyntiem (Mandal et al, 2002). Both the Garo and the Khasi are matrilineal community and are divided into several endogamous clans. The Khasi groups speak a dialect of Mon-khmer group which belongs to the Austro-Asiatic language family. The Garo dialect on the other hand is one from the Tibeto-Burman family. There are other tribal groups living in the state viz. Hajong, Mikir, Mizo, Kuki, Dimasa Kacharis, Naga group, Hmar, etc.

2.6.1. Population Density Zones

In general Meghalaya has low density of population as already mentioned. Therefore, 27 out of 30 blocks of the state are grouped under the *Low Density Zone* supporting less than 150 persons living per square kilometre area. The *Moderate Density Zone* (with a land-man ratio of 150 to 400 persons/sq. km.) extends over four blocks in Garo Hills bordering Assam and two blocks in East Khasi Hills adjoining Shillong Town. The Myllem block including the capital town of Shillong falls under the *High Density Zone* due mainly to its high urban population (Fig. 2.7).

2.7 Literacy Rate

The 1991 census enumerated 49.10 per cent of the total population (excluding 0-6 age group) as literate which is lower than the national average 52.21 per cent. The

MEGHALAYA

C. D. BLOCKS

DENSITY OF POPULATION

1996

Density Per Sq. Km.
 High [>400]
 Moderate [150 - 400]
 Low [<150]

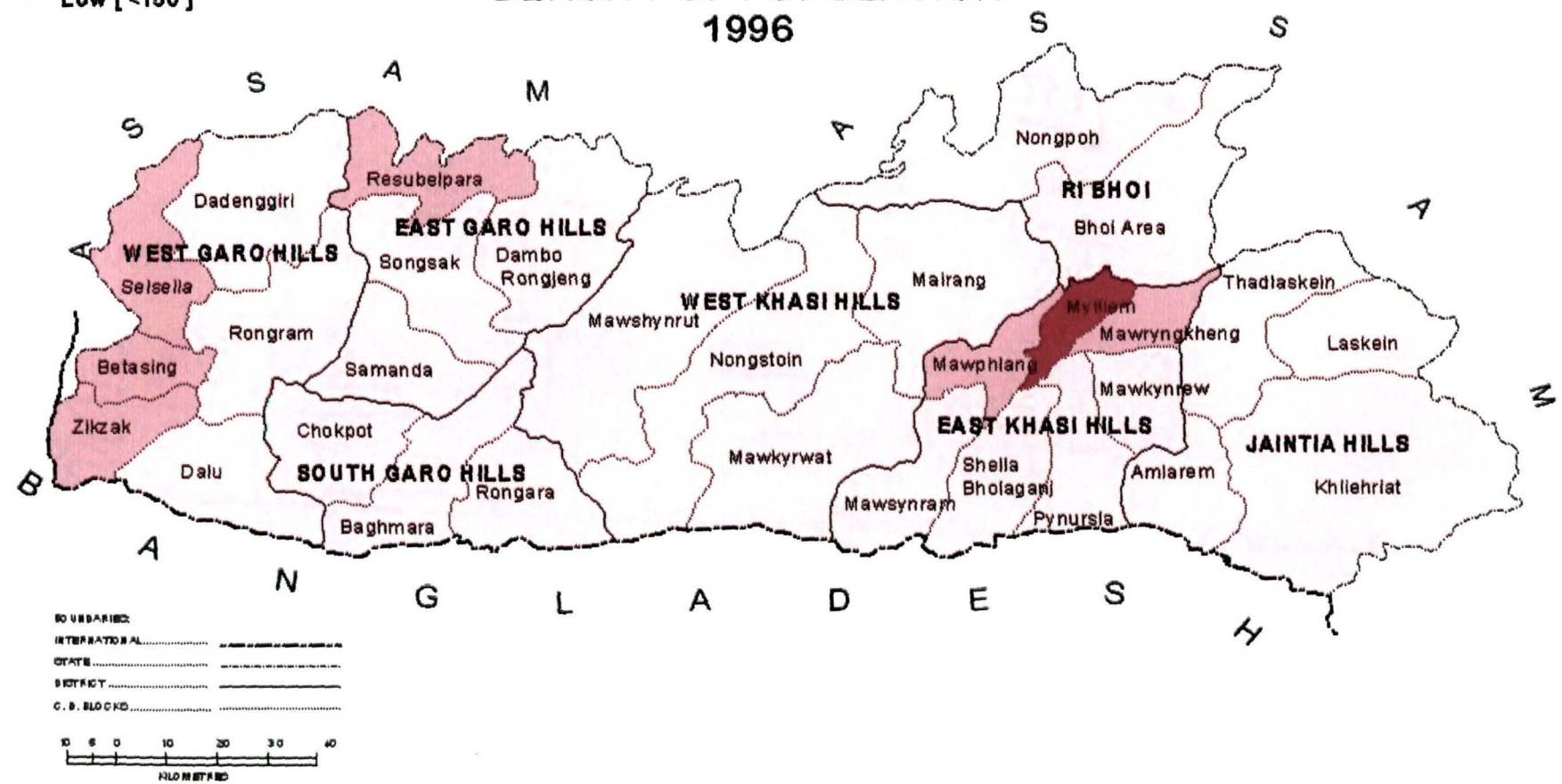


Figure - 2.7

male literacy rate (41.72 per cent) was also lower than the national average. However, the female literacy rate of 44.78 per cent is comparatively higher than the all India average of 39.00 per cent. This is probably due to better status enjoyed by the women in this state under the impact of the matrilineal social custom practiced among the people of the state. However there is important regional variation in the extent of literacy rate attained by the population living in different parts of the state as revealed by a comparison of literacy figures pertaining to different Community Development Blocks.

2.7.1 General Literacy Zones

The block level general literacy rate for the year 1996, the index year, has been computed on the basis of 1991 and 2001 census figures and this permits identification of different literacy zones. The *Very High Literacy Zone* with an overall literacy rate of over 60 percent extends over five blocks scattered over East Garo Hills, West Khasi Hills and East Khasi Hills. A good majority of the blocks in the central part of the state recorded a literacy rate ranging between 50 and 60 percent and have been included in the *High Literacy Zone*. The *Moderate Literacy Zone* is characterised by a literacy rate of 40 to 50 per cent and extends over five blocks in Garo Hills and two in East Khasi Hills. There are only two blocks each on the extreme east and western part of the state which represent the *Low Literacy Zone* with a literacy rate lower than 40 per cent (Fig. 2.8).

2.7.2 Female Literacy Zones

It has been noted that the female population of the state are relatively better literate than their counterparts in most parts of the country. Fig. 2.9 presents variation in female literacy using data at the block level. The extent of variation permits to identify at least four distinct female literacy zones. Over 60 per cent of the female

MEGHALAYA

C. D. BLOCKS

GENERAL LITERACY RATE

1996

- General Literacy Rate**
- Very High [> 60.00%]
 - High [50.01 - 60.00%]
 - Moderate [40.01 - 50.00%]
 - Low [< 40.01%]

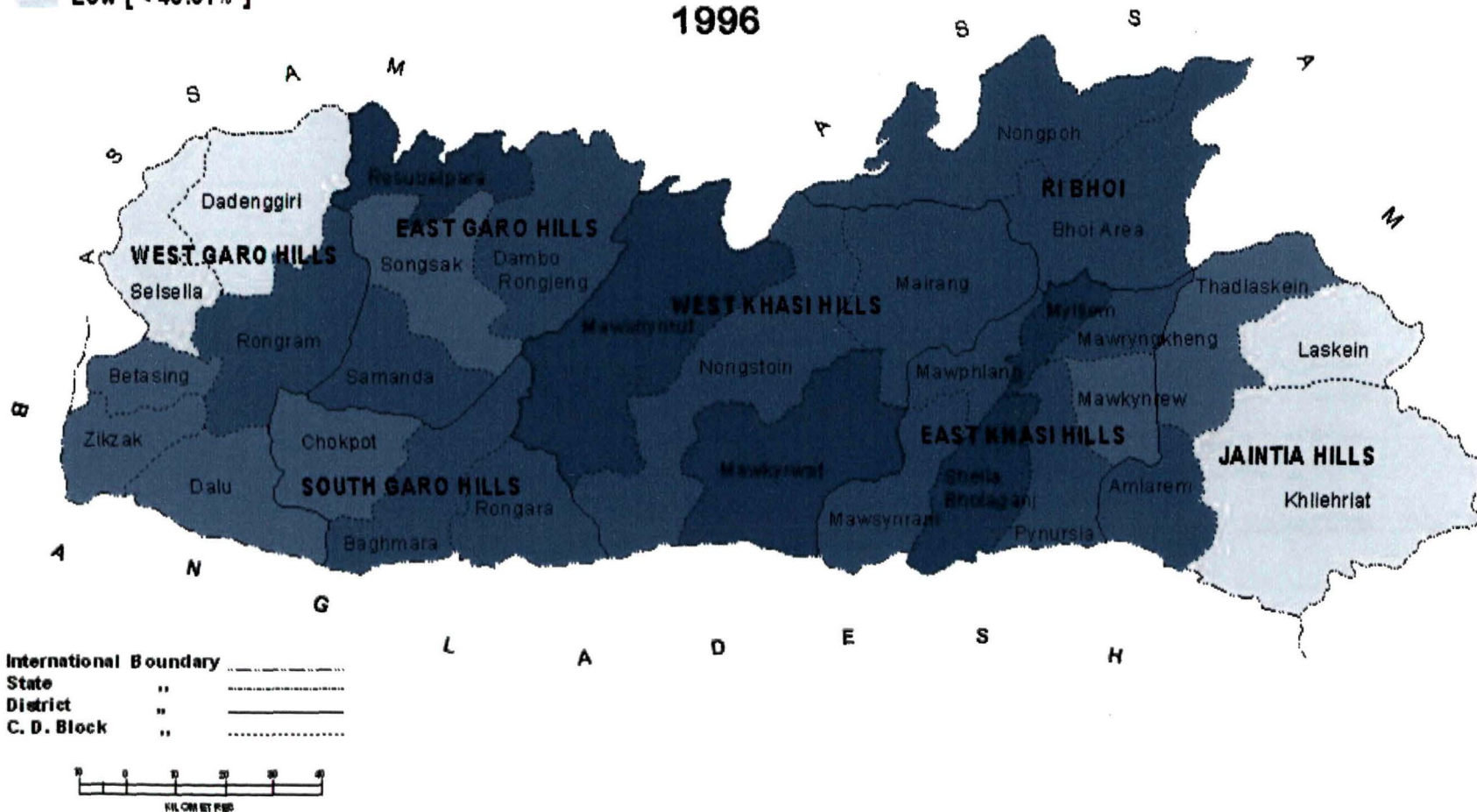


Figure - 2.8

population is literate in Myllem and Mawkyrwat blocks of the East and West Khasi Hills districts and thus are included in the *Very High Female Literacy Zone*. All the remaining blocks of these two districts and the Resubelpara block of East Garo Hills are included in the range of *High Female Literacy Zone* wherein the 50 to 60 per cent of all women can read and write. The *Moderate Female Literacy Zone* with a female literacy rate of 35 to 50 per cent is quite extensive and forms a large zone including whole of the Jaintia Hills, Ri Bhoi, South Garo Hills and parts of West and East Garo Hills as well. Only four blocks of the Garo Hills area fall under the *Low Female Literacy Zone* where less than 35 per cent of all women are enumerated as literate.

2.7.3 Availability of Educational Facility

An important determinant of the level of education in any area relates to availability of educational facility. It is likely that greater availability of educational facility not only improves general literacy, it may also increase general awareness regarding functional aspects of literacy. Hence an attempt has been made to delineate areas of different levels of availability in terms of this vital infrastructure. Fig. 2.10 presents the percentage of villages having educational facility in each block as per 1991 census data, in order to understand the extent of disparity in availability of educational institutions including Primary, Middle, High Schools and Colleges. The figure reveals that only four blocks in the Garo Hills have less than 60 per cent villages with educational facility. Another set of five blocks mostly in Garo Hills and one in Khasi Hills have 60 to 80 per cent villages which are provided with educational infrastructure of one kind or the other. In the remaining part of the state, educational facilities are available in more than 80 per cent of the villages. Except some parts of the Garo Hill districts the level of educational facility is fairly adequate in the state.

Villages Having Educational Facility

- 80.00 % and above
- 60.01 - 80.00 %
- Less than 60.00 %

MEGHALAYA

C. D. BLOCKS

EDUCATIONAL FACILITY AVAILABLE

1991

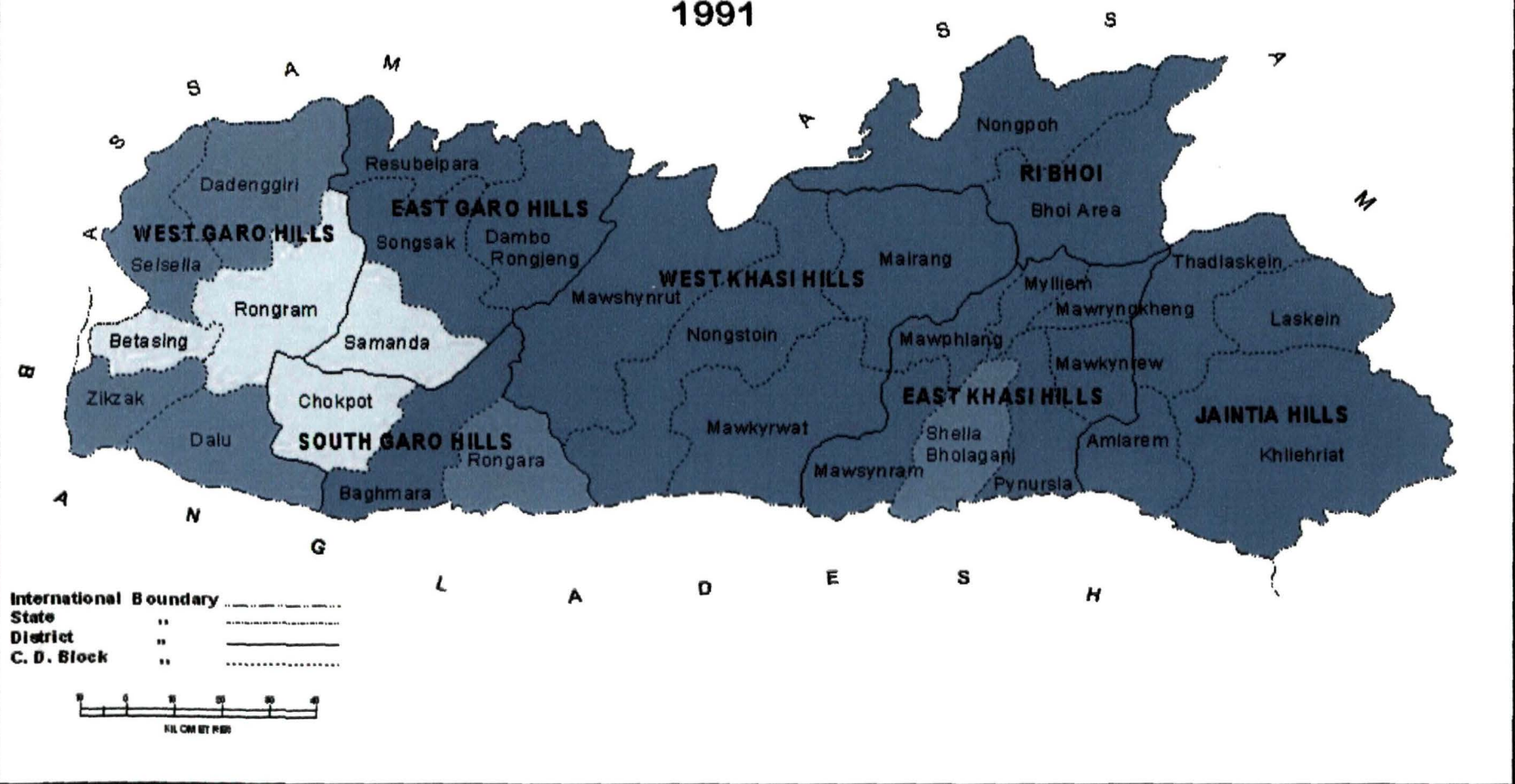


Figure - 2.10

2.8. Availability of Drinking Water Facility

In terms of villages having their own source of drinking water, a vast majority of the blocks falls under cent per cent (above 98 per cent) coverage as per the 1991 Census figures. It is to be noted that as per census report majority of the villages have rivers, streams and springs as their sources of drinking water and very few villages are supplied with piped water. One block each in Ri Bhoi, East Khasi Hills and Jaintia Hills have the lowest percentage (below 94 per cent) of villages with drinking water supply. In fact there is a very insignificant variation in this regard among the blocks of the state as depicted in the fig. 2.11. This picture however cannot be taken as adequate as it is generally known that Meghalaya is one of the few states that suffer from acute shortage of potable water and the population suffers most from diseases transmitted by water.

2.9 Availability of Medical Facility

Availability of medical facility in close spatial proximity is extremely important in combating and managing diseases, particularly those of communicable in nature. Spatial patterns in the prevalence of major diseases are affected by availability of medical facility. It helps in better recording of incidence of diseases as more cases are likely to be reported if the medical facility is located within manageable distance. Secondly, location of a medical facility helps in creating awareness regarding occurrence of certain diseases and that also helps in timely control of outbreak of communicable diseases. Hence the importance of availability of medical facility as an indicator cannot be belittled. As is well known, this vital infrastructure is not uniformly available to all the people living in any region and there exist serious disparity in availability of health facility in Meghalaya. Fig. 2.12 shows the variation in percentage of villages having institutional medical facility at block level. According to census

MEGHALAYA

C. D. BLOCKS

DRINKING WATER FACILITY

1991

Villages Having Drinking Water Facility

- 98.01 % and more
- 96.01 - 98.00 %
- 94.01 - 96.00 %
- Less than 94.01 %

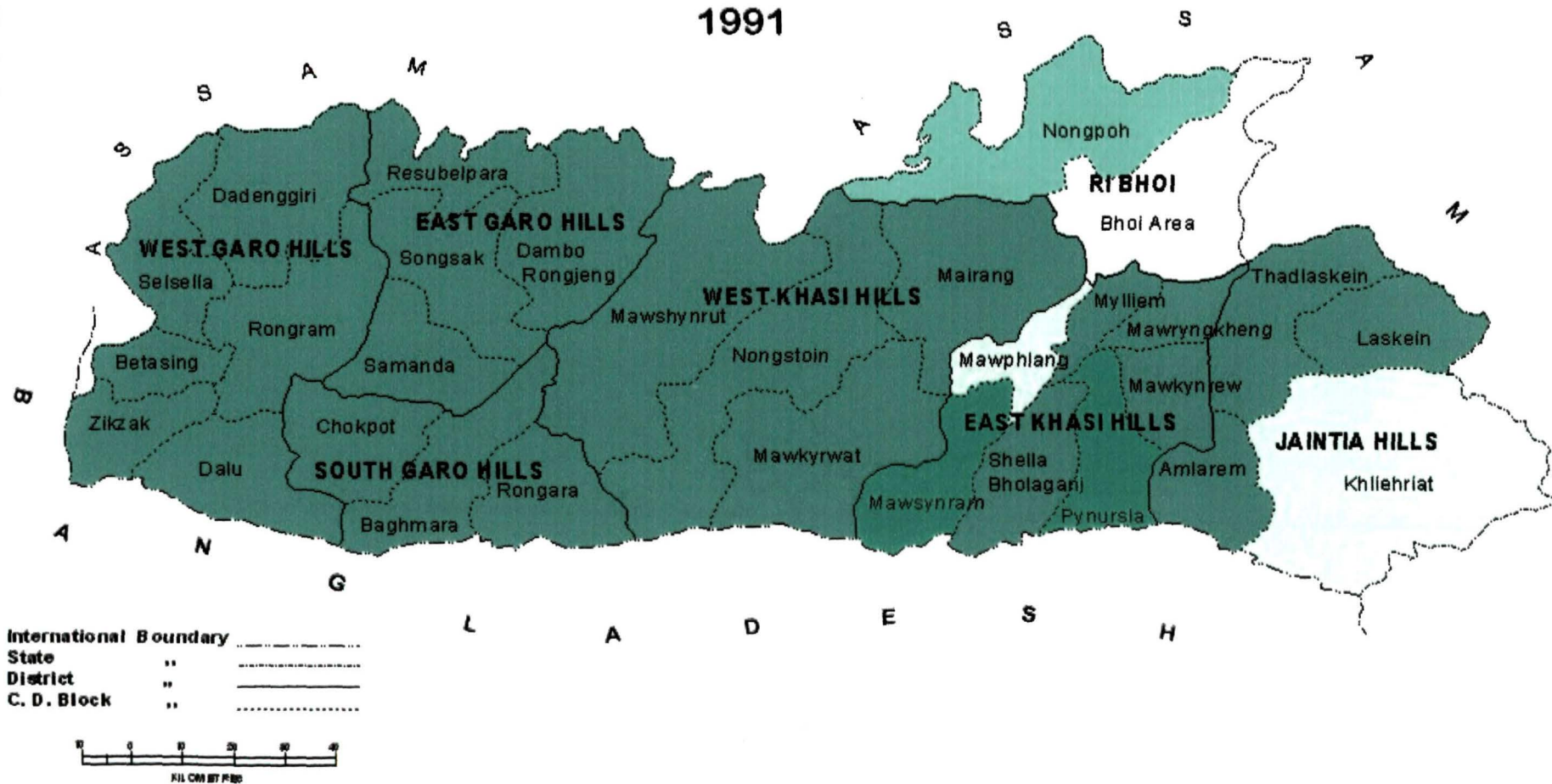


Figure - 2.11

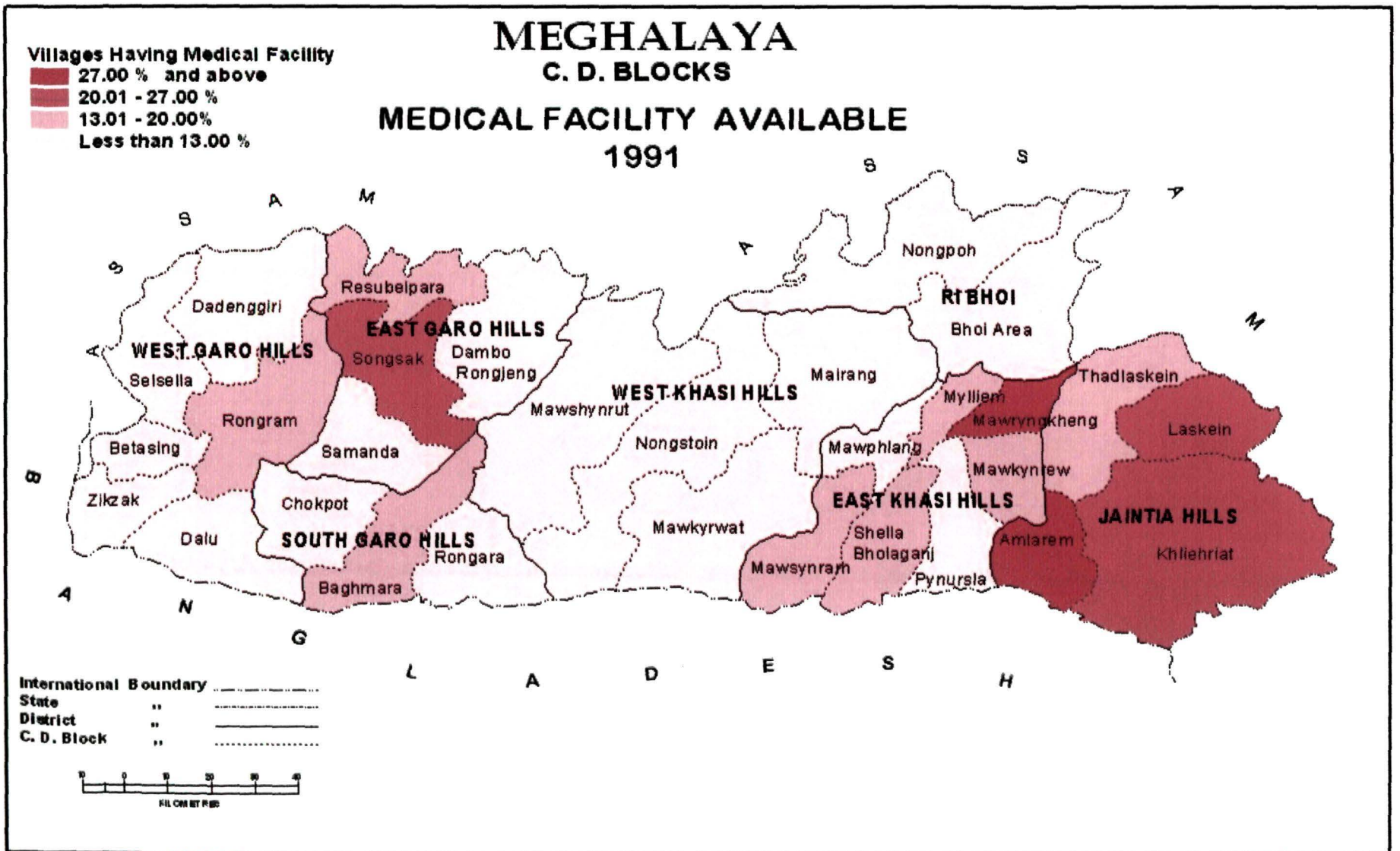


Figure – 2.12

definition medical facility includes any type of health institution like Hospital, Community Health Centre, Primary Health Centre, Health Sub-Centre, Dispensary, Maternity and Child Welfare Centre, etc. The Executive Summary Report (1994) showed that less than half (42.3%) of the rural population is covered under the institutional health care network. Considering the available health care delivery, the state is very poorly served compared to many other states of the North-East with only one hospital bed per thousand populations and one government doctor per 5337 people. In all, there are nine hospitals including four private and five district Civil Hospitals. In addition there are 82 Primary Health Centre, 323 Sub Centre, 9 Community Health Centre and 23 State Dispensaries. Thus the rural health infrastructure is lying well below the norms set by the governments.

It is evident from the fig.-2.11 that availability of medical facility is exceedingly poor i.e. below 13 per cent in a vast majority of blocks all over the state except in the Jaintia Hills district. The condition is slightly better with 13-20 per cent coverage in the three Garo Hill blocks and five blocks in East Khasi and Jaintia Hills districts. There are one block in East Garo Hills and two in Jaintia Hills with medical facility in 20 to 27 per cent villages and by far the highest availability of more than 27 per cent is recorded in one block each in Jaintia Hills and East Khasi Hills districts.

2.10 Concluding Statement

Within the limits of this chapter only the important aspects of physical environment and socio-economic background of the study area have been discussed. In brief, the state of Meghalaya has its own physiographic uniqueness in terms of its plateau landscape receiving world's highest rainfall under the impact of tropical monsoon climate. There are tangible variations in altitude, rainfall, temperature and forest cover within the state. It is a relatively small but important tribal state in the

north eastern India. Dominantly rural in population composition, the state however is experiencing a relatively higher decennial growth rate. Nevertheless the density of population is relatively low except in a few towns. Literacy rate is relatively higher in the Khasi Hills compared to the Garo Hills region though overall level of literacy is at higher level compared to national average. Other than the medical facility the study area enjoys a relatively better level of both educational and drinking water facility according to the norms adopted by the state authority. In fact it is evident that availability of medical vis-à-vis health care facility in the state is low by any standard and certainly a matter of serious concern.

The environmental and socio-economic aspects narrated in this chapter are purposively chosen as the probable factors controlling the distribution pattern of the prevailing diseases. In the following chapters the pattern of disease distribution will be discussed and analyzed in the light of the factors described in this chapter.

CHAPTER III

IDENTIFICATION AND DISTRIBUTION PATTERN OF MAJOR DISEASES PREVALENT IN MEGHALAYA

3.1 Introductory Statement

The present chapter is devoted to describing and analysing the emerging pattern of distribution of the prevalent major diseases in Meghalaya during the index year 1996. Firstly, six statistically significant diseases are sorted from out of all the diseases recorded in the health institutions spread over whole of the state. On the basis of the disease ranking, disease combination has also been worked out and mapped. Thereafter, distribution of all those major diseases is mapped at block level both in terms of percentage share of each disease to all diseases and its incidence per thousand populations. The variations in the seasonality of the each disease has also been depicted and analysed through tables, graphs and maps.

3.2 Disease Ranking

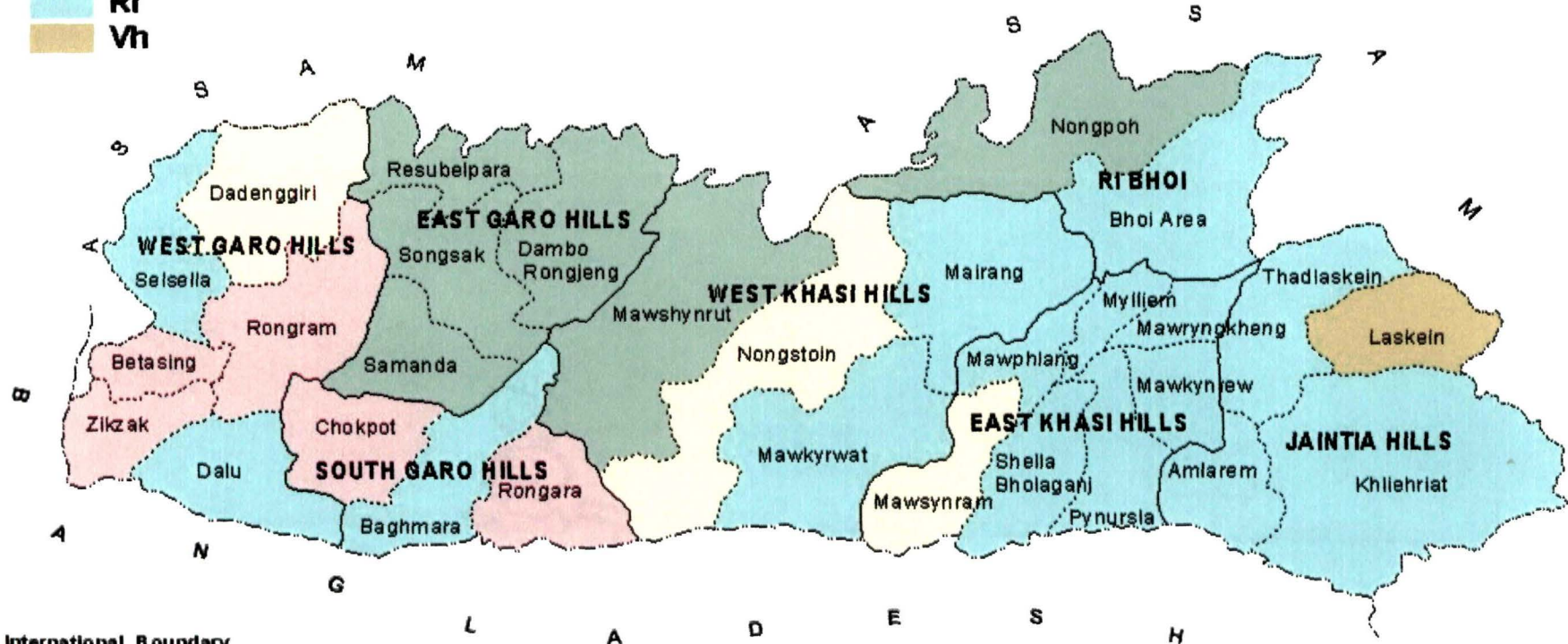
All the 22 categories of diseases recorded during the index year 1996 have been arranged in terms of their relative statistical importance. For this purpose all the diseases are ranked in descending order of the total recorded cases. Then to find the relative importance of these diseases both percentage share and incidence rate per thousand populations have been worked our and are placed in separate columns in the table (Table – 3.1).

Diseases of respiratory infections or Ri has emerged at the top rank, accounting for 26.06 per cent of the of all the diseases and with an incidence rate as high as 100.24 persons per thousand populations. The diarrhoeal diseases ranked second having 20.44 percent share and 78.80 incidence rate. It can be mentioned here that in the report on health conditions of mother and children of Meghalaya (Khandekar, M. et al, 1985) the

MEGHALAYA

C. D. BLOCKS DISEASES OF RANK - I

- Dd
- Po
- Pu
- Ri
- Vh



International Boundary
 State " "
 District " "
 C. D. Block " "



Figure - 3.1

upper respiratory tract infection and diarrhoeal diseases were found as two top ranked diseases both among the mothers and children. The third position is occupied by pyrexia of unknown origin (Po) because it shared 19.23 per cent and an incidence rate of 73.96. It is noticeable from the table that the top three diseases together account for almost two-thirds (65.73 per cent) of all diseases prevalent in the state leaving only one third for the remaining 19 categories. This clearly indicates a huge dominance of these diseases in the state as a whole.

Table – 3.1
Recorded Diseases Ranked on Incidence Rate

Rank	Disease	Abbreviations Used	Recorded Cases	Incidence Rate per '000	Percentage to all Diseases
1	Respiratory infections	Ri	207049	100.24	26.06
2	Diarrhoeal diseases, amoebiasis, giardiasis, etc.	Dd	162365	78.60	20.44
3	Pyrexia of unknown origin	Po	152779	73.96	19.23
4	Diseases of Skin and subcutaneous tissue	Sd	46723	22.62	5.88
5	Peptic ulcer syndrome	Pu	34432	16.67	4.33
6	Malaria	Ml	26681	12.92	3.36
7	Viral hepatitis	Vh	25779	12.48	3.24
8	Infection of worm	Wi	20468	9.91	2.58
9	Anaemia	An	13928	6.74	1.75
10	Diseases of Oral cavity	Od	11192	5.42	1.41
11	Diseases of Eye	Ey	6985	3.38	0.88
12	Diseases of urinary Track	Ud	6708	3.25	0.84
13	Pulmonary tuberculosis	Tb	6148	2.98	0.77
14	Diseases of Ear	Er	6038	2.92	0.76
15	Measles	Ms	1889	0.91	0.24
16	Diseases of heart	Hd	739	0.36	0.09
17	Whooping cough	Wc	714	0.35	0.09
18	Enteric fever	Ef	320	0.15	0.04
19	Nutritional deficiencies	Nu	120	0.06	0.02
20	Leprosy	Lp	117	0.06	0.01
21	Diseases of thyroid gland	Th	50	0.02	0.01
00	All other diseases	Misc	63307	30.65	7.97
			794531	384.65	100.00

Diseases in the fourth to seventh rank account for only 5.88 to 3.24 percent, namely diseases of skin, peptic ulcer syndrome, malaria and viral hepatitis in order of importance. The next three diseases, notably the infection of worms, anaemia and

diseases of oral cavity, account for less than 3.00 to 1.00 percent. Remaining diseases are statistically insignificant with less than 1.00 percent share each. In the miscellaneous category, cases like accidental injuries and trauma etc dominated, which are not primarily related to the general environment and hence not important for the present research.

It is evident from the above discussion that the first three diseases viz. Ri, Dd and Po are highly prevalent in the state and are therefore selected as major diseases due to clear dominance both in terms of percentage and incidence rate and together account for 65.73 percent of all prevalence. If we combine the first six diseases the total share comes to 79.20. Therefore, those three groups viz. diseases of skin, malaria and peptic ulcer syndrome are also chosen as major diseases for further discussion and analysis in detail. It is to be mentioned here that though viral hepatitis also shares above 3.00 per cent of all the reported cases, the disease is not taken in the major disease groups because of its uneven or scattered occurrence among the blocks.

3 2.1 Disease Ranking at Block Level

All the diseases recoded at the block level are also ranked in descending order to understand the relative importance of these diseases in the spatial units in the state (Table – 3.2). For further depiction of spatial variations in relative importance, the diseases in first four ranks are plotted in separate maps (Fig. – 3.1 to 3.5).

3. 2.2.a Diseases of Rank I

There are five different diseases emerged as Rank I among those Ri clearly dominates in most number of blocks (Fig.–3.1). In most blocks of Khasi and Jaintia Hills with higher altitude and lower temperature and also some parts of South and West Garo Hills districts Ri is present at the first rank. In the whole of West Garo Hills and in the adjacent blocks of West Khasi Hills and Ri Bhoi Po ranked first. Pu is present in

MEGHALAYA

C. D. BLOCKS

DISEASES OF RANK - II

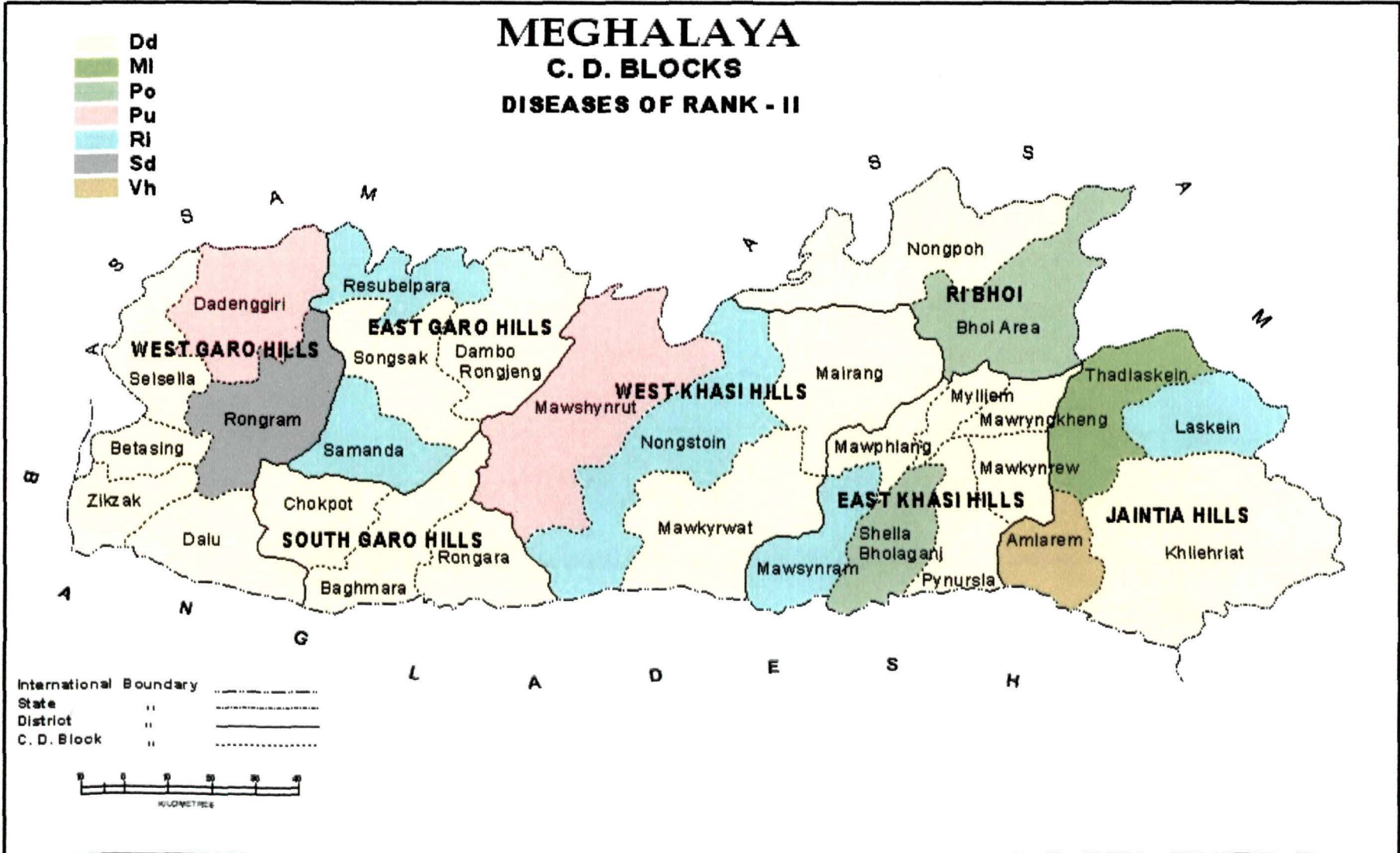


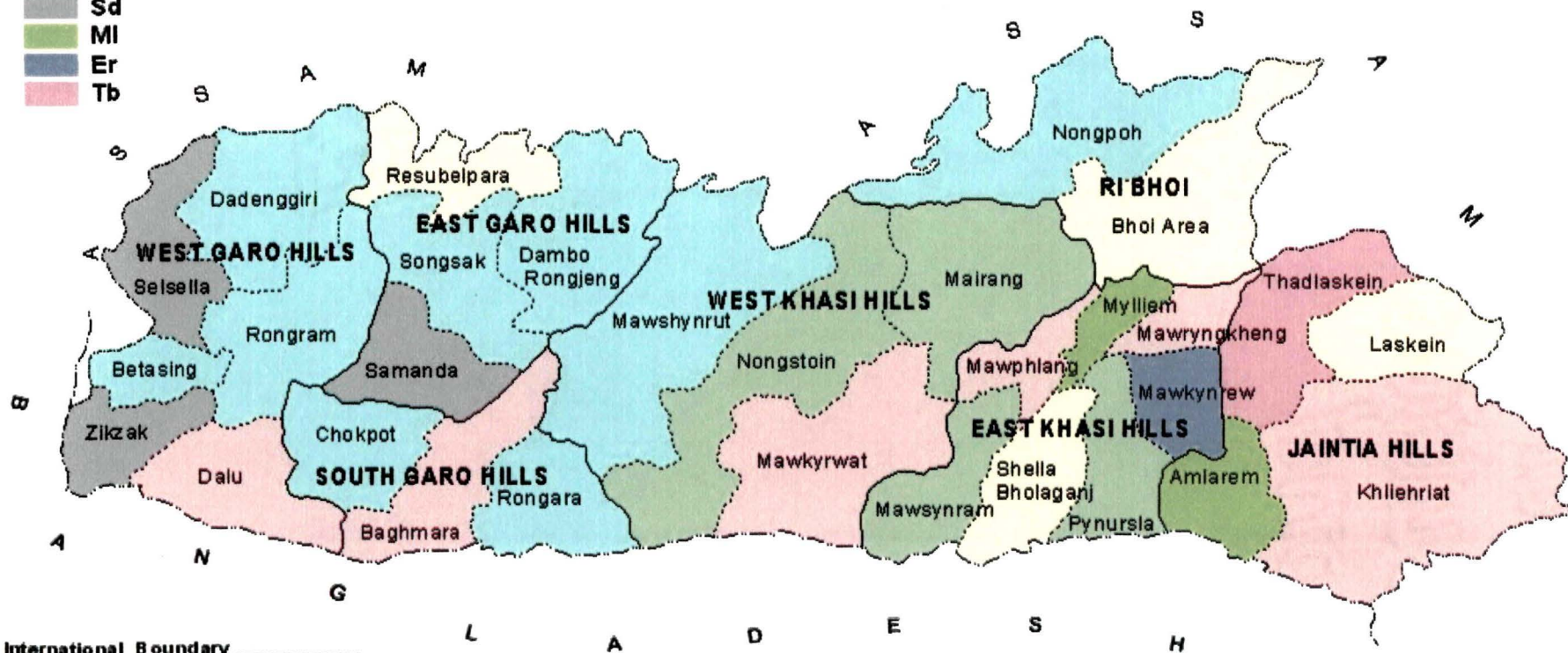
Figure - 3.2

MEGHALAYA

C. D. BLOCKS

DISEASES OF RANK - III

- RI
- Pu
- Dd
- Po
- Sd
- MI
- Er
- Tb



International Boundary -----
 State "-----
 District "-----
 C. D. Block "-----



Figure - 3.3

four blocks of West and South Garo Hills, Dd in only three blocks in scattered manner.

In the Laskein block of Jaintia Hills viral hepatitis is in the top order.

3. 2.2.b *Disease of Rank II*

In the Rank II there are seven diseases (Fig.– .2). Instead of higher diversity of diseases Dd dominates clearly covering 18 out of total 30 blocks in the state at the second rank. Ri has emerged as the second most occurring disease of Rank II and is present in five blocks scattered all over the state. Both Po and Pu holds two blocks each while the other diseases like malaria, viral hepatitis and diseases of skin are present in one block each.

3. 2.2.c *Diseases of Rank III*

In the Rank III there are eight different diseases. It is clearly noticeable that in major parts of Garo Hills and in one block of Ri Bhoi Ri is the third Rank disease. Here Po is present in four blocks each of East and West Khasi Hills district. There are six blocks having Pu disease and four having Dd in this rank. Malaria, diseases of skin, tuberculosis and diseases of ear are the other diseases scattered all over the state (Fig.– 3.3).

3. 2.2.d *Diseases of Rank IV*

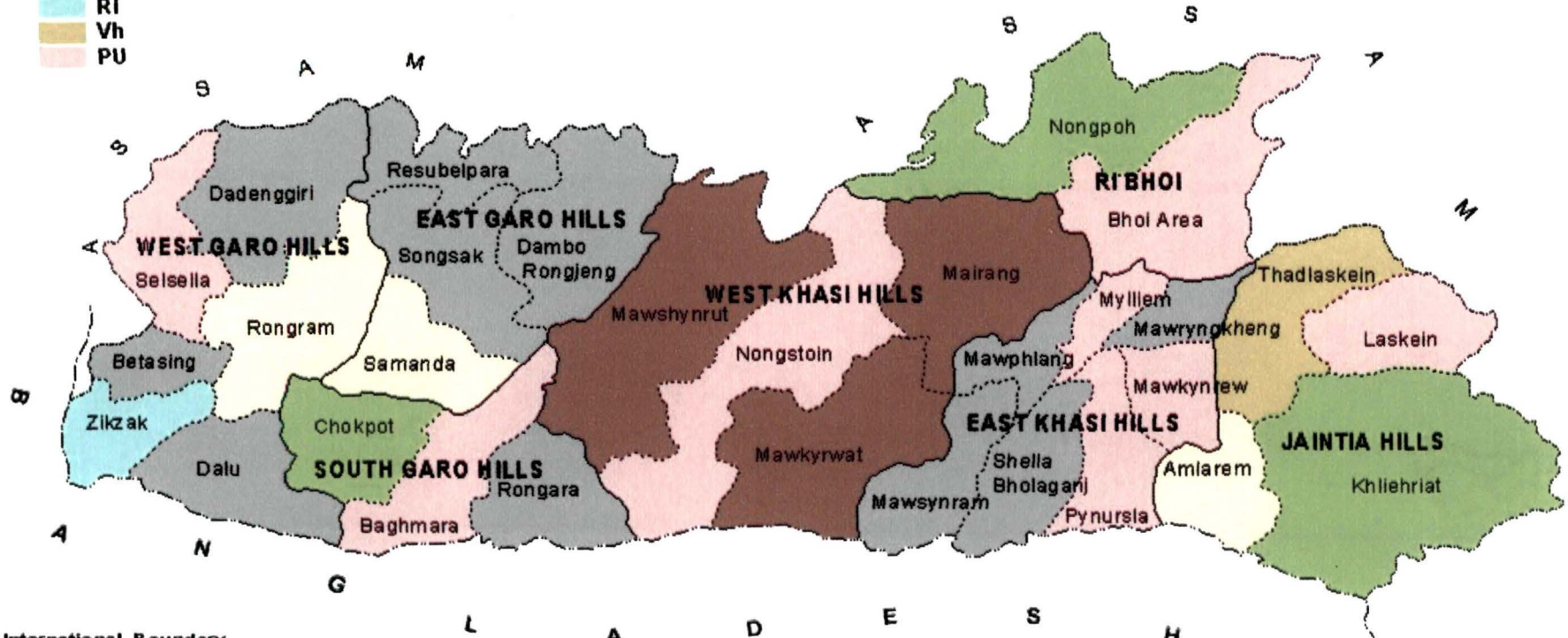
Diseases of Skin (Sd) happens to be the most important fourth rank disease present in eleven blocks spread mostly over Garo Hills and East Khasi Hills(Fig. – 3.4). Pu is the second important disease in this rank covering eight blocks followed by Malaria, diarrhoeal diseases and infection of worms found in three blocks each. Ri and Vh are found in one block each.

MEGHALAYA

C. D. BLOCKS

DISEASES OF RANK - IV

- Sd
- Pu
- WI
- MI
- Dd
- Vh
- PU



International Boundary _____
 State " " _____
 District " " _____
 C. D. Block " " _____



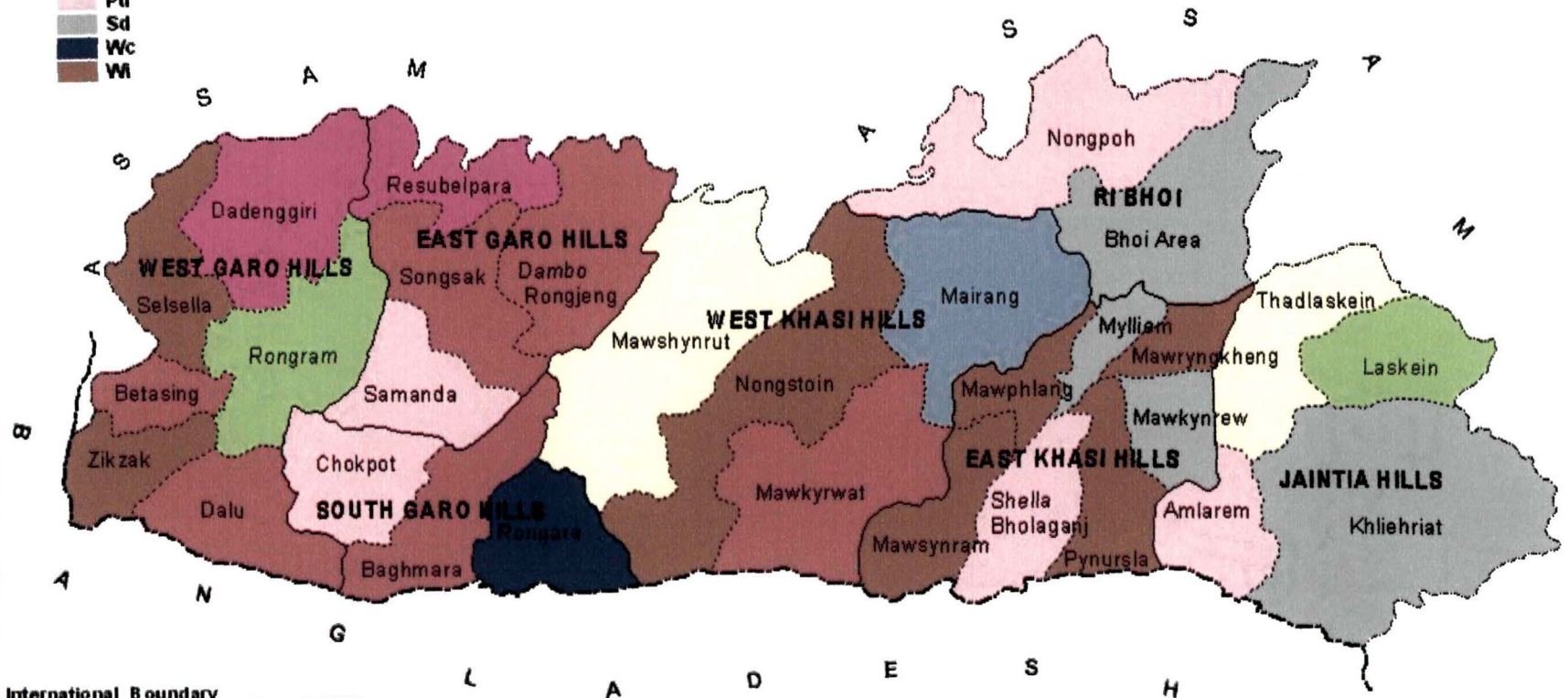
Figure - 3.4

MEGHALAYA

C. D. BLOCKS

DISEASES OF RANK - V

- An
- Dd
- Ey
- MI
- Od
- PU
- Pu
- Sd
- Wc
- Wl



International Boundary - - - - -
 State
 District
 C. D. Block



Figure - 3.5

Table – 3.2
Rank Wise Arrangement of Diseases in C. D. Blocks

Sl. No.	C. D. Block	R_I	R_II	R_III	R_IV	R_V	R_VI	R_VII	R_VIII	R_IX	R_X	R_XI	R_XII
1	Thadlaskein	Ri	Ml	Tb	Vh	Dd	Pu	Ms	Ey	Er	Od	Wi	An
2	Laskein	Vh	Ri	Dd	Pu	Ml	An	Sd	Ey	Ms	Ud	Od	Po
3	Khliehriat	Ri	Dd	Pu	Ml	Sd	Od	Wi	Er	An	Ud	Ey	Tb
4	Amlarem	Ri	Vh	Ml	Dd	Pu	Sk	Od	Ud	Ey	An	Wi	Ms
5	Nongpoh	Po	Dd	Ri	Ml	Pu	Sd	Wi	Er	An	Ud	Od	Ey
6	Bhoi Area	Ri	Po	Dd	Pu	Sd	Ml	Wi	Ud	An	Ey	Od	Er
7	Mawryngkheng	Ri	Dd	Pu	Sd	Wi	Po	Er	Od	Ey	Ml	An	Tb
8	Mylliem	Ri	Dd	Ml	Pu	Sd	Po	An	Wi	Er	Ud	Od	Ey
9	Mawphlang	Ri	Dd	Pu	Sd	Wi	Er	Od	Ud	An	Ey	Ml	Ms
10	Pynursla	Ri	Dd	Po	Pu	Wi	Sd	Ud	Er	An	Od	Ml	Ey
11	Shella Bholaganj	Ri	Po	Dd	Sd	Pu	Wi	Od	Er	An	Ud	Ml	Ey
12	Mawsynram	Dd	Ri	Po	Sd	Wi	Pu	Er	Ey	An	Od	Ms	Ud
13	Mawkynrew	Ri	Dd	Er	Pu	Sd	Wi	An	Ms	Od	Po	Ey	Ml
14	Mairang	Ri	Dd	Po	Wi	Od	Vh	Sd	An	Ey	Tb	Ms	Pu
15	Mawkyrwat	Ri	Dd	Pu	Wi	An	Sd	Ey	Po	Tb	Ud	Ml	Vh
16	Nongstoin	Dd	Ri	Po	Pu	Wi	An	Ey	Sd	Ud	Wc	Od	Ms
17	Mawshynrut	Po	Pu	Ri	Wi	Dd	Od	An	Sd	Ud	Ey	Tb	Ms
18	Resubelpara	Po	Ri	Dd	Sd	Ey	An	wi	Pu	Od	Ml	Er	Hd
19	Dambo Rongjeng	Po	Dd	Ri	Sd	An	Ml	Ey	Wi	Pu	Er	Od	Ud
20	Songsak	Po	Dd	Ri	Sd	An	Ey	Pu	Er	Od	Ml	Ud	Wi
21	Samanda	Po	Ri	Sd	Dd	Pu	Ml	Od	An	Ey	Er	Wi	Ud
22	Dadenggre	Dd	Pu	Ri	Sd	Ey	An	Pu	Ml	Od	Wi	Er	Ud
23	Selsella	Ri	Dd	Sd	Pu	Wi	An	Od	Ud	Ml	Ms	Vh	Ef
24	Rongram	Pu	Sd	Ri	Dd	Ml	Lp	Wi	Ud	Od	An	Tb	Wc
25	Betasing	Pu	Dd	Ri	Sd	An	Ml	Od	Wi	Ud	Ms	Pu	Tb
26	Zikzak	Pu	Dd	Sd	Ri	Wi	Od	Ml	An	Vh	Ud	Th	Ms
27	DaluCD	Ri	Dd	Pu	Sd	An	Ml	Od	Wi	Ud	Vh	Tb	Ms
28	Baghmara	Pu	Dd	Ri	Ml	PU	An	Ml	Ef	Wi	Sd	Tb	Od
29	Chokpot	Ri	Dd	Pu	PU	An	Pu	Sd	Wc	An	Tb	Ud	Vh
30	Rongara	Pu	Dd	Ri	Sd	Wc	Wc	Pu	Tb	Od	Wi	Vh	Ef

N.B. See table 3.1 for expanded names of diseases for abbreviations used in this table.

3.2.2.e Diseases of Rank V

In the fifth rank there are as many as ten diseases in those thirty blocks indicating no clear dominance of single diseases (Fig.-3.5). Here diseases like infection of worms and anaemia are present in seven and six blocks respectively followed by Pu in five and Sd in four blocks. In addition Dd, Ml, Od and Wc are also

present to form a heterogeneous mosaic with no particular spatial pattern. As an exception a small zone of anaemia in the Garo Hills region can be mentioned here.

3.3 Disease Combination

Disease combination has been computed considering the ranked data of percentage share of each disease in individual block. The statistical application is already been discussed in the paragraph 1.7 of the first chapter. Proper analysis of the disease combination pattern helps to determine and depict the level of plurality of diseases which ultimately can indicate the inherent relation between certain diseases and the environment of a particular space where it occurs. On the other hand this also helps in finding the polarization of a particular disease or two over a particular space. Certain disease or disease groups may come out as interrelated or isolated to each other which ultimately hint at the disease environment.

There are eight major combination groups in Meghalaya as results show (table-3.3). In tune with the rank wise distribution here too the combination of Ri+Dd+other (includes Vh, Sd and Ml) diseases dominates clearly as depicted in the map (Fig.-3.6). In fact different combinations of Ri are dominant over 20 out of 30 blocks. The second major combination is with Po+Pu+Dd. over four larger blocks. In the low land areas of Garo Hills districts peptic ulcer syndrome forms the main combination.

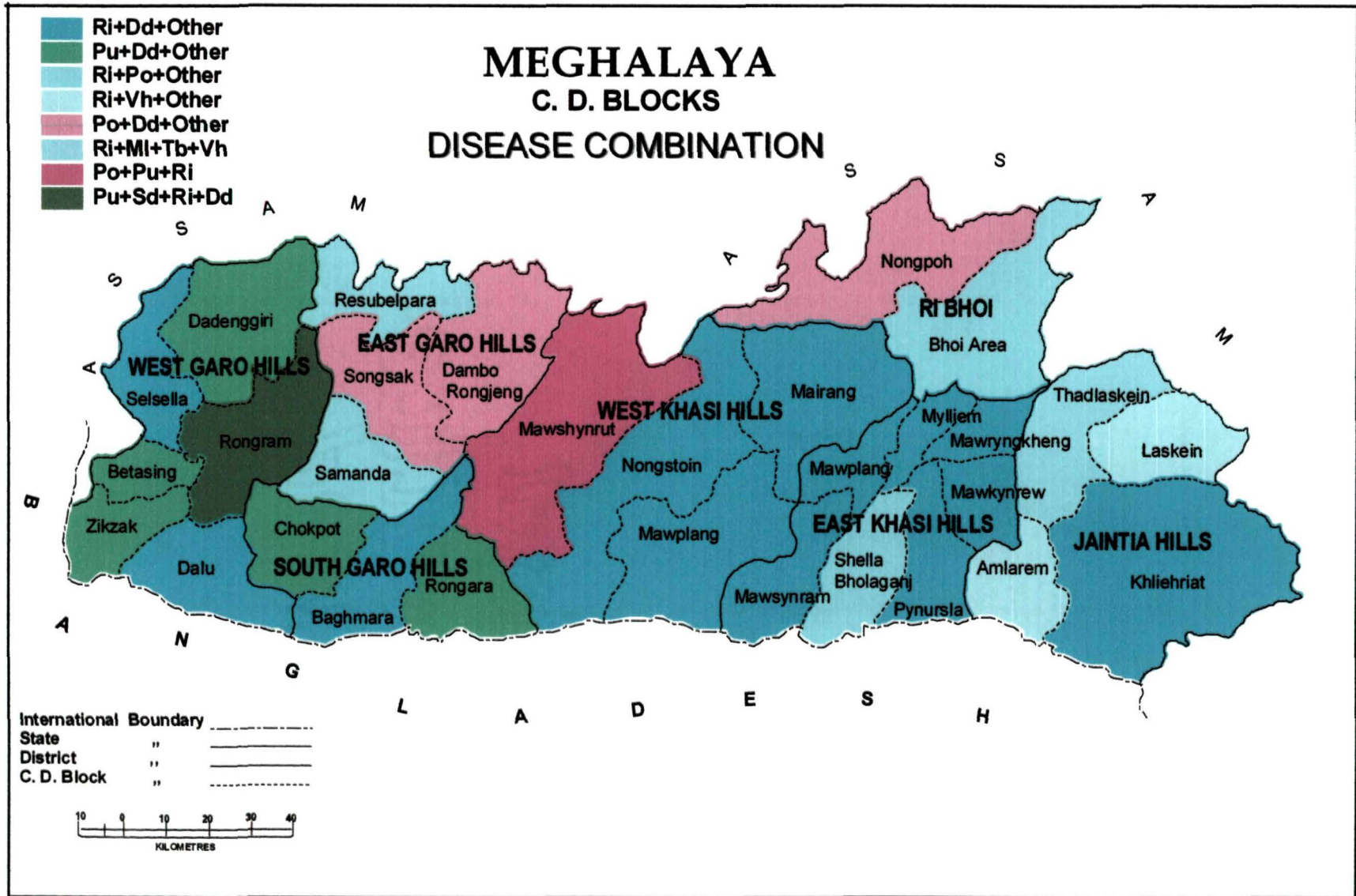


Figure – 3.6

Table – 3.3
Disease Combination in C. D. Blocks

Sl. No.	C. D. Blocks	Disease Combination	Depth of Combination
1	Thadlaskein	RiMiTbVh	4
2	Laskein	VhRiDd	3
3	Khliehriat	RiDd	2
4	Amlarem	RiVhMI	3
5	Nongpoh	PoDdRiMI	4
6	Bhoi Area	RiPoDdPu	4
7	Mawryngkheng	RiDd	2
8	Mylliem	RiDdMI Pu	4
9	Mawphlang	RiDdPuSd	3
10	Pynursla	RiDdPo	3
11	Shella Bholaganj	RiPoDd	3
12	Mawsynram	RiDdErPu	4
13	Mawkynew	DdRiPo	3
14	Mairang	RiDdPo	3
15	Mawkyrwat	RiDdPu	3
16	Nongstoin	DdRiPo	3
17	Mawshynrut	PoPuRi	3
18	Resubelpara	PoRiDdSd	4
19	Dambo Rongjeng	PoDdRi	3
20	Songsak	PoDdRi	3
21	Samanda	PoRiSd	3
22	Dadenggre	DdPuRiSd	4
23	Selsella	RiDdSdPu	4
24	Rongram	PuSdRiDd	4
25	Betasing	PuDdRi	3
26	Zikzak	PuDdSdRi	4
27	DaluCD	RiDdPuSd	4
28	Baghmara	PuDdRi	3
29	Chokpot	RiDdPoPu	4
30	Rongara	PuDdRi	3

3.3.1 Depth of Disease Combination

The level of disease plurality is shown in the map considering the number of diseases in a combination. Combination of four diseases is found in 12 blocks in two main spatial zones (Fig.–3.7). The bigger zone covers the bordering blocks of Garo Hills and the second zone is in the districts of Ri Bhoi and East Khasi Hills. It seems that higher number of combinations occur in low land with high population density. Mawryngkheng and Khliehriat are the two blocks with only two disease combination is found indicating a high polarization of the first ranked disease i.e. Ri in both cases

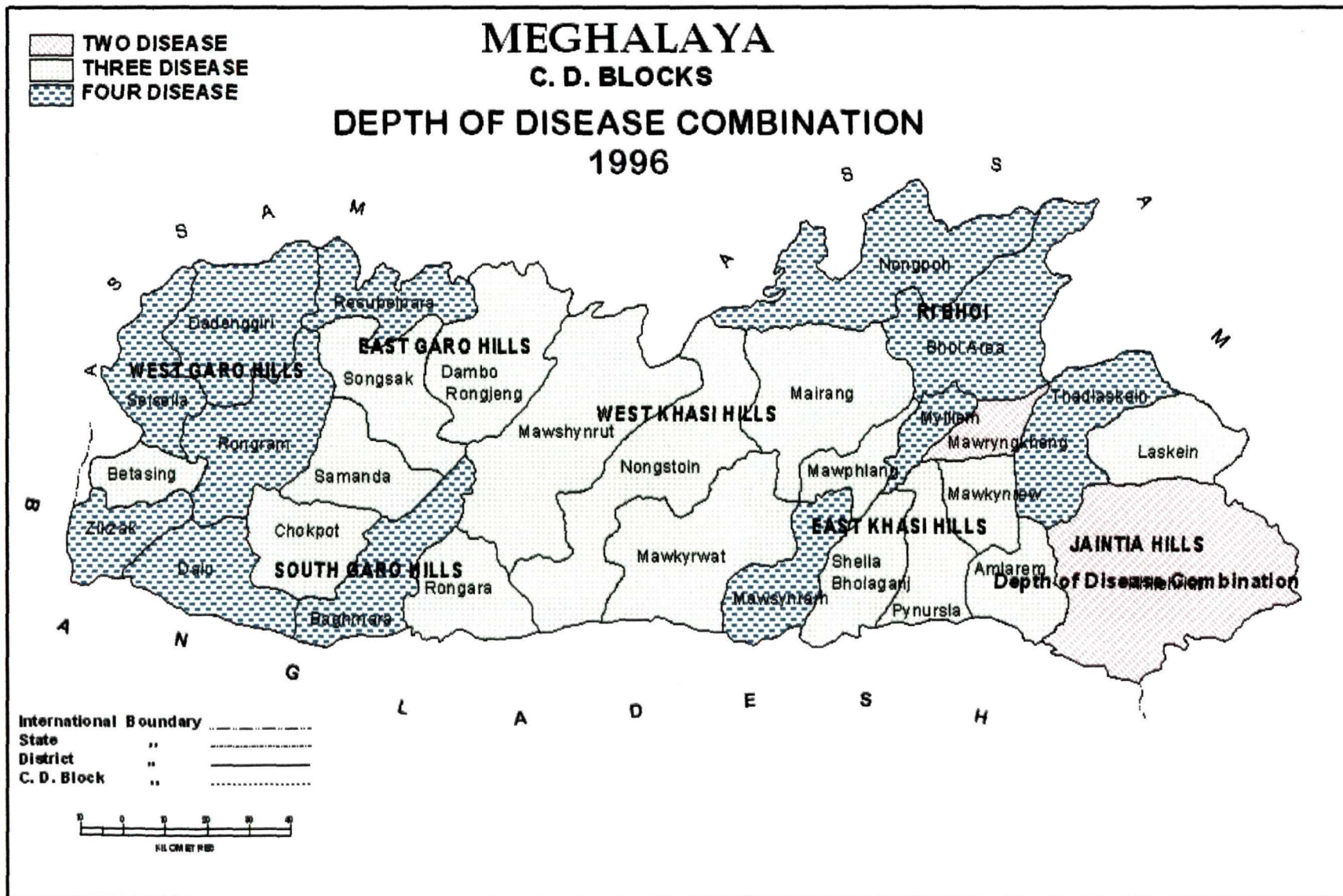


Figure - 3.7

(table-3.3). The remaining large portion of the state, mainly the central and south eastern parts of Meghalaya, has three disease combinations.

3.4 Distribution of the Diseases of Respiratory Infections

Diseases like common cough and cold, bronchial Infections, influenza, asthma etc. of both acute (ARI) and chronic nature, are grouped together as Ri. Among them Influenza is the single most Important disease and often break out into epidemics affecting a very large number of people. It affects all ages and both sex. In general the attack is lower among adults. Influenza spreads from person to person by droplet infection created by sneezing, coughing and talking. Epidemics usually occur in winter months but in India it often occurs in summer. Overcrowding enhances transmission, so rates are higher in close population i.e., in schools, overcrowded houses, public gatherings, etc (Park, 1997).

Respiratory Infections range in severity from milder common cold to bacterial pneumonia with respiratory failure. Influenza of 'flu' virus is potentially lethal while pneumonia, an out come of all respiratory infections, is the greatest killer. Contrary to the earlier believe, diseases like flu and pneumonia are equally common killer in warm countries as in the colder temperate Hemisphere. According to Cruickshank (1976) the viral respiratory infections are a serious menace in warm climatic countries and resemble both bacteriological and epidemiologically those present in the temperate zones. Though the mortality of these diseases is similar in both the regions, incidence and deaths are the highest among the very young group in warm climate whereas older people suffer most in temperate climate. Hence it is needless to say in countries like India that ARI demand a special attention to asses and control the higher IMR in the wake of far less than adequate immunization level of the children. Edmundson and Harris (1992) found cold, flu and pneumonia are the greatest causes of morbidity in

every nation. Although dysentery is still the number one child killer in Africa north of Sahara, respiratory diseases are the killer in Asia and Latin America. WHO (1995) has reported that ARI - primarily pneumonia, is a major cause of illness throughout the world. In developing countries, an estimated 4.1 million children die from ARI. In India, as in many other countries, ARI is a leading cause of childhood death (Murray and Lopez, 1996). An estimated 30% of all Indian child mortality indicates more than 1.4 million child deaths per year caused by pneumonia in India alone (Edmundson and Harris (1992). Similarly the NFHS has also found that one in every child under age three years had suffered from ARI during the two weeks before the survey (IIPS, 1995). The above observations certainly emphasize the importance of ARI disease as a valued index of public health status of any given geographical region in India or any specific community and particularly in a state like Meghalaya.

The diseases of respiratory infections (Ri) are the most prevalent of all diseases in Meghalaya during the index year. Ri shared 26.06 per cent of total recorded diseases with an incidence rate as high as 100.24 per thousand population. In particular, EKH district suffered most from Ri diseases. In fact four blocks of the district namely Mawryngkheng, Mawphlang, Pynursla and Shella Bholaganj as well as two adjacent blocks of WKH and RB recorded incidence rates over 200. Both highest percentage (47.17) and incidence rate (281.34) is found in the Mairang block of WKH, whereas the Rongram block of WGH experienced lowest incidence (3.84) (Annexure-III).

The map (Fig - 3.8a) depicts that the higher range of percentage share of Ri to all diseases occurs in the higher altitude and higher rainfall belt of EKH, WKH and JH districts with some exceptions like in the low flood plains of WGH and SGH districts.

Incidence rate is also found on the higher sides in the central upland zone of EKH, WKH and JH districts (Fig - 3.8b). Further, there are four blocks in the Garo

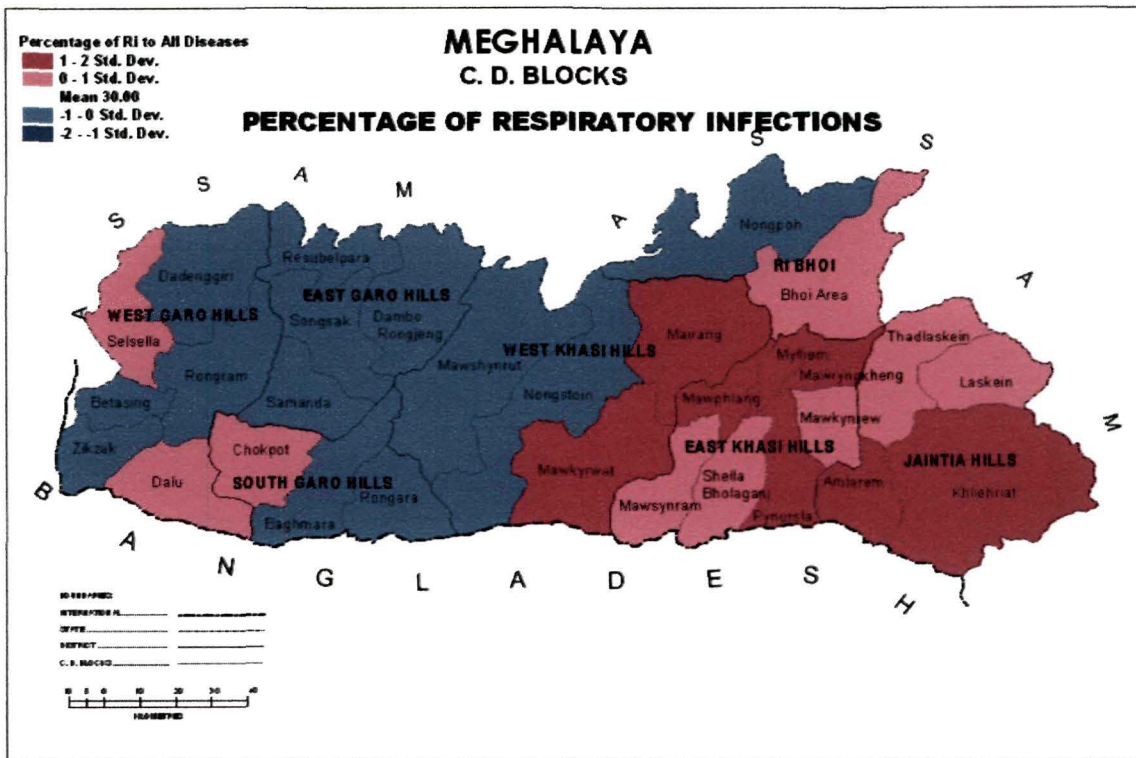


Figure – 3.8a

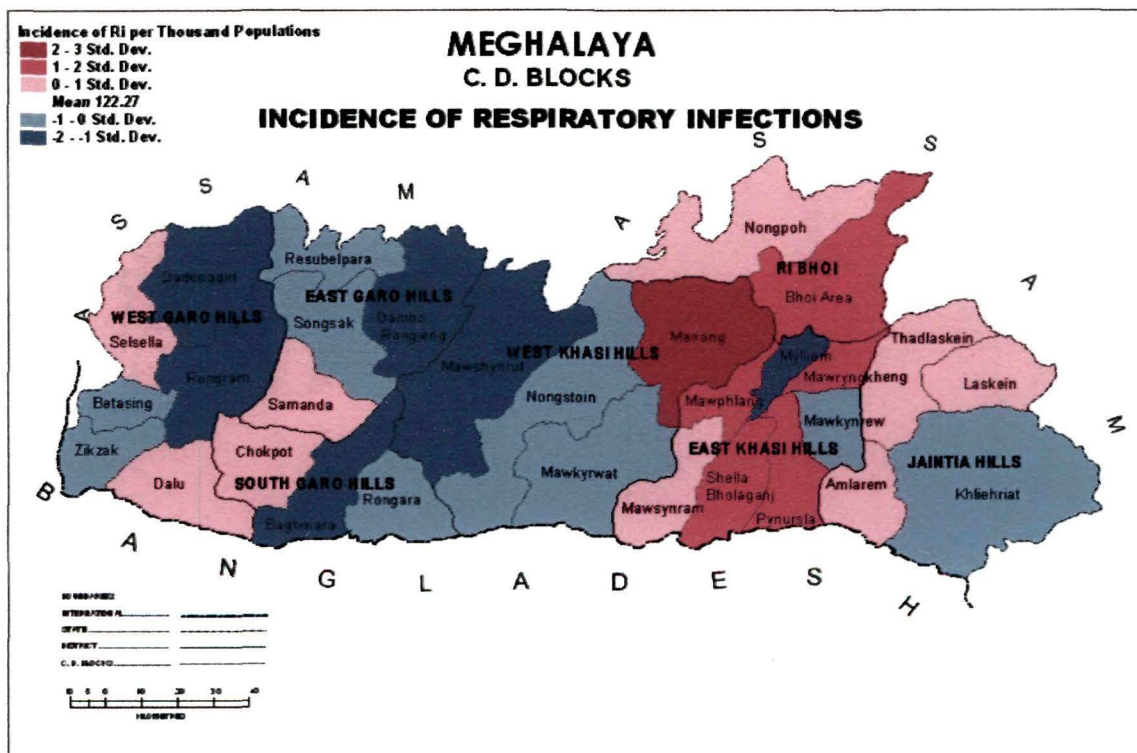


Figure – 3.8b

Hills region having higher incidence rate of Ri viz. Samanda and Chokpot of hilly character whereas Selsella and Dalu in the low valley plains. Noticeably low incidence rate of Ri in the hilly Myllem block of EKH most likely to be due to the extremely high density of population in the capital city of Shillong. The trend could have been the same if the data was compared taking the rural population only which was not available in case morbidity records.

Thus it is evident from the spatial pattern of Ri diseases that both altitude and rainfall relate positively with its occurrence in Meghalaya. Further, the over all dominance of ARI in Meghalaya can be seen as an impact of several associated factors namely i) the sharp change in temperature during winter months, particularly in the higher altitude zone; ii) villagers get drenched in wide spread rainfall almost in all the months and more frequently during agricultural activities; iii) people live in ill-ventilated congested traditional houses owing largely to considerably large size of families; iv) almost cent per cent houses in the villages use bio-mass fuels like wood, cow dung etc. emanating harmful smoke in the windowless kitchens or even in the living rooms; v) Villagers hardly report the ARI diseases (cough and cold) at an early stage and thus increasing the risk of higher transmission and occurrence.

The monthly variations in Ri occurrence in the health centres of each district are plotted in line graphs to understand the seasonality pattern (fig.-3.9). The seasonal variations in reported cases of Ri shows almost similar pattern all over Meghalaya. Reported cases are higher in two different periods i.e., one during March-May (the pre monsoon season) and another in Sept-October (early winters).

In general the three Garo Hill districts present slightly different seasonality pattern with a few similarities like higher occurrence during pre-monsoon through post-monsoon months which is the observed normal trend in the warm tropical countries as

SEASONALITY OF RESPIRATORY INFECTIONS IN DISTRICTS OF MEGHALAYA

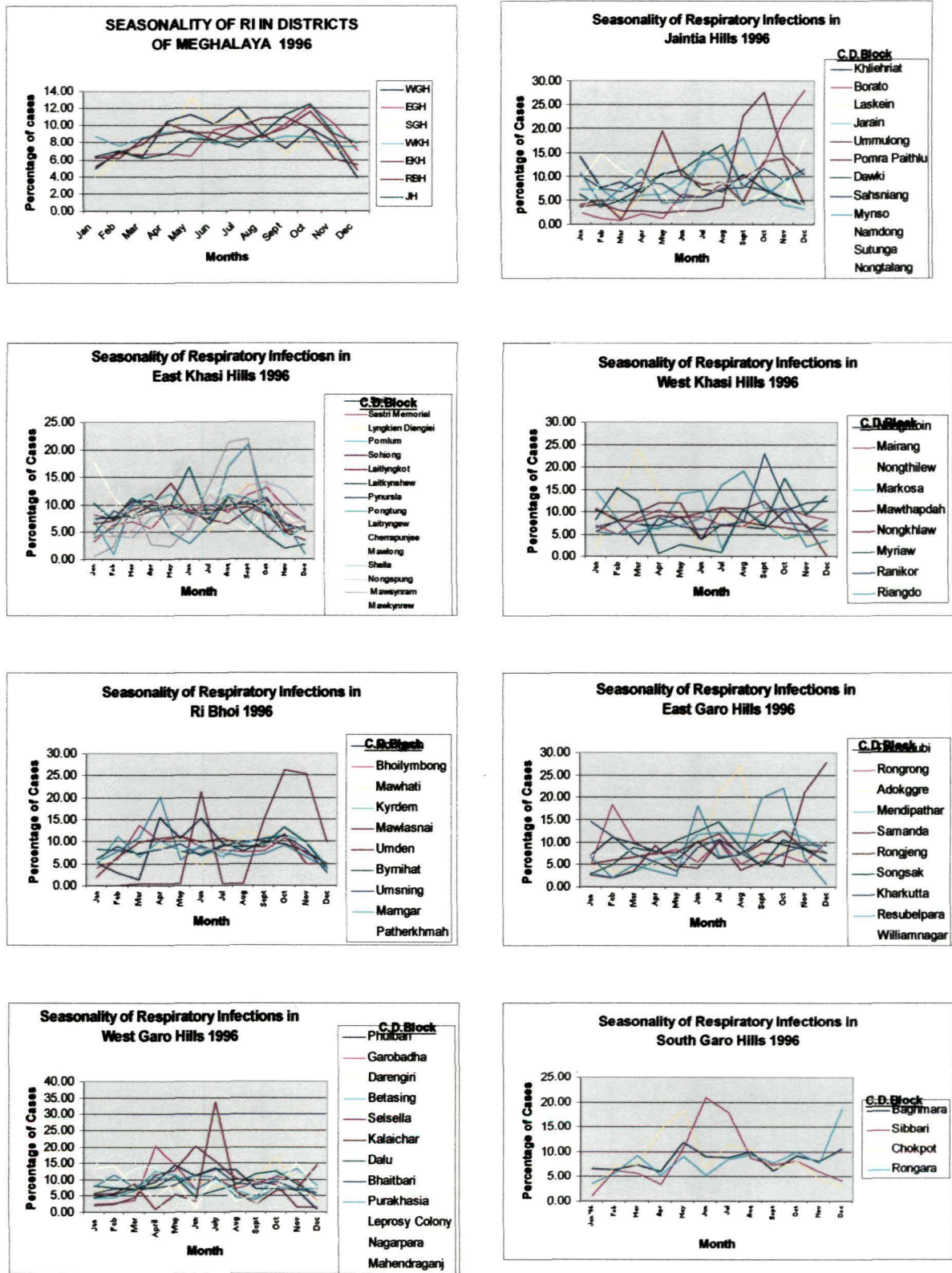


Figure – 3.9

mentioned earlier in this chapter. In the WGH district monthly variation is less among the health centres and the emerging pattern is less distinct if not opposite in some centres (Fig - 3.9). This may be due to higher physiographic variations among the health centres within the district e.g. from flood plains to high hill ranges. In the district of EGH the pattern is closer to normal trend excepting in Samanda and Rongrong blocks where higher occurrences are found in winter months. Except in Rongara block higher Ri cases are observed during March to September in SGH district.

In Khasi and Jaintia Hills the general pattern of seasonality is also observed clearly (Fig - 3.9). in WKH the pre and post monsoon months recorded higher Ri cases though cases were moderately high during rainy season as well. The normal pattern is also quite clear in case of EKH district. It is interesting to notice that considerably high Ri cases are recorded in the actual rainy season in those health centres located along the world's highest rainfall zone (e.g. Mawsynram, Cherrapunjee, Pongtung, Pynursla, etc.) in the Ri Bhoi district a strong normal trend is visible from the line graph. On the other hand the pattern is not so clear in JH probably owing to greater variation in physiographic and climatic conditions within the district. But a close second look helps to find the expected pattern in most of the health centres.

3.5 Distribution of Diarrhoeal Diseases

The term diarrhoeal disease is used for a group of diseases in which the predominant symptom is diarrhoea. The word gastroenteritis is most frequently used to describe acute diarrhoea though it is a generalized term. Many of these diseases develop due to certain viruses, bacteria and other parasites e.g. amoebiasis, giardiasis. WHO/UNICEF define acute diarrhoea as an attack of sudden onset which usually lasts 3-7 days but may last up to 10-14 days. As per WHO report at present in the tropical

belt 15 - 40 percent of all diseases among children less than five years of age are diarrhoea related. In India at least 115 million children below 5 years die every year owing to acute diarrhoeal diseases. Thus it is major public health problem in all developing countries and distinctly so in India. A current estimation shows that in India 32.3% of all hospital admissions were due to Diarrhoea compared to 13.6% due to ARI and that the proportion of death was 16.7% and 13% respectively. There were 6.27 lakh deaths annually which include 20% child population (Park, K. 1997).

The incidence of these diseases is related to hot season, poor environmental sanitations and quality of potable water etc. Flies and cockroaches also spread the infection from one person to another. A temperature of 25°C or more is found suitable for faster breeding of these insects. The incidence of these diseases is directly related to hot season, poor environmental sanitation and quality of potable water. It is thus referred to a disease of unwashed hands.

Unhealthy environment is the main culprit for causation in the community, however not many efforts are made to understand and improve the condition yet the key to the prevention and control lies in the environment as a whole and in specific.

As a primary barrier of transmission of organisms causing diarrhoea, the system of safe disposal of excreta is emphasised e.g. its collection, transportation, treatment and disposal. On the other hand, improvement of awareness of water sanitation behaviour results in prevention of diarrhoeal epidemic (Esrey S. A et al, 1985 cited by Dutta, P. 1999). Cruickshank (1976) observed that the incidence was highest amongst those who had no easy access to water for personal ablutions and lowest among those with water within their domicile.

In terms of percentage share of Dd to all diseases there is quite a high spatial variation in the state (Fig - 3.10a). Nongstoin block of WKH district recorded the

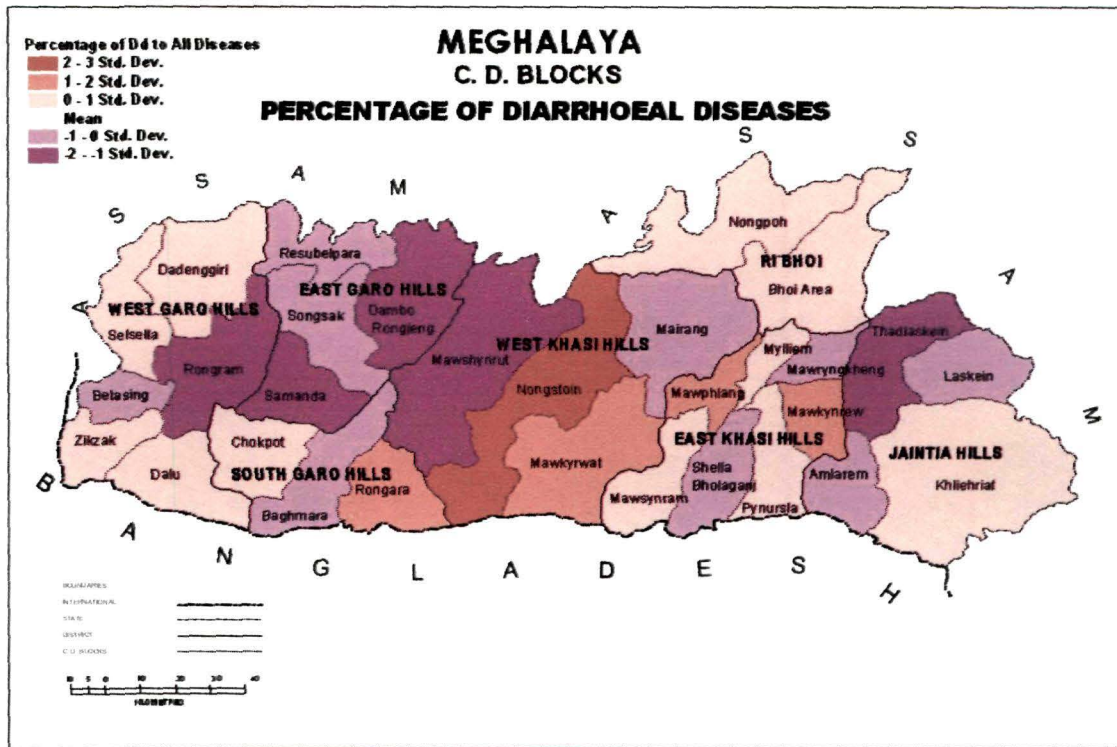


Figure – 3.10a

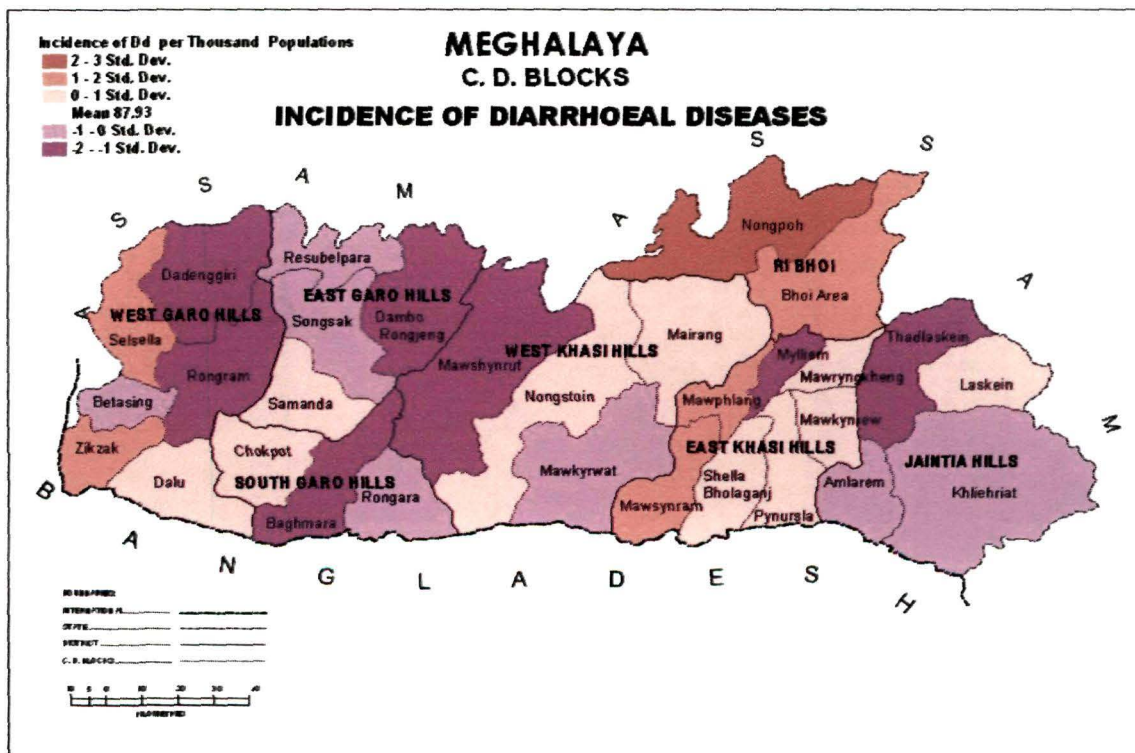


Figure – 3.10b

highest (39.18 per cent) in the state. In fact higher percentage ranges are present in majority of blocks of EKH and RB district and also in some parts of JH district, which are located at different plateau levels and foot hill zone. On the other hand there are five blocks along the valley plains of Garo Hills region having higher than the state average i.e. 20.57 per cent. In contrast whole of the central and northern parts of the Garo Hills including one block of WKH share of Dd was at lower side. A few blocks also have lower percentage located scattered over the central plateau of Khasi Hills. The lowest share of 7.11 per cent was recorded on the Mawshynrut block of interior WKH district. In fact just one third of the C.D. Blocks had diarrhoeal disease percentage lower than the state average of 20.57% (Annexure-III).

The variation of incidence rate of Dd is also high among the blocks of Meghalaya (Fig - 3.10b). The highest rate of 205.09 cases per thousand populations was reported from the Nongpoh block of Ri Bhoi district. In fact the RB district along with the adjacent blocks of WKH and EKH has formed a distinct belt of high incidence. Interestingly the Samanda block of EGH having one of the lowest percentage share reports higher incidence than the state average. The pattern of incidence remains same over the other parts of Garo Hills. The two least incidence rates are found in the blocks of Rongram (3.79) in SGH and Mawshynrut (8.65) in WKH.

The over all spatial patterns emerging from these two maps referred above indicates that Dd cases are relatively more prevalent in Khasi Hills compared to Garo Hills.

The fact that the diarrhoeal diseases are related to warmer climate is clearly depicted in its seasonal distribution (Fig - 3.11). With only exception of the WKH district the summer as well as rainy seasons, more precisely excepting the actual winter

SEASONALITY OF DIARRHOEAL DISEASES IN DISTRICTS OF MEGHALAYA

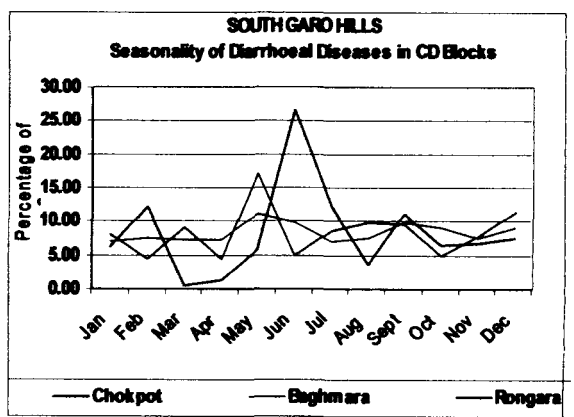
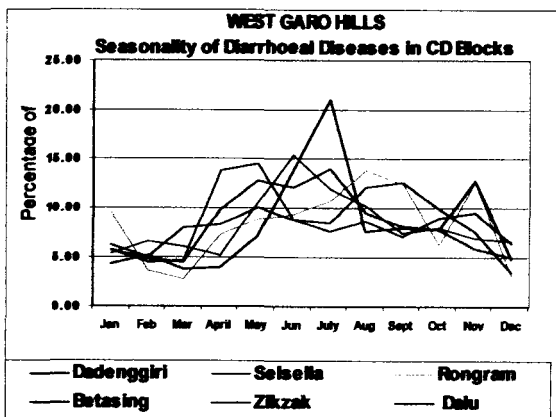
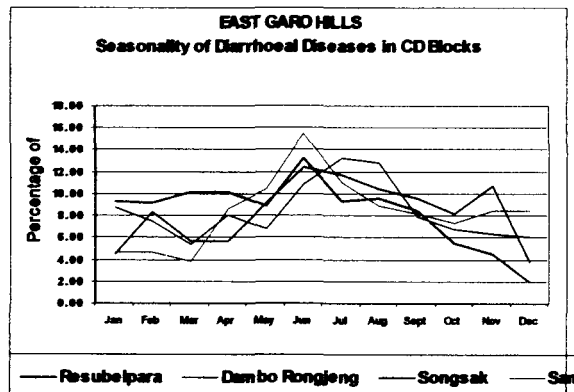
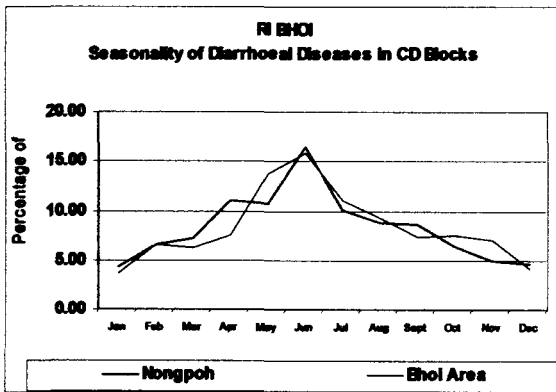
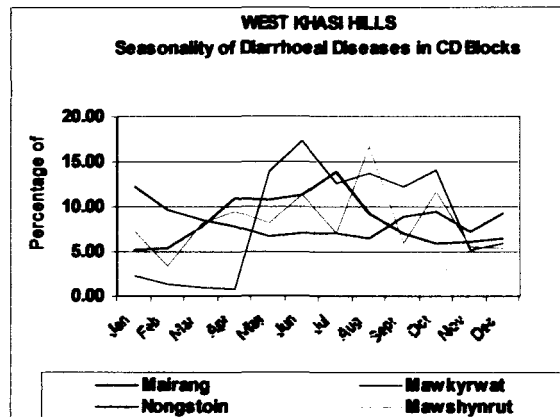
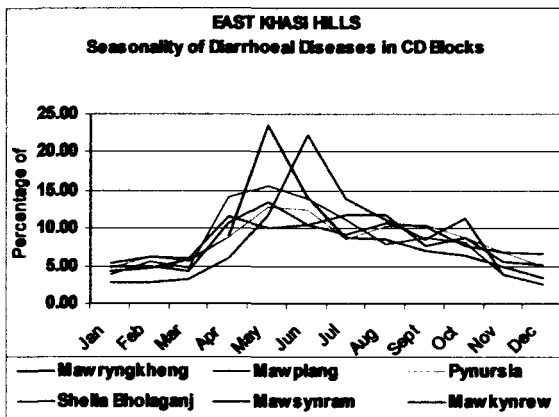
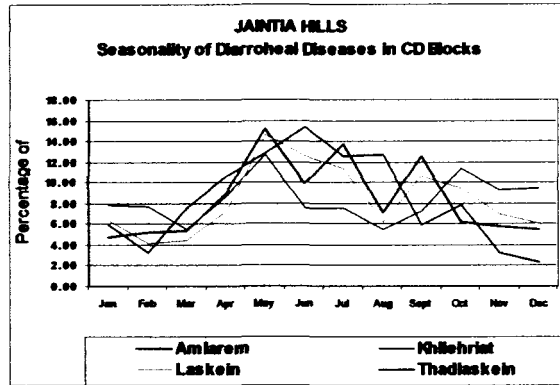
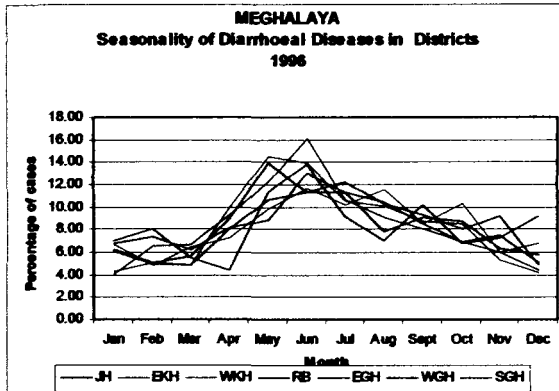


Figure – 3.11

months, prevalence of Dd remains high. The peak months for this disease are June and July the hottest ones in the state.

3. 6 Distribution of Malaria

Malaria is one of the oldest and most wide spread diseases in the world particularly between 60°N and 40°S. At present this is the major public health problem among the entire (95.9%) mass in 91 of the tropical countries. This signifies that 40% of the world's population is now deemed to be under malaria risk (Park, 1997). Malaria is most serious in the poorest countries and among populations living under the most difficult and most impoverished conditions. It contributes to a vicious circle of disease-poverty-disease and to the continued marginalization of people living in malaria areas (Kondrachine and Trigg 1997). In India malaria is a serious health problem in forest related areas, particularly in the North Eastern states, Bihar, Orissa, Gujarat, Maharashtra and Madhya Pradesh where 40% of the cases are *P. falciparum*. Foci of malaria *falciparum* resistant to chloroquine and S-P have been found in N-E states and in Karnataka state. Around 2,500,000 lab confirmed cases are reported at Slide Positive Rate 3% annually (WHO 2000). The history of malaria in Meghalaya and the North East India as a whole perhaps corresponds to the existence of the disease itself owing to the geo-environmental character of the region. Meghalaya along with other malaria infested states of India experienced the resurgence of the disease from 1971 onward challenging the declaration of the state as malaria free by the year 1964. The situation started developing after the implementation of the Modified Plan of Operation in 1977 under the National Malaria Eradication Programme. Since early 90's both the incidence and death started spurting in Meghalaya. Subsequently in 1995 Malaria Action Plan was adopted incidentally corresponding with the abnormal increase in number of positive cases detected through blood slide examination during the same year. Instead

of all efforts 81.4 % of villages in Meghalaya was found malaria endemic (Lakiang and Lyngdoh, 1997) and still receive regular DDT spray.

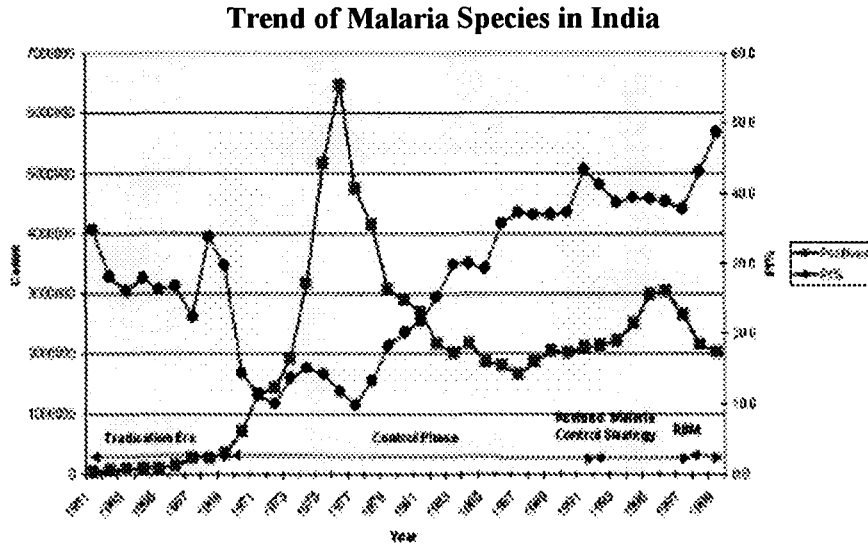


Figure- 3.12

Malaria is termed as a parasitic disease of communicable nature caused by certain protozoa living and multiplying in the human red blood corpuscles producing parasitic fever associated with anaemic enlargement of spleen (Park, 1997). The malaria parasite, a Protozoa of genus Plasmodium is transmitted to man by certain species of the infected female Anopheline mosquitoes. In Meghalaya Plasmodium vivax and Plasmodium falciparum are two dominant parasites of which the second one is the most dreaded and termed as cerebral or malignant malaria. Under the state Malaria Action Plan (MAP), 1995 the parasites are detected through microscopic studies of blood slides collected from infected patients to diagnose and measure the incidence of malaria positive cases by species.

The environment in which man lives or the geographical and socio-cultural characters of the human habitat as well as certain behavioural factors have considerable

impact on the vector (the mosquito), the agent (parasite) and the host i.e. the man. The transmission of malaria depends upon the complicated and multifaceted interaction between those three elements of the malaria ecology. Normally anopheline mosquito and the plasmodium protozoa thrive well in the tropical climate with high rainfall and warmer temperature. Geographical factors mainly climate, terrain conditions, altitude, forest, nature of water bodies and soil etc. play vital role in the breeding and life cycle of mosquito, incubation period of the parasite and also living conditions of man influencing exposure to the risk. Malaria is a focal disease, but *P. falciparum* predominates in the foot hills and in forest and forest fringes which are predominantly the tribal settlement areas. In the country 7.8 per cent tribal population contributes > 30 per cent of malaria, > 60 per cent *P. falciparum* cases (Sharma, 1996). Because of the peculiarities in transmission dynamics in the forests and difficulties in control operations this type of malaria is known as forest malaria or tribal malaria. Factors like poor housing, living near the mosquito breeding centres, poor clothing, exposure to the vector during work in the fields and large scale human migration between malaria endemic areas to malaria free areas are the most important in rural India in general.

Of all factors air temperature alone immensely affects the life of both vector and agent. The optimum temperature for the mosquito development is 25°-30° C and its development is hindered at above 35° C and below 16° C though higher extremities of heat are more destructive. Similarly the malaria parasite in the mosquito requires a temperature range of 20°-30° C while above 30° and below 16°C either kills or stops development. Moreover *P. vivax* can develop in lower temperature than *P. falciparum* though the development phase is longer. Temperature also influence favourably to the laying of eggs, larval development and biting frequency etc. (Pacholi 1993). Similarly at least above 60% relative humidity is found suitable as in higher humidity the insect

is more active and eats more voraciously. Rainfall is another climatic factor that governs the geographical and seasonal distribution of transmission of malaria. Mosquito breeds in stagnant water containing required amount of micronutrients. Hence excessive rainfall or flood, though increase available moisture but help flushing out of the breeding centres. In fact larval density increases many times after the recession of the floodwaters during low to moderate rainfall periods. Monsoon winds help mosquito increasing the flight length but strong winds damage the larva. The seasonal variation of temperature and rainfall complicates the epidemiology of malaria by differential transmission among species. In fact *P. falciparum* infection increases with the decrease in *P. vivax*. Altitude (above mean sea level), which has direct bearing on air temperature, is also a limiting factor of the mosquito vector and the malaria parasite as well. In fact *Anopheles* species are not found at altitudes above 2000 – 2500m. The protozoan parasite cannot complete the development at higher altitude mainly due to lower temperatures.

During the index year 1996 all the seven districts of Meghalaya had registered malaria positive cases. The Annual Parasite Index (API) per thousand populations showed a wide range of variation from mere 1.09 in the East Khasi Hills district up to 42.33 in Jaintia Hills (Fig.-3.13). In fact the low incidence districts are the East and West Khasi Hills (<5), moderate incidence (5 – 15) was in all the three Garo Hills districts, whereas the Ri Bhoi and Jaintia Hills had very high rates (>30). On the other hand PF% varied from 20.9 % in Jaintia Hills to 98.17 % in West Garo Hills. Looking at the coefficient of variability (CV %) among the districts it is easy to deduct that though the variability was very high in API (91.91%) but there was less variation considering the PF%. Thus as a whole Meghalaya shown a state of high and increasing

cases of malaria from *P. falciparum* parasites compared to *P. vivax*, the two dominant varieties in the state (Annexure-III).

Table -3.4
Geo-ecological Attributes and Prevalence (1996) of Malaria in the districts of Meghalaya

Districts	Av. Altitude (m.)	Av. Annual Rainfall (mm)	Av. Annual Temperature (°C)	API(Per cent)	PF %
West Garo Hills	280	2000	23	8.67	98.17
East Garo Hills	400	1500	22	11.90	97.70
South Garo Hills	180	3000	23	9.20	97.78
West Khasi Hills	950	3800	18	3.81	92.12
East Khasi Hills	1250	6500	15	1.09	53.40
Ri Bhoi	650	1200	21	31.71	64.80
Jaintia Hills	940	2500	20	47.60	21.80
				c.v.= 96.61%	c.v.= 36.91%

The Meghalaya state is divided into three malaria Units. 1). The Garo Hill Unit comprising West, East and South Garo Hill districts. 2). Khasi Hill Unit comprising the West Khasi Hills, East Khasi Hills and Ri Bhoi districts and 3). Jaintia Hills Unit for the single district. Among these three units the Jaintia Hills showed abnormally high figures (47.6) of API and at the same time an increasing trend over 1995 when it was 40.10 the Khasi Hill unit recorded lowest API (9.4) but slightly more than the 1995 (7.4). But API went down marginally in the Garo Hill unit from 10.2 to 9.7 during the same period (table-3.4 and fig.-3.13).

On the other hand interesting trends have been observed in the relative prevalence of *P. vivax* and *P. falciparum* which are two species of parasites in whole Meghalaya in 1996 Garo Hill Unit had the highest proportion of *P. falciparum* cases (97.9) marginally higher over 1995 (95.8) though this Vivax region was traditionally the cent percent P.F. infested area particularly all along the lower altitude zone bordering Assam and Bangladesh. In the Khasi Hill unit too the *P. falciparum* percentage was remarkably high (60%) though it was less than that of 1995 (65.4). the

MEGHALAYA MALARIA UNIT WISE ANNUAL PARASITE INDEX 1989 - 1999

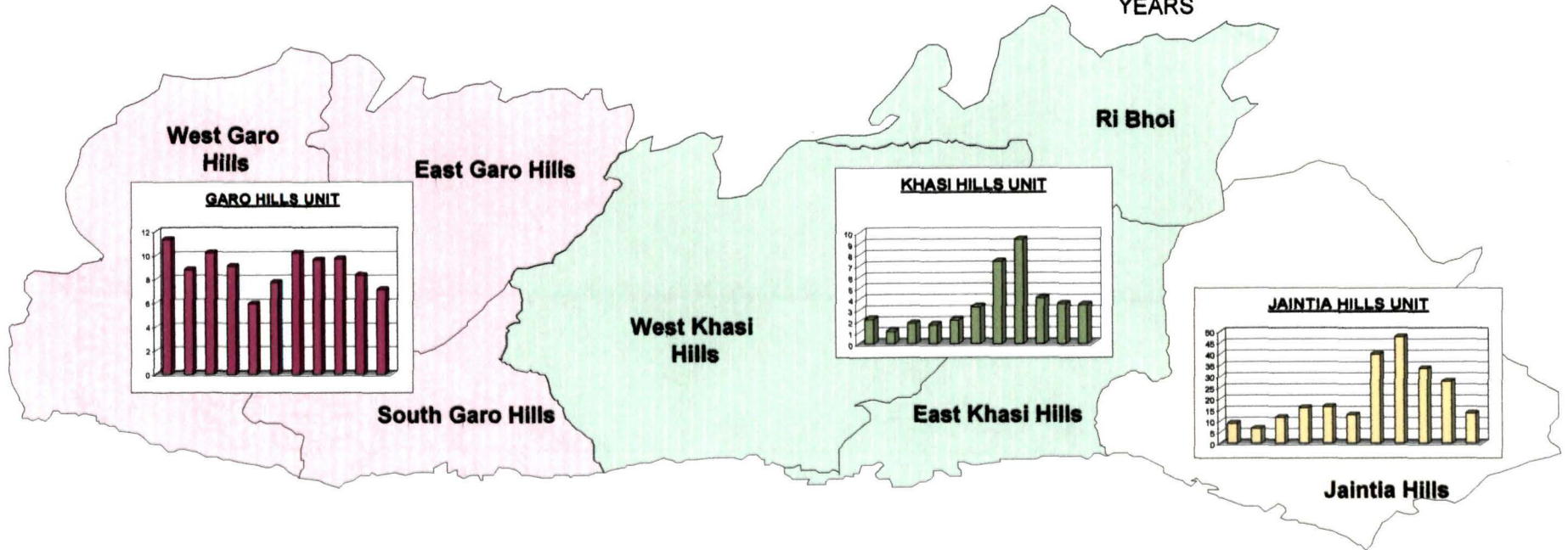
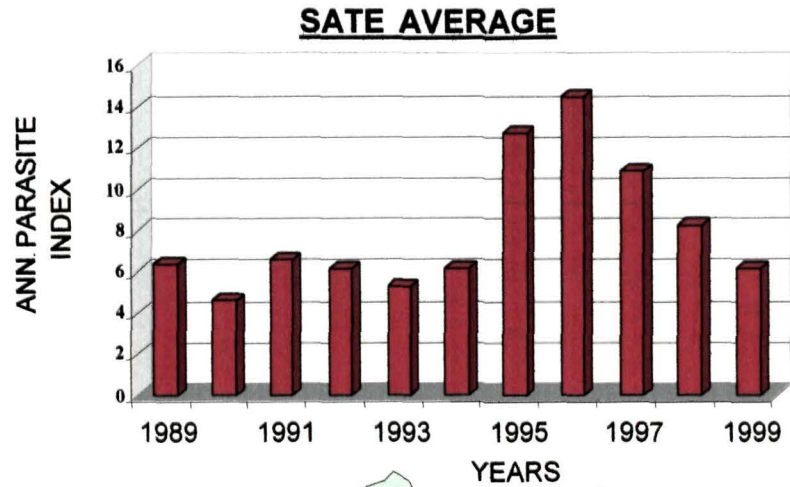


Figure – 3.13

Jaintia Hill unit which was earlier a *P. vivax* zone shown a strong increase in *P. falciparum* case from mere 3.1 %to 21.8% during 1995 and 1996.

The block level distribution pattern arising from the map (Fig.-3.14a) is clearly giving indications that entire Garo Hills region, Ri Bhoi and Jaintia Hills districts are having high to very high API. On the opposite in most parts of the West and East Khasi Hill districts the index remains below 2.01 i.e. the critical limit for identifying endemicity. The figure 3.14b is further clear in understanding the different risk zones of malaria. It may be noted here that there is a belt of endemic but risk free zone in between the parasite free zone on the higher altitude and risk area of the foot hill and valley plains.

Considering the average annual temperature the district of Meghalaya can be grouped into two. All the three Garo Hill districts, Ri Bhoi and Jaintia Hills are relatively warmer with more than 20° C whereas East and West Khasi Hill district experience milder air temperature at 15° C and 18 C respectively due to higher altitude. A clear positive control of temperature on malaria incidence rate in the districts has been found as expected. The very high rate of API in the moderately warm districts of Ri Bhoi and Jaintia Hills may be attributed to certain additional factors too. The relative dominance of *P. falciparum* cases over *P. vivax* were found in a the lower altitude districts .In accordance with the observations made by Pacholi (1993) in Madhya Pradesh the *P. vivax* species occupied the higher altitude regions of colder climate e.g. East Khasi Hills and Jaintia Hills because this specie can thrive better in colder climate than *P. falciparum* the WKH had high rate of PF instead of higher altitude in fact whole of the Garo Hills, particularly all along its low altitude bordering areas with Bangladesh and Assam was traditionally a complete PF zone which shows a trend of swing towards *P. vivax* species. Both Ri Bhoi and Jaintia hills experienced an increasing trend of

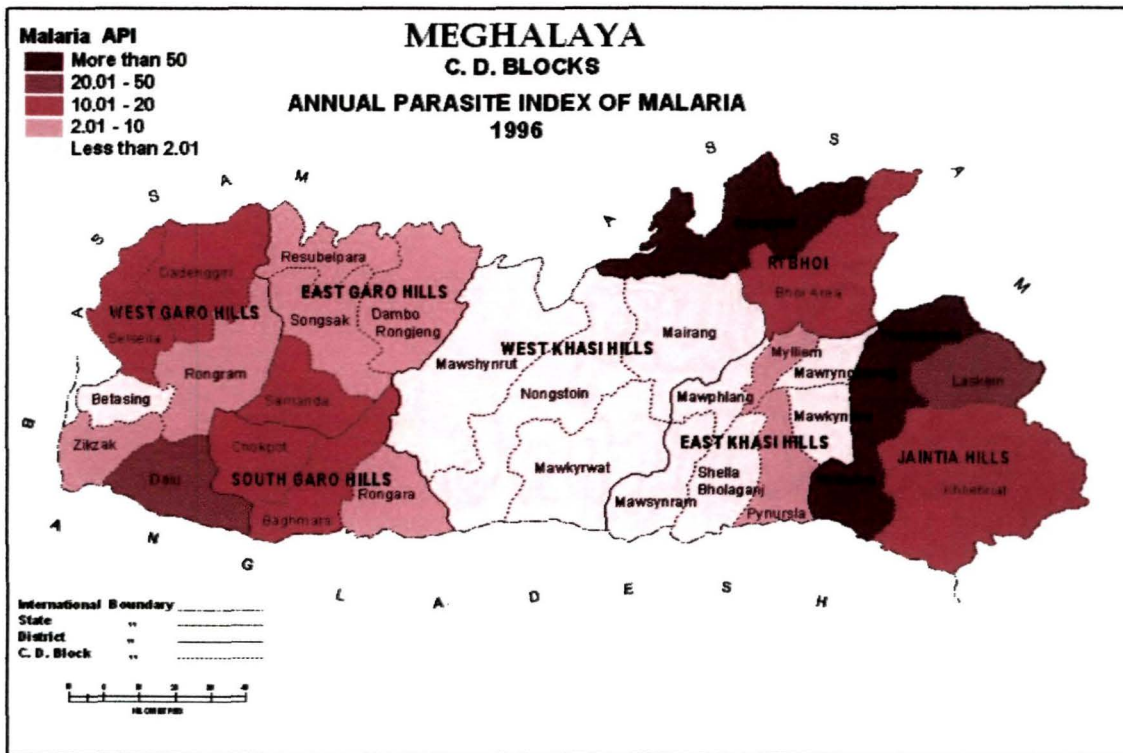
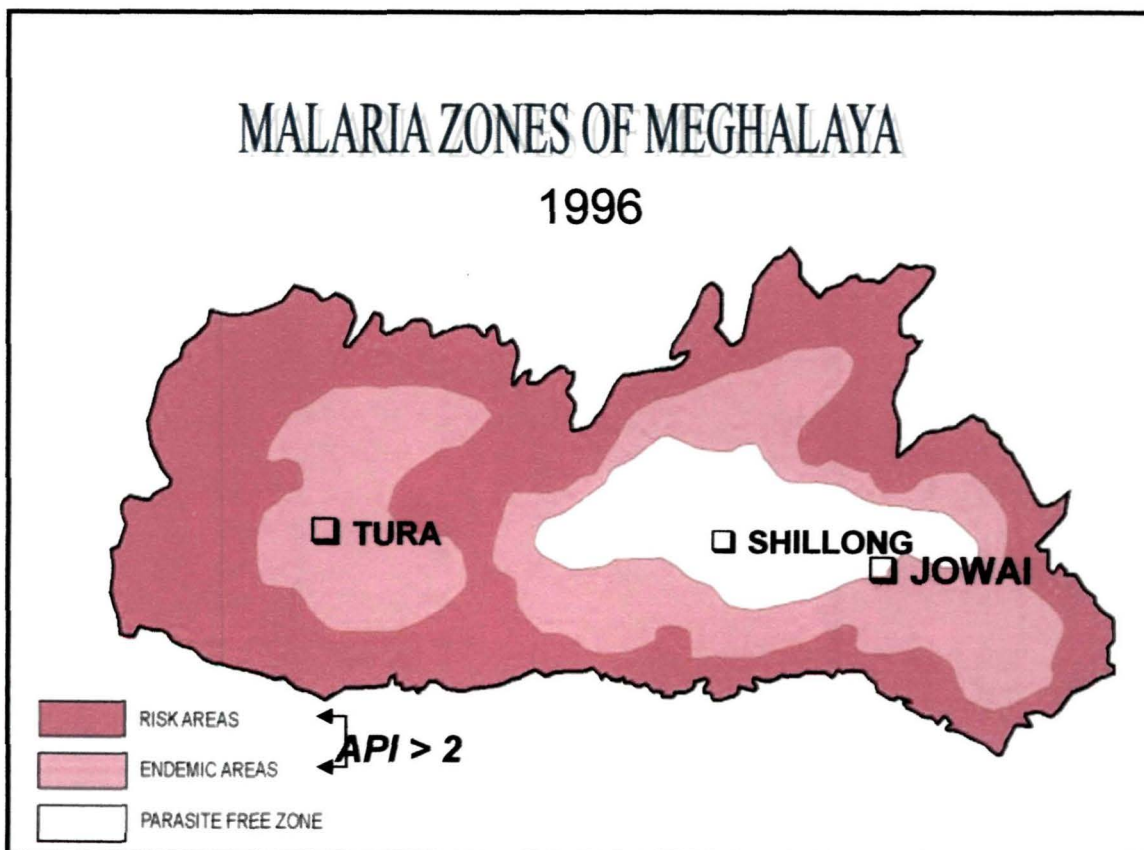


Figure – 3.14a



Based on NMEP Report 1996-97, Directorate of Health Services, Meghalaya.

Figure – 3.14b

falciparum percentage though till 1996 *P. vivax* was the dominant one in Jaintia hills (78.2). In general it seems air temperature had a reasonably marked control over the presence of either of the Plasmodium species in the state.

Table-3.5
Correlation Coefficients between Malaria Indices and Selected Variables in Blocks of Meghalaya

Variables	Positive Cases	API
Altitude	-0.08	-0.06
Mean Ann. Rainfall	-0.35	-0.27
Mean Ann. Temperature	0.19	0.27
Density of Population	0.10	-0.08

The table- 3.5 gives a clear negative correspondence between malaria incidence in the study area and the interrelated physiographic factors i.e. altitude and rainfall. The district level distribution of malaria indices (Table-3.4) also gives the same trend. The prevailing situation in the Jaintia Hills may be taken as an exception where none of those factors were found responsible for both extremely high API and lower *P. falciparum* per cent as well. Probably the right answer lies in the fact that there is a large number of crudely operated coal mines, any of those deserted pits serving as the favourable breeding ground for the vector. Moreover a large number of seasonal mining labourers regularly emigrate mainly from the surrounding plain areas of Assam and even Bangladesh, act as the probable carrier of the parasite.

All over Meghalaya only *P. vivax* and *P. falciparum* are by far the only contributing species for all the positive cases. Hence these two occur alternatively in different climatic conditions. During the index year it was observed (Table-3.6) that the seasonality of malaria cases was more prominent in Jaintia hills Unit (CV 52.27%) and Khasi Hill unit (51.16%) than in the Garo Hill unit (48.04%). In Khasi Hills the actual monsoon period (June to September) with the highest rainfall recorded high malaria

cases as well as the PF% with minimum exceptions in the winter months of December returning high PF as well (fig.-3.15). The JH condition was also similar showing higher positive cases (about 12.5%) during the period from July to November indicating a high incidence rate in the later half of monsoon season. But PF % was detected very high also in winter and autumn season (Dec – April) though a second prominent season was recorded in the rainy season as well. In Garo Hills too the highest Malaria infested months corresponded to the main rainy season but PF cases were very high between 96 – 99 percent throughout the year with the only exception in the month of September – an isolate case of no apparent reason.

Table-3.6
Seasonality of Malaria in Meghalaya, 1996

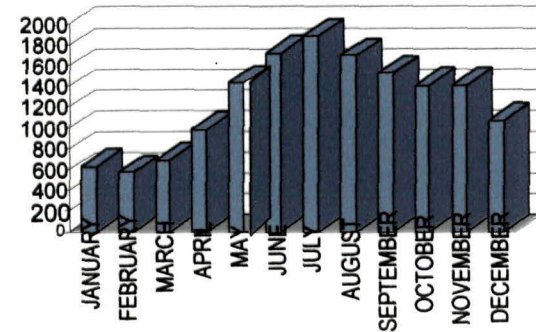
MONTH	Khasi Hill Unit		Jaintia Hill Unit		Garo Hill Unit	
	API	PF%	API	PF%	API	PF%
JAN	4.7	47.2	3.2	25.9	4.7	97.3
FEB	3.4	40.2	4.9	65.5	3.9	97.1
MAR	4.4	40.9	5.1	57.3	3.9	97.7
APR	4.9	36.3	4.2	51.2	6.1	97.7
MAY	4.9	41.4	3.6	3.1	9.6	99.1
JUN	11.8	57.8	6.7	23.6	12.5	98.8
JUL	4.4	78	12.5	12.4	14.8	98.4
AUG	16.6	64.7	13.8	14.7	11.4	96.6
SEP	12	59.7	12.9	11.3	15.5	48.3
OCT	10	64.6	15.1	13.3	5.7	98.7
NOV	7.1	43.9	12.5	8.2	7.9	97.3
DEC	5.8	70.4	5.5	19.6	4.3	96.4
Annual	9.4	47.5	7.6	21.8	9.6	97.9
<i>CV%</i>	<i>50.7368</i>	<i>24.6101</i>	<i>52.53875</i>	<i>77.99705</i>	<i>49.13899</i>	<i>14.62192</i>
<i>Mean</i>	<i>7.5</i>	<i>53.75833</i>	<i>8.333333</i>	<i>25.50833</i>	<i>8.358333</i>	<i>93.61667</i>
<i>SD</i>	<i>11.72339</i>	<i>13.22998</i>	<i>4.378229</i>	<i>19.89575</i>	<i>4.107201</i>	<i>13.68855</i>

3. 7 Distribution of Pyrexia of Unknown Origin

The symptoms of illness usually denoted as ‘pyrexia of unknown origin’ (Po) to the cases of persistent fever causes of which are yet to be diagnosed. The Po cases are found to be remarkably high in all over Meghalaya as already pointed out in the previous chapter. Most of the health centre doctors were found unanimous in the

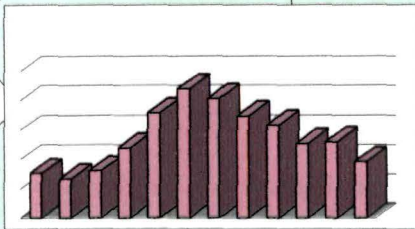
MEGHALAYA SEASONALITY OF MALARIA IN THREE UNITS 1996

STATE AVERAGE



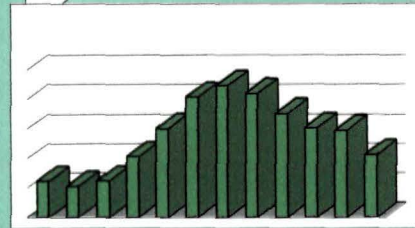
C.V. = 36.01 %

GARO HILLS UNIT



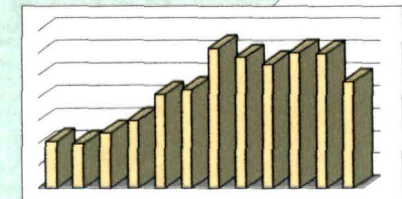
C.V. = 37.66 %

KHASI HILLS UNIT



C.V. = 43.71 %

JAIANTIA HILLS UNIT



C.V. = 37.15 %

Figure – 3.15

opinion that Po cases in the state are largely that of clinical malaria not proved through pathological tests. Hence, these are also recorded under the head of 'probable cases of malaria' in the patient register. Here Po is discussed as a separate disease to understand its expected similarity with malaria with respect to distribution pattern. The prevalence of Po poses a serious challenge before the malaria eradication programme in the state.

Po ranked third among the diseases recorded in Meghalaya in the year 1996 sharing 19.23 per cent and an incidence rate of 73.96 per thousand. The highest percentage of Po is found in the EGH district as such and Samanda block (48.95) in particular. In SGH it is also on the higher side. On the other hand most blocks in JH and EKH recorded low to very low proportion of Po to all diseases. In terms of incidence rate a similar pattern of distribution is evident (Fig.-3.16b). Highest rate of 599.64 is recorded in the Samanda block (Annexure-III - 2).

Now it is quite interesting to compare the distribution pattern of Po and malaria. From the two respective maps (Fig.-3.14a-b and 3.16a-b) it can be stated that i) in general Po cases are low in the areas of high malaria occurrence, which may be due to higher detection rate through better surveillance and awareness of both the health workers and the people. In fact JH and Garo Hills region are the two major malaria infested areas with alarming severity in the state at present. ii) Po cases are low also over the central plateau region, less affected with malaria as well, which includes major parts of WKH and EKH districts. iii) In case of RB and EGH districts it seems that the malaria detection laboratories are not sufficient compared to the higher occurrence rate. Therefore, many cases are being recorded as pyrexia of unknown origin.

Similarly, the seasonal variation of Po (Fig.-3.17) gives a pattern similar to that of malaria (Fig.-3.15) i.e. cases are low in winter and increases with the increase in air temperature up to June – July with a slide deviations in case of JH and WKH districts.

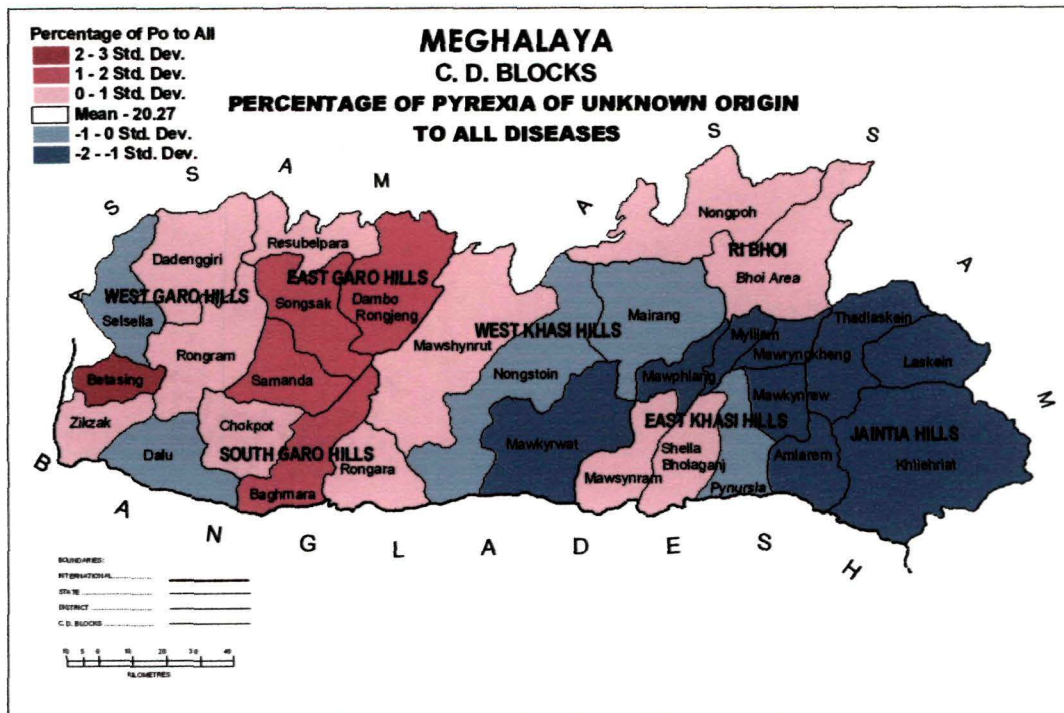


Figure – 3.16a

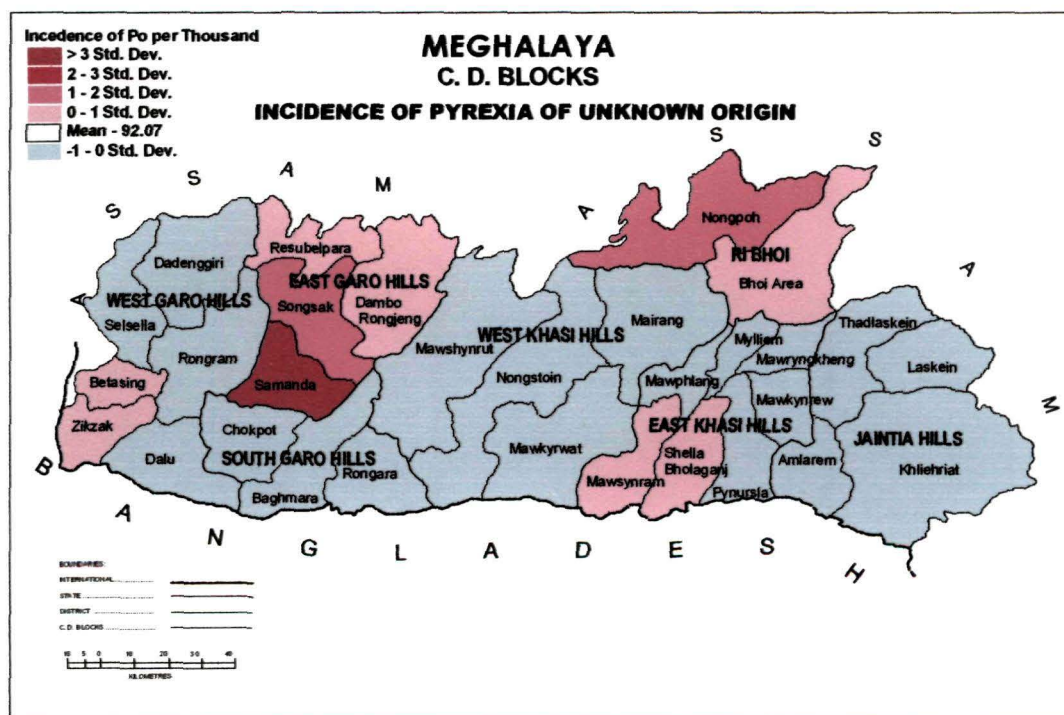


Figure – 3.16b

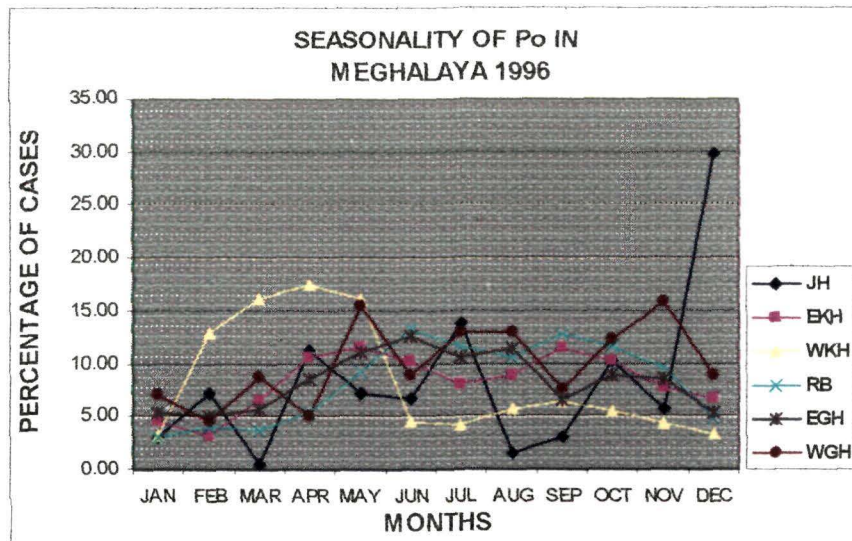


Figure - 3.17

Therefore, it can be inferred that most of the Po recorded is probable cases of malaria in Meghalaya as justified by the statistical and graphical trends of those two diseases.

3.8 Distribution of Diseases of Skin

Diseases of skin ranked fourth sharing just 5.88 per cent of all diseases recorded. Dalu block of WGH shared 14.13 per cent the highest whereas Thadlaskein of JH recorded just 0.23 per cent the lowest during the year 1996. Even with a cursory glance to the map one can easily identify that occurrence of Sd is clearly higher in almost all over Garo Hills region excepting SGH compared to Khasi and Jaintia Hills (Fig.-3.18a). It is really interesting to observe the contrast in distribution patterns between the eastern and western Meghalaya, the two major physio-cultural regions. It seems that Khasi and Jaintia tribesmen are less susceptible to diseases of skin in general or they practise a better skin hygiene. Only exception of above average Sd cases in Khasi Hills is in the highest altitude blocks with cold climate and higher density of population due to presence of the Shillong town.

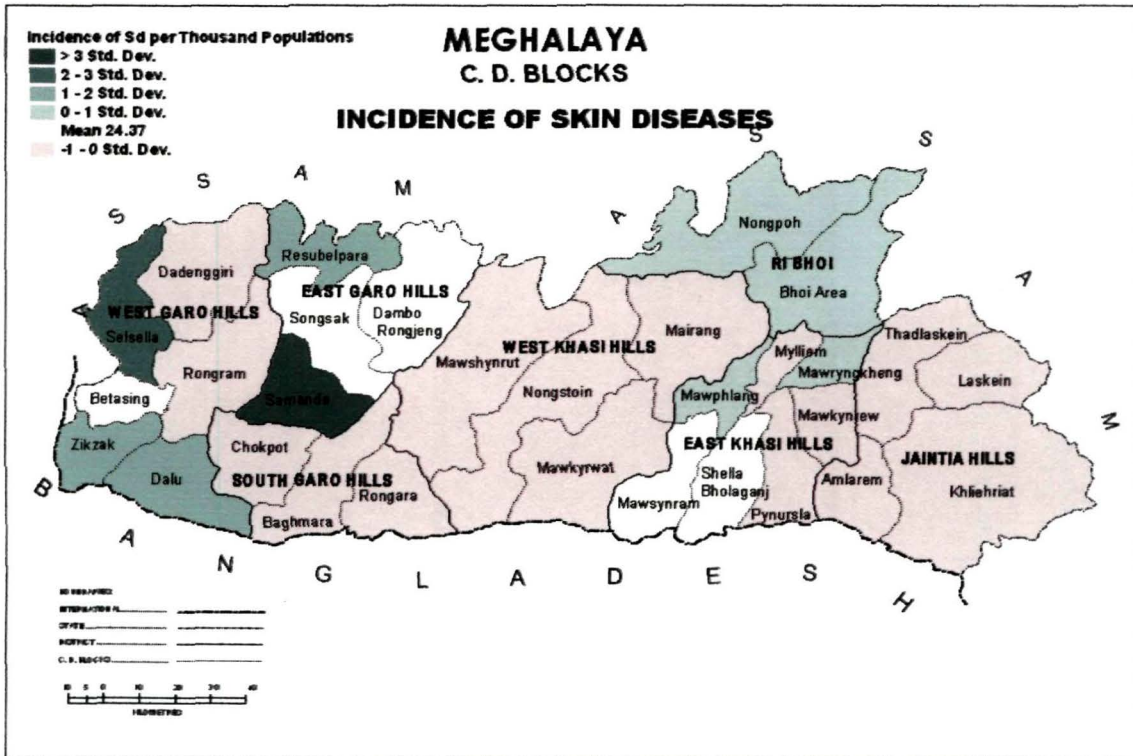


Figure - 3.18a

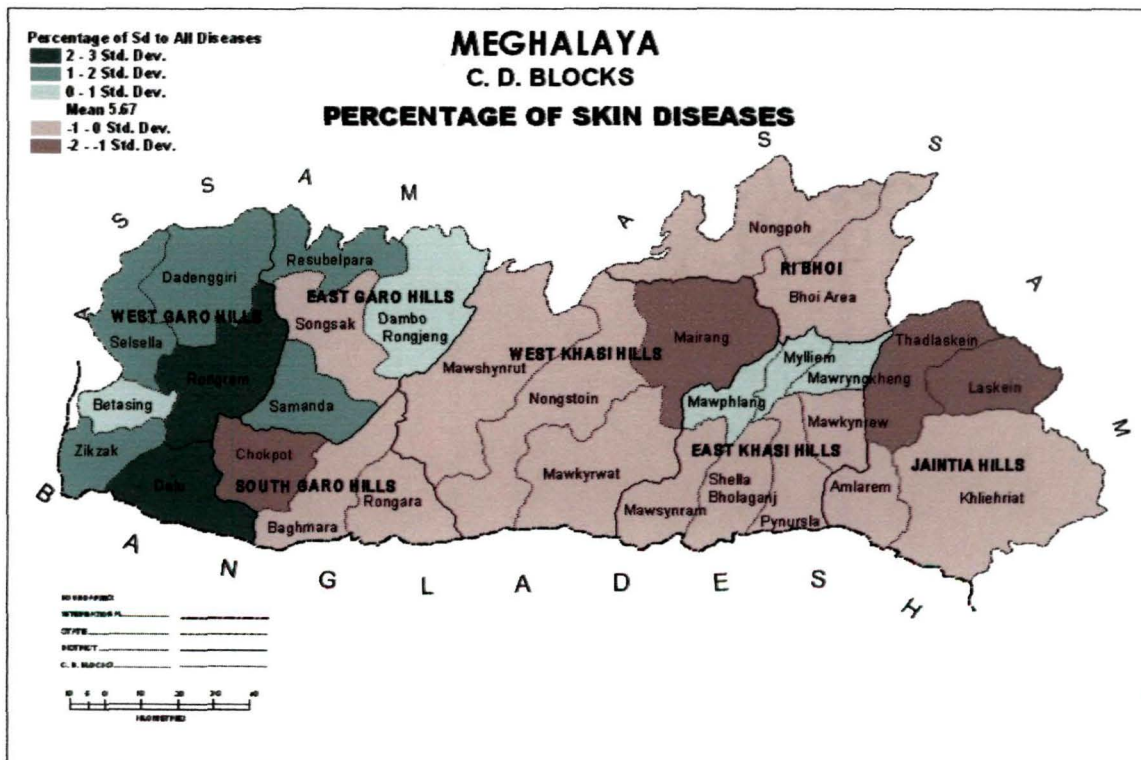


Figure - 3.18b

On an average Meghalaya recorded 22.62 persons suffering from Sd per thousand with quite a large variation (Fig.-3.18b) of its incidence rate over the geographical space (C.V. = 112.60% among the blocks). The highest incidence rate of 116.56 is observed in the Samanda block of EGH and the lowest (0.78) in the Thadlaskein block of JH district. Incidence rate above the state average is found mostly in the blocks of EGH, RB and partly in WGH and EKH. As such there is no apparent spatial association of Sd with altitude or temperature as such. It is noticeable that areas along the border with Assam Sd cases are occurring above average rate (Annexure-III).

The seasonal variation of Sd does not give any clear pattern as such. Due to insufficient details of data at block level month wise percentage cases are compiled at district level only and are presented in a graph (Fig -3.19). In SGH district no record of Sd is available for the index year. In JH, WKH and EGH districts the monthly variation is relatively more perceptible in the graph having C.V. of 30% and above. In majority of districts, except WKH, reporting of Sd has been highest in the summer through rainy months and declines slowly during autumn while the lowest level is reached in the winter. It is noticeable that these three districts are having higher altitudinal variation as well. The trend in WKH is different in a way that cases start rising with rainy season and falls in winter with another high during late winter (February).

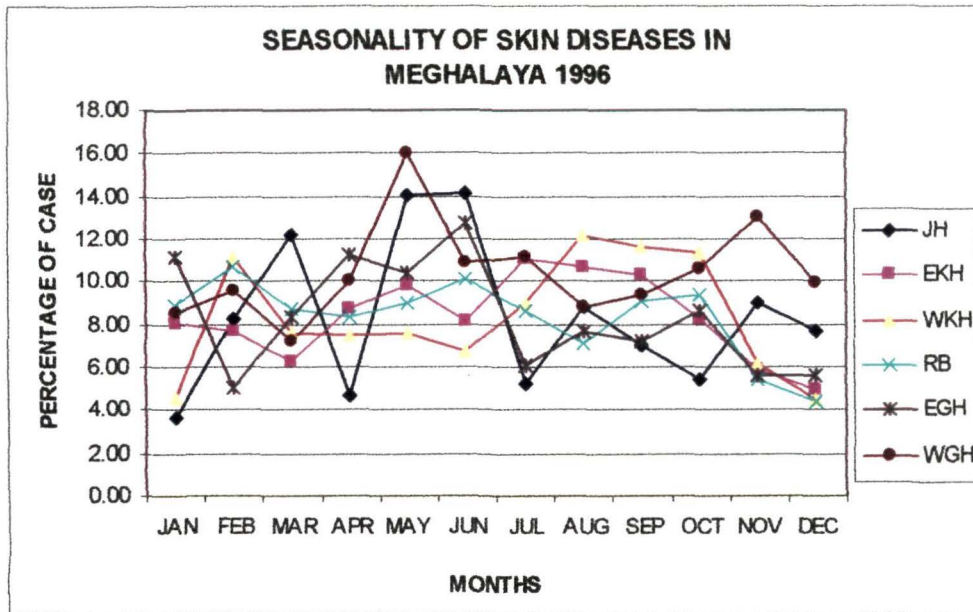


Figure – 3.19

3. 9 Distribution of Peptic Ulcer Syndrome

The term peptic ulcer is defined as a disease of digestive track with several variations in terms of the particular part of the track affected. Here ulceration is a breach or scar in the lining (mucosa) of digestive track produced by digestion of mucosa by digestive enzyme (pepsin) and acid. This may occur when pepsin and acid occur in abnormally high concentration or when some other mechanism reduces the normal protective mechanisms of the mucosa: bile salts may play a part mainly the stomach ulcer. A peptic ulcer may be found in the oesophagus (oesophageal ulcer); the stomach (gastric ulcer); duodenum (duodenal ulcer) and jejunum (jejunal ulcer), etc (Harrison, 1986). Most commonly reported is gastric ulcer or gastric in all over rural Meghalaya which, as per medical practitioners, is synonymous to all common types of digestive disorder or burning sensation in the stomach or digestive system. The final diagnosis of these requires sophisticated aids like endoscope and gastroscop. Therefore, in the rural health centres these diseases are symptomatically segregated as probable cases of peptic ulcer and are recorded under the head 'peptic ulcer syndrome'. In fact gastric ulcer is caused by the action of acid, pepsin and bile on the stomach

lining. Symptoms include vomiting and pain in the upper abdomen soon after eating, and such complications as bleeding, perforation and obstruction due to scarring may occur. Gastritis, the early symptom of gastric ulcer, is caused by smoking and chronic irritation and may also be caused by bile entering the stomach from duodenum. The output of stomach acid at an excessive rate is also associated with abnormal food habit, longer intervals between meals and certain addictive habits (Haririson, 1986). Lam (1994) also mentioned that there are five known environmental, causative factors for peptic ulcer, namely, non-steroidal anti-inflammatory drugs (NSAID), *Helicobacter pylori* infection, cigarette smoking, environmental stress and dietary habit. But finally he concluded that his report supports the concept of heterogeneity in peptic ulceration.

The disease shares only 4.33 percent of all recorded diseases during the index year in the state. Among the blocks the percentage varies from zero in Rongram of WGH up to 14.19 in Mawshynrut of WKH district. Therefore spatial variation of Pu is quite high in the study area (C.V. =109.44). The spatial pattern as depicted in the map (Fig.-3.20a) shows those twelve blocks of EKH, WKH, RB and SGH has formed an almost contiguous belt of high Pu. On the other hand districts like WGH, EGH and JH recorded little or no such case (Annexure-III).

In terms of incidence rate the SGH and RB districts are the main areas of concern with clearly higher range above the state average of 16.67 persons per thousand populations (Fig.-3.20b). In fact 18 out of 30 administrative blocks recorded below average incidence rates. Therefore, there is an uneven distribution of Pu in the state both in percentage and incidence rate. One of the probable reasons of such a large contrast in disease occurrence among the blocks seems to be faulty or under reporting in certain districts.

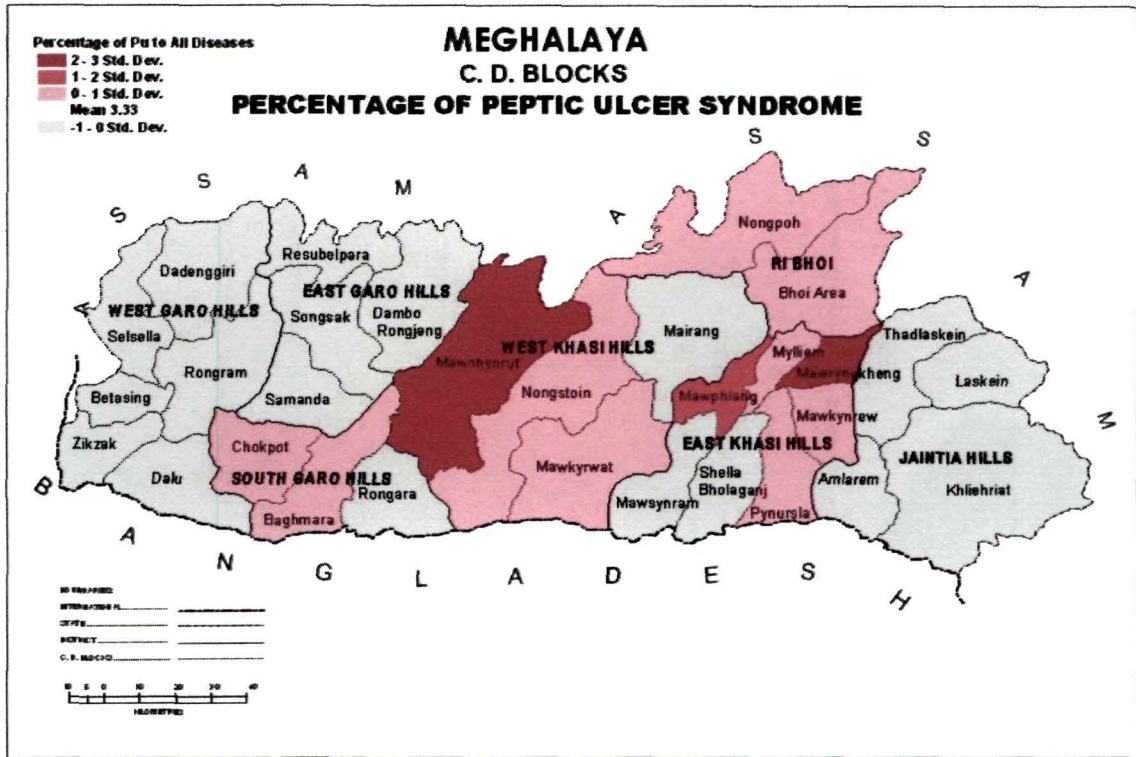


Figure - 3.20a

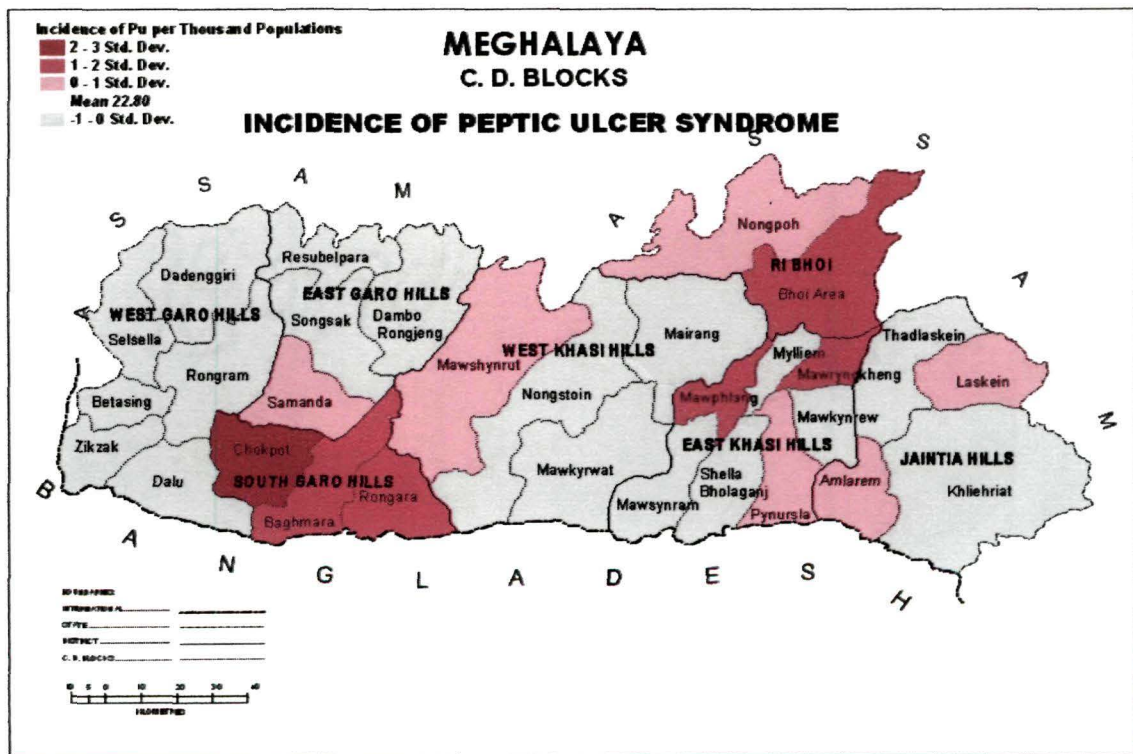


Figure - 3.20b

The seasonal variation of Pu cases as plotted in the line graphs (Fig -3.21) indicates i) there is general upward trend at start of summer season (Feb - March); ii) the curve dips down during the rainiest months of June – August and iii) cases rise to a greater height in the post monsoon period to fall again with the onset of winter. Then, examining the graphs of EKH, WKH and JH districts a more or less similar pattern is found. But in the districts of RB and EGH, receiving less rainfall and located along the northern boundary of the state, Pu cases remain high even during rainy season and falls only in winter. Therefore, it seems rainfall has a controlling impact on this disease in general. The data from the health centres of both WGH and SGH districts is too scanty to be plotted for interpretation.

3.10 Concluding Statement

The present chapter, being the pivotal one, presents major diseases of Meghalaya and the prevailing pattern in fulfilment of the main objective of the thesis. Diseases like respiratory infections, diarrhoea, probable cases of malaria fever, skin infections; peptic ulcer syndrome and malaria are found as statistically major diseases during the index year 1996. In fact the first three diseases together shared three fourths of all the 22 disease categories recorded. As expected discernible spatial variation are present in distribution pattern of all the major diseases. Among the administrative blocks respiratory infections dominated as the first rank and diarrhoeal diseases as the second rank followed by pyrexia of unknown origin and malaria. It is important to note that incidence of respiratory infections are more over the high altitude areas whereas diarrhoea cases are found in middle and lower altitude belts of the Meghalaya plateau.

The dominance of the three top order diseases is also reflected in the computed results of disease combination. Moreover, it is also observed that four disease combinations are present mainly in the thickly populated border blocks of Garo Hills

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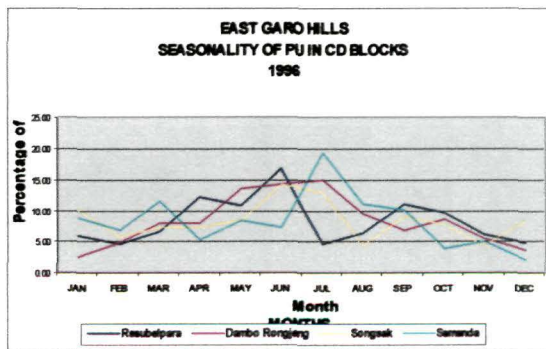
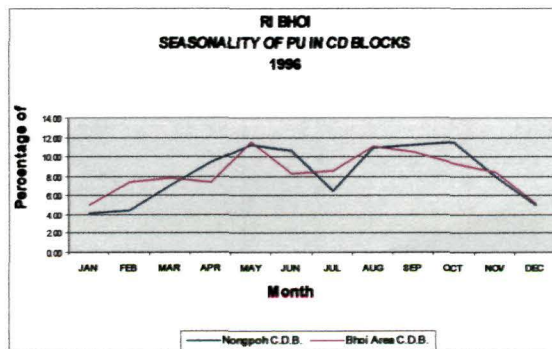
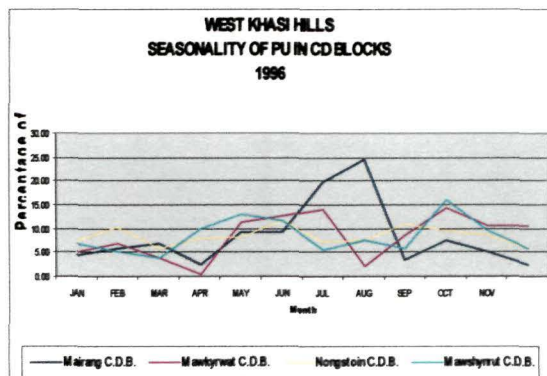
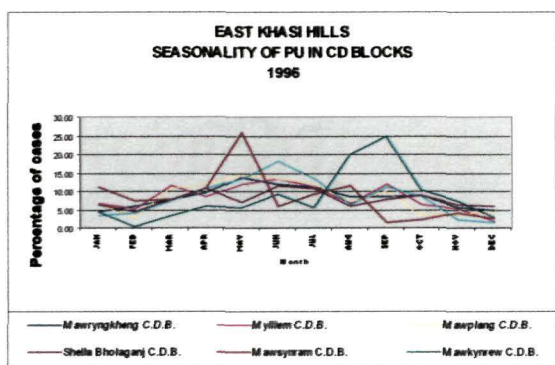
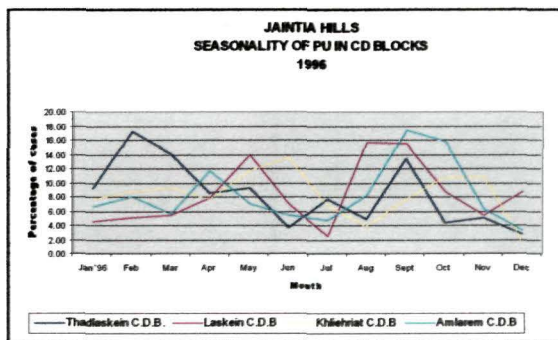
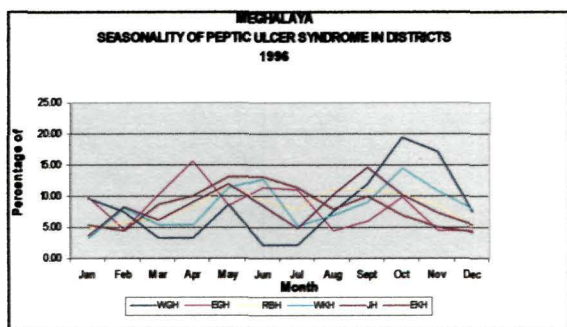


Figure – 3.21

and Ri Bhoi districts. On the other hand in two higher altitude blocks viz. Khliehriat and Mawryngkheng, extreme dominance of Ri and Dd has resulted in two disease combination.

Higher altitude and higher rainfall areas are seen associated with Ri diseases which occur mostly during pre-monsoon and early winter seasons. The Dd on the other hand prevails relatively more over the Khasi Hills than in Garo Hills which may probably be due to differences in availability and quality of drinking water and level of personal hygiene.

Malaria, historically endemic in most parts of Meghalaya, is found presenting a controlled spatial distribution directly related to factors like altitude, temperature and rainfall. The lower altitude areas of the districts like WGH, EGH, SGH and WKH remains highly malaria infested where more than 90 per cent is *P. falciparum* species. The highest part of the central plateau ridge of JH, EKH and WKH, roughly above the 1350 m contour line, is recorded as the malaria free zone. The hottest and wettest months in the year record maximum positive cases of malaria. The undetected fever cases grouped as Po are being revealed largely as the probable cases of malaria by nature of occurrence. By and large both spatial and seasonal distribution pattern conform to that of malaria.

In general skin diseases are present higher among the people of Garo Hills region compared to the other half of the state viz. Khasi Hills and Jaintia Hills. Hence it may be stated that the disease is associated with over all physio-cultural character of the region and not merely with any of the specific environmental precursors. Though the seasonality pattern is obscured due to gaps and incompatibility in data, on an average cases are higher during hot and humid months and low in winter as expected.

The peptic ulcer syndrome, a disease caused by certain food habits and addictions etc, has emerged as an important disease in the state. The spatial variation is quite high which may also be due to faulty and under reporting from several blocks. There is one contiguous zone of high Po cases but seems not related to any of the parameters used in this study.

CHAPTER IV

ENVIRONMENTAL ATTRIBUTES OF MAJOR DISEASES

4.1 Introductory Statement

The following chapter is devoted to an analysis of the existing distribution pattern of major diseases in the light of the chosen environmental attributes, both physical and cultural. The percentage of each disease to all recorded diseases and their incidence per thousand populations in each of the 30 Community Development Blocks of Meghalaya are taken as the dependent variables. On the other hand the C. D. Block level data on chosen environmental attributes of those diseases, e.g. altitude, mean annual rainfall, mean annual temperature, percentage of forest cover pertaining to physical environment and density of population, literacy rate, female literacy rate, availability of drinking water, availability of medical facility and availability of educational facility as indices of cultural environment are taken as dependent variable. The block level values of each attribute are grouped into suitable ranges to work out spatial zones. Then mean distribution of disease parameters in each environmental/cultural zone are worked out applying statistical software SPSS 7.5. The results are presented in small tables, one for each independent variable and one disease group. In addition the computed values of correlation coefficient (r_{xy}) between the two variables are given at the bottom row of each table. Brief analytical notes are given for each table with an attempt to bring out the probable disease and attribute relations.

4.2 Respiratory Infections and Environmental Attributes

In this section an attempt has been made to understand the relation between respiratory infection diseases and some of the environmental as well as cultural attributes.

4.2.1 Altitudinal Zones

The diseases of respiratory infection is found to have occurred (in percentage to all diseases) more in higher altitudinal zones like high plateau zone (37.0 per cent) and high ridges (30.17 per cent). The lowest mean percentage is found in the foothill zone (17.20 per cent). The correlation value equally suggests a strong positive relation [Table - 4.1].

Table-4.1
Comparison between Respiratory Infections and Altitude

Altitudinal zone	Mean of Respiratory Infections Percentage	Mean of Respiratory Infections Incidence
Low Valley[<350m]	18.66	77.36
Foot Hills[351 - 800m]	17.20	97.29
High Slope[801 - 1250m]	30.17	126.65
High Ridge[>1250m]	37.00	143.00
<i>Correlation r =</i>	<i>0.62</i>	<i>0.33</i>

Similar association has been observed in case of Ri incidence rate and altitude. In the high ridge zone mean incidence rate is as high as 143 which decrease sharply to only 77.36 at the lowest altitude zone, low valley.

4.2.2 Annual Rainfall

Table-4.2 shows that both moderate to very high rainfall zones have recorded higher percentage and higher incidence of Ri. There are two high Ri zones in two extremities of rainfall ranges. The mean incidence rate has greater variation from 204.27 to 72.59 whereas the mean of percentage has a lower variation among the four ranges.

Table-4.2
Comparison between Respiratory Infections and Mean Annual Rainfall

Rainfall Zone	Mean of Respiratory Infections Incidence	Mean of Respiratory Infections Percentage
Moderate [<2000mm]	204.27	30.11
Moderately High [2001-5000mm]	98.18	23.76
High [5001 - 8000mm]	72.59	22.19
Very High [>8000mm]	154.63	34.22
<i>Correlation r =</i>	<i>0.26</i>	<i>0.04</i>

Therefore, a low positive link is present between these two variables which support the fact that higher rainfall causes more Ri diseases probably by exposing the peasant population to frequent drenching in rain.

4.2.3 Annual Temperature

It is evident from the Table-4.3 that both occurrence and incidence rates are negatively associated with mean annual temperature. It is 19.74 of mean percentage in the hot zone which increases gradually up to 36.71 at the cold zone. Likewise mean Ri incidence rate is found the lowest (69.98) at the hot zone and it increased up to 151.94 at the cold zone as expected. In fact a strong negative correspondence exists between these two variables as given in the table.

Table-4.3
Comparison between Respiratory Infections and Mean Annual Temperature

Temperature Zones	Mean of Respiratory Infections Percentage	Mean of Respiratory Infections Incidence
Cold [$<19^{\circ}\text{C}$]	36.71	151.94
Cool [$19^{\circ} - 21^{\circ}\text{C}$]	30.58	135.56
Warm [$22^{\circ} - 23^{\circ}\text{C}$]	21.53	101.97
Hot [$>23^{\circ}\text{C}$]	19.74	69.98
Correlation $r =$	- 0.56	- 0.31

4.2.4 Forest Cover

Both proportionate occurrence and incidence of Ri are more in low forest cover areas. In case of incidence rate the trend is much clearer with 140.01 incidences in low forest zone and 65.47 in zones with high forest cover (Table-4.4). The explanation may be two fold i.e. the forest cover reduces the risk of the disease and that the forested areas are less crowded.

Table-4.4
Comparison between Respiratory Infections and Forest Cover

Forest Cover (%)	Mean of Respiratory Infections Percentage	Mean of Respiratory Infections Incidence
Low ($<40.00\%$)	29.80	140.01
Moderate ($40.01\% - 48.00\%$)	24.92	101.06
High ($>48.00\%$)	18.12	65.47
Correlation $r =$	- 0.34	- 0.31

4.2.5 Availability of Drinking Water

Availability of drinking water presents a low negative relation with the distribution of Ri (Table-4.5). But in general drinking water does not have known control on this disease. In fact this is not water born disease.

Table-4.5
Comparison between Respiratory Infections and Drinking Water

Villages Having Drinking Water Facility	Mean of Respiratory Infections Percentage	Mean of Respiratory Infections Incidence
Less than 94.00%	37.15	182.15
94.01% - 96.00%	17.94	170.66
96.01% - 98.00%	34.47	201.11
More than 98.0%	23.95	93.65
<i>Correlation r =</i>	<i>- 0.31</i>	<i>- 0.41</i>

4.2.6 Density of Population

The Table-4.6 indicates that there is a weak positive relation between density of population and Ri occurrence among the three density zones compared. But a low negative trend is observed in terms of Ri incidence rate. The least crowded zone had 116 persons per thousand population reporting Ri diseases whereas, the high density zone has only 23.

Table-4.6
Comparison between Respiratory Infections and Density of Population

Density of Population per Sq. Km.	Mean of Respiratory Infections Percentage	Mean of Respiratory Infections Incidence
Low (<150)	26.21	115.77
Moderate (151 - 400)	21.62	113.07
High (>400)	36.04	22.97
<i>Correlation r =</i>	<i>0.17</i>	<i>- 0.17</i>

It should be noted here that this group of diseases are spread quickly in the crowded indoor but as such higher population density does not necessarily mean the same.

4.2.7 Availability of Educational Facility

A perceptible variation of Ri occurrence is present among the different zones in terms of availability of educational facility and highest share (28.78%) is present in the

higher educational zone (Table-4.7). The same trend with higher variation is observed in case of the disease incidence. Hence, this factor can be taken as important but not singularly significant for the distribution of the disease.

Table-4.7
Comparison between Respiratory Infections and Availability of Educational Facility

Villages Having Educational Facility	Mean of Respiratory Infections Percentage	Mean of Respiratory Infections Incidence
Less than 60%	16.57	72.59
60.00% - 80.00%	21.90	97.19
More than 80.00%	28.78	124.67
<i>Correlation r =</i>	<i>0.45</i>	<i>0.24</i>

4.2.8 Availability of Medical Facility

Variation in availability of medical facility shows a mixed impact on the Ri diseases. Though the percentage share of the disease was more in areas with higher medical facility but incidence rate is high in both higher and lower facility areas (Table - 4.8).

Table-4.8
Comparison between Respiratory Infections and Availability of Medical Facility

Villages Having Medical Facility	Mean of Respiratory Infections Percentage	Mean of Respiratory Infections Incidence
Less than 13.00%	24.17	115.93
13.01% - 20.00%	24.84	87.83
20.01% - 27.00%	26.92	104.73
More than 27.00%	41.45	189.65
<i>Correlation r =</i>	<i>0.30</i>	<i>0.15</i>

Therefore, one can assume that people tend to report more in areas with better medical facility.

4.2.9 Literacy Rate

It is observed from the Table- 4.9 that percentage share of Ri presents no significant relation to the distribution of general literacy rate in Meghalaya, excepting a weak positive one. But on the other hand Ri incidence is quite high (133.99) in higher literacy zones. It may be due to the fact that higher literacy zone spatially corresponds to higher altitude in the study area.

Table-4.9
Comparison between Respiratory Infections and Literacy Rate

Literacy Zone	Mean of Respiratory Infections Percentage	Mean of Respiratory Infections Incidence
Low [Below 35.01%]	20.33	20.12
Moderate [35.01% - 50.00%]	21.61	94.88
High [50.01% - 65.00%]	24.53	106.32
Very High [Above 65.00%]	29.45	133.99
<i>Correlation r =</i>	<i>0.24</i>	<i>0.14</i>

Similar to general literacy rate Ri is reported more from the higher female literacy zones. Even the incidence rate was quite high (149.32) in the very high female literacy areas (Table-4.10).

In short female literacy as well as general literacy does not seem to be an important controlling factor for this disease.

Table-4.10
Comparison between Respiratory Infections and Female Literacy Rate

Female Literacy Zone	Mean of Respiratory Infections Percentage	Mean of Respiratory Infections Incidence
Low [Below 45.01%]	18.31	80.42
Moderate [45.01% - 55.00%]	24.26	78.31
High [55.00% - 65.00%]	21.96	118.21
Very High [Above 65.00%]	36.82	149.32
<i>Correlation r =</i>	<i>0.44</i>	<i>0.30</i>

4.3 Diarrhoeal Diseases and Environmental Attributes

The following section is devoted to an analysis of the relation between Diarroeal diseases and the environmental attributes.

4.3.1 Altitudinal zones

The percentage shares of diarrhoeal diseases to all diseases at the C. D. Block level have been tabulated (Table-4.11) against four altitudinal zones. Thus we get the highest mean of percentage in those blocks which are located in the high ridge zone above 1250 m. On the opposite the low valley region also shows a higher share. The intermediate zone of foot hills and high plateau shares marginally less. In terms of the Dd incidence rate per thousand populations the distributional variations are further less.

Excepting the lowest incidence rate in the plateau zone all the other three zones have similar incidence rates ranging between 92.30 and 95.52.

Table-4.11
Comparison between Diarrhoeal Diseases and Altitude

Altitudinal zone	Mean of Diarrhoeal Diseases Percentage	Mean of Diarrhoeal Diseases Incidence
Low Valley[<350m]	22.38	92.30
Foot Hills[351 – 800m]	18.05	95.52
High Slope[801 - 1250m]	18.69	75.24
High Ridge[>1250m]	25.63	94.27
<i>Correlation r =</i>	<i>0.15</i>	<i>0.003</i>

The prevalent distribution pattern indicates there is a very little impact of altitude on the occurrence of the Dd in general. Low valley zone is normally the high risk area of the Dd group due to the hot humid conditions and occasional floods and water logging render pollution to the available potable water. It is important to observe that even at the highest altitude zone these diseases are having the maximum share and incidence rate as well, which seems to be the result of unavailability of enough potable water.

Thus it is further understood that altitude alone doesn't have direct control on the Dd distribution pattern in Meghalaya.

4.3.2 Annual Rainfall

The distribution of Dd among the four rainfall zones does not reveal strong variations and the mean of percentage shares vary from 18.44 – 25.66 % (Table-4.12). The highest rainfall zone is associated with highest percentage indicating a rather paradoxical situation. In fact it seems that high rainfall does not assure steady availability of safe drinking water to the people to protect themselves from this water born diseases. On the contrary the excess rainfall in the low valley region leads to contamination of water and water born diseases.

Table-4.12
Comparison between Diarrhoeal Diseases and Mean Annual Rainfall

Rainfall Zone	Mean of Diarrhoeal Diseases Percentage	Mean of Diarrhoeal Diseases Incidence
Moderate [$<2000\text{mm}$]	20.61	158.02
Moderately High [2001-5000mm]	18.44	76.85
High [5001 - 8000mm]	21.78	65.15
Very High [$>8000\text{mm}$]	25.66	110.60
<i>Correlation r =</i>	<i>0.43</i>	<i>0.050</i>

Incidence of Dd per thousand populations is clearly high in both the lowest and highest rainfall zones in Meghalaya receiving world's highest rainfall. In the moderate rainfall areas highest mean incidence rate is found whereas the rate is also high in the very high rainfall zone.

Hence this typical distribution pattern indicates neither a positive nor a negative relation between rainfall and Dd incidence. It seems that there are several other factors controlling the prevalence pattern of the disease.

4.3.3 Annual Temperature

The distribution of mean percentage share of Dd among four temperature zones shows a little variation (Table-4.13). The highest share of 26.30% is present on the cold zone followed by the hot zone recording 25.03% the lowest mean percentage is observed in the warm zone.

A similar pattern exists in comparison to the incidence of Dd per thousand populations in temperature zones. The lowest incidence is associated with the warm zone and the highest with cold zone followed by the hot zone.

Table-4.13
Comparison between Diarrhoeal Diseases and Mean Annual Temperature

Temperature Zones	Mean of Diarrhoeal Diseases Percentage	Mean of Diarrhoeal Diseases Incidence
Cold [$<19^{\circ}\text{C}$]	26.32	97.48
Cool [$19^{\circ} - 21^{\circ}\text{C}$]	21.99	92.36
Warm [$22^{\circ} - 23^{\circ}\text{C}$]	16.17	81.00
Hot [$>23^{\circ}\text{C}$]	25.03	91.05
<i>Correlation r =</i>	<i>-0.024</i>	<i>-0.038</i>

Now, this can be conferred from the above distribution pattern that in Meghalaya Dd is not directly or singularly dependent on mean annual temperature and that combination of several other factors are expected to be involved.

4.3.4 Forest Cover

It is found that low forest cover is marginally more associated with higher mean share of Dd. Though there is hardly any variation among the three levels of forest cover zones (Table - 4.14).

Table- 4.14
Comparison between Diarrhoeal Diseases and Forest Cover

Forest Cover Zone	Mean of Diarrhoeal Diseases Incidence	Mean of Diarrhoeal Diseases Percentage
Low (<40.00%)	109.15	22.74
Moderate (40.01% - 48.00%)	71.30	17.94
High (>48.00%)	61.18	19.23
<i>Correlation r =</i>	<i>- 0.07</i>	<i>- 0.29</i>

On the other hand it is clearly revealed from the table that higher rate of incidence of Dd is associated with lower forest cover and vice versa. This may be explained in terms of higher population density in the areas with lower forest cover and. Moreover, the healthy forests cover in the catchments holds and maintain the groundwater by quality and quantity. In fact the deforested slopes and plateau ridges of Meghalaya suffer from acute water shortage in stead of heavy rainfall as observed during the field study.

4.3.5 Availability of Drinking Water

In tune with the expected relation the table shows a higher rate of incidence of Dd in the areas with lower availability of drinking water. In fact the highest rate of 205.09 is observed in the zone with the 94.01 – 96.00% coverage which is not really far from cent percent. The higher mean incidence rates correspond more with the lower drinking water availability resulting in a moderate negative correlation value.

Table-4.15
Diarrhoeal Diseases and Villages Having Drinking Water Facility

Villages Having Drinking Water Facility (%)	Mean of Diarrhoeal Diseases Percentage	Mean of Diarrhoeal Diseases Incidence
Less than 94.00%	24.72	131.91
94.01% - 96.00%	21.56	205.09
96.01% - 98.00%	25.21	149.42
More than 98.0%	19.71	72.34
<i>Correlation r =</i>	<i>- 0.19</i>	<i>- 0.45</i>

The Table-4.15 depicts that the availability of drinking water facility in the villages does not show much impact on the Dd occurrence pattern in Meghalaya.

In fact the expected level of dependency with this important factor remains obscured as there is hardly any spatial variation as per the official records on percentage of villages having drinking water facility. There are as many as 17 blocks out of 30 are shown having nearly cent percent villages enjoying drinking water facility. This is to be noted here that the ground realities in the rural Meghalaya differs (in fact piped water supplied from a reservoir or directly from a natural spring of stream) from the official records which will be discussed in the chapter dedicated to micro level study.

4.3.6 Literacy Rate

The percentage occurrence of Dd among the four categories of literacy zones does not show much variation indicating that these two variables are independent to each other. Nevertheless the mean share is slightly higher (24.19%) in the areas with lowest general literacy rate. But unexpectedly the highest literacy zones have also recorded a good number of Dd cases (21.86%).

Table- 4.16
Comparison between Diarrhoeal Diseases and Literacy Rate

Literacy Zone	Mean of Diarrhoeal Diseases Percentage	Mean of Diarrhoeal Diseases Incidence
Low [Below 35.01%]	24.19	17.87
Moderate [35.01% - 50.00%]	21.25	100.91
High [50.01% - 65.00%]	18.66	74.34
Very High [Above 65.00%]	21.86	99.57
<i>Correlation r =</i>	<i>- 0.05</i>	<i>- 0.01</i>

It is interesting to observe from the Table - 4.16 that the highest mean incidence rate of 100.91 per thousand is found with moderate literacy zones but again the areas with very high literacy rate also reported an average rate of 100.

Hence it can be inferred that though Dd is to some extent associated with the lower literacy rate but there are certain other factors which has due impact on it.

Female literacy rate is an important indicator of public health aspects of any community or society as a whole. This is particularly true in Meghalaya where almost 100 percent of the rural communities follow matrilineal family norms. But from the Table – 4.17 the percentage of occurrence of Dd does not show any clear association with the lower literacy rate of the female population. In fact there is negligible level of positive relations.

Table- 4.17
Comparison between Diarrhoeal Diseases and Female Literacy Rate

Female Literacy Zone	Mean of Diarrhoeal Diseases Percentage	Mean of Diarrhoeal Diseases Incidence
Low [Below 45.01%]	22.44	99.07
Moderate [45.01% - 55.00%]	21.92	67.32
High [55.00% - 65.00%]	16.37	91.32
Very High [Above 65.00%]	24.43	91.52
<i>Correlation r =</i>	<i>- 0.01</i>	<i>0.03</i>

In terms of Dd incidence as well the trend is similar. The highest incidence of 99 per thousand occurred in the areas having below 45% of female literacy rate. But in high and very female literacy zones the rate was considerably higher 91%.

Thus we find that the female literacy rate does not have significant control over the occurrence of Dd and hence it is expected that certain other factors are responsible for in a combined form.

4.3.7 Availability of Educational Facility

The Table – 4.18 below suggests no particular trend of Dd in relation to the educational facility. In fact there is very low positive relation as indicated by the

correlation values. Hence this variable is not accepted as significant for the disease in Meghalaya.

Table- 4.18
Comparison between Diarrhoeal Diseases and Availability of Educational Facility

Villages having Educational Facility	Diarrhoeal Diseases Percentage	Diarrhoeal Diseases Incidence
Less than 60%	16.29	65.59
60.00% - 80.00%	24.23	98.80
More than 80.00%	20.44	89.04
<i>Correlation r =</i>	<i>0.18</i>	<i>0.08</i>

4.3.8 Availability of Medical Facility

The availability of medical facility shows some amount of negative association with Dd percentage and incidence. Both highest mean occurrence and incidence are found in the areas having less than 13 % villages having medical facility. Thus it may be said that there will be less Dd cases if enough medical facilities are available (Table – 4.19).

Table- 4.19
Comparison between Diarrhoeal Diseases and Availability of Medical Facility

Villages having Medical Facility	Diarrhoeal Diseases Percentage	Diarrhoeal Diseases Incidence
Less than 13.00%	22.71	102.49
13.01% - 20.00%	18.20	63.61
20.01% - 27.00%	18.38	78.71
More than 27.00%	16.22	74.34
<i>Correlation r =</i>	<i>- 0.21</i>	<i>- 0.13</i>

4.4 Malaria and Environmental Attributes

It may now be interesting to examine the impact of environmental attributes on the occurrence of malarial diseases.

4.4.1 Altitudinal zones

It is already stated that malaria parasites do not survive at higher altitude i.e. above 2200 m. and the same trend is faintly reflected in the Table- 4.20. In Meghalaya malaria cases are found minimum at the high ridge zone, whereas highest number of cases are recorded in the high slope zone where most of the villages are under high

forest cover and located along the Bangladesh border facing south. The low valley and foot hills are equally affected as expected. The highest API values are also found in those regions with high recorded cases. In brief altitude and malaria show a very low negative relation.

Table-4.20
Comparison between Malaria and Average Altitude

Altitudinal zone	Mean of Malaria Positive Cases	Mean of Malaria API
Low Valley[<350m]	861.83	11.96
Foot Hills[351 - 800m]	946.63	17.44
High Slope[801 - 1250m]	1299.20	21.58
High Ridge[>1250m]	322.83	2.10
<i>Correlation r =</i>	<i>- 0.09</i>	<i>- 0.07</i>

4.4.2 Annual Rainfall

Amount of rainfall also has a negative relation with malaria occurrence as it is depicted in the Table- 4.21 where higher number of cases is found in the moderate and moderately high rainfall zones. But the highest API is in the high rainfall zone which is at an intermediate attitude and generally under heavy forest cover. Mean API value is negligible in the very high rainfall zone where altitude is high and that the mosquito habitats are wash out due to heavy rains in most period of the year.

Table- 4.21
Comparison between Malaria and Mean Annual Rainfall

Rainfall Zone	Mean of Malaria Positive Cases	Mean of Malaria API
Moderate [<2000mm]	1741.67	24.23
Moderately High [2001-5000mm]	1069.07	12.58
High [5001 - 8000mm]	864.00	25.56
Very High [>8000mm]	72.80	1.50
<i>Correlation r =</i>	<i>- 0.35</i>	<i>- 0.24</i>

4.4.3 Annual Temperature

The Table- 4.22 shows the mean occurrence of malaria cases are high in the warm and hot zone and the cool and cold zone recorded considerably low cases. The API values also conform to the similar trend with the highest in the warm zone. Hence it is proper to confer that air temperature and malaria possesses a negative relation.

Table-4.22
Comparison between Malaria and Mean Annual Temperature

Temperature Zones	Mean of Malaria Positive Cases	Mean of Malaria API
Cold [$<19^{\circ}\text{C}$]	284.83	1.34
Cool [$19^{\circ} - 21^{\circ}\text{C}$]	143.60	2.07
Warm [$22^{\circ} - 23^{\circ}\text{C}$]	1591.57	25.04
Hot [$>23^{\circ}\text{C}$]	592.80	13.33
<i>Correlation r =</i>	<i>0.20</i>	<i>0.28</i>

4.4.4 Density of Population

It is obvious that higher number of positive cases is recorded from places with high population density in Meghalaya, which is historically known as a malaria endemic region. The Table- 4.23 depicts an interesting fact that API or actual incidence rate per thousand population is high in the low density zone and the vice versa. This can be explained that low density areas are situated in the interior high slope land covered under forests where malaria is common.

Table- 4.23
Comparison between Malaria and Density of Population

Density of Population per Sq. Km.	Mean of Malaria Positive Cases	Mean of Malaria API
Low (<150)	996.46	17.03
Moderate (151 - 400)	442.00	5.19
High (>400)	1548.00	4.69
<i>Correlation r =</i>	<i>0.10</i>	<i>- 0.09</i>

4.4.5 Availability of Educational Facility

Availability of educational facility as a parameter related to the awareness of the people towards preventing diseases does not show any expected trend. In fact there is a clear positive relation between these two variables which indicates that in the study area malaria occurrence is not dependent on the educational facility (Table- 4.24).

Table-4.24
Comparison between Malaria and Availability of educational Facility

Villages Having Educational Facility	Mean of Malaria Positive Cases	Mean of Malaria API
Less than 60%	339.75	7.13
60.00% - 80.00%	829.17	13.17
More than 80.00%	1066.95	16.39
<i>Correlation r =</i>	<i>0.18</i>	<i>0.17</i>

4.4.6 Availability of Medical Facility

It is understood from the Table- 4.25 that malaria cases and API are higher in the areas with higher available medical facility. In fact it is expected that availability of more medical facility in villages enhances the possibility of reporting as well as to get more records through surveillance. The same is reflected in the Table- though this variable can not be taken as a factor influencing malaria occurrence.

Table-4.25
Comparison between Malaria and Availability of Medical Facility

Villages Having Medical Facility	Mean of Malaria Positive Cases	Mean of Malaria API
Less than 13.00%	709.53	11.05
13.01% - 20.00%	1220.25	13.23
20.01% - 27.00%	889.33	14.45
More than 27.00%	1590.50	48.08
<i>Correlation r =</i>	<i>0.19</i>	<i>0.36</i>

4.4.7 Forest Cover

It is interesting to observe that highest number cases are found in the areas with low forest cover though the highly forested areas also recorded higher malaria cases. In case of API the trend is similar (Table- 4.26). The fact that areas of moderate forest cover have the lowest occurrence of malaria can be explained only examining the other factors related to malaria. Thus it may be said that forest as an important criteria induces malaria infestation but certain other factors are to be considered in combination.

Table-4.26
Comparison between Malaria and Forest Cover

Forest Cover (%)	Mean of Malaria Positive Cases	Mean of Malaria API
Low (<40.00%)	1343.73	19.87
Moderate (40.01% - 48.00%)	292.13	4.10
High (>48.00%)	740.00	15.23
<i>Correlation r =</i>	<i>- 0.22</i>	<i>- 0.15</i>

4.4.8 Availability of Drinking Water

As expected the availability of drinking water and occurrence of malaria are not found related to each other (Table-4.27). In fact an insignificant negative relation exists in the correlation values.

Table-4.27
Comparison between Malaria and Availability of Drinking Water

Villages Having Drinking Water Facility	Mean of Malaria Positive Cases	Mean of Malaria API
Less than 94.00%	1034.33	11.73
94.01% - 96.00%	3302.00	52.39
96.01% - 98.00%	92.00	1.83
More than 98.0%	878.50	14.39
<i>Correlation r =</i>	<i>- 0.08</i>	<i>- 0.01</i>

4.4.9 Literacy Rate

Unlike educational facility the spread of literacy shows somewhat expected relation with the distribution of malaria. In the Table – 4.28 highest malaria cases are found in the lowest literacy zone and vice-versa. But API values do not have enough variation among the literacy zones. Hence it can be said that literacy rate of the people is a possible factor associated with malaria occurrence in Meghalaya but not enough significant as revealed from the given table.

Table-4.28
Comparison between Malaria and Literacy Rate

Literacy Zone	Mean of Malaria Positive Cases	Mean of Malaria API
Low [Below 35.01%]	1270.00	13.05
Moderate [35.01% - 50.00%]	732.33	10.44
High [50.01% - 65.00%]	992.36	15.10
Very High [Above 65.00%]	924.42	15.75
<i>Correlation r =</i>	<i>- 0.03</i>	<i>- 0.04</i>

The female literacy rate taken as an important factor does not give the expected trend (Table- 4.29). There is almost no or poor positive correspondence between malaria and female literacy rate in the study area.

Table-4.29
Comparison between Malaria Female Literacy Rate

Female Literacy Zone	Mean of Malaria Positive Cases	Mean of Malaria API
Low [Below 45.01%]	967.80	13.96
Moderate [45.01% - 55.00%]	609.50	11.89
High [55.00% - 65.00%]	1279.18	16.51
Very High [Above 65.00%]	638.25	13.51
<i>Correlation r =</i>	<i>0.05</i>	<i>0.03</i>

4.5 Pyrexia of Unknown Origin and Environmental Attributes

In this section the relation between pyrexia of unknown origin and the environmental attributes is examined.

4.5.1 Altitudinal Zones

The disease/symptoms grouped under the head of pyrexia of unknown origin, as discussed in earlier chapter, are mostly cases of fever undetected as malaria. This assumption may be tested while by comparing the distribution patterns of these two groups in the following paragraphs. Here Po cases are found to be distributed mostly in the lower altitude zones and highest in the foot hills (Table- 4.30). The similar trend is also seen in case of incidence of the same. The high ridge zone recorded least cases. Thus we find a negative association of Po with altitude in conformity with that of malaria.

Table-4.30
Comparison between Pyrexia of Unknown Origin and Altitude

Altitudinal zone	Mean of Pyrexia of Unknown Origin (Percentage)	Mean of Pyrexia of Unknown Origin (Incidence)
Low Valley[<350m]	27.86	102.05
Foot Hills[351 - 800m]	35.35	197.67
High Slope[801 - 1250m]	11.13	30.85
High Ridge[>1250m]	7.87	43.69
<i>Correlation r =</i>	<i>- 0.60</i>	<i>- 0.34</i>

4.5.2 Annual Rainfall

In general Po is found more in moderate to high rainfall zones as depicted in the Table - 4.31. Very high rainfall zone recorded least of Po cases. Thus the pattern of association with rainfall is also similar to that of malaria.

Table-4.31
Comparison between Pyrexia of Unknown Origin and Mean Annual Rainfall

Rainfall Zone	Mean of Pyrexia UO (Percentage)	Mean of Pyrexia UO (Incidence)
Moderate [<2000mm]	17.06	145.53
Moderately High [2001-5000mm]	22.58	105.12
High [5001 - 8000mm]	21.17	46.86
Very High [>8000mm]	14.07	84.56
<i>Correlation r =</i>	<i>- 0.17</i>	<i>- 0.15</i>

4.5.3 Annual Temperature

It is clearly observed that both percentage and incidence of Po are increasing from low to high temperature zone, again indicating its similarity to that of malaria. There is moderate level of positive correlation among these two variables (Table- 4.32).

Table- 4.32
Comparison between Pyrexia of Unknown Origin and Mean Annual Temperature

Temperature Zones	Mean of Pyrexia UO (Percentage)	Mean of Pyrexia UO (Incidence)
Cold [<19°C]	5.54	22.43
Cool [19 °- 21°C]	20.62	86.28
Warm [22° - 23°C]	22.38	118.67
Hot [>23°C]	31.76	107.38
<i>Correlation r =</i>	<i>0.52</i>	<i>0.29</i>

4.5.4 Density of Population

The areas with moderate density of population have returned most cases of Po, but there is hardly any clear pattern of association with the density zone. It may be noted that as in case of malaria the population density can not be taken as an indicator of Po diseases (Table- 4.33).

Table-4.33
Comparison between Pyrexia of Unknown Origin and Density of Population

Density of Population per Sq. Km.	Mean of Pyrexia UO (Percentage)	Mean of Pyrexia UO (Incidence)
Low (<150)	19.90	93.03
Moderate (151 - 400)	25.51	105.91
High (>400)	3.27	2.09
<i>Correlation r =</i>	<i>- 0.20</i>	<i>- 0.15</i>

4.5.5 Availability of Educational Facility

This is interesting to note that Po percentage and incidence are inversely distributed with availability of educational facility in Meghalaya (Table- 4.34). This

may be due to the fact that access to educational facility imparts awareness on health and disease to the people. On the other hand either proper diagnoses of fever cases are not being done in those backward areas or cases are not being clinically tested due to absence of laboratories in those zones.

Table-4.34
Comparison between Pyrexia of Unknown Origin and Availability of Educational Facility

Villages having Educational Facility	Pyrexia UO (Percentage)	Pyrexia UO (Incidence)
Less than 60%	39.37	206.88
60.00% - 80.00%	24.21	98.08
More than 80.00%	15.29	67.41
<i>Correlation r =</i>	<i>- 0.59</i>	<i>- 0.38</i>

4.5.6 Availability of Medical Facility

That the disease group is clearly most prevalent in the areas with low medical facility strongly indicates the undiagnosed or unknown character of it (Table- 4.35). The occurrence of Po sharply falls where more than 27% villages are having medical facilities. It is most likely that the probable malaria fever cases are reported at a far off medical unit and hence laboratory detections are not done in time and in proper way to find those as confirm malaria positive cases.

Table-4.35
Comparison between Pyrexia of Unknown Origin and Availability of Medical Facility

Villages Having Medical Facility	Mean of Pyrexia UO (Percentage)	Mean of Pyrexia UO (Incidence)
Less than 13.00%	23.30	115.25
13.01% - 20.00%	20.47	70.93
20.01% - 27.00%	14.99	73.26
More than 27.00%	1.85	8.91
<i>Correlation r =</i>	<i>- 0.38</i>	<i>- 0.33</i>

4.5.7 Forest Cover

The Table- 4.36 shows clearly that high forest cover is associated with maximum Po cases and incidence. It is already discussed that the interior hilly and forested areas are likely to be more prone to malaria fever and less equipped to detect it and the same is reflected in the table.

Table-4.36
Comparison between Pyrexia of Unknown Origin and Forest Cover

Forest Cover (%)	Mean of Pyrexia UO (Incidence)	Mean of Pyrexia UO (Percentage)
Low (<40.00%)	75.23	14.02
Moderate (40.01% - 48.00%)	76.25	21.04
High (>48.00%)	146.55	32.84
<i>Correlation r =</i>	<i>0.47</i>	<i>0.19</i>

4.5.8 Availability of Drinking Water

As usually expected there is no clear pattern of distribution of Po in relation to availability of drinking water as this group of disease is not related to quality of water.

This also indicates its similarity with malaria fever (Table- 4.37).

Table-4.37
Comparison between Pyrexia of Unknown Origin and Availability of Drinking Water Facility

Villages Having Drinking Water Facility	Mean of Pyrexia UO (Percentage)	Mean of Pyrexia UO (Incidence)
Less than 94.00%	8.56	69.50
94.01% - 96.00%	22.31	212.22
96.01% - 98.00%	19.24	115.47
More than 98.0%	21.75	88.02
<i>Correlation r =</i>	<i>0.21</i>	<i>- 0.06</i>

4.5.9 Literacy Rate

Literacy rate is found not clearly related to distribution of Po though it was found related to malaria. It can be noted in the Table- 4.38 that lowest percentage of Po is present in the very high literacy zone as expected but variations are very low among these zones.

Table-4.38
Comparison between Pyrexia of Unknown Origin and Literacy Rate

Literacy Zone	Mean of Pyrexia UO (Percentage)	Mean of Pyrexia UO Incidence
Low [Below 35.01%]	20.92	5.25
Moderate [35.01% - 50.00%]	23.94	101.68
High [50.01% - 65.00%]	22.17	99.99
Very High [Above 65.00%]	16.67	87.42
<i>Correlation r =</i>	<i>- 0.12</i>	<i>0.05</i>

A very few case of Po and a very low incidence rate are recorded in the blocks with very high female literacy rate in the following Table- 4.39. This is again in

conformity with the prevailing relation with malaria and female literacy rate though at less prominence.

Table- 4.39
Comparison between Pyrexia of Unknown Origin and Female Literacy Rate

Female Literacy Zone	Mean of Pyrexia UO (Percentage)	Mean of Pyrexia UO (Incidence)
Low [Below 45.01%]	25.69	111.75
Moderate [45.01% - 55.00%]	24.89	57.37
High [55.00% - 65.00%]	24.31	140.53
Very High [Above 65.00%]	7.91	39.44
<i>Correlation r =</i>	<i>- 0.33</i>	<i>- 0.0711</i>

4.6 Diseases of Skin and Environmental Attributes

Diseases of skin are one of the important diseases that may now be analysed with relation to the chosen environmental attributes

4.6.1 Altitudinal Zones

Diseases of skin are found prevailing at highest rate in the low valley zone both in percentage to all diseases and per thousand incidences (Table- 4.40). On the opposite high slope and high ridge zones reported least. So there is a clear negative association between these two variables as it is already stated that higher altitude and colder climate restricts spread of skin infections in Meghalaya.

Table-4.40
Comparison between Diseases of Skin and Altitude

Altitudinal zone	Mean of Skin Diseases (Percentage)	Mean of Skin Disease (Incidence)
Low Valley[<350m]	11.61	48.40
Foot Hills[351 - 800m]	4.90	31.40
High Slope[801 - 1250m]	3.81	10.29
High Ridge[>1250m]	4.14	14.82
<i>Correlation r =</i>	<i>- 0.45</i>	<i>- 0.55</i>

4.6.2 Annual Rainfall

The occurrence of Sd is less in the zone of high rain fall as depicted in the Table- 4.41 where highest percentage value and higher incidence are both found in the moderate and moderately high rainfall zones. The trend of distribution conforms to that expected as in the region as a whole high rainfall occurs in higher altitude.

Table- 4.41
Comparison between Diseases of Skin and Mean Annual Rainfall

Rainfall Zone	Mean of Skin Diseases (Percentage)	Mean of Skin Disease (Incidence)
Moderate [<2000mm]	5.36	36.71
Moderately High [2001-5000mm]	7.34	30.46
High [5001 - 8000mm]	4.37	13.52
Very High [>8000mm]	3.00	14.33
<i>Correlation r =</i>	<i>- 0.29</i>	<i>- 0.40</i>

4.6.3 Annual Temperature

There are more cases and incidence of skin diseases in the areas having higher air temperature as shown in the Table- 4.42. This is again an expected trend as lower temperature restricts spread of skin infections in the study area.

Table-4.42
Comparison between Diseases of Skin and Mean Annual Temperature

Temperature Zones	Mean of Skin Diseases (Percentage)	Mean of Skin Disease Incidence
Cold [<19°C]	4.49	16.30
Cool [19 °- 21°C]	5.07	13.19
Warm [22° - 23°C]	5.85	29.95
Hot [>23°C]	7.52	30.08
<i>Correlation r =</i>	<i>0.20</i>	<i>0.19</i>

4.6.4 Density of Population

Occurrence of skin diseases and density of population do not relate in the prevailing distribution pattern as revealed in the Table- 4.43. Though Sd percentage is high in moderate and high density zones but incidence rate does not give any clear trend. Hence population density in the region can not be taken as a significant associated factor of the diseases.

Table- 4.43
Comparison between Diseases of Skin and Density of Population

Density of Population per Sq. Km.	Mean of Skin Diseases (Percentage)	Mean of Skin Disease (Incidence)
Low (<150)	4.80	19.70
Moderate (151 - 400)	9.89	51.20
High (>400)	7.03	4.48
<i>Correlation r =</i>	<i>- 0.05</i>	<i>0.16</i>

4.6.5 Availability of Educational Facility

In terms of available educational facility skin diseases correspond at a low negative trend (Table- 4.44). Thus it can be conferred that having better educational facility reduces the chance of getting infections of such diseases.

Table-4.44
Comparison between Diseases of Skin and Availability of Educational Facility

Villages Having Educational Facility	Mean of Skin Diseases (Percentage)	Mean of Skin Disease (Incidence)
Less than 60%	7.93	35.86
60.00% - 80.00%	9.61	41.23
More than 80.00%	4.12	17.13
Correlation $r =$	- 0.26	- 0.48

4.6.6 Availability of Medical Facility

The recorded percentage and incidence rate of Sd are slightly more in the areas where villages have less medical facility available to get the benefit of treatment (Table-4.45). But the existing level of association of this factor is a weaker one indicating that some other factors are also responsible in combination for occurrence and spread of this disease.

Table- 4.45
Comparison between Diseases of Skin and Availability of Medical Facility

Villages Having Medical Facility	Mean of Skin Diseases (Percentage)	Mean of Skin Disease (Incidence)
Less than 13.00%	6.24	30.87
13.01% - 20.00%	5.80	15.43
20.01% - 27.00%	2.98	11.98
More than 27.00%	5.19	24.62
Correlation $r =$	- 0.20	- 0.15

4.6.7 Forest Cover

It is clear from the Table- 4.46 that forest cover and occurrence of skin diseases do not present any particular relation and that forest cover alone does not play an important role in case skin diseases as expected.

Table- 4.46
Comparison between Diseases of Skin and Forest Cover

Forest Cover (%)	Mean of Skin Diseases (Percentage)	Mean of Skin Disease (Incidence)
Low (<40.00%)	4.98	25.13
Moderate (40.01% - 48.00%)	5.58	16.62
High (>48.00%)	7.48	31.92
<i>Correlation r =</i>	<i>0.07</i>	<i>0.15</i>

4.6.8 Availability of Drinking Water

In fact availability of drinking water and skin diseases are not related variables and the same fact is revealed in the Table- 4.47 where there is no significant variation in distribution of the diseases with the variation in drinking water availability as this is not water born disease.

Table-4.47
Comparison between Diseases of Skin and Availability of Drinking Water Facility

Villages Having Drinking Water Facility	Mean of Skin Diseases (Percentage)	Mean of Skin Disease (Incidence)
Less than 94.00%	4.62	25.66
94.01% - 96.00%	3.68	34.97
96.01% - 98.00%	2.87	17.03
More than 98.0%	6.19	24.47
<i>Correlation r =</i>	<i>- 0.05</i>	<i>0.17</i>

4.6.9 Literacy Rate

The Table – 4.48 depicts that highest percentage of skin diseases are recorded in the lowest literacy zone and it decreases with increased literacy rate as such. But in case of per thousand incidences of the diseases there is no clear pattern present. Hence literacy of people can not be taken as an important associated factor for the disease as such.

Table-4.48
Comparison between Diseases of Skin and Literacy Rate

Literacy Zone	Mean of Skin Diseases (Percentage)	Mean of Skin Disease (Incidence)
Low [Below 35.01%]	12.18	8.91
Moderate [35.01% - 50.00%]	6.87	34.24
High [50.01% - 65.00%]	4.99	24.61
Very High [Above 65.00%]	5.29	20.69
<i>Correlation r =</i>	<i>- 0.11</i>	<i>- 0.21</i>

In case of female literacy rate both percentage and incidence rate of skin diseases are found significantly high in the low literacy zone, though incidence is also a bit high in the high literacy zone as well (Table- 4.49). Therefore, it can be inferred that female literacy plays a significant role in controlling the disease in Meghalaya.

Table- 4.49
Comparison between Diseases of Skin and Female Literacy Rate

Female Literacy Zone	Mean of Skin Diseases (Percentage)	Mean of Skin Disease (Incidence)
Low [Below 45.01%]	11.13	48.43
Moderate [45.01% - 55.00%]	3.38	7.79
High [55.00% - 65.00%]	5.66	28.37
Very High [Above 65.00%]	4.19	16.55
<i>Correlation r =</i>	<i>- 0.20</i>	<i>- 0.37</i>

4.7 Ulcer Syndrome and Environmental Attributes

In this section the relation between peptic ulcer syndrome and environmental attributes is analysed.

4.7.1 Altitudinal zones:

The mean share of Pu Occurrence in altitudinal zones gives a low positive relation. Thus the high plateau zone counts highest 5.74% and low valley only 0.30%. But the incidence rate shows an almost opposite trend. The highest incidence of 43.61 persons per thousand is observed in the foot hills zone, while low valley had the lowest. Moderate rates prevailed in the higher altitude zones (Table – 4.50)

Table- 4.50
Comparison between Peptic Ulcer Syndrome and Altitude

Altitudinal zone	Mean of Peptic Ulcer Syndrome (Percentage)	Mean of Peptic Ulcer Syndrome (Incidence)
Low Valley[<350m]	0.30	1.44
Foot Hills[351 - 800m]	3.71	43.61
High Slope[801 - 1250m]	3.53	20.02
High Ridge[>1250m]	5.74	21.01
<i>Correlation r =</i>	<i>0.45</i>	<i>0.06</i>

Therefore, Pn diseases are found to be less dependent to altitudinal variation though it is to some extent clear that the people in the low valley zone didn't suffer much from Pu.

4.7.2 Annual Rainfall

The mean occurrence of Pu is found to be high in the moderate rainfall zone i.e. the lowest range in the State. In the high and very high rainfall zones the disease prevailed at a lower proportion (Table- 4.51). Similarly the highest incidence rate of 50.68 per thousand was recorded in the moderate rainfall zone and the high rainfall zone also had a higher rate (39.49).

Table- 4.51
Comparison between Peptic Ulcer Syndrome and Mean Annual Rainfall

Rainfall Zone	Mean of Peptic Ulcer Syndrome (Percentage)	Mean of Peptic Ulcer Syndrome (Incidence)
Moderate [$<2000\text{mm}$]	7.57	50.68
Moderately High [2001-5000mm]	1.70	11.13
High [5001 - 8000mm]	4.61	39.49
Very High [$>8000\text{mm}$]	4.14	17.67
Correlation $r =$	0.18	0.06

Thus the above table indicates a negatively related association between Pn and mean annual rainfall.

4.7.3 Annual Temperature

The Table – 4.52 shows that the reported percentage of occurrence was high (6.29) in the cold zone and it decreased gradually up to the high temperature zone (1.45%). In contrary the incidence rate shows a very low variation among the four temperature zones. Here hot zone had the highest (29) and cool zone the lowest.

Table-4.52
Comparison between Peptic Ulcer Syndrome and Mean Annual Temperature

Temperature Zones	Mean of Peptic Ulcer Syndrome (Percentage)	Mean of Peptic Ulcer Syndrome (Incidence)
Cold [$<19^{\circ}\text{C}$]	6.27	23.48
Cool [$19^{\circ} - 21^{\circ}\text{C}$]	3.42	15.35
Warm [$22^{\circ} - 23^{\circ}\text{C}$]	2.80	22.83
Hot [$>23^{\circ}\text{C}$]	1.45	29.29
Correlation $r =$	- 0.48	0.02

The above statement indicates a low level of relation exists between these two variables and that there seems to be some other associated factors for this disease in the study area.

4.7.4 Forest Cover

In brief the Table – 4.53 indicates that percentage of Pu diseases increases with the decrease in forest cover but incidence rate shows higher values (35.25) in the high forest cover zones.

It may be accepted here that people in the forested areas actually gets more Pu but the percentage share of the disease is less in those thinly populated zones under high forest cover probably due to presence of other diseases.

Table-4.53
Comparison between Peptic Ulcer Syndrome and Forest Cover

Forest Cover (%)	Mean of Peptic Ulcer Syndrome (Percentage)	Mean of Peptic Ulcer Syndrome (Incidence)
Low (<40.00%)	4.00	23.54
Moderate (40.01% - 48.00%)	3.02	10.50
High (>48.00%)	2.44	35.25
Correlation $r =$	- 0.18	0.24

4.7.5 Availability of Medical Facility

In the Table- 4.54 both highest percentage and highest incidence of Pu are present in the areas with above 27 % villages having medical facility. In fact there is no clear pattern of distribution. This may be taken as an indication of no clear dependency between these two variables.

Table-4.54
Comparison between Peptic Ulcer Syndrome and Availability of Medical Facility

Villages having Medical Facility	Mean of Peptic Ulcer Syndrome (Percentage)	Mean of Peptic Ulcer Syndrome (Incidence)
Less than 13.00%	3.72	23.90
13.01% - 20.00%	2.85	15.70
20.01% - 27.00%	0.84	21.34
More than 27.00%	6.33	43.95
Correlation $r =$	- 0.03	0.12

4.7.6 Availability of Drinking Water

A clear negative relationship between Pu and drinking water availability has emerged from the Table- 4.55. Both higher percentage share of occurrence and high

incidence rates are seen to have been associated with lower supply of drinking water in the villages. Hence, drinking water has emerged as an important factor for this disease.

Table- 4.55
Comparison between Peptic Ulcer Syndrome and Availability of Drinking Water Facility

Villages Having Drinking Water Facility	Mean of Peptic Ulcer Syndrome (Incidence)	Mean of Peptic Ulcer Syndrome (Percentage)
Less than 94.00%	36.32	4.78
94.01% - 96.00%	45.11	4.74
96.01% - 98.00%	23.27	4.02
More than 98.0%	20.13	3.09
<i>Correlation r =</i>	<i>- 0.15</i>	<i>- 0.23</i>

4.7.7 Density of Population

Percentage of Pu is high in the more crowded belts of the State as revealed in the Table- 4.56 though the variations are not enough to justify the trend. On the opposite less crowded blocks combined to have more incidence rates (26.01 per cent).

Table- 4.56
Comparison between Peptic Ulcer Syndrome and Density of Population

Density of Population per Sq. Km.	Mean of Peptic Ulcer Syndrome (Percentage)	Mean of Peptic Ulcer Syndrome (Incidence)
Low (<150)	3.48	26.01
Moderate (151 - 400)	2.06	10.98
High (>400)	7.31	4.66
<i>Correlation r =</i>	<i>0.17</i>	<i>- 0.20</i>

This phenomena can not be explained in isolation but is an indicator of varied other factors of the disease.

4.7.8 Availability of Educational Facility

High incidence rate of Pu (28.62) is associated with places having lower educational facility as expected (Table- 4.57). But in terms of percentage share of occurrence there exists a very meagre variation to enlighten the above fact.

Table- 4.57
Comparison between Peptic Ulcer Syndrome and Availability of Educational Facility

Villages Having Educational Facility	Mean of Peptic Ulcer Syndrome (Percentage)	Mean of Peptic Ulcer Syndrome (Incidence)
Less than 60%	1.97	28.62
60.00% - 80.00%	0.84	13.64
More than 80.00%	4.42	24.37
<i>Correlation r =</i>	<i>0.32</i>	<i>0.05</i>

4.7.9 Literacy Rate

Surprisingly both the occurrence and incidence rate of Pu are higher in areas having high general literacy rate (Table- 4.58). On the other hand the disease was not reported much from the low literacy zones. This may be taken as an indicator for the differences in food habits as well as occupation between the low and high literate population.

Table- 4.58
Comparison between Peptic Ulcer Syndrome and Literacy Rate

Literacy Zone	Mean of Peptic Ulcer Syndrome (Percentage)	Mean of Peptic Ulcer Syndrome Incidence
Low [Below 35.01%]	0.05	0.01
Moderate [35.01% - 50.00%]	0.44	10.78
High [50.01% - 65.00%]	3.98	30.36
Very High [Above 65.00%]	4.56	23.76
<i>Correlation r =</i>	<i>0.46</i>	<i>0.10</i>

The trend of association of female literacy rate and Pu also conform to that of general literacy with certain exceptions. Highest incidence (43.94) is present among the zone of moderate female literacy. But as such it will not be justified to take female or general literacy as the main associates of the Pu diseases in Meghalaya (Table- 4.59).

Table-4.59
Comparison between Peptic Ulcer Syndrome and Female Literacy Rate

Female Literacy Zone	Mean of Peptic Ulcer Syndrome (Percentage)	Mean of Peptic Ulcer Syndrome (Incidence)
Low [Below 45.01%]	0.45	2.19
Moderate [45.01% - 55.00%]	2.10	43.99
High [55.00% - 65.00%]	3.40	17.33
Very High [Above 65.00%]	6.12	27.29
<i>Correlation r =</i>	<i>0.48</i>	<i>0.11</i>

4.8 Concluding Statement

In course of interpretation and analysis of the correspondence between distribution of the six major diseases and the associated factors it has been observed that, excepting a few, most of the variables are related to normal trends though not significantly. In certain cases the statistical trend is just opposite to the accepted or

normal one. Diseases of Respiratory infections are closely associated with altitude, air temperature and educational facilities. Diarrhoeal diseases are related to drinking water and availability of medical facilities. Variation of rainfall is significant attribute to malaria occurrence whereas Pyrexia of unknown origin is closely associated to altitude, air temperature, forest cover, educational and medical facilities. Altitude is found as limiting factor for diseases of skin. Altitude, air temperature and literacy rates play important roles for occurrence of peptic ulcer syndrome.

CHAPTER V

PREVALENCE OF DISEASES IN MEGHALAYA: AN ATTEMPT AT MICRO LEVEL EXPLANATION

5.1 Introductory Statement

After assessing the overall disease incidence pattern of the state of Meghalaya as a macro unit let us now evaluate the micro level conditions among the villagers of five villages studied. Therefore, this chapter is dedicated to assess ground conditions in terms of disease prevalence at individual and household level in purposively chosen villages located at different eco-cultural zones. Thus the secondary information from larger units are being complemented by primary data collected from field which will help a better understanding of the disease environment from closer and multiple angles. This will fulfil the objective of detecting the micro environmental factors, both physical and cultural, responsible for disease occurrence. Selected demographic, socio-economic and cultural aspects are correlated with the disease reported at household level for each village. The results are then tabulated to find the probable controlling factors for those diseases suffered by the villagers.

5.2. The Studied Villages

The villages were selected from different altitudinal zones inhabited by different communities under varied micro-ecological conditions. All the available households were interviewed to get the morbidity condition of all the family members during past one year. At the same time the overall living conditions including community and personal hygiene were recorded to assess the disease environment at micro level.

5.2.1 Demdema is a typical low altitude Garo village in the malaria (*P. falciparum*) endemic belt close to the north western border with Assam (Fig. -5.1). The village is regularly being affected by floodwaters from Jinjiram River. The actual settlements are

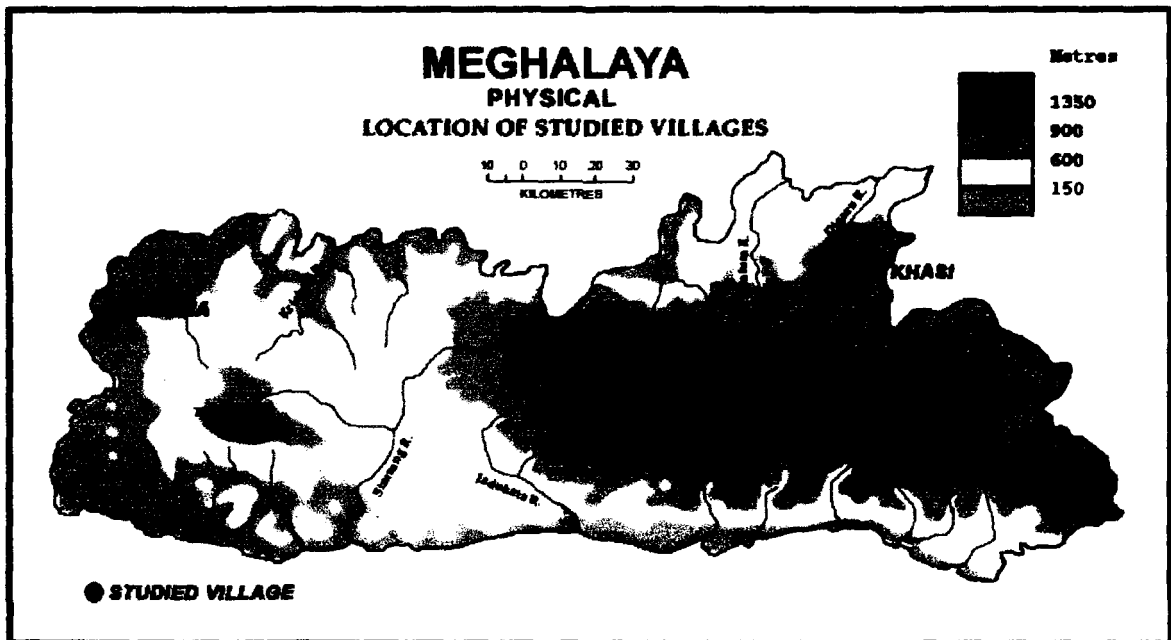
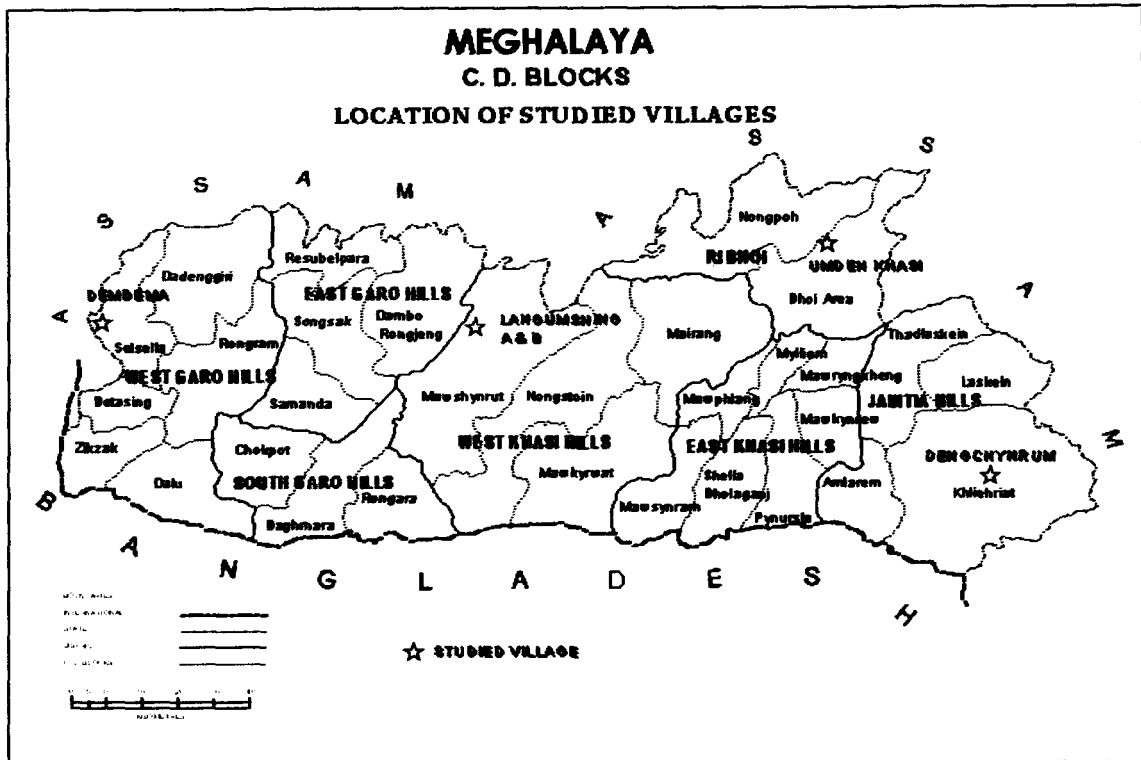


Figure - 5.1

located on top of the scattered hillocks surrounded by low marshy fields utilized for wet paddy cultivation. The main water sources are along the foot of the hillocks in the form of natural springs and open mud wells. There are 216 souls including 122 males and 94 females. The average size of the 41 Household is 5.2 persons with 9.3% population below the age of five years (Table-5.1). Almost half (41.5%) of the Household has taken up settled cultivation while the remaining are still dependent mostly on traditional *Jhum* cultivation though a good majority of them earn their livelihood from daily wages. Plantation of fruit bearing plants is common around the homestead land. The Phulbari primary health centre with a few indoor beds is located some 6 kilometres away along the metalled road. But mainly due to insufficient public transport and non availability of required medicine at the hospital most of the villagers get modern medicine readily available either from quacks and a nearby pharmacy. For certain diseases local traditional medicine man *kambiraj* is consulted who cater herbal medicine.

5.2.2. In contrast the **Umden Khasi** in the Nongpoh block of Ri Bhoi district is an example of traditional Bhoi Khasi village practicing *jhum* cultivation along with forest gathering within a degraded hilly environment. The area is a part of the low plateau with undulating landscape dotted with protected community forests (sacred groves). Lack of flat land and water do not allow wet paddy cultivation. A serpentine stream course across the village with a few pools of stagnated water is defined in local Khasi dialect, as *um den*. But water from the small stream is grossly insufficient for even the domestic water needs during dry season though there are a few tap water sources which remain mostly dry. Still very traditional Bhoi khasi people live in the village with 45 households of 6.7 average sizes. For last two decades they have transformed most of the cultivable and barren lands into profitable broom stick grass plantations which is

endemic specie in the state. Paradoxically the villagers do not get the benefit of modern medicine instead of having the Umden primary health centre within the village.

Table – 5.1
Profile of the Sample Villages

Sl. No	Name of Village	District	C. D. Block	Altitude (m.)	Average Annual Rainfall (mm.)	Average Annual Temperature (Celsius)	Major Community (Scheduled Tribe)	Nearest Primary Health Centre (Dist. Km.)
1	Demdema	West Garo Hills	Selsella	80	<2000	23	Garo	Phulbari (6.0)
2	Umden Khasi	Ri Bhoi	Nongpoh	670	<2000	21	Khasi (Bhoi)	Umden (0.2)
3	Langunshing ('A' and 'B')	West Khasi Hills	Mawshynrut	918	<2000	19	Khasi (Lyngam)	Riangdo (13.0)
4	Dengchynrum	Jaintia Hills	Khliehriat	1125	3000	19	Jaintia (Pnar)	Khlierihat (1.5)

5.2.3 Dengchynrum, the third village populated by the Pnar (Jaintia) tribesmen has been selected from the critically problematic environmental niche affected by long continued uncontrolled and hazardous coal mining in the Khliehriat block of Jaintia Hill district. The topography of this eastern most part of the plateau is smooth and rolling grassy with residual patches of once healthy sacred groves. In total 51 households containing 394 persons presents the highest average size of 7.72 persons among the four villages studied. Occupationally they are mostly wage labourers in both mining and other sectors. Water is acutely scarce except during the rainy months. Instead of its nearness to the Khliehriat community health centre (1km.) and location along the national highway 44 the villagers suffer from various health hazards specially malaria and other digestive and enteric diseases.

Lastly to understand the health-environment of the forested highland settlement of the least known Lyngam Khasi group the twin village of **Languishing A and B** have been studied in the interior West Khasi Hills district. The Languishing village has recently been divided for administrative purposes. Situated near the Garo Hills and

Khasi Hills borderland in the Mawsynrut block of the less accessible corner of West Khasi Hill district, these villages have unique physio-cultural set up. There is a good amount of forests protected either for the village community or as sacred. This area is the traditional homeland of the less known Lyngum sub-group of the Khasi tribe. A un-metalled road passes though the village connecting a coal mining belt with western Assam. The Riangdo primary health centres some 13 km away had no attending doctor or enough medicine at the time of survey. The village settlement area is drained by a stream surrounded by forested hills of moderate altitude (918 m. approx.). Potable water is a problem though the village A has piped connection. It is interesting to know that these villagers took pioneering role in giving up shifting cultivation about 18 years back but after imposition of the new Forest Protection Act in recent times several villagers were found returning to the traditional shifting cultivation finding no ready substitute for their income from selling various forest produce. They are the only group among Khasi tribe who practice cow herding. Out of the total population of 365 Langumshing A shared 122 and B 243 with an average household size of 5.79 persons (Table – 5.2).

Table – 5.2
Population Structure of the Sample Villages

Sl. No	Name of Village	Total No. of House Holds	Total Population	Average Size of House Hold	Percentage Population in Age Group		
					0 - 4	5 - 14	15 +
1	Demdema	41	216	5.26	9.30	25.90	64.80
2	Umden Khasi	45	302	6.70	16.20	32.10	51.70
3	Langumshing 'A' & 'B'	63	365	5.79	17.50	31.20	51.30
4	Dengchynrum	51	394	7.73	19.00	31.50	49.50
	Total	200	1277	6.39	16.30	30.60	53.10

5.3. Diseases and Illness at Village Level

In terms of intensity of reported illness i.e. the percentage of total number of persons reported ill to the total population, the highest values were obtained from the two Langumshing villages (147% and 135% for 'A' and 'B') followed by Demdema (103%), Umden Khasi (78%) and the least among the Jaintia villagers (50%). This situation can be interpreted in the lights of the i) degree of health hazards actually faced by the villagers, ii) actual urge of the people to report their sufferings - which is found to be low among the villagers engaged in more commercialized and well paid occupation as in the case of Dengchynrum located in the coal mining belt; iii) moreover higher intensity i.e. above 100% means incidence of more than one disease was reported per person, within last one year; iv) When compared with the mean household size of the villages - a negative relation is visible. Largest household size corresponds to the lowest intensity e.g. in Dengchynrum, similarly highest intensity with smallest household size.

5.3.1. Disease Ranking

All the reported disease and illness, at the village level, have been tabulated as per the relative importance of a single category over the total number of diseased person (Table-5.3). Thus we get the village wise rank of diseases. Malaria has been ranked one in all the villages other than the middle altitude interior Langumshing 'A' & 'B' where diarrhoea has taken the lead. Again malaria emerged at the second rank for these two villages signifying the higher prevalence of parasitic diseases at per with different communicable diseases in the state. The Dominance of fever in higher ranks may further be taken as probable cases of malaria fever. 'Gastric' is indeed a generalized term indicating acidity or burning sensation in the stomach associated with loss of appetite and indigestion. The villagers themselves pointed out that irregularity in

taking daily meals and drinking water are the main causes of gastric so this disease or symptom (burning stomach, indigestion or acidity) can be taken as the indicator of changing economic activity e.g., from short duration *Jhum* cultivation work schedules to more labour intensive settled cultivation and 8 to 10 hours daily wage duties etc.

Table- 5.3

Disease Ranking in Sample Villages

Sl. No.	Name of Village	Diseases in Ranks (Percentage to total diseased person)						
		I	II	III	IV	V	VI	VII
1	Demdema	Malaria (27.0)	Fever (10.8)	Gastric (9.9)	A.Resp.infect. (9.0)	Head/body ache (6.7)	Joint Pain(5.8)	Diarrhoea (4.5)
2	Umden Khasi	Malaria (42.4)	Gastric (14.8)	A.Resp.infect. (5.5)	Head/body ache (4.7)	Stomach Pain (2.5)	Joint Pain(2.1)	---
3	Langumshing 'A' & 'B'	Diarrhoea (43.7)	Malaria (41.0)	Gastric (11.5)	Fever (3.4)	Skin (3.1)	A.Resp.infect. (2.5)	-----
4	Dengchynrum	Malaria (27.2)	Fever + Gast (12.8)	Diarrhoea (8.7)	Gastric (7.2)	Head/body ache (4.6)	Skin (4.1)	A.Resp.infect. (3.6)

The ailments like intestinal or digestive problems, respiratory disease like cough and cold, pneumonia, etc. comes next in rank. Illnesses like headache, body pain, joint pain, stomach pain, tooth ache and skin disease came at lower ranks but have reasonable significance on general health status of those villagers.

5.4. Chosen Parameters

The economic condition of the villagers is taken as one of the most important parameter of disease occurrence. For the purpose of assessing the economic level several factors like annual household income from agriculture and non-agricultural occupations during past one year, the average annual expenditure declared by the household along with the condition and type of the dwelling houses etc have been considered. Moreover, in case of certain villages e.g. the Demdema and Umden Khasi data was gathered on the amount of contribution given by each household to the bereaved family for holding the death ritual and community feast. This is a custom

where villagers voluntarily contribute proportionate to their economic and social status. Thus this data serves as a more realistic yardstick for computing the economic status which is otherwise a much difficult job.

The educational level, a prime indicator to health awareness, has been computed by taking the aggregate point score proportionate to the level of education of each member of the household.

Size of household is taken as one important factor responsible for acquiring and spreading the infectious diseases in a congested house. Diseases of respiratory infections, intestinal infections, tuberculosis and skin etc are most commonly spread within a close population group as already discussed in previous chapters.

House type is another single index of economic status as well as healthy living of the household and hence considered as an indicator too.

The fact that most of the villagers still practice open air defecation in Meghalaya demands a separate assessment of those few who use latrines to find if there is any difference in terms of disease prevalence. But it is understandable that the habit of open air defecation among majority will affect the whole village environment through contamination of water sources etc causing a sudden outbreak of intestinal infections among a larger community.

The availability of separate kitchen and presence of ventilation in the rooms, as parameters related to economic and housing conditions have been considered separately mainly to find the expected association with the diseases of respiratory infections as already pointed out in previous chapter. It is observed during the field work that in the colder hilly climate people tend to crowd in a single room in winter increasing the risk of spreading droplet infections from flu affected persons.

As it was observed and discussed before different occupation of the people are responsible for different levels of exposures to the risks of getting the disease. A sedentary occupation exposes a person totally different disease environment than a white collar job.

Jhum or shifting cultivation demands more work hours in the forest than the settled cultivation. Therefore, in case of Umden Khasi many households still depend largely on products of shifting cultivation, discrimination between *Jhumia* households has been made from others for correlating the morbidity pattern.

An attempt is made to assess the probable association of infectious diseases with the sources of drinking water in dry and wet seasons.

The variation observed in the source and quality of drinking water as a special case in the twin villages of Langumshing has demanded a separate explanation. Hence an attempt is made to assess the probable association of infectious diseases with the sources of drinking water in dry and wet seasons.

5.4.1 Village Demdema

Table -5.4

Distribution of Household by Economic Condition and Reported Diseases in Demdema

Economic Condition	Percentage of Household Reporting Diseases						
	ARI	DIARR	GAS	MAL	MAL+ARI	MAL+DIA	MAL+GAS
Very Low	31.82	71.43	11.76	30.77	57.14	20.00	22.22
Low	13.64	28.57	29.41	35.90	42.86	40.00	0.00
Medium	31.82	0.00	17.65	23.08	0.00	40.00	22.22
High	22.73	0.00	41.18	10.26	0.00	0.00	55.56
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Particularly diarrhoea, malaria and malaria plus respiratory infections are found associated more with households from low and very low economic levels in this village. But in case gastric and gastric with malaria the condition is just reverse. Hence this may be inferred that these three major diseases are to some extent are controlled by

the economic condition of the people of Demdema. Other diseases are not found clearly related to this parameter as seen in the table-5.4

Table -5.5
Distribution of Household by Educational Level and Reported Diseases in Demdema

Educational Level	Percentage of Household Reporting Diseases						
	ARI	DIARR	GAS	MAL	MAL+ARI	MAL+DIA	MAL+GAS
Low	4.55	42.86	23.53	23.08	0.00	0.00	0.00
Medium	81.82	42.86	76.47	70.51	100.00	100.00	88.89
High	13.64	14.29	0.00	6.41	0.00	0.00	11.11
<i>Total</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>

It is interesting to observe (Table-5.5) those households with medium and low educational levels suffered most from most of the diseases reported and from malaria in particular. This may be due to the fact that majority of the villagers fall under the medium educational level.

Table -5.6
Distribution of Household by Household Size and Reported Diseases in Demdema

Household Size Class	Percentage of Household Reporting Diseases						
	ARI	DIARR	GAS	MAL	MAL+ARI	MAL+DIA	MAL+GAS
Small	9.09	14.29	23.53	15.38	0.00	40.00	0.00
Medium	81.82	85.71	47.06	61.54	100.00	20.00	88.89
Large	9.09	0.00	29.41	23.08	0.00	40.00	11.11
<i>Total</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>

The medium sized households (3-5) shows higher morbidity rate in general (Table-5.6). In case of MAL+ARI and MAL+GAS this trend is almost cent percent. On the other hand defying general belief larger household size alone is found does not case higher morbidity.

Table -5.7
Distribution of Household by House Type and Reported Diseases in Demdema

House Type	Percentage of Household Reporting Diseases						
	ARI	DIARR	GAS	MAL	MAL+ARI	MAL+DIA	MAL+GAS
Pucca	18.18	0.00	29.41	15.38	57.14	0.00	33.33
Semi Pucca	40.91	0.00	29.41	41.03	42.86	40.00	44.44
Kachcha	40.91	100.00	41.18	43.59	0.00	60.00	22.22
<i>Total</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>

The table-5.7 clearly shows that diarrhoea, ARI, GAS, and MAL+DIA cases are high among the household living in kachcha houses. Only in case of MAL+ARI the trend is opposite. In brief house type has some amount of relation to the diseases in this village.

Table -5.8

Distribution of Household by Occupational Categories and Reported Diseases in Demdema

Occupational Categories	Percentage of Household Reporting Diseases						
	ARI	DIARR	GAS	MAL	MAL+ARI	MAL+DIA	MAL+GAS
Agricultural	90.91	42.86	82.35	65.38	84.26	60.00	100.00
Non Agricultural	9.09	57.14	17.65	34.62	15.74	40.00	0.00
<i>Total</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>

The village households engaged in agricultural occupation mainly suffers from various diseases s depicted in the table -5.8. Except diarrhoea all other diseases were reported by the agriculture category.

Table -5.9

Distribution of Household Separate Kitchen by Reported Diseases in Demdema

Kitchen Separate	Percentage of Household Reporting Diseases						
	ARI	DIARR	GAS	MAL	MAL+ARI	MAL+DIA	MAL+GAS
Yes	50.00	0.00	52.94	33.33	0.00	40.00	77.78
No	50.00	100.00	47.06	66.67	100.00	60.00	22.22
<i>Total</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>

In fact ARI is not found associated with the houses having no separate kitchen. That the fact behind higher morbidity of other diseases is associated with no kitchen group can be explained by the fact that they also belong to low economy and live in kachcha house type (Table-5.9).

Table -5.10

Distribution of Household by Privy Type and Reported Diseases in Demdema

Privy Type	Percentage of Household Reporting Diseases						
	ARI	DIARR	GAS	MAL	MAL+ARI	MAL+DIA	MAL+GAS
Flush	9.09	0.00	23.53	8.97	0.00	0.00	33.33
Pit	72.73	28.57	47.06	39.74	0.00	80.00	55.56
Open	18.18	71.43	29.41	51.28	100.00	20.00	11.11
<i>Total</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>

The table-5.10 clearly depicts that all types of diseases are reported more from the household using either pit latrine or going open air. But this is another indicator of economic condition and does not control morbidity in isolation.

Table -5.11
Distribution of Household by Ventilation in Rooms and Reported Diseases in Demdema

Ventilation in Rooms	Percentage of Household Reporting Diseases						
	ARI	DIARR	GAS	MAL	MAL+ARI	MAL+DIA	MAL+GAS
Present	54.55	0.00	64.71	33.33	0.00	40.00	77.78
Absent	45.45	100.00	35.29	66.67	100.00	60.00	22.22
<i>Total</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>

It may be concluded from the table-5.11 that presence or absence of ventilation in rooms is not associated with respiratory disease morbidity as such. But the pattern of relation indicates that in general low economic group seems represented by the houses where ventilation is absent.

5.4.2 Village Umden Khasi

Table -5.12
Distribution of Household by Economic Condition and Reported Diseases in Umden Khasi

Economic Condition	Percentage of Household Reporting Diseases									
	ARI	DIARR	EPILEPSY	GASTRIC	HYPERTN	MAL	MAL+GAS	MEASLES	RHEUMA	WORM
Very low	35.71	80.00	0.00	26.32	0.00	27.40	46.67	0.00	0.00	0.00
Low	0.00	20.00	0.00	42.11	0.00	32.88	20.00	100.00	0.00	100.00
Medium	21.43	0.00	100.00	31.58	0.00	19.18	13.33	0.00	100.00	0.00
High	42.86	0.00	0.00	0.00	100.00	20.55	20.00	0.00	0.00	0.00
<i>Total</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>

In the Umden Khasi village the households at low to very low economic level suffer most from diseases like diarrhoea, GAS, MAL, Measles and worm. On the other hand certain diseases are not clearly related to the economic condition of the villagers (Table-5.12).

Table -5.13
Distribution of Household by Educational Level and Reported Diseases in Umden Khasi

Level of Education	Percentage of Household Reporting Diseases									
	ARI	DIARR	EPILEPSY	GASTRIC	HYPERTN	MAL	MAL+GAS	MEASLES	RHEUMA	WORM
Low	28.57	20.00	0.00	5.26	0.00	1.37	6.67	0.00	0.00	0.00
Medium	71.43	60.00	100.00	89.47	100.00	80.82	73.33	100.00	0.00	100.00
High	0.00	20.00	0.00	5.26	0.00	17.81	20.00	0.00	100.00	0.00
<i>Total</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>

The table-5.13 suggests that households at both high and low education level are relatively healthier than those in the medium category. In fact educational level is not responsible for the disease morbidity among the households in this village.

Table -5.14
Distribution of Household by Household Size and Reported Diseases in Umden Khasi

Household Size	Percentage of Household Reporting Diseases									
	ARI	DIARR	EPILEPSY	GASTRIC	HYPERTN	MAL	MAL+GAS	MEASLES	RHEUMA	WORM
Small	7.14	60.00	0.00	36.84	0.00	9.59	13.33	0.00	0.00	0.00
Medium	50.00	20.00	0.00	36.84	0.00	32.88	46.67	100.00	0.00	100.00
Large	42.86	20.00	100.00	26.32	100.00	57.53	40.00	0.00	100.00	0.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Malaria and the minor diseases like epilepsy, hypertension, and rheumatic joints are found associated with large household in the village (Table-5.14). But gastric and diarrhoea are the common diseases in small households. This pattern does not show any logical correlation between the independent and dependent variables.

Table -5.15
Distribution of Household by House Type and Reported Diseases in Umden Khasi

House Type	Percentage of Household Reporting Diseases									
	ARI	DIARR	EPILEPSY	GASTRIC	HYPERTN	MAL	MAL+GAS	MEASLES	RHEUMA	WORM
Pucca	71.43	80.00	0.00	78.95	50.00	73.97	86.67	100.00	0.00	100.00
Semi Pucca	28.57	20.00	100.00	21.05	50.00	24.66	13.33	0.00	100.00	0.00
Katcha	0.00	0.00	0.00	0.00	0.00	1.37	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The table-5.15 shows that all the reported diseases have higher incidence among households living in pucca or semi pucca houses which is a trend against the expected. In fact in this village house type alone does not have much clear control over the disease morbidity.

Table -5.16
Distribution of Household Practising Jhum Cultivation by Reported Diseases in Umden Khasi

Jhum Cultivation	Percentage of Household Reporting Diseases									
	ARI	DIARR	EPILEPSY	GASTRIC	HYPERTN	MAL	MAL+GAS	MEASLES	RHEUMA	WORM
Practised	50.00	80.00	0.00	57.89	50.00	82.19	93.33	100.00	100.00	100.00
Not Practiced	50.00	20.00	100.00	42.11	50.00	17.81	6.67	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The household practising *Jhum* cultivation clearly suffers most from almost all diseases reported. The common diseases like malaria, gastric and diarrhoea are more

prevalent among *jhumia* households as they are more exposed to the varied disease environment and their general economic condition is low in this village (Table-5.16).

Table -5.17
Distribution of Household Having Separate Kitchen by Reported Diseases in Umden Khasi

Kitchen Separate	Percentage of Household Reporting Diseases									
	ARI	DIARR	EPILEPSY	GASTRIC	HYPERTN	MAL	MAL+GAS	MEASLES	RHEUMA	WORM
Yes	71.43	60.00	100.00	68.42	100.00	71.23	73.33	100.00	100.00	100.00
No	28.57	40.00	0.00	31.58	0.00	28.77	26.67	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The abnormal relation between morbidity and kitchen as revealed in the table-5.17 can be understood by the fact that there are 35 houses out of 45 having separate kitchen and hence the statistically dominant group reports higher morbidity rate. In short there is no logical relation among these two variables.

Table -5.18
Distribution of Household by Privy Type and Reported Diseases in Umden Khasi

Privy Type	Percentage of Household Reporting Diseases									
	ARI	DIARR	EPILEPSY	GASTRIC	HYPERTN	MAL	MAL+GAS	MEASLES	RHEUMA	WORM
Flush	0.00	20.00	0.00	0.00	0.00	10.96	6.67	0.00	0.00	0.00
Pit	64.29	20.00	100.00	78.95	100.00	63.01	60.00	0.00	100.00	0.00
Open	35.71	60.00	0.00	21.05	0.00	26.03	33.33	100.00	0.00	100.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The above table (Table-5.18) presents a clear trend of higher morbidity among the households using pit latrine and open air. As a good majority of households use pit latrine the majority of disease prevalence is found associated with this category as well. In fact the existing relation is not viable for a stronger relation as such.

Table -5.19
Distribution of Household having Ventilation in Rooms and Reported Diseases in Umden Khasi

Ventilation in Rooms	Percentage of Household Reporting Diseases									
	ARI	DIARR	EPILEPSY	GASTRIC	HYPERTN	MAL	MAL+GAS	MEASLES	RHEUMA	WORM
Present	28.57	0.00	100.00	5.26	50.00	31.51	13.33	83.33	100.00	0.00
Absent	71.43	100.00	0.00	94.74	50.00	68.49	86.67	16.67	0.00	100.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

A clear majority of households are found reporting respiratory diseases living in non-ventilated rooms as expected (Table-5.19). Though it may be noted that in case of

other diseases it is more of low economic status, represented by this category, which is responsible for higher morbidity.

5.4.3 Micro Level Explanation for the Village Langumshing 'A' and 'B'

Table -5.20
Distribution of Household by Economic Level and Reported Diseases in Langumshing

Economic condition	Percentage of Household Reporting Diseases								
	MALARIA	GASTRO	DIARR	FLU	COLD	SKIN DIS	HEART DIS	OTHERS	TOT DISEA
V. low	41.92	53.85	44.44	46.15	100.00	100.00	100.00	100.00	46.12
Low	44.91	41.03	55.56	53.85	0.00	0.00	0.00	0.00	44.08
Medium	7.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.90
High	5.99	5.13	0.00	0.00	0.00	0.00	0.00	0.00	4.90
All	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

In the Langumshing villages economic level of the households is found having control over the reported disease prevalence. The table-5.20 shows that majority households in low and very low level of economy suffer most from all the diseases. It is to be noted that 90 per cent of the households are falling under those two lower categories which otherwise is reflected in the distribution pattern.

Table -5.21
Distribution of Household by Educational Level and Reported Diseases in Langumshing

Educational level	Percentage of Household Reporting Diseases								
	MALARIA	GASTRO	DIARR	FLU	COLD	SKIN DIS	HEART DIS	OTHERS	TOT DISEA
LOW	14.37	7.69	22.22	15.38	0.00	0.00	0.00	0.00	13.47
MIDDLE	64.07	71.79	66.67	76.92	100.00	100.00	100.00	100.00	67.35
HIGH	21.56	20.51	11.11	7.69	0.00	0.00	0.00	0.00	19.18
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Among the three educational levels computed the middle group has a clear majority in total and individual disease category (Table-5.21). Further, major diseases like malaria and gastric are present moderately among high level groups as well. In general it may be said that educational level as such can not taken as a main parameter of morbidity in the village.

Table -5.22

Distribution of Household by Household Size and Reported Diseases in Langumshing

Household size	Percentage of Household Reporting Diseases								
	MALARIA	GASTRO	DIARR	FLU	COLD	SKIN DIS	HEART DIS	OTHERS	TOT DISEA
<=3	4.19	7.69	16.67	15.38	0.00	0.00	0.00	100.00	6.94
3-5	29.94	41.03	33.33	38.46	0.00	100.00	0.00	0.00	32.65
>5	65.87	51.28	50.00	46.15	100.00	0.00	100.00	0.00	60.41
<i>Total</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>

The table shows that more household suffers from these reported diseases having more number of family members. In fact average household size in these villages is at the highest among all four studies and that the size matters in case of disease prevalence (Table-5.22).

Table -5.23

Distribution of Household by House Type and Reported Diseases in Langumshing

House Type	Percentage of Household Reporting Diseases								
	MALARIA	GASTRO	DIARR	FLU	COLD	SKIN DIS	HEART DIS	OTHERS	TOT DISEA
Pucca	2.99	0.00	0.00	7.69	0.00	0.00	0.00	0.00	2.45
Semi Pucca	23.95	28.21	0.00	7.69	0.00	0.00	0.00	0.00	21.22
Kachcha	73.05	71.79	100.00	84.62	100.00	100.00	100.00	100.00	76.33
<i>Total</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>

People living in kachcha houses are found to be more vulnerable to be diseased compared to those privileged with a semi pucca or pucca one. From the table it is also clear that more than two third households live in those kachcha houses (Table-5.23).

Table -5.24

Distribution of Household Having Separate Kitchen by Reported Diseases in Langumshing

Kitchen Separate	Percentage of Household Reporting Diseases								
	MALARIA	GASTRO	DIARR	FLU	COLD	SKIN DIS	HEART DIS	OTHERS	TOT DISEA
Yes	19.29	25.64	0.00	7.69	0.00	0.00	0.00	0.00	20.00
No	80.71	74.36	100.00	92.31	100.00	100.00	100.00	100.00	80.00
<i>Total</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>

Households having a separate kitchen are an indicator of economic level and which on the other hand causes cross infection and development of respiratory diseases. This fact is well reflected in the table-5.24.

Table -5.25

Distribution of Household by Type of Privy and Reported Diseases in Langumshing

Type of Privy	Percentage of Household Reporting Diseases								
	MALARIA	GASTRO	DIARR	FLU	COLD	SKIN DIS	HEART DIS	OTHERS	TOT DISEA
Flush	2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Pit	36.04	46.15	16.67	30.77	0.00	0.00	0.00	0.00	5.00
Open Air	61.93	53.85	83.33	69.23	100.00	100.00	100.00	100.00	94.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

In the table-5.25 it is clearly revealed that open air defecation is associated with higher rate or disease morbidity among the household members. In fact all the reported diseases are found more in the open air category.

Table -5.26

Distribution of Household Having Ventilation in Rooms by Reported Diseases in Langumshing

Ventilation in Rooms	Percentage of Household Reporting Diseases								
	MALARIA	GASTRO	DIARR	FLU	COLD	SKIN DIS	HEART DIS	OTHERS	TOT DISEA
Present	22.84	28.21	0.00	7.69	0.00	0.00	0.00	0.00	23.27
Absent	77.16	71.79	100.00	92.31	100.00	100.00	100.00	100.00	76.73
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Ventilated rooms are healthier in terms of diseases reported from the households (table-5.26) in this village. It is interesting to note that almost all the households suffered from flu live in ill ventilated rooms,

Table -5.27

Distribution of Household by Source of Drinking water in Dry Season and Reported Diseases in Langumshing

Source of Drinking water in Dry Season	Percentage of Household Reporting Diseases								
	MALARIA	GASTRO	DIARR	FLU	COLD	SKIN DIS	HEART DIS	OTHERS	TOT DISEA
Piped	68.53	58.97	11.11	46.15	0.00	0.00	0.00	100.00	56.33
Spring	12.18	25.64	16.67	15.38	100.00	0.00	0.00	0.00	16.73
Stream	13.20	7.69	55.56	38.46	0.00	100.00	100.00	0.00	19.59
Pond	6.09	7.69	16.67	0.00	0.00	0.00	0.00	0.00	7.35
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

There is no apparent relation exists between the different source of drinking water in the dry season and the diseases. Only diarrhoea is slightly high among household drinking water from stream whereas even the piped water supply hasn't made much impact on controlling gastric diseases (Table-5.271).

Table -2.28
Distribution of Household by Source of Drinking water in Wet Season and Reported Diseases in Langumshing

Source of Drinking water in Wet Season	Percentage of Household Reporting Diseases								
	MALARIA	GASTRO	DIARR	FLU	COLD	SKIN DIS	HEART DIS	OTHERS	TOT DISEA
Piped	58.38	43.59	22.22	38.46	0.00	0.00	0.00	100.00	46.12
Spring	36.04	56.41	38.89	38.46	100.00	100.00	100.00	0.00	45.31
Stream	5.58	0.00	38.89	23.08	0.00	0.00	0.00	0.00	8.57
<i>Total</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>

In the wet season also different sources of drinking water in village hasn't shown any clear control over disease occurrence. Here (Table-5.28) also malaria and gastric and flu are seen associated with households drinking piped water without any apparent causes.

Table -5.29
Distribution of Household Practicing Water Purification and Reported Diseases in Langumshing

Water Purification Practiced	Percentage of Household Reporting Diseases								
	MALARIA	GASTRO	DIARR	FLU	COLD	SKIN DIS	HEART DIS	OTHERS	TOT DISEA
Yes	13.70	9.09	0.00	10.00	0.00	0.00	0.00	0.00	11.27
No	75.34	84.85	100.00	90.00	100.00	100.00	100.00	0.00	80.28
Occasionally	10.96	6.06	0.00	0.00	0.00	0.00	0.00	0.00	8.45
<i>Total</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>0.00</i>	<i>100.00</i>

As majority (80.28 %) of the households do not purify the collected water prior to drinking all the reported diseases are also found to be associated with this category. Hence apparently purification of drinking water provides some kind of resistance to the prevailing morbidity (Table-5.29).

5.4.4 Micro Level Explanation for the Village Dengchynrum

Table -5.30
Distribution of Household by Economic Level and Reported Diseases in Dengchynrum

Economic Level	Percentage of Household Reporting Diseases									
	ANAEM	ARI	DIARR	GAST	MAL+GAS	MAL+DIAR	MALARIA	SKIN DIS	TB	ALL DIS
Very Low	18.18	28.57	18.18	9.52	25.00	10.00	12.50	0.00	0.00	13.30
Low	45.45	28.57	45.45	21.43	12.50	30.00	34.38	0.00	0.00	30.85
Medium	27.27	28.57	36.36	54.76	50.00	40.00	41.67	100.00	0.00	43.09
High	9.09	14.29	0.00	14.29	12.50	20.00	11.46	0.00	100.00	12.77
<i>Total</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>

In the Dengchynrum village of Jaintia Hills more households from medium and low economic levels reported morbidity. But in case of respiratory infections economic levels seem to have little relation. Surprisingly not many of the low economic group reported diseases. Hence, as such, economic level is not found a clear associate to disease morbidity in this village (Table-5.30).

Table -5.31
Distribution of Household by Educational Level and Reported Diseases in Dengchynrum

Educational Level	Percentage of Household Reporting Diseases									
	Anaemia	ARI	Diarrhoea	Gastric	Mal+Gas	Mal+Diar	Malaria	Skin D	TB	Tot Dis
Low	9.09	42.86	9.09	28.57	12.50	40.00	21.88	0.00	0.00	22.87
Medium	72.73	57.14	90.91	57.14	62.50	50.00	64.58	100.00	0.00	63.30
High	18.18	0.00	0.00	14.29	25.00	10.00	13.54	0.00	100.00	13.83
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Level of education is also not seen to have any clear control over the disease morbidity from the table-5.31. Majority of the household from medium educational level is found to be suffering from diseases while high and low level groups are seem to be healthier.

Table -5.32
Distribution of Household by Household Size and Reported Diseases in Dengchynrum

Household Size Class	Percentage of Household Reporting Diseases									
	Anaemia	ARI	Diarrhoea	Gastric	Mal+Gas	Mal+Diar	Malaria	Skin D	TB	Tot Dis
Small	9.09	0.00	18.18	7.14	12.50	30.00	18.75	0.00	100.00	15.96
Medium	63.64	85.71	54.55	57.14	50.00	60.00	54.17	100.00	0.00	56.38
Large	27.27	14.29	27.27	35.71	37.50	10.00	27.08	0.00	0.00	27.66
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The above table shows (Table-5.32) that mainly the medium and large sized households reported diseases at higher rates. In fact small families are healthiest and mediums are most diseased in this village.

Table -5.33
Distribution of Household by House Type and Reported Diseases in Dengchynrum

House Type	Percentage of Household Reporting Diseases									
	Anaemia	ARI	Diarrhoea	Gastric	Mal+Gas	Mal+Diar	Malaria	Skin D	TB	Tot Dis
Pucca	0.00	0.00	0.00	4.76	12.50	20.00	4.17	0.00	100.00	5.85
Semi Pucca	54.55	42.86	36.36	64.29	50.00	50.00	57.29	100.00	0.00	55.85
Kachcha	45.45	57.14	63.64	30.95	37.50	30.00	38.54	0.00	0.00	38.30
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

In terms of house type more number of households have reported diseases from semi pucca and kachcha types than those of pucca ones. Two major diseases viz. ARI and Diarrhoea are found having a clear relation with this parameter as depicted in the table-5.33.

Table -5.34

Distribution of Household Having Separate Kitchen by Reported Diseases in Dengchynrum

Kitchen Separate	Percentage of Household Reporting Diseases									
	Anaemia	ARI	Diarrhoea	Gastric	Mal+Gas	Mal+Diar	Malaria	Skin D	TB	Tot Dis
Yes	9.09	14.29	0.00	14.29	12.50	20.00	11.46	0.00	100.00	12.77
No	90.91	85.71	100.00	85.71	87.50	80.00	88.54	100.00	0.00	87.23
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

It is interesting to observe (Table-5.34) that not only the ARI but all other diseases are more prevalent in the houses where there is no separate kitchen. Hence it may be suggested here that presence of kitchen is a good indicator of health and hygiene at least in this village.

Table -5.35

Distribution of Household by Type of Privy and Reported Diseases in Dengchynrum

Type of Privy	Percentage of Household Reporting Diseases									
	Anaemia	ARI	Diarrhoea	Gastric	Mal+Gas	Mal+Diar	Malaria	Skin D	TB	Tot Dis
Flush	0.00	0.00	0.00	4.76	12.50	20.00	3.13	0.00	0.00	4.26
Pit	27.27	42.86	36.36	52.38	37.50	50.00	42.71	100.00	100.00	44.68
Open	72.73	57.14	63.64	42.86	50.00	30.00	54.17	0.00	0.00	51.06
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The practise of open air defecation is again found clearly related to higher disease prevalence in this village (Table-5.35). Except gastric, malaria and other minor diseases, which are high among users of pit latrine, all other diseases are found at higher percentage among households going open air.

Table -5.36

Distribution of Household Having Ventilation in Rooms by Reported Diseases in Dengchynrum

Ventilation in Rooms	Percentage of Household Reporting Diseases									
	Anaemia	ARI	Diarrhoea	Gastric	Mal+Gas	Mal+Diar	Malaria	Skin D	TB	Tot Dis
Yes	9.09	14.29	27.27	16.67	37.50	20.00	18.75	0.00	100.00	19.68
No	90.91	85.71	72.73	83.33	62.50	80.00	81.25	100.00	0.00	80.32
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The presence of better ventilation is found helps avoiding diseases like ARI directly and also act as an economic parameter for morbidity pattern in general (Table-5.36). The table- shows a clear majority of diseases are reported from the houses with poor or no ventilation in the rooms.

Table -5.37
Distribution of Household by Occupational Groups and Reported Diseases in Dengchynrum

Occupational Group	Percentage of Household Reporting Diseases									
	Anaem	ARI	Diarr	Gas	Mal+Gas	Mal+Diarr	Malaria	Skin D	TB	Tot_Dis
Agriculture	18.18	14.29	0.00	28.57	37.50	20.00	27.08	0.00	100.00	25.53
Mining	18.18	28.57	27.27	11.90	12.50	30.00	19.79	100.00	0.00	19.15
Business & Service	0.00	14.29	0.00	11.90	0.00	0.00	5.21	0.00	0.00	5.85
Wage Labour	63.64	42.86	72.73	47.62	50.00	50.00	47.92	0.00	0.00	49.47
<i>Total</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>

In this village wage labour is an important occupation but it is alarming to find that almost all diseases are reported at higher percentage from this occupational category. Moreover households engaged in mining works are found getting more respiratory infection and Mal+Diarr while the agriculturists are suffering more from gastric, Mal+Gas and malaria etc disease categories (Table-5.37).

5.5 Concluding Statement

In this chapter an attempt has been made to analyse the disease prevalence pattern at the house hold level of five chosen villages in relation to important socio-economic and demographic criterion. The following are the major highlights of the above discussion:

Firstly, economic conditions along with all its related components like house type, presence of separate kitchen and privy etc have statistically emerged as the main determinant of disease morbidity in all the four villages.

Education as such does not have a direct implication on general disease morbidity pattern.

Household size is found not associated logically to variations in disease occurrence except in the case of villages Umden Khasi and Langumshing.

Occupation such as agriculture, both *jhum* and settled forms, enhances more exposure to the prevalent disease environment. In the village Demdema cultivators are found suffering from more disease compared to those in non- agricultural occupations. Wage labourers, the major occupational group in Denchynrum, reported greater morbidity from almost all diseases and those in agriculture get gastric and malaria. The majority of households of Umden Khasi practicing *jhum* cultivation reported all the major diseases like gastric, malaria and diarrhoea.

Most of the communicable diseases of infectious nature seem to affect more to the people going for open air defecation as well as using open pit privy. It is to be noted here that a very low number of households having sanitary toilets are not statistically reflected in the results.

Malaria, the most dreaded and significant parasitic disease does not show any differential spread over the different categories of people practicing different levels of household hygiene.

Finally, it is observed that villages from different eco-cultural zones possess different disease attributes as reflected from the comparison between the four villages. In general economic parameters and occupation remain the common explanatory variables in all the villages.



Plate -1: The sacred grove of Denchynrum village in the barren coal mining belt of Jaintia Hills

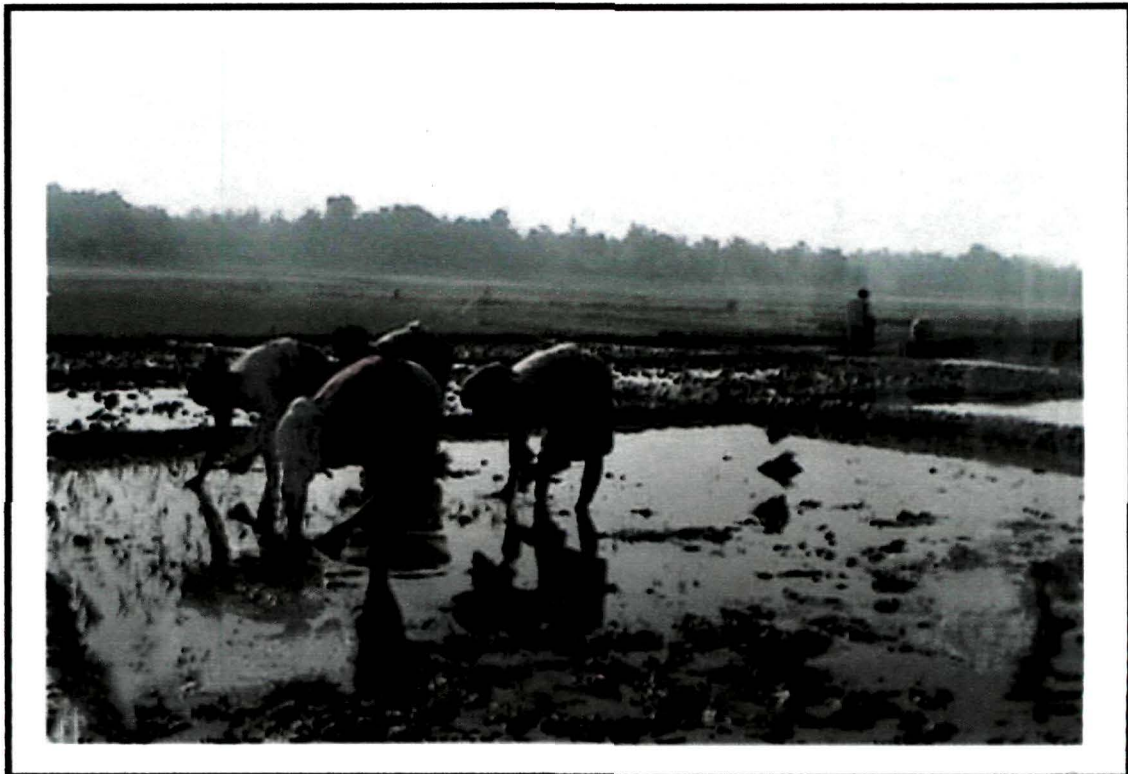


Plate -2: Settled cultivation is taken as a better option than shifting cultivation in Demdema village of West Garo Hills.



Plate -3: Jhum cultivation is still the main option for Umden Khasi village in Ri Bhoi district.



Plate -4: Least altered forested surroundings of the Langumshing village in West Khasi Hills ditrict.



Plate – 5: A section of the village settlement of Umden Khasi in Ri Bhoi district.



Plate-6: The traditional medicine man in Demdema village.



Plate-7: Living with malaria for generations –An old traditional Garo Lady..

CHAPTER VI

SUMMARY OF FINDINGS AND RECOMMENDATIONS

6.1 At the conclusion of this research, it may be pertinent to look back at the very conception of the work which was initiated with an idea of understanding the inherent characteristics of the wide range of diseases prevalent among the people of Meghalaya. The aspects of health, at the present day perspective, are immensely important and hence this field demands to be studied by social scientists in addition to the practitioners of medicine. The spatial and social aspects of human disease are not being taken up seriously and regularly by the professional in medical sciences. While preparing the proposal for this particular thesis the researcher found it as a pity that there is hardly any remarkable contribution in this field from social scientists of this part of India. Baring a few notable contributions in the field of bio-anthropology and ethno medicine the field of human health has not been touched from a North East India perspective. Prevalence of diseases has a spatial dimension too which when viewed in its environmental and social context brings the issue closer to a geographical scrutiny for the benefit of better management, preventive as well as curative, of health of the people at large. Geographers unlike in the past are becoming increasingly aware of the practical importance of their discipline which can contribute to the welfare of the society by way of identifying the spatial patterning inherent in the distribution of social phenomena and thereby calling for intervention by social action and social planning. Health of the people is an extremely important aspect of social planning and the present study is devoted to an in-depth understanding of the patterns in the prevalence of major diseases in the study area with a view to understanding the locational, ecological and cultural attributes of the disease prevalence so that it leads to

better management of health of the people. Problems of health and health care demands particular attention in view of the specific disease ecology and constraints involved in providing adequate health care. Furthermore, statistics available at aggregate levels often conceal the true picture while evaluating achievement levels with reference to normative goals. It is imperative therefore to scrutinize data at smaller spatial units and for peoples socially and culturally distinguished so as to arrive at a meaningful evaluation of health standards achieved after decades of strenuous efforts and to influence public policy for further improvement.

6.2 The problems of health care in Meghalaya, a region in India's north-east, characterized by difficult terrain conditions and dominated by communicable diseases are too many. The state has a special responsibility in looking after the health of the people in a state like Meghalaya, where the poor, rural tribal people are largely unaware of the benefits of modern health care. Unfortunately the health care delivery in Meghalaya leaves much to be desired as over 42 per cent of the rural people are yet to be covered under any institutional health care network. Much of the health care facility is confined to the urban areas only. The more glaring aspect however is not so much the inadequacy of health infrastructure, but the disparity in whatever is available. A second area of concern remains at the level of utilisation of this facility. There are structural constraints in utilising the health care facility, which may not be confined only to accessibility factor.

The whole of North East India and Meghalaya in particular provides a wide array of disease environment owing to the anthropo-geographical variations. An important aspect of the geographical reality of the North-East India in general and Meghalaya in particular is that the region subsumes within itself a sizeable proportion of tribal people

who have been exposed to modernisation only recently, particularly since the Colonial times. Though the Missionary efforts in the region achieved spectacular success in areas of education and health, yet the people suffer most from a wide range of communicable diseases. Partly the reason lies in the extended contacts of the relatively isolated tribes to the outside world and partly it is due to unavailability of modern health care to most people living in rural areas and also due to ignorance of the people. The region also suffers greatly from lack of transport and communication facility aggravating the problem of health. The main aim of the present research is however not related to look into these problems, but to get an insight into the prevalence pattern of some of the major diseases. Infrastructure undoubtedly influences the prevalence. It is contended that a geographical perspective to the problem of the prevalence of major diseases would reveal the spatial dimension of the problem- a n aspect which is generally ignored while planning health.

With this perspective in mind, the present study considered Meghalaya as an appropriate study area where the prevalence pattern of major diseases have been examined. Meghalaya represents North-east in several ways, both physically and in terms of its population which consists largely of tribes. The communicable diseases predominate and the state has a wide variety of disease environments due largely to extraordinary variation in almost all attributes of physiography, terrain, soil, climate vegetation and above all cultural practices.

6.3 Accepting the above mentioned problems to be dealt with within the span of this thesis the objectives placed before the research were to identify the major diseases prevalent in the State; analyse the pattern of distribution of those major diseases; find the associated macro and micro environmental factors, natural and cultural, of those major

diseases; evaluate the impact of available health care facilities as well as the level of awareness on health and to propose suitable measures for improving the prevailing health situation in Meghalaya.

In course of this study the major questions have been attempted to answer whether there are discernible spatial patterns in the prevalence of diseases, if so to what extent does the natural environment determine the prevalence of these diseases? What are particular demographic and economic characteristics of the people reporting the major diseases? Are there any cultural habits associated with those diseases and also what is the level of availability and acceptance of the different health care facilities before the people of Meghalaya?

The relevant data and information, on the study area required was not readily available. Both secondary and primary sources of data have been tapped from different libraries, offices and institutions. The data on disease morbidity over the spatial unit or the epidemiological data on disease was collected directly from major health centres and hospitals of all the seven districts. The basic data on reported disease were gathered from all the 85 Government Health Centres spread all over Meghalaya distributed among 30 Community Development Blocks in seven districts. Field survey was also required to collect the household level morbidity data from five villages selected purposively from different ethno-geographic as well as risk zones in Meghalaya.

It must be noted here that serious problems were faced to organize the raw data and to make those compatible and uniform. Instead of good efforts certain data gaps due to poor quality and irregularity of recording could not be overcome.

6.4 All the reported diseases were ranked as per the number of cases recorded in the state as a whole so as to determine the empirically major and most important categories of human morbidity. In this process 21 different diseases were recorded including the miscellaneous group where both minor and undiagnosed diseases are clubbed together. Within the limit of the present research the most prevalent diseases were dealt with at different levels of details.

The morbidity data were tabulated and mapped for the purpose of depicting spatial and seasonal variations in occurrence of each disease category. Taking the Blocks as the lowest administrative unit disease ranking, percentage share of each disease category and disease incidence per thousand populations were computed and mapped. The most important explanatory variables considered to have significant bearing on disease prevalence included such factors as absolute altitude above mean sea level mean annual rainfall, mean annual temperature, percentage of forest cover, density of population per square kilometre, general literacy rate, female literacy rate, percentage of villages having educational facility, percentage of villages having medical facility and percentage of villages having drinking water facility.

6.5 The entire analysis has been presented in five broad chapters preceding the present one. The first chapter provides details pertaining to the basic research design including the statement of the problem, definitions and concepts, relevance of the study, a brief note on the selection of the study area, state of health in Meghalaya, broad objectives placed before the research, important research questions, methodology and database, data analysis and presentation, an overview of relevant literatures and the chapter design. It may be pointed out again that no relevant and substantive work could be found for similar subject on

Meghalaya to be referred here. The second chapter is devoted to an understanding of the environmental and socio-economic background of Meghalaya. In this chapter the study area has been introduced in relation to those attributes which have a direct bearing on the disease distribution pattern of the region. The aspects chosen for description include location, relief and drainage, climatic character, extent of forest cover, distribution of Population, literacy rate, availability of educational facility, availability of drinking water facility and availability of medical facility. Each of those aspects has been presented through maps and charts for a better understanding of geographical variations of those. Distribution Pattern of prevalent diseases in Meghalaya is the major concern for analysis in the third chapter. First the statistically major diseases have been sorted out from total 21 diseases recoded during the index year. Thereafter, an attempt has been made in this chapter to identify the spatial pattern in the distribution of major diseases in the study area through block level maps of each disease and graphs presenting the seasonal variation of those. The next chapter i.e., Chapter IV is devoted to an understanding of the environmental attributes of the major diseases prevalent in Meghalaya. The chapter includes a detailed analysis of six major diseases and their relation with environmental attributes; both physical as well as socio-cultural. There are in all 49 tables comparing six major diseases against all the selected attributes along with short interpretations.

An explanation of the micro level data collected from the household of five selected villages have been done in the fifth chapter to cross examine and complement the already found correlation between different environmental attributes and the disease pattern at macro level in previous chapters. First the sample villages have been described in details giving the geographical, demographic and socio-economic characteristics.

Thereafter, the pattern of disease morbidity of each household has been compared with the variables which are likely to have impact on the disease environment at the village level.

6.6 Major findings of the research may be outlined as below:

From the first chapter it was understood that Meghalaya as an unique North-east Indian state provides immense scope for conducting research on health in general and geography of health in specific. There are gaps in the recording of data making temporal analysis a hazardous exercise. No standard classification procedure for the diseases has been followed making it exceedingly difficult in classifying morbidity pattern.

Environmental and socio-economic background of Meghalaya provided the much needed geographical basis to understand the disease environment prevalent in the state. However, only the most important aspects of the physical environment and socio-economic background of the study area were discussed. It was noted that the state of Meghalaya has its own physiographic uniqueness in terms of its plateau landscape receiving world's highest rainfall under the impact of tropical monsoon climate. There are tangible variations in altitude, rainfall, temperature and forest cover within the state. Moreover, it is a relatively small but important tribal state in the north eastern India. Dominantly rural in population composition, the state is experiencing a relatively higher decennial growth rate. Nevertheless the density of population is relatively low except in a few towns. Literacy rate is relatively higher in the Khasi Hills compared to the Garo Hills region though overall level of literacy is at higher level compared to national average. the study area enjoys a relatively better level of both educational and drinking water facility but is constrained with insufficient medical facility according to the present norms. In fact

it is evident that availability of medical vis-à-vis health care facility in the state is low by any standard and certainly a matter of serious concern.

The analysis of the prevailing distribution pattern of the major diseases of Meghalaya has been presented as the main objective of the thesis. Diseases like respiratory infections, diarrhoea, probable cases of malaria fever, skin infections; peptic ulcer syndrome and malaria are found as statistically major diseases during the index year. In fact the first three diseases together shared three fourths of all the 21 disease categories recorded. Prominent spatial variations were found in distribution pattern of all the major diseases. The diseases of respiratory infections dominated at the first rank followed by diarrhoeal diseases. Malaria and pyrexia of unknown origin were treated successively and was found interrelated. It is important to note that incidence of respiratory infections were more over the high altitude areas whereas diarrhoea cases are found in middle and lower altitude belts of the Meghalaya plateau. The huge dominance of the three top order diseases was also in the computed results of disease combination. Moreover, it is also observed that four disease combinations are present mainly in the thickly populated border blocks of Garo Hills and Ri Bhoi districts. On the other hand in two higher altitude blocks viz. Khliehriat and Mawryngkheng, extreme dominance of Ri and Dd has resulted in two disease combination. Higher altitude and higher rainfall areas were seen associated with Ri diseases which occur mostly during pre-monsoon and early winter seasons. The Dd on the other hand prevailed relatively more over the Khasi Hills than in Garo Hills, probably be due to differences in availability and quality of drinking water and level of personal hygiene. Malaria was found presenting a controlled spatial distribution directly related to factors like altitude, temperature and rainfall. The low valley and foothill zones of the

districts like WGH, EGH, SGH and WKH remains highly malaria infested where more than 90 per cent is *P. falciparum* species. The highest part of the central plateau ridge of JH, EKH and WKH, roughly above the 1350 m contour line, is recorded as the malaria free zone. The hottest and wettest seasons had maximum positive cases of malaria in Meghalaya. The undetected fever cases grouped as Po were revealed largely as the probable cases of malaria by nature of occurrence. By and large both spatial and seasonal distribution pattern conform to that of malaria. In general skin diseases were present higher among the people of Garo Hills region compared to the other half of the state viz. Khasi Hills and Jaintia Hills indicating that the disease is associated with over all physio-cultural character of the region and not merely with any of the specific environmental precursors. The seasonality pattern of skin diseases was found obscured due to gaps and incompatibility in data. The peptic ulcer syndrome, a disease caused by certain food habits and addictions etc, was found to have emerged as an important disease in the state. The spatial variation is quite high which may also be due to faulty and under reporting from several blocks. There is one contiguous zone of high Po cases but seems not related to any of the parameters used in this study.

In course of interpretation and analysis of the correspondence between distribution of the six major diseases and the associated factors it was observed that, excepting a few, most of the variables are related to normal trends though not significantly. In certain cases the statistical trend was found to be just opposite of the accepted or normal one. Diseases of Respiratory infections are closely associated with altitude, air temperature and educational facilities. Diarrhoeal diseases were found related to drinking water and availability of medical facilities. Variation in rainfall is significant attribute to malaria

occurrence whereas Pyrexia of unknown origin was observed closely associated to altitude, air temperature, forest cover, educational and medical facilities. Finally, diseases of skin were found related to altitudinal variations. Altitude, air temperature and literacy rates played important roles for occurrence of peptic ulcer syndrome.

One of the most significant findings was that the economic conditions along with all its related components like house type, presence of separate kitchen and privy etc have statistically emerged as the main determinant of disease morbidity in all the five villages as emerged during the micro level explanations of the disease attributes. But education as such did not depict a direct implication on general disease morbidity pattern. This is contrary to expectation as literacy is always cited as an important factor in making people aware about disease occurrence. This does not hold true in the case of Meghalaya, where the general literacy level is high, but is possibly not accompanied by health education. It may be suggested that the state should take special care in health education among the people through special campaigns and through school curriculum. Household size also was found not associated logically to variations in disease occurrence except in the case of villages Umden Khasi and Langumshing, representing two less privileged ones. Occupation such as agriculture, both *jhum* and settled forms, was found to enhance more exposure to the prevalent disease environment. In the village Demdema cultivators were found suffering from more diseases compared to those in non- agricultural occupations. Wage labourers, the major occupational group in Denchynrum, reported greater morbidity from almost all diseases and those in agriculture get gastric and malaria in particular. Majority of the households of Umden Khasi practicing *jhum* cultivation reported all the major diseases like gastric, malaria and diarrhoea. Most of the communicable diseases of

infectious nature seemed to affect more to the people going for open air defecation as well as using open pit privy. It was also noted that a very low proportion of households having sanitary toilets were not statistically reflected in the results. Malaria, the most dreaded and significant parasitic disease did not show any differential spread over the different categories of people practicing different levels of household hygiene. Finally, it was observed that villages from different eco-cultural zones possess different disease attributes as reflected from the comparison between villages. In general economic parameters and occupation remained the common explanatory variables in all the villages.

In a nut shell, the observed distribution pattern of major diseases in Meghalaya is mostly unique to each disease. The extent of spatial variations in individual as well as in different diseases is remarkable in the state owing to the prevailing diversities in environmental and cultural aspects and this very fact is extremely important for the researchers in the field of health geography and the practitioners of medicine alike.

6.7 The present piece of research, instead of being limited within its own extent, has highlighted certain hitherto unknown dimensions of the disease and environment relation existing in this small and less studied tribal state located at a far corner of India. In the absence of any noticeable background information, either in form of database or published material, this seemingly initial attempt is expected to raise more relevant questions to the students and researchers of an important universal issue – human health.

In fact human health remains to be one of the most neglected subjects in the developing countries in particular which has immense impact on the development economy of any country. The targets set on ‘Health for all...’ programme by the Government of India is constantly being rescheduled due to several serious lacuna in

health care delivery system which is otherwise related to the health information and knowledge base. Therefore, it is hoped that this attempt to understand the salient features of the problems related to health of the people of Meghalaya will be helpful to the planners and managers of the much important health policy.

6.8 It may be noted that the study has been limited to only one calendar year though it is expected that the intricate nature of diseases needs to be examined in a much broader perspective and preferably on long term basis using time series data for a sufficiently long period. Follow up studies are needed where infectious diseases are at rampant. On the other hand the nature and extent information required for such studies are immensely scanty in Meghalaya due mainly to inaccessibility of the risk areas and less awareness about the importance of such information among the health workers and even medical practitioners in some cases. Moreover, several other equally important parameters to be considered for better understanding of the disease causatives.

6.9 Therefore, it is important to propose that a concrete and comprehensive epidemiological data base is to be developed at the earliest using the available network of both state and private sector health institutions in the state. Preventive measures, as already in practise, needs to be revamped and implemented up to the lowest level.

Public awareness needs to be generated against over congestion of houses and proper ventilation to prevent incidence of respiratory diseases, the most important of all diseases in Meghalaya. Adequate preventive measures to be taken from both government and public to destroy the mosquito habitats and simultaneously people in the endemic belts to be made aware to regularly using mosquito nets, the only proven prevention from mosquito bites.

In a region with high proportion of rural population dispersed in villages scattered all over the state characterised by difficult terrain conditions and poor road facility doubly constrained with very low health care coverage with only one hospital bed per thousand population a Better health care network with a sound regional coverage, removing the strong urban bias present in the state, is an urgent necessity.

The paradoxical situation of acute water crisis even in the world's highest rainfall zone may only be overcome through better and appropriate rural water management. Supply of safe piped water to all villages has to be ensured in effective manner, for which rain water harvesting system has a bright prospect in this rainiest state in the world. Even if supply of piped water is not feasible for economic reason, the campaign for clean drinking water through traditional methods of boiling and filtering can be effective. The NGOs have a particularly important role to play in this regard.

Utilising the already available NIC net connection in all development blocks, sudden onset of the disease can be monitored closely and emergency services can be provided at the time of need.

As a primary barrier of transmission of organisms causing diarrhoea, the system of safe disposal of excreta is emphasised e.g. its collection, transportation, treatment and disposal. On the other hand, improvement of awareness of water sanitation behaviour will result in prevention of diarrhoeal epidemic.

It may be noted here that these recommendations are based on the particular research and does not take into consideration the cost aspect. Some of these recommendations may be easily implemented as they are already emphasised by Government policy. In such cases emphasis needs to be placed on their effective

implementation. In other cases however, more fundamental research is required for methods that are economically sound. At research level, the Geographical Information System (GIS) can be profitably used for understanding disease patterning in their composite occurrence and the future research in this area requires GIS techniques to be used for not only identifying the pattern but also to suggest measures to combat them more effectively.

The present research is a humble beginning in this direction and was handicapped by less than expected research in this area and for the region as a whole. Nevertheless within the scope of the research, the study made an attempt at answering some of the questions pertaining to the topic of research while leaving many more partially answered or totally unanswered and making one aware about new questions that emerged.

Annexure-I

Meghalaya: Distribution of Sampled Health Centres in the C.D. Blocks 1996			
DISTRICT	C. D. BLOCK	HEALTH CENTRES (Sampled)	
			(Sampled)
1. JAINTIA HILLS	1. Thadlaskein	1	Ummulong
		2	Namdong
	2. Laskein	3	Laskein
		4	Borato
		5	Mynso
		6	Sahsniang
		7	Shangpung
2. RI BHOI	3. Khliehriat	8	Khliehriat
		9	Sutnga
		10	Pomra Paithlu
	4. Amlarem	11	Dawki
		12	Jarain
		13	Nongtalang
		5. Nongpoh	14
	15		Nongpoh
	16		Umden
	17		Marngar
	18		Patherkhamah
	6. Bhoi Area	19	Umsning
		20	Kyrdem
21		Mawhati	
22		Bhoilymbong	
23		Mawlasnai	
3. EAST KHASI	7. Mawryngkheng	24	Smit

HILLS	8. Myllem	25	Nehru Memorial
		26	Diengiei
	9. Mawphlang	27	Pomlum
		28	Sohiong
	10. Pynursla	29	Laitlyngkot
		30	Laitkynsew
		31	Pynursla
		32	Pongtung
	11. Shella-Bholaganj	33	Swer
		34	Laitryngew
		35	Cherrapunjee
		36	Mawlong
		37	Shella
12. Mawsynram	38	Nongspung	
	39	Balat	
13. Mawkynrew	40	Mawkynrew	
	41	Jonksa	
4. WEST KHASI HILLS	14. Mairang	42	Nongkhlaw
		43	Nongthliew
	15. Mawkyrwat	44	Mawthapdah
	16. Nongstoin	45	Nongstoin
		46	Markasa
		47	Myriaw
	17. Mawshynrut	48	Riangdo
49		Ranikor	
5. EAST GARO HILLS	18. Resubelpara	50	Resubelpara
		51	Mendipathar
		52	Dainadubi
	19. Rongjeng	53	Kharkutta
		54	Rongjeng
	20. Songsak	55	Songsak
56		Rongrong	

	21. Samanda	57	Adokggre
		58	Samanda
		59	Williamnagar
6. WEST GARO HILLS	22. Dadenggre	60	Ttikrikilla
		61	Dadenggiri
		62	Raksangiri
	23. Selsella	63	Phulbari
		64	Bhaitbari
		65	Selsella
		66	Garobadha
	24. Rongram	67	Asananggiri
		68	Leprocy Colony
	25. Betasing	69	Betasing
	26. Zikzak	70	Kaliachar
		71	Zikzak
		72	Nagarpara
		73	Mahendraganj
27. Dalu	74	Purakhasia	
	75	Dalu	
	76	Darengre	
7. SOUTH GARO HILLS	28. Chokpot	77	Chokpot
	29. Baghmara	78	Sibbari
		79	Baghmara
	30. Rongara	80	Rongara

ANNEXURE – II, Meghalaya: Block Level Distribution of Physio-cultural Parameters

Sl. No.	Name of C. D. Block	Altitude(m)	Rain(mm)	Temp °C	% of Forest area,'91	Density of Pop. '96	% Vill. with Drinking Water	% Rural Pop. with Med. Facility	% Rural Pop. with Edu. Facility	Gen. Literacy Rate 1996	Female Literacy Rate 1996	Density of Population 1996
1	Thadlaskein	825	2300	22	38.45	140.97	100.00	14.18	96.08	58.7	64	90083
2	Laskein	850	2500	22	31.17	78.55	100.00	26.48	93.38	42.2	47.6	56241
3	Khliehriat	900	4800	22	43.19	38.12	92.12	22.27	96.69	48.8	47.1	78764
4	Amlarem	1250	5200	22	34.42	82.90	100.00	33.78	97.84	66.8	67	32996
5	Nongpoh	450	1800	23	33.29	54.66	95.80	6.90	81.50	65.5	59.6	63028
6	Bhoi Area	750	1800	23	37.18	79.20	91.63	11.65	84.08	66.5	64.8	97026
7	Mawryngkheng	925	1900	16	39.32	145.21	100.00	29.46	98.94	65.3	69	42547
8	Mylliem	1500	4000	15	26.62	1534.85	99.50	16.39	92.70	85.2	83	330300
9	Mawphlang	1425	4200	16	37.52	205.43	93.24	9.66	82.20	65	66.6	51151
10	Pynursla	1300	9000	21	35.11	102.49	97.20	9.86	91.91	69.3	68.8	51759
11	Shella-Bholaganj	1275	9750	21	37.63	86.42	99.38	13.47	70.97	69.5	68.6	49949
12	Mawsynram	1250	10500	20	41.39	66.77	97.85	13.96	86.19	67.6	62.9	41599
13	Mawkynrew	1650	9550	18	40.83	90.55	99.02	14.16	96.01	53.2	57.9	32146
14	Mairang	1100	2500	18	42.48	72.74	100.00	8.00	95.61	59.8	61.4	71935
15	Mawkyrwat	1298	10150	21	35.55	42.75	100.00	6.07	96.64	72.3	71.5	53561
16	Nongstoin	1000	6250	18	38.79	46.32	100.00	5.65	95.64	70.9	69.4	75217
17	Mawshynrut	1150	6000	22	42.02	40.86	100.00	7.94	98.59	61.8	57.8	56424
18	Resubelpara	300	2200	23	40.92	162.92	99.13	17.14	85.95	68.1	61.5	76249
19	Rongjeng	400	2300	23	49.1	77.16	100.00	5.91	91.28	61.3	56.1	68290
20	Songsak	400	2250	22	46.44	53.41	100.00	22.88	87.85	45.7	38.9	37546
21	Samanda	500	3250	22	50.59	66.93	99.27	1.72	45.46	64.7	59.4	36609
22	Dadenggre	150	2400	23	51.32	91.73	100.00	6.84	73.97	30.7	23.9	97326
23	Selsella	90	3000	23	38.17	238.83	100.00	8.94	74.18	42.3	36.3	114877
24	Rongram	850	2500	21	41.18	118.07	100.00	14.08	18.99	72	63.8	101698
25	Betasing	90	3200	24	39.18	191.51	100.00	4.99	31.94	48.9	46.4	57645
26	Zikzak	90	3400	24	35.36	170.28	100.00	12.56	79.81	46.9	39.1	60959
27	Dalu	100	5250	24	49.58	77.78	100.00	9.41	79.03	50.4	43.4	51569
28	Baghmara	475	7250	24	49.51	55.47	100.00	5.74	56.43	52.6	46.3	39495
29	Chokpot	450	5500	23	49.38	57.66	100.00	16.49	83.71	58.1	50.4	32678
30	Rongara	400	7500	24	67.18	27.13	100.00	9.59	79.62	56.3	48.8	15926

Annexure-III

Meghalaya: Block Level Distribution of Diseases, 1996

Sl. No.	C. D. Block	Respiratory Infections		Diarrhoeal Diseases		Malaria		Pyrexia of Unknown Origin	
		Percentage to all cases	Incidence per '000 Pop.	Percentage to all cases	Incidence per '000 Pop.	Positive Cases	Annual Parasite Index	Percentage to all cases	Incidence per '000 Pop.
1	Thadlaskein	33.00	109.33	9.31	30.84	6848	76.02	0.04	0.13
2	Laskein	25.97	153.52	20.47	121.03	1287	22.88	0.34	1.99
3	Khliehriat	42.98	102.99	21.78	52.19	1170	14.85	0.06	0.15
4	Amlarem	37.17	154.11	14.14	58.61	3145	95.31	0.43	1.79
5	Nongpoh	17.94	170.66	21.56	205.09	3302	52.39	22.31	212.22
6	Bhoi Area	26.67	216.97	21.99	178.90	1887	19.45	25.61	208.34
7	Mawryngkheng	45.73	225.19	18.29	90.07	36	0.85	3.26	16.03
8	Mylliem	36.04	22.97	22.01	14.03	1548	4.69	3.27	2.09
9	Mawphlang	41.81	226.49	30.39	164.65	46	0.90	0.00	0.00
10	Pynursla	41.97	237.60	23.45	132.75	163	3.15	12.05	68.22
11	Shella-Bholaganj	31.35	200.06	16.20	103.41	82	1.64	29.14	185.97
12	Mawsynram	26.97	164.62	26.97	166.09	21	0.50	26.43	162.72
13	Mawkyntew	29.90	99.17	29.90	95.00	31	0.96	0.76	2.43
14	Mairang	47.17	281.34	18.15	108.26	29	0.40	12.75	76.07
15	Mawkyrwat	40.90	71.69	31.80	55.75	67	1.25	1.97	3.45
16	Nongstoin	19.60	56.46	39.18	112.85	19	0.25	13.17	37.93
17	Mawshynrut	11.45	15.06	7.11	8.65	52	0.92	21.32	0.66
18	Resubelpara	17.37	83.75	15.24	73.51	438	5.74	28.88	139.27
19	Rongjeng	8.73	24.86	9.63	27.41	630	9.23	46.80	133.29
20	Songsak	11.81	57.69	12.88	62.91	211	5.62	44.57	217.65
21	Samanda	10.67	130.76	8.73	107.00	448	12.24	48.95	599.64
22	Dadenggre	20.33	20.12	24.19	17.87	1270	13.05	20.92	5.25
23	Selsella	24.93	168.81	24.79	167.85	1185	10.32	11.40	77.22
24	Rongram	11.69	3.84	11.51	3.79	385	3.79	33.52	11.02
25	Betasing	14.85	36.01	19.72	47.83	105	1.82	54.38	131.89
26	Zikzak	9.12	50.28	27.87	153.64	436	7.15	32.87	181.17
27	Dalu	25.37	105.18	22.46	93.08	1737	33.68	18.69	77.47
28	Baghmara	29.08	119.76	25.19	103.73	421	10.66	20.64	84.97
29	Chokpot	12.36	18.91	14.49	22.19	409	12.52	41.68	63.80
30	Rongara	20.30	38.68	29.89	56.95	265	8.61	32.23	61.41

Contd

Source: Directorate of Health Services, Govt. of Meghalaya, 1996

Meghalaya: Block Level Distribution of Diseases, 1996 (Contd.)

Sl. No.	C. D. Block	Skin Diseases		Peptic Ulcer Syndrome		Viral Hepatitis		Anaemia	
		Percentage to all cases	Incidence per '000 Pop.	Percentage to all cases	Incidence per '000 Pop.	Percentage to all cases	Incidence per '000 Pop.	Percentage to all cases	Incidence per '000 Pop.
1	Thadlaskein	0.23	0.78	0.04	4.56	12.99	43.04	0.34	1.12
2	Laskein	0.59	3.50	0.34	37.70	45.96	271.73	1.88	11.13
3	Khliehriat	3.35	8.04	0.06	15.98	0.16	0.39	0.86	2.06
4	Amlarem	2.40	9.94	0.43	27.70	32.93	136.53	0.70	2.91
5	Nongpoh	3.68	34.97	4.74	45.11	0.01	0.05	1.26	12.03
6	Bhoi Area	4.41	35.87	5.75	46.74	0.12	0.96	1.07	8.74
7	Mawryngkheng	7.98	39.30	12.22	60.19	0.00	0.00	0.11	0.52
8	Mylliem	7.03	4.48	7.31	4.66	0.010	0.01	2.59	1.65
9	Mawphlang	6.11	33.08	8.53	46.24	0.00	0.00	0.28	1.51
10	Pynursla	2.43	13.74	5.89	33.33	0.014	0.08	1.22	6.88
11	Shella-Bholaganj	3.63	23.18	3.10	19.80	0.006	0.04	0.82	5.25
12	Mawsynram	3.30	20.31	2.14	13.20	0.00	0.00	0.23	1.39
13	Mawynrew	3.19	10.14	3.64	11.57	0.00	0.00	2.46	7.81
14	Mairang	1.08	6.42	0.38	2.29	1.72	10.23	0.68	4.07
15	Mawkyrwat	2.45	4.29	5.95	10.44	0.53	0.93	2.50	4.39
16	Nongstoin	1.52	4.37	5.53	15.93	0.21	0.61	2.58	7.45
17	Mawshynrut	4.09	5.76	14.19	22.63	0.75	0.92	5.42	6.42
18	Resubelpara	11.08	53.43	1.65	7.97	0.18	0.89	2.64	12.75
19	Rongjeng	8.11	23.11	2.49	7.09	1.23	3.51	3.63	10.32
20	Songsak	5.00	24.40	2.12	10.33	0.61	2.98	4.31	21.07
21	Samanda	9.54	116.86	2.40	29.45	0.52	6.31	2.01	24.61
22	Dadenggre	12.18	8.91	0.05	0.01	0.26	0.00	2.65	1.44
23	Selsella	12.85	86.99	0.09	0.61	0.19	1.27	3.29	22.30
24	Rongram	13.55	4.45	0.00	0.00	0.00	0.00	0.69	0.23
25	Betasing	7.92	19.22	0.03	0.07	0.00	0.00	1.00	2.43
26	Zikzak	11.48	63.29	0.00	0.00	0.69	3.81	1.28	7.05
27	Dalu	14.13	58.58	0.00	0.00	0.14	0.56	4.26	17.67
28	Baghmara	0.71	2.91	5.43	84.97	0.16	0.66	3.86	15.90
29	Chokpot	4.36	6.67	4.90	63.80	0.72	1.10	2.24	3.43
30	Rongara	3.36	6.40	1.81	61.41	0.49	0.94	0.00	0.00

Contd.

Source: Directorate of Health Services, Govt. of Meghalaya, 1996

Meghalaya: Block Level Distribution of Diseases, 1996 (Contd.)

Sl. No.	C. D. Block	Diseases of Oral Cavity		Infection of Worms		Tuberculosis	
		Percentage to all cases	Incidence per '000 Pop.	Percentage to all cases	Incidence per '000 Pop.	Percentage to all cases	Incidence per '000 Pop.
1	Thadlaskein	0.40	1.31	0.36	1.19	17.01	56.35
2	Laskein	0.41	2.40	0.20	1.19	0.01	0.07
3	Khliehriat	2.88	6.91	1.41	3.39	0.58	1.38
4	Amlarem	1.73	7.18	0.65	2.70	0.18	0.76
5	Nongpoh	1.02	9.71	1.73	16.47	0.03	0.29
6	Bhoi Area	0.93	7.56	1.77	14.42	0.01	0.11
7	Mawryngkheng	0.66	3.27	4.52	22.23	0.00	0.00
8	Mylliem	1.73	1.10	1.95	1.24	0.00	0.00
9	Mawphlang	1.08	5.85	3.04	16.46	0.03	0.18
10	Pynursla	0.62	3.52	4.84	27.42	0.03	0.17
11	Shella-Bholaganj	1.38	8.79	1.44	9.19	0.03	0.22
12	Mawsynram	0.21	1.27	2.63	16.20	0.00	0.02
13	Mawkynrew	0.94	2.99	2.91	9.24	0.00	0.00
14	Mairang	2.39	14.25	3.53	21.05	0.50	3.00
15	Mawkyrwat	0.31	0.54	4.57	8.01	1.41	2.46
16	Nongstoin	0.61	1.77	4.68	13.49	0.26	0.74
17	Mawshynrut	6.04	7.55	8.15	11.79	1.30	3.00
18	Resubelpara	1.61	7.75	1.94	9.36	0.05	0.24
19	Rongjeng	1.49	4.23	2.50	7.12	0.09	0.25
20	Songsak	1.65	8.07	0.91	4.45	0.14	0.67
21	Samanda	2.06	25.29	0.72	8.88	0.11	1.31
22	Dadenggre	2.15	1.08	4.37	5.49	0.02	0.00
23	Selsella	2.53	17.12	6.26	42.39	0.03	0.19
24	Rongram	0.96	0.31	2.96	0.97	0.06	0.02
25	Betasing	0.70	1.70	0.31	0.75	0.00	0.00
26	Zikzak	2.55	14.04	3.19	17.59	0.01	0.05
27	Dalu	1.63	6.77	1.39	5.78	0.05	0.19
28	Baghmara	0.42	1.72	0.83	3.42	0.47	1.95
29	Chokpot	0.40	0.61	0.50	0.77	1.10	1.68
30	Rongara	0.76	1.44	0.53	1.00	0.82	1.57

Source: Directorate of Health Services, Govt. of Meghalaya, 1996

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