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NMSHE NATIONAL MISSION FOR
SUSTAINING THE HIMALAYAN
ECOSYSTEM



State Climate Change Cell, Manipur

Directorate of Environment & Climate Change
Government of Manipur

মহাৰাষ্ট্ৰৰ ৰাজ্যিক সৰ্বস্বত্ব
State Climate Change Cell, Manipur

ANNUAL REPORT

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CONTENTS

CHAPTERS	PARTICULARS	PAGE NO.
Chapter 1	General	1
1.1	Overview of the Climate Change Cell, Manipur	1
1.2	About the host institute	4
1.3	Linkage with the national mission	5
1.4	Objectives	6
1.5	Deliverables	6
1.6	Work plan	7
1.7	Activities and approach	8
1.8	Targets and achievements	10
Chapter 2	Thematic Sectoral Information	13
2.1	Agriculture & its allied sectors	13
2.1.1	Impact of climate variability on agricultural sector	16
2.2	Health sector	17
2.2.1	Interpretation and Analysis	18
2.3	Water resources	20
2.3.1	Rainfall in Manipur	21
2.3.2	Climate change effects on water resources	23
2.4	Forest resources and biodiversity	25
2.4.1	Forest in Manipur	25
2.5	Socio-economic and livelihood	29
Chapter 3	District profile and information	35
3.1	Imphal West	35
3.2	Imphal East	37
3.3	Bishnupur	38
3.4	Thoubal	40
3.5	Churachandpur	41
3.6	Senapati	43
3.7	Tamenglong	45
3.8	Ukhrul	47
3.9	Chandel	48
Chapter 4	Radio programme	51

4.1	7th March, 2018: Community forests of Phayeng village	51
4.2	14th March, 2018: Shifting of agricultural practice	52
4.3	21st March, 2018: Reporting of the workshop on “Empowering Jhumias with secure livelihood: A challenge of Ecological Governance” at Moreh, Manipur	53
4.4	28th March, 2018: Jhum cultivation and its effect on the climate	54
Chapter 5	Workshops and trainings	55
Chapter 6	Reports and publications	60

TABLES

TABLE NO.	PARTICULARS	PAGE NO.
1.1	Targeted activities and linkages with national mission under NAPCC	5
1.2	Target and achievement	10
2.3.1	District wise average seasonal distribution of rainfall of Manipur (2017)	22
2.4.1	District wise forest cover in Manipur (FSI report, 2017)	27
2.4.2	Forest cover change matrix, FSI report, 2017	27
2.4.3	Land use pattern	28
2.5.1	Percentage Contribution of Gross State Domestic Product of Manipur by major sectors at Current and Constant (2011 - 12=100) Prices	30
2.5.2	Percentage Contribution of Net State Domestic Product of Manipur at basic price by major sectors at Current and Constant (2011 -12=100) Prices	31

2.5.3	Poverty Ratio and Number of Poor in Manipur in 2009-10 and 2011-12 based on the Expert Group (Rangarajan) Methodology	32
5.1	List of trainings/workshops conducted during 2017-18	52

FIGURES

FIGURE NO.	PARTICULARS	PAGE NO.
2.1.1	Total crop area in Manipur	14
2.1.2	Area under paddy cultivation in Manipur	14
2.1.3	Yield of rice in Manipur	15
2.1.4	Irrigation of paddy cultivation in 2016-17	15
2.2.1	Percentage distributions of Vector Borne Diseases in Manipur-2016	18
2.2.2	Correlation between rainfall and Malaria	19
2.2.3	Correlation between temperature and acute respiratory	19
2.3.1	District wise annual rainfall in Manipur (2017)	22
2.5.1	Comparison of per capita income between Manipur and all India	31



CHAPTER 1 : GENERAL

1.1 Overview of Climate Change Cell, Manipur

With rugged hills and valleys, the state of Manipur is situated in the far east corner of India. A land rich in floral and faunal diversity and a vast area of forest harbouring many rare and endangered species. The new dawn of globalization and rapid development have encroached upon the natural habitats leading to destruction and degradation of the environment. Existence of many species have become difficult and the survival of human beings is questionable in the long run. Management of natural resources has become a priority to conserve the fragile ecosystem around us. The livelihood of the people has to be ensured throughout but with assurance to protect the ecosystem and conserve the biodiversity. The change in the climate over the years have is impact on all forms of life and it is altering the Himalayan ecosystem which is very important to sustain life as it linked to the maintenance of perennial water sources required for drinking and irrigation purposes for sustaining agriculture which in turn relate to the livelihood of the people.

The North Eastern Region (NER) of India (viz. Upper part of Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim with northern hill station of West Bengal) is subjected to high vulnerability due to the changing climate variability. Such changing scenario is likely to affect the eco-system through increased temperature, altered precipitation patterns, episodes of weather events like drought & flood, and biotic influences. This would not only impact the very sustenance of the indigenous communities in uplands but also the life of downstream dwellers across the region and beyond.





Ecologically sensitive mountainous areas, like the NER including Manipur, are prone to adverse impacts of global climate changes on account of both natural causes and anthropogenic emissions in other parts of the world as well as those arising out of unplanned developmental activities in the region. Some of the significant consequences arising out of such changes could be

- Serious effect to the volumetric flow of water in the streams, rivers, etc.
- loss in biodiversity and unsustainable changes in ecology,
- changing of forests composition,
- Dislocation of traditional societies who were dependent on the natural ecosystem, etc.

Issues on climate change is undergoing for various studies in multidisciplinary approaches including various greenhouse gas emission through global general circulation models (GCM). But it limits to the global consequences of climate change. The consequences of climate change on the social systems are expected to vary from region to region due to their local factors. Therefore, different modeling studies, adaptation strategies and technology systems would be required in differing geographical and social contexts. There are a number of constraints that limit the ability of the knowledge system in the region to deliver the required and expected outcomes for effective response, like

- knowledge gaps and limited information data base on climate science of the Himalayan Ecosystem including North Eastern Region of India;
- poor communication in between and within knowledge generating communities and user communities;
- inadequate knowledge on climate change sensitive issues at certain important sectors viz. agriculture, livelihood, natural ecosystem, health, bio-diversity, etc;
- fragmented knowledge base in terms of people, institutions and capabilities;
- lack of a systemic institutional mechanism for collating, synthesizing and delivering knowledge products for decision-making;

Addressing these constraints and the need for studies on climate change related issues within the Himalayan ecosystem, two specific dedicated missions have already been included in the National Action Plan on Climate Change (NAPCC) with different objectives & goals like

- i. **National Mission for Sustaining the Himalayan Ecosystem (NMSHE)** with primary objective for development of a sustainable National capacity to continuously assess the health status of the Himalayan Ecosystem and enable policy bodies in their policy-formulation functions and assist States in the Indian Himalayan Region with their implementation of actions selected for sustainable development, and



- ii. **National Mission on Strategic Knowledge for Climate Change (NMSKCC)** with the target for development of appropriate institutional, human resource capacity, enhancing the strategic knowledge network for the climate change at different regions of the Nation.

Appropriate efforts are taken up at present in the state of Manipur but are still inadequate to deal with the climate change issues due to lack of integration and networking. Aligning with the above two national mission of NAPCC and to achieve the mission goal in the state, two sectors have been integrated as mission mode in the Manipur State Action Plan on Climate Change namely State Mission on Ecosystem, Biodiversity & Livelihood Sustainability and the State Mission on Climate Change Strategic Knowledge and Information. In this continuation, a dedicated State **Climate Change Cell (C C Cell)** is put in place to facilitate the regional climate information networking system and monitor the consequences of climate change.

The State Climate Change Cell in Manipur is a unit which functions under the roof of the Directorate of Environment, Government of Manipur, the State Nodal Agency for Climate Change. The Cell was established during 2012 to perform the major functions like

- emphasising on the research activities to minimise the data gap, develop policies, conduct case studies on climate change adaptation practices;
- developing resource material and support to the line departments/agencies for functioning of the climate sensitive activities;
- functioning as a disseminating agent for the climate change information by organizing workshops/interaction programmes at different forum/level;
- develop MIS for monitoring various climate change factors and consequences;
- updating agency of the regional climate change database and information;
- advisory services to the society on climate change adaption.

This cell has a research, advisory and coordinating role on climate change issues in the state. It will be a single-window contact for dealing with the state government and other external funding agencies in issues pertaining to climate change related proposed actions. This will be a multi-stakeholder platform which includes NGOs, bi-lateral and multi-lateral agencies, various central as well as state government departments, climate research institutes, individual researchers, etc.



1.2 About the Host Institute:

Being the State Nodal Agency for Climate Change in Manipur, the Directorate of Environment under the Department of Forests and Environment in the Government of Manipur is the host institute of the existing State Climate Change Cell of Manipur. The main functions of the Directorate of Environment in the state are policy planning, conservation, regulation, co-ordination and promotion of environment related issues along with its meaningful application in various developmental programmes to achieve the socio-economic objectives of the State. The Directorate is mandated to enforce the Environment Protection Act, 1986 and its subsequent rules in the state. The office implements many plan schemes, projects, programmes, etc. for advancing mass awareness and protection of the fragile environment in order to maintain a consistent balance between the development programmes and restoration of natural environment of Manipur. Besides these, some of the prime activities of the department are data collection, information dissemination, research and development on the state specific environmental issues. It also extends services to different Government Departments/Academic Institutions/NGOs on Water-Air-Soil quality through its R&D Laboratory, which is considered to be the only referral laboratory in the state.

Recognizing the importance of the climate change vulnerability, its possible impacts and the policy of the National Action Plan On Climate Change (NAPCC), the Directorate of Environment, Government of Manipur, as Nodal Agency, in collaboration with 20 line government departments / agencies of Manipur Government and 22 different local sectoral experts, has prepared the **MANIPUR STATE ACTION PLAN ON CLIMATE CHANGE (SAPCC)**. The main objective of SAPCC is to address the existing as well as future challenges of climate change and take actions to reduce the associated risks and vulnerabilities.

Livelihood





1.3 Linkage with the National Mission of NAPCC and the State Mission of SAPCC:

The objectives and functions of the Cell to achieve the targeted goals are closely linked with the two national missions i.e. NMSHE and NMSKCC as at **Table 1.1**.

Table 1.1: Targeted Activities and Linkages with National Mission under NAPCC

Targeted activities under NMSHE & NMSKCC	Targeted activities under CC Cell, Manipur (reference from SAPCC, Manipur)
Continuous Monitoring of the Eco-system and Data Generation	<ul style="list-style-type: none"> ▪ Documenting district level weather information, estimation of GHG emission and ecosystem profile ▪ Identification of research gap in each identified sectors with review of existing sectoral policies and strategies
Vulnerability Assessment	<ul style="list-style-type: none"> ▪ Study the climate data and project the climate changes for the vulnerability assessment at the regional and local level
Identification of Desirable Adaptation Policies to Improve Regional Sustainability	<ul style="list-style-type: none"> ▪ Development of strategies to improve the livelihood, increase climate change adaptive capacity and appropriate skill development ▪ Study on appropriate land-use planning, sustaining traditional knowledge/practices, sustainable management of natural resources
Sustainable agriculture and food security	<ul style="list-style-type: none"> ▪ Study on mountain farming, modernization of Agricultural practices through agronomic practice, agro-forestry, dry-land horticulture plantation, including multiple farming/relay cropping, etc.
Sustainable forestry	<ul style="list-style-type: none"> ▪ Research extension on use of forest produce for value addition by promoting Agro Forestry, Social Forestry and Urban Forestry ▪ Documentation on rehabilitation of shifting cultivators, restoration of shifting cultivated areas ▪ Inventory and study on sacred groves and forests landscapes
Strengthening of Regional Cooperation	<ul style="list-style-type: none"> ▪ Mapping of the knowledge base and data resources relevant to climate change for mobilization of state specific strategic knowledge ▪ institutional support to the state wide knowledge network amongst the state level institutions
Sustainable Urbanization in Mountain Habitats	<ul style="list-style-type: none"> ▪ Integration of climate change strategies in City Development Plan, existing master plans of state urban development and creation of awareness and interaction on urban education
Solid Waste Management	<ul style="list-style-type: none"> ▪ Research & development on waste management including waste to bio-energy like domestic waste to biogas, electricity, etc.
Water security	<ul style="list-style-type: none"> ▪ Documentation on water resources [Wetland, lakes, rivers, major water bodies] and its conservation practices by the indigenous & community ▪ Research on rain water harvesting at community lands, roof top harvesting, etc. for collection of water sources [integrate to the building by laws]



1.4 Objectives:

The primary objective is to "***develop a resource base climate information network and sustainable capacity for continuous assessment of the ecosystem health so as to enable in policy formulation and implementation of climate sensitive activities***".

Focusing on the primary objectives, the Cell has identified some secondary objectives such as

- i. Development of a wider knowledge network platform for regional climate information & science among the existing different institutions, individuals;
- ii. Connectivity, cooperation and sharing of regional climate information and creation of a regional climate data base information management system;
- iii. Research on vulnerable thematic sectors/sections with risk assessment and prediction of future trends on the potential impact of climate change on the different sectors;
- iv. Evaluation of climate sensitive policy alternatives towards sustainable development of habitat and health of ecosystem;
- v. Understanding and linking the traditional knowledge system for community participation to the climate sensitive activities in adaptation, mitigation and coping;
- vi. Building the capacity of local researchers, planner, executers, communities etc. and encouraging the regional young scientists, who are working on climate change;
- vii. Periodic awareness and trainings to the stakeholders for inclusion of them in designing, planning and implementing the climate sensitive action programmes;
- viii. Evaluation, monitoring and updation of the existing State Action Plan of Climate Change report in dynamic form.

Basing on the above primary and secondary objectives, the Cell has been functioning with a long term objective as "***to position a viable and self-learning climate knowledge networking system to assist the policy makers and the state authorities in the long run***".

1.5 Deliverable:

Some of the major deliverables of the Cell are

- i. Networking and strengthening of regional climate knowledge institutions and individuals researchers/practitioners for sharing and access to knowledge;
- ii. Capacity building and trainings to the stakeholders including government planners & executers, technical experts, young scientists, community practitioners, etc.



- Trainings to the young scientists in areas relevant to Himalayan Eco-system
 - Training system for community based organisations to relate lab findings to real field
 - Training to technical experts of EIA (Environmental Impact Assessment)
 - Capacity building and skill development to the planners and executers
- iii. Development of State level Climate Information System through observational network to monitor the health of Himalayan ecosystem
- Deliberate the updated State level Climate Information System
 - Assessment of climate change vulnerability with modelling and prediction
- iv. Development of a log frame for sustainable management through adaptation, mitigation and coping measures by integrating traditional knowledge and community based management system for sustaining livelihood and protecting ecosystem in place;
- v. Development of the sectoral document of identified sectors under SAPCC and evaluation of the activities of SAPCC by creating a support system in planning and implementation.

1.6 Work Plan:

To achieve the objectives and targeted deliverables, the work plan has been developed as

Task	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Develop district level climate information & its updation																				
Vulnerability and risk assessment at district level																				
Knowledge gap analysis and adaptation policy research																				
Developing training module & identification of stakeholders																				
Institutional capacity building & trainings to the stakeholders																				
Thematic workshops / inter-actions at different sections																				
Preparation of thematic reports & sectoral document of SAPCC																				
Monitoring, evaluation and annual report preparation																				



1.7 Activities and Approach:

The main activity of the Cell is to develop a long term coordinated action programme in the knowledge domain for smooth functioning of the ongoing & upcoming climate sensitive activities through an appropriate institutional mechanism for steering and monitoring. Some of the major target activities of the Cell are

i. Vulnerability and Risk Assessment at district & sub-district level

- Study of climate data/climate exposure mapping
- Vulnerability assessment on Biophysical & socio economic environment
- Developing composite vulnerability index
- Studies on barriers to adaptation
- Disaster risk assessment

ii. R & D, Institutional Capacity Building, Data base generation

- Mapping of climate information/knowledge
- Trainings on causes and impacts of climate change, convergence, different mission and schemes of Government of India/bilateral/multilateral
- Knowledge gap analysis/sectoral policies/strategies
- Down scale climate modeling
- Assessment of traditional knowledge

iii. Strategic Networking, Monitoring & Evaluation (M & E) of SAPCC activities and implementation

- Augmentation of knowledge network & monitoring stations
- Effective monitoring mechanism, self-monitoring including social auditing
- Development of different Institutional framework
- Monitoring of impacts of climate change and of progress in achieving key targets proposed under

iv. Awareness for communities, dissemination

- Climate change sciences & information including causes and impacts
- Adaptation and mitigation strategy
- Building adaptive capacity



Some of the basic approaches to achieve the objectives and target activities are

- ***Identification of vulnerabilities of the resource system to climate and socio-economic changes and for evaluating options of adaptation science;***
 - To achieve this approach, the cell targets to address and measure the gaps in existing ecosystem vulnerability and adaptive capacity of the current institutional and physical structure to deal with climate variations;
 - The Cell is also examining the critical thresholds of vulnerabilities and barriers to adaptation in the resource systems;
 - the trends of socio-economic changes with its cultural implications and potentials for integration of indigenous knowledge systems are also being evaluated;
 - Community based management systems are also being studied for their potential on effective collaboration and participatory approaches with pilot trials;
 - A uniform approach with global datasets, the Cell targets to promote the weather information management system along with the observations and monitoring system;
 - The Cell targets to develop an integrated assessment (IA) framework for enhancing the adaptive capacity of resource planning and management to the impacts of climate change and other socio-economic changes;
 - Finally, the Cell can evolve a framework to integrate sensitivity analysis, vulnerability indicator setting, vulnerability assessment, and adaptation option evaluation.

- ***Enhancing the strategic knowledge system with inputs from various stakeholders inclusive of the communities traditional knowledge and promoting the climate science information network aligning to the global network;***
 - The Cell prioritizes in strengthening the existing local climate related institutions and actions around key thematic areas such as climate modeling and climate projections;
 - The Cell is using existing delivery structures empowered as necessary to develop knowledge portal and provide the information products for use at specific & different levels as an internal knowledge alert system;
 - An open consortium has been created which will enable to promote and share the information, managing the flow of resources, functions in assimilation, synthesis, communication and outreach of strategic knowledge.



1.8 Target and Achievement:
Table 1.2: Target and Achievement

Sl. No.	Target activities	Overall Target (2014-2019)	Target during 2017-18	Status as on 31 st March 2018	Target during 2018-19
1	Thematic Sectoral Information	Updation of the information for all the climate sensitive sectors	Updation with latest achievement of activities & strategies on the 5 (five) Sectors, viz.	Completed and uploaded on website	
			i. Agriculture & its allied		
			ii. Health security		
			iii. Forest Biodiversity		
			iv. Livelihood		
			v. Water resources		
2	Data base Development	Updation and cataloguing of non-numeric and numeric time series database for all the climate sensitive sectors	Updation and data at sub-district level (for vulnerable villages) on	Data at district level is updated till 2017 and some vulnerable village have been identified	
			i. Natural resources (including Flora & Fauna)		
			ii. Weather Data and Climate Events		
			iii. Demographic profile		
			iv. Agricultural Activities		
			v. Health statistics		
3	District profile and information	Updation of the information with village level	Updation of the Basic baseline information of the district with more detail of sub-district information, focusing on vulnerable villages	District profile has been uploaded on website	



4	Climate vulnerable village level information	At all districts	At least 1 (one) each at 5 (five) hill districts	One village each from three district have been identified	
5	Survey and investigation	All the climate change related sector	Focus on Thonglang Akutpa village		
6	Vulnerability and risk assessment	Survey questionnaire	i. District level	In progress	
			ii. Village information sheet		
			iii. Household		
			iv. Thematic questionnaires		
		Data entry template	Develop regional thematic baseline data	In progress	
		Identification of pilot village	2 villages per district		
		Data gap analysis		Updation on all parameter in progress	
Reporting	Quarterly	Prepared			
7	Workshop and Training	District level workshop	One each at all districts	A two days workshop on “Empowering Jhumias with secure livelihood – A challenge of Ecological governance” on 10 th and 11 th March, 2018 at Trade Centre, Moreh, Tengnoupal District, Manipur	
		Annual state level workshop	1 (one) time	One-day Orientation programme for legislators and administrative secretaries on climate Change	



				adaptation at Imperial Hall, Hotel Classic Grande, Manipur on 13 th October, 2017	
		Institutional Capacity building of State Climate Change Cell	Attend workshop & trainings	<ol style="list-style-type: none">1. Training on “Introductio n to GIS and Remote Sensing” from April- June, 20172. Training workshop on “Vulnerabilit y and Risk Assessment” for Sikkim and Manipur at Centre for Sustainable Technologie s, Indian Institute of Science (IISc), Bangalore from 24-27 July, 20173. Need Assessment Workshop on Climate Change Vulnerability Assessment in the Eastern Himalayan States in India from 15th and 16th	



				March, 2018 at IIT- Guwahati	
		Trainings in area relevant to Himalaya Eco-system	Training to Media forum & young media fellowship		
		Training system for community based organization	Media Group		
		Training of technical experts EIA, government officials and young scientists	Govt. official	Trainings of Level 2 : State Level Officers on Climate change on 29 th May 2017 at State Academy for Trainings, Takyel, Imphal West	
		Developing of sector wise training module and awareness materials	Finalization of Training Module	In the process	
8	Report and publication	i. 2 nd Edition of SAPCC report	i. Quarterly CC News letter	Published till March 2017	
		ii. Evaluation report of SAPCC	ii. Annual CC Cell Activities Report 2017-18	Submitted	
		iii. Sectoral document of SAPCC	iii. Evaluation of SAPCC		
		iv. Thematic Reports	iv. Sectoral document	Reviewed	
9	Website Development	Official web site for State Climate Change Cell	Content management	Continuing	



CHAPTER 2 : THEMATIC SECTORAL INFORMATION

The changing climate scenario has a great potential of affecting various sectors and it is important for the State to take measures for adaptation as well as mitigation. As such the Manipur State Action Plan on Climate Change has identified some sectors which have been considered as the most vulnerable to the probable climate change scenario projected for the future. These identified sectors are (i) Agriculture and its allied Sectors, (ii) Health Sector, (iii) Water Resources, (iv) Forests resources and biodiversity and (v) Socio-economic based on source of Livelihood. Following up the previous report on these sectors, the significance changes and the data in all these sectors has been updated and analysed.



2.1 Agriculture and Its Allied Sectors

A large part of our economy depend on agriculture and its allied sectors. For a state like Manipur, where 49.08 % of the total workers population is agriculture based, development of technologies should also be towards sustainable and productive agriculture through blending of traditional and modern technology. Agricultural land occupies around 16.25% of the total geographical area of the State of which 58.23% is confined to the valley area. With the rise in population and more mouths to feed, the agricultural production level of the state need to be increase keeping in mind the changing climate scenario. Agriculture had played an important role in the rise of sedentary human civilization and its development has been driven and defined by greatly different climates, cultures, and technologies.

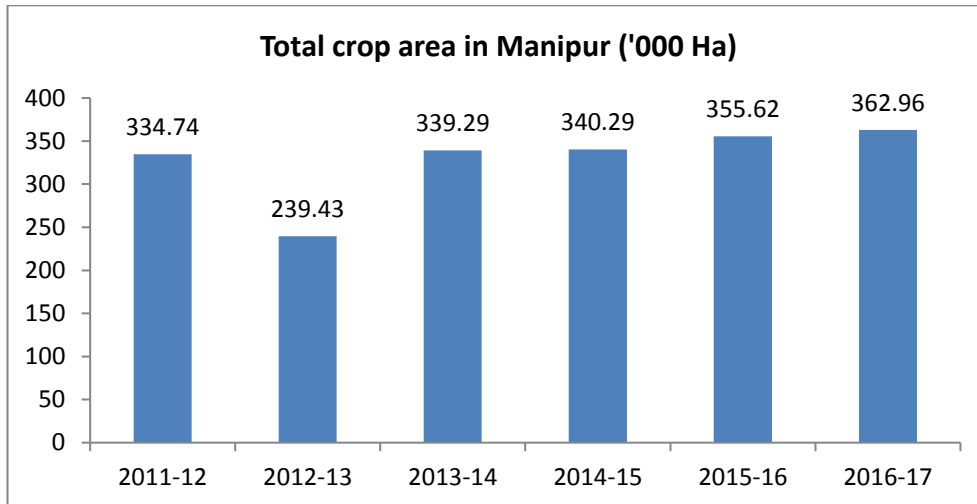


Fig 2.1.1: Total crop area in Manipur

Of the total crop area, most part of it is under rice cultivation which is constantly increasing through the years. The agricultural practices in Manipur are broadly of two distinct types, viz., (i) settled (permanent) farming practiced in the plains, valleys, foothills and terraced slopes and (ii) shifting cultivation (*Jhum*) practiced on the hill slopes.

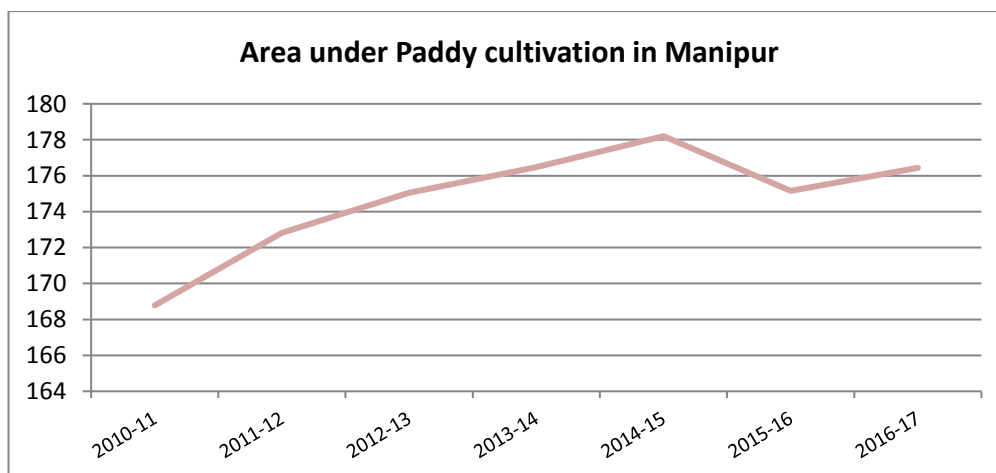


Fig 2.1.2: Area under Paddy cultivation in Manipur

Crops in Manipur can be largely categorized into cereals, pulses, oilseeds and other commercial crops. The main cereal crops in the state are rice and maize while ahar, urd, cowpea, pea, broad beans etc, are the pulses generally grown by the people. Mustard, groundnut, soyabean are the major oilseeds of Manipur. Fruits like pineapple, lime/lemon, banana, orange, papaya, plum are also found in plenty while cauliflower, cabbage, tomato, peas, carrot, pumpkin are the commonly found vegetables of the state.



There are different varieties of rice grown in the state and a number of high yielding varieties are also introduced. The average yield of rice is 2795.85 kg/ha as of 2016-17.

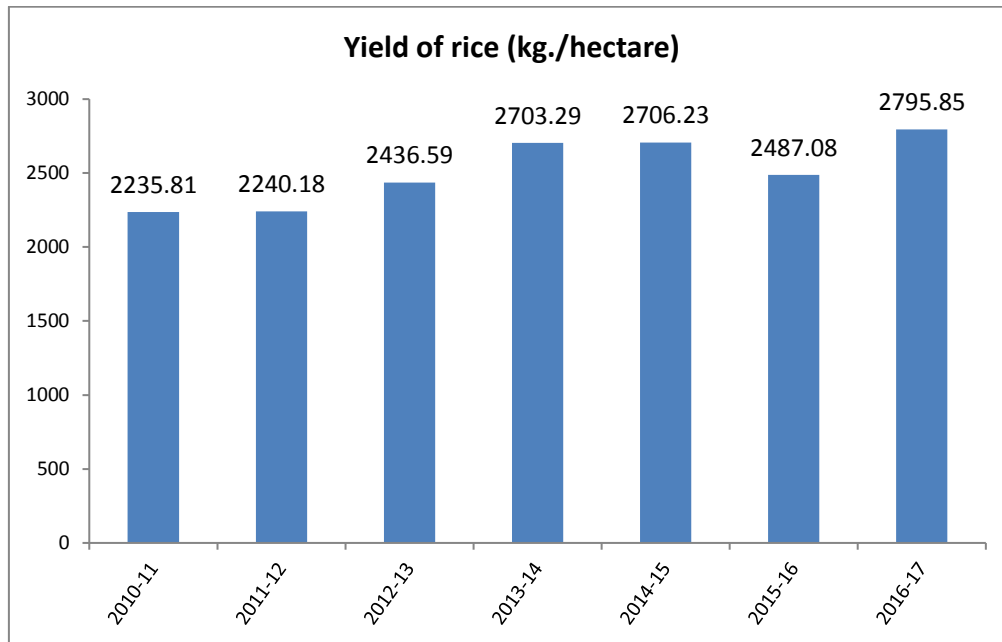


Fig 2.1.3: Yield of rice in Manipur

With the rainfall becoming more irregular, irrigation system of the state need more improvement since the area under irrigation is just 39% of the total area under crop. A large part of the crop area is still un-irrigated.

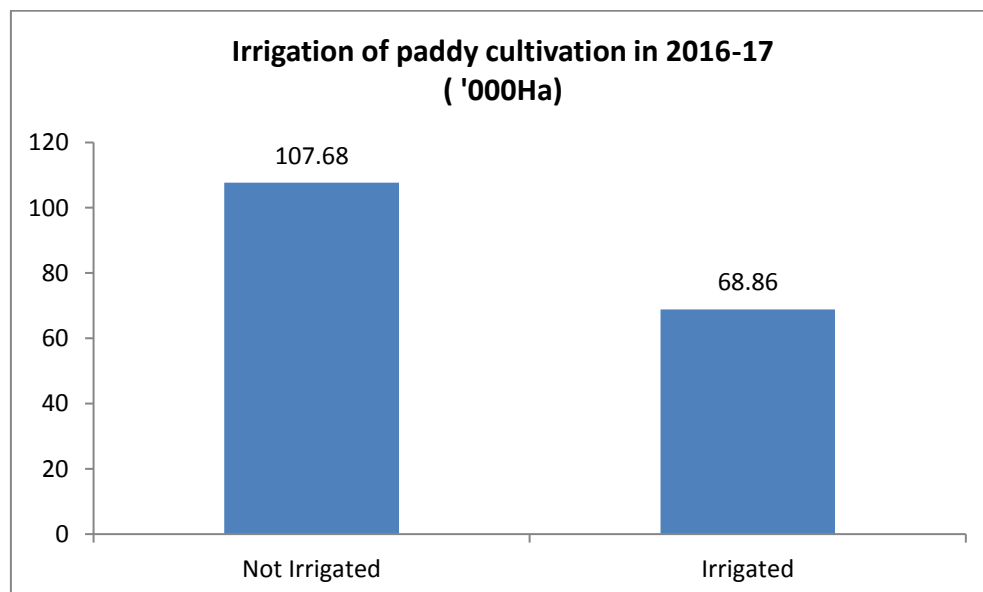


Fig 2.1.4: Irrigation of paddy cultivation in 2016-17



2.1.1 Impact of climate variability on the agricultural sector

The agricultural sector is one of the most important sector that is highly vulnerable to the climate variability. The important parameter that affect the production of agriculture is the rainfall which has become very erratic in the last few years. Climatic conditions and its variability like droughts, floods, tropical cyclones, heavy precipitation events have brought negative impact agricultural production and farmers' livelihood. Climate change may have its negative impact but it is also argued that the increasing CO₂ in the atmosphere can also have certain beneficial aspects in crop production.

Most parts of Manipur indicated to have experienced an increase in both minimum & maximum temperature of $\geq 1.75^{\circ}\text{C}$ and $\geq 1.5^{\circ}\text{C}$ respectively in the last 100 years. The average relative humidity of the state also observed to have increased during the last decades. These changing trends of climate in the state could link in the decreased in crop production because rice yield can be attributed to the increase in temperature and CO₂ concentration coupled with the change in rainfall pattern for the region.

Apart from these, there has been report of certain agricultural activities like changes in crop productivity, phenology and morphology, moisture stress, diminishing soil productivity during the last decades which may be interpreted as an impact of climate change. But to combat these changes, the area under paddy cultivation have been increased and not only that, the yield of the crop has also increased which ultimately led to increased in productivity of paddy in the state. But it has still yet to meet the requirement since the population of the state is also on an increasing trend and the production remains far below the requirement of the state populace.

Combating the impact of climate change on agriculture has become a major problem since 57.04% of the population is engaged in agriculture and its related activities. With majority of the population depending on agriculture for their livelihood and just 1.04% of the total geographical area of the state, it is high time to give more focus on the agricultural sector.



2.2 Health Sector

Changing of climate and its impact may link to health directly and indirectly in many ways through propagation of many diseases like increase in the number of vector borne and water borne diseases, deterioration in nutritional health due to loss of food security. Climate change can further impact population which has a lower capacity to combat the impacts and their access to medical facilities.

Extreme high temperatures contribute directly to deaths from cardiovascular and respiratory disease. High temperatures also raise the levels of ozone and other pollutants in the air that exacerbate cardiovascular and respiratory disease. Pollen and other aeroallergen levels are also higher in extreme heat. Increase in precipitation can lead to health hazards for example; uncontrolled runoff can overwhelm water and sewage treatment plants and septic fields, contaminating drinking water and food crops. Untreated water and contaminated food can cause gastrointestinal illness from bacteria, viruses, protozoa, and chemicals that are hazardous to human health. Extreme rainfall and rising temperatures can also foster the growth of molds and fungi, particularly in the wake of receding floodwaters, resulting in increasing rates of respiratory illnesses in people exposed to them. Increasingly variability in the rainfall patterns are likely to affect the supply of fresh water. A lack of safe water can compromise hygiene and increase the risk of diarrhea disease. Floods are also increasing in frequency and intensity, and is expected to continue increasing throughout the current century.

Increasing temperatures and more variable rainfalls and loss of agricultural land due to flash floods are expected to reduce crop yields. This is likely to threaten the food security in the state. Malnutrition causes both a lack of sufficient nutrients to sustain life and a resulting



vulnerability to infectious diseases such as malaria, diarrhea, and respiratory illnesses. Excessive monsoon rainfall and high humidity identified as a major influence, enhancing mosquito breeding and survival. About 95% population in India resides in malaria endemic areas and 80% of malaria reported in the country is confined to areas consisting 20% of population residing in tribal, hilly, difficult and inaccessible areas.

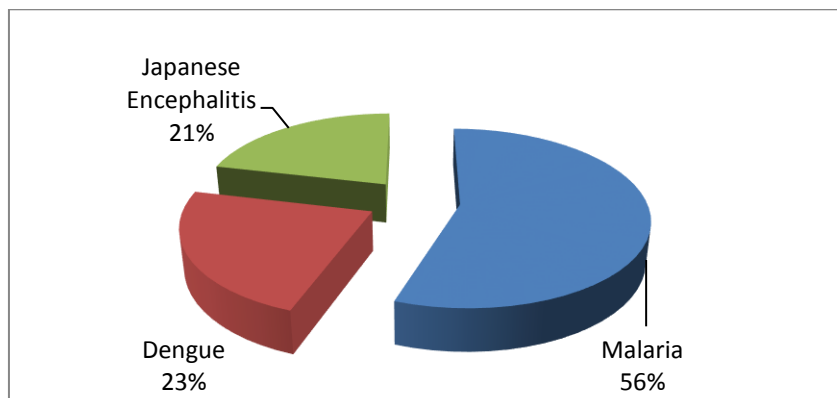


Fig 2.2.1: Percentage distributions of Vector Borne Diseases in Manipur-2016

A changing climate is likely to affect all these conditions and have a powerful impact on human health and well-being. Climate change can affect human health directly (e.g., impacts of thermal stress, death/injury in floods and storms) and indirectly through changes in the ranges of disease vectors (e.g., mosquitoes), water-borne pathogens, water quality, air quality, and food availability and quality. Human beings are already exposed to short and long term health risks of climate variability and change. Climate-sensitive diseases and health conditions today kill millions. Climate change threatens to increase disease burdens and erode the environmental conditions that support good health and well-being of mankind. The changing climate is linked to increases in a wide range of non-communicable and infectious diseases. There are complex ways in which climatic factors (like temperature, humidity, precipitation and extreme weather events) can directly or indirectly affect the prevalence of disease.

2.2.1 Interpretation and Analysis

The graph shows the decreasing trend of correlation between rainfall and malaria cases from the past 7 years. However, drastic increase is seen in malaria cases in 2006 while there is very low rainfall is recorded.

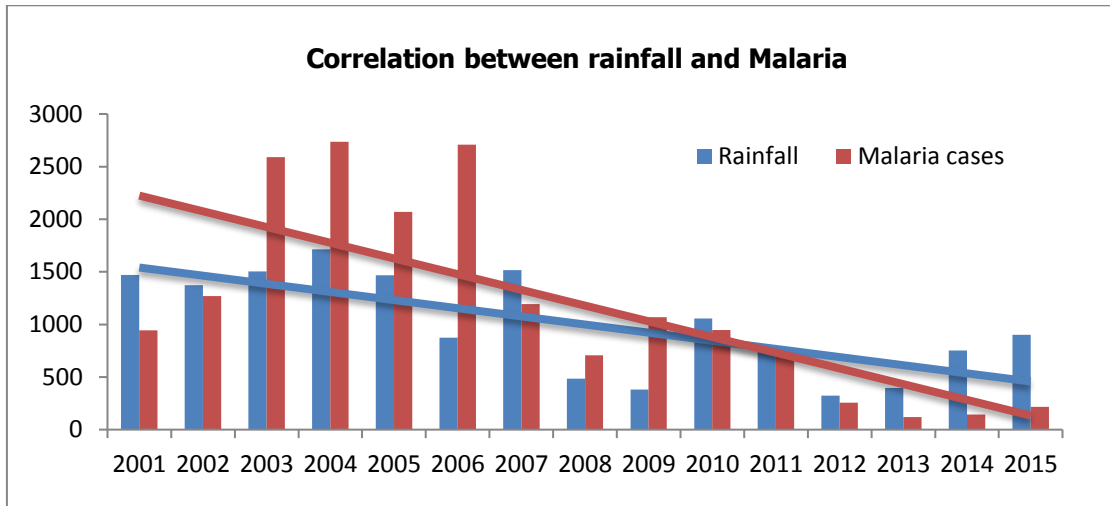


Figure 2.2.2: Correlation between rainfall and Malaria

The current Correlation between temperature and acute respiratory infection of 9 years is presented in the graph below:

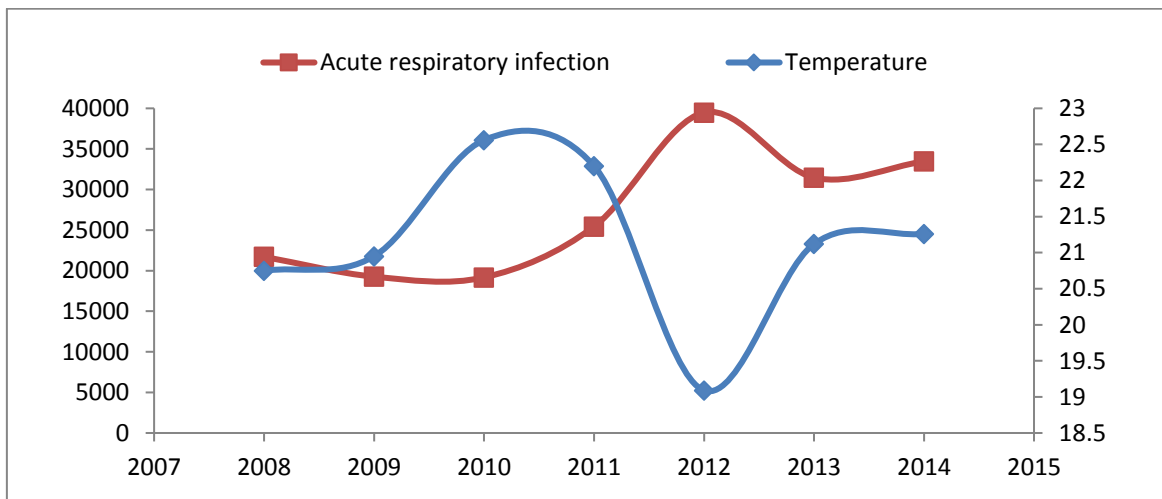


Figure 2.2.3: Correlation between temperature and acute respiratory

The changing climate is linked to increase in a wide range of non-communicable and infectious diseases. There are complex ways in which climatic factors like temperature, humidity, precipitation and extreme weather events can directly or indirectly affect the prevalence of disease. Climate change can affect human health directly (e.g., impacts of death/injury in floods and storms) and indirectly through changes in the ranges of disease vectors (mosquitoes), water-borne pathogens, water quality, air quality and food shortage. Human beings are already exposed to short and long term health risks of climate variability and change. A changing climate is likely to affect the various conditions of air and water pollution and vector-borne diseases which in turn will have an adverse impact on human health and well-being.



2.3 Water Resources

The water resources and the hydrologic cycle is a very inseparable component of climate change. The climatic factors mainly rainfall and temperature changes affect the water resources by altering the water cycle which will have a direct effect on the evaporation, runoff, soil humidity and so on. Climate change will definitely change the hydrologic cycle thereby resulting in the redistribution of water resources in time and space. At the same time, the water resources system changes will affect the local climate, and will exacerbate climate change in a certain extent. Water resources are important essence for the survival of both society as well as the ecosystems. For the sustenance of our health, a reliable, clean supply of drinking water is essential in addition to the water required in different sectors such as agriculture, energy production, navigation, recreation, and manufacturing. In addition to the various anthropogenic factors which put pressure on the water resources, climate change is likely to exacerbate stresses on the depleting resources.

According to the National Wetland Inventory and Assessment published by the Space Application Centre, Manipur is reported to have 15 major rivers / streams having 166.77 sq. km. of total area i.e. about 0.75 % of the total geographical area of the state.

The Barak basin and the Manipur river basin comprised the main river basins of the state. The Barak River of the Barak basin originates from the hills of the northern parts of Manipur and ultimately drains into the Cachar district of Assam without passing through the valley areas of the State. Thereby it does not affect the valley as far as floods are concern.



The main drainage channel of the Manipur valley is the Manipur river which flows towards Burma through the southern hills. The major rivers of this basin are Imphal/Manipur, Iril, Thoubal, Nambul, Wangjing, Sekmai, Kongba, Khuga etc. The Imphal river originates from the hills of Kangpokpi about 45 kms from Imphal and is joined by Iril river at Lilong, 10 kms south of Imphal and by Thoubal river at the Irong Ichin near Mayang Imphal and the Sekmai river at Sekmai jin. From this point onwards the Imphal river is known as Manipur River. The Khuga river joins the Manipur river near Ithai, upstream of Ithai barrage. The Manipur river is linked to the Loktak lake through a natural cut known as Khordak. The biggest freshwater lake, the Loktak lake covering an area of 216 sq. kms plays a major role in the hydrological system of the state. All the rivers which originate from the western hills namely Nambul, Merakhong, Nambol, Thongjaorok, Ningthoukhong, Potsangbam, Khujairok, Moirang river etc. drain into the lake with many other small streams and streamlets. Other lakes such as Ikokpat, Kharungpat, Lamjaopat, Pumlapat situated on the left side of the Manipur river are also connected to the river through a number of natural drainages. All these major lakes act as flood reservoir of the rivers.

All the riverine system of the state originates from the hills and as a result their flows depend on the annual monsoon. Even though Manipur receives high rainfall acute shortage of water is also faced by the region particularly during dry / lean season i.e. January - May every year. Ecological changes such as deforestation and traditional jhum cultivation practices in the upper catchment areas of the rivers, reclamation of low lying areas which served the purpose of flood reservoirs and inadequate carrying capacity of the rivers have also disturb the hydrologic cycle. The problem is further aggravated due to the climate variability, as a result, the state is also facing erratic monsoon for the past few years resulting in shortage of water supply every year.

2.3.1 Rainfall in Manipur

Manipur received average annual rainfall readings of 1116 mm in 1972 and 2646 mm in 1983 and 2887.6 mm in 1995 from the South West (SW) and North East (NE) monsoons. However, overall average total rainfall during the last 6 decades (1961-2010) was 1435 mm. Most of the districts of Manipur experienced a decrease in precipitation in the last few years. As per record obtained from the Directorate of Environment, Government of Manipur, average total rainfall available for Imphal West district during the last 4 decades (1970-2010) was 1324.33 mm. In 2017, the annual average rainfall of Manipur was recorded as 906 mm, which is way too low to be called a high intensity rainfall area. The distribution of the annual rainfall (figure) widely varies with Bishnupur district recording just 69.1 mm while Ukhrul recorded the highest at



2091.47 mm for the year 2017. The seasonal rainfall distribution of the districts is shown in Table below.

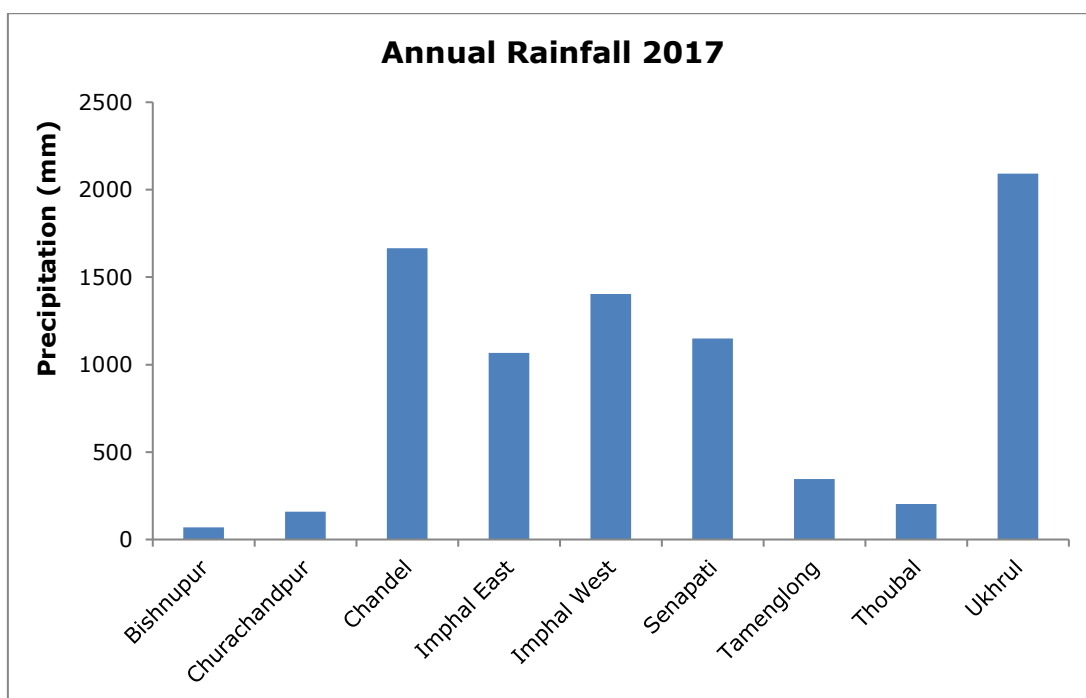


Fig 2.3.1: District wise annual rainfall in Manipur (2017)

Table 2.3.1: District wise average seasonal distribution of rainfall of Manipur (2017)

District	Winter (Jan to Feb)	Pre-monsoon (March to May)	Monsoon (June to Sept)	Post monsoon (Oct to Dec)	Total
Bishnupur	0	22.5	3.4	43.2	69.1
Churachandpur	37.4	59.07	10.4	53.01	159.88
Chandel	0	59.49	1401.2	204.9	1665.59
Imphal East	23.28	141.64	716.44	186.02	1067.38
Imphal West	186.6	377.91	660.75	178.7	1403.96
Senapati	125.2	248.15	576.6	198.41	1148.36
Tamenglong	5.6	186.34	70	83.95	345.89
Thoubal	3	18.58	164	17.2	202.78
Ukhrul	0	26.27	1972	93.2	2091.47



2.3.2 Climate change effects on water resources

i. Floods

In Manipur, flash floods are common phenomena mostly in the Imphal valley areas during rainy season due to poor drainage conditions, overflowing of rivers, caused by uncontrolled rainwater run-off in the hills owing to denudation of forests. The major floods experienced by the state of Manipur had occurred in the year 1952, 1965, 1966, 1974, 1980, 1984, 1985, 1986 while the most devastating one occurred in the year 1989 which had inundated almost all of the Imphal valley. However, occurrence of floods continued in 1992, 1997, 1998, 1999, 2000, 2001, 2002, 2015 and 2017 which caused heavy damage to properties, crops, and loss of human lives and miseries in the state. The primary causes of flood in Manipur valley are increased urbanization, change in land use patterns resulting in the destruction of basins in the valley, high intensity of rainfall in the hilly areas, which are the upper catchments areas of various rivers draining the valley during the rainy season, and heavy runoff and low infiltration in degraded watersheds in the upper reaches of the rivers resulting in flash floods, poor drainage systems, breaching of river banks, in adequacies of channel conveyances, in adequacies of flood protection works and blocking of rivers.

There are many vulnerable points along the river banks of major rivers of Manipur valley and in these areas, erosion, sliding, depression or slumping of banks and bank cracks are quite common causing breach of river banks at these vulnerable points during high peak flood stages of the rivers. At least 11 vulnerable points in Imphal river, 14 in Thoubal river and 5 in Iril river were identified as per the survey report of the Manipur Science and Technology Council. The rapid increase in the valley's built areas is also an important factor for the recent increase in flash floods in urban areas.

ii. Droughts

The erratic rainfall pattern of the state has increased leading to occurrence of floods on one hand and droughts on the other. The loss of forest cover due to large scale deforestation coupled with the diminishing rainfall has led the state towards a drought scenario. In 2009, all the nine districts of the State were affected by drought and the whole state was declared as a drought state by the State Government of Manipur. A rainfall deficit of 49 percent was reported upto the end of July, 2009. Around 1.02 lakh hectares were left unsown out of the total kharif crop area of 2.34 lakh hectare.



The vicious cycle between climate change and water is sure to increase drastically in the years to come. As such management of the water resources in an integrated manner would be essential as it would affect the social, economic as well as the environment. Water use efficiency should be increased by optimizing the water use with the help of different government agencies to continue availability of water for various purposes. Rainwater harvesting can be one of the alternatives for meeting the acute shortage of water requirements that has been a prominent problem being faced by the people of the State during the past few decades. Rooftop rain water harvesting can be adopted to augment shortage of water supply system to the people because the uncertain and intense rainfall received could be easily harvested in many houses already have GI sheet-covered sloping roof tops, and installing a collection tank for storage and collection could be made. Strategies should be formulated on water resources utilization and conservation under the State Action Plan on Climate Change to ensure integrated water resource management including conservation and protection for improvement of water resources, minimize wastage and more equitable distribution both across and within the state.



2.4 Forest Resources and Biodiversity

Manipur has its own unique setting within the Eastern Himalayan region representing many angiospermic flowering plants, medicinal plants, different kinds of edible fungi, orchids, bamboos, fishes, migratory birds and a multitude of low and high altitude butterflies. Presently, many of the species are on the verge of extinction due to the extensive process of forest fragmentation, degradation, deforestation, climate variability and change. Therefore, conservation of forests is the primary duty of the people in order to maintain the ecological process in balance. The conservation of forest not only helps in maintaining the ecological balance but also the environmental stability, biodiversity protection, food security and sustainable development of a given environment. They are the natural beauty on the earth which is very necessary to be conserved to go everything in balance.

2.4.1 Forest in Manipur

Manipur covers an area of 22,327 km² which constitute 0.68% of the geographical area of the country. It is bounded by Nagaland in the north, Mizoram in the south west, Myanmar in the east and south and Assam in the west respectively. The average altitude of the valley is 760m above sea level while the maximum altitude reaches up to 3000m in the upper ranges. Loktak, the largest fresh water lake in the north eastern regions lies in the south of the Imphal valley covering the only floating National park in the world, the Keibul Lamjao National park. Mount Tenipu (2994m) on the Barail Range is the highest peak in Manipur. The lowest elevation lies at the confluence of the Barak and Jiri rivers (40m) near the Assam border. The climate is tropical monsoon type with hot wet summer and a cool dry winter, although winter rains are not uncommon. The annual rainfall of the state varies from about 1250 mm to more



than 2700 mm. The annual temperature generally ranges from 14.5°C to 38°C in summer. Forest is divided according to the different altitudes (above 3000 MSL) and belongs to 5 types of forest groups (ISFR, report) such as Tropical Semi – evergreen Forests (24.82 % of total state forest), Tropical Moist Deciduous Forests (3.05 % of the state forest), Subtropical Broadleaved Hill Forests (52.94 % of the state forest); Subtropical Pine Forests (8.4 % of the state forest), and Montane Wet Temperate Forest (10.46 % of the state forest). Tropical wet evergreen and semi-evergreen forests occur in patches in the lower and middle elevations throughout, except in the central valley plains. In the higher hills, subtropical broadleaf (evergreen) forest occurs with small areas of conifers in the eastern areas. Temperate broadleaf forest is found higher up in Mt Tenipu. Owing to logging and *jhum* (slash-and-burn shifting cultivation), large areas is being replaced by bamboo, especially in older abandoned *jhums*. The only grassland of significance is found in Keibul Lamjao National Park. These grasslands are on floating mats of vegetation, locally called phumdi, composed of decaying organic matters. The state falls under the Indo Burma global biodiversity hotspot and the eastern Himalayas endemic bird area. The existing protected area network covers 757.6 km² or 3.4 % of Manipur. The protected areas in the state are Keibul Lamjao National Park (40 km²), Shirui Hill National Park (41 km²), Bunning Wildlife Sanctuary (115.8 km²), Jiri Makru Wildlife Sanctuary (198 km²), Kailam Wildlife Sanctuary (157.8 km²), Yangoupokpi Lokchao Wildlife Sanctuary (184 km²) and Zeilad Wildlife Sanctuary (21 km²) (source: Forest dept). Besides the protected areas, wetland is another storehouse for the conservation of diverse floral and faunal species. It is a unique area with features all their own that change from season to season. They are considered as land areas covered by water some or all the time. Wetland can store significant amount of carbon playing a vital role in climate change mitigation strategies. Wetlands include marshes, swamps, bogs, meadows, sloughs, potholes and river overflows lands. Important examples of wetlands in the state are Ikokpat, Yaralpat, Kakwapat and Poiroupat.

Based on interpretation of satellite data, the forest cover in the state is 17,346 sqkm which is 77.69% of the State geographical area. In terms of forest canopy density classes, the state has 908 sq km under very dense forest, 6510 sq km under moderately dense forest and 9928 sq km under open forest.



Table 2.4.1: District wise forest cover in Manipur (FSI report, 2017)

District	Geographical area	Very dense forest	Moderate dense forest	Open forest	total	% of GA	Change	scrub
Bishnupur	496	0	1	21	22	4.44	0	2
Chandel	3313	11	970	2907	2907	87.75	17	120
Churachandpur	4570	42	1663	4169	4169	91.23	-17	143
Imphal east	709	0	61	278	278	39.21	-2	15
Imphal west	519	0	16	54	54	10.40	-1	9
Senapati	3271	272	751	2184	2184	66.77	102	285
Tamenglong	4391	390	1754	1809	3953	90.03	13	152
Thoubal	514	0	2	71	73	14.20	0	11
Ukhrul	4544	193	1292	2221	3706	81.56	151	374
Total	22327	908	6510	9928	17346	77.69	263	1111

Table 2.4.2: Forest cover change matrix, FSI report, 2017

Class	2017 Assessment			Total ISFR 2015 updated		
	VDF	MDF	OF	SCRUB	NF	
Very dense forest	682	41	5	0	1	729
Moderately dense forest	208	5276	417	10	53	5964
Open forest	18	1142	8852	100	278	10390
Scrub	0	26	458	601	97	1182
Non forest	0	25	196	400	3441	4062
Total ISFR	908	6510	9928	1111	3870	22327
Net change	179	546	-462	-71	-192	



Table 2.4.3: Land use pattern

Land use types	Area (in 000'ha)	Percentages
Total Geographic area	2233	Nil
Reporting area for land utilization	2111	100
Forests	1699	80.48
Not available for land cultivation	27	1.28
Permanent pastures and other grazing lands	1	0.05
Land under misc, tree, crops and groves	6	0.28
Culturable wasteland	1	0.05
Fallow land other than current fallows	0	0
Current fallows	0	0
Net area sown	377	17.86

(Source: FSI report, 2017)

Forests play an important role in natural phenomenon which stabilizes the climate on earth. They form the source of livelihood to all living beings by providing watershed, habitat and ecosystems, economic benefits, and control of climate change along with carbon sequestration as co-benefit. The net increase of 263 sq km observed in the FSI report, 2017 is a good sign of conservation and plantation activities as well as re growth in shifting cultivation areas. Through their destruction, forests can be serious sources of greenhouse gases and through their sustainable management they can be important sinks of the same gases.



2.5 Socio-economic and Livelihood

Socio economic condition of a region is an important determinant of measuring the real quality of life and welfare of the region. The main indicators of socio-economic status include Gross State Domestic Product (GSDP), Net State Domestic Product (NSDP), Net Per Capita Income (PCI), and the level of Deprivation etc. Further, percentages of Houseless, Slum Population, Poverty Rate, Rural and Urban Poverty, Unemployment Rate, Rural and Urban Unemployment Rate, Illiteracy Rate, Rural and Urban Illiteracy Rate, Male and Female Illiteracy Rate, Percent of Scheduled Caste Population, Scheduled Tribe Population, Household and Land Holdings size, Population Growth and Density are some of the indicators for Socio-Economic Deprivation study. Socio-economic status (SES) often have profound effects on environment and climate change and its impacts due to the differences in ability to access everyday life choices that are associated with income, education, work participation and the social structure. Manipur is characterised with low socio-economic status which is a risk factor for climate change.

Gross State Domestic Product: Gross State Domestic Product (GSDP) is one of the economic indicators to measure the growth and structural changes in the economy of the state. The Gross Domestic Product of the state in absolute term has been increasing over the years. However, there have been some fluctuations in the composition of State Domestic



Product. About two thirds of the GDP at constant prices is contributed by tertiary sectors. There has been a slight decrease of about 2% during the period 2014-15 in the share of tertiary sector to GDP.

Table 2.5.1: Percentage Contribution of Gross State value added of Manipur at basic price by major sectors at Current and Constant (2011 -12=100) Prices

Year	At current prices				At constant (2011 -12=100) prices			
	Primary Sector	Secondary Sector	Tertiary Sector	Total	Primary Sector	Secondary Sector	Tertiary Sector	Total
2011-12	19.77	15.39	64.84	100	19.77	15.39	64.84	100
2012-13	21.65	14.01	64.34	100	21.30	14.16	64.54	100
2013-14	22.02	13.54	64.44	100	20.88	14.98	64.14	100
2014-15	22.41	14.87	62.72	100	19.85	17.23	62.92	100
2015-16(Q)	21.20	14.55	64.25	100	17.58	17.24	65.18	100
2016-17(A)	21.48	13.74	64.78	100	16.93	18.03	65.04	100
2017-18(P)	21.70	13.82	64.48	100	16.26	18.90	64.84	100

Q: Quick Estimates

A: Advance Estimates

P: Projected Estimates

Source: Economic Survey Manipur, 2017-18

Net State domestic Product: Annual growth of Net State domestic product (NSDP) of Manipur at current prices in different sectors indicates a fluctuating trend in all the three sectors during the period 2011-12 to 2017-18. Secondary sector shows the lowest growth trend during the seven year period.

The trend at current prices shows that there was a sharp decrease in the annual growth rate from 2014-15 to 2015-16 (13.72 % to 6.83%). In case of price at constant, there is abruptly increase in annual growth rate from 2012-13 to 2013-2014 (0.12% to 8.72%). Among many factors that are responsible for these fluctuations, climate change too could be playing a major role as most of the primary sectors are climate sensitive. In sectoral composition of NSDP, the percentages of primary sectors for both the current and constant prices are slightly decreases from the conjugative years 2012-13 to 2017-18.



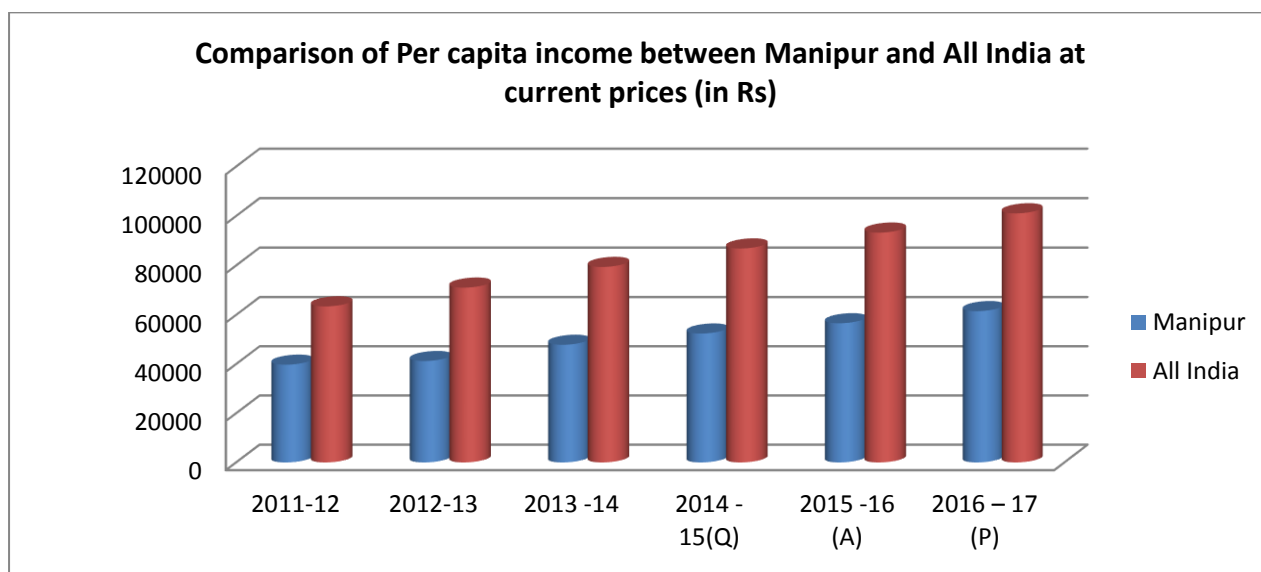
Table 2.5.2: Percentage Contribution of Net State Domestic Product of Manipur at basic price by major sectors at Current and Constant (2011 -12=100) Prices

Year	At current prices				At constant (2011 -12=100) prices			
	Primary Sector	Secondary Sector	Tertiary Sector	Total	Primary Sector	Secondary Sector	Tertiary Sector	Total
2011-12	20.39	14.89	64.72	100	20.39	14.89	64.72	100
2012-13	22.34	13.39	64.27	100	22.01	13.53	64.46	100
2013-14	22.69	12.85	64.46	100	21.59	14.40	64.01	100
2014-15	22.85	14.52	62.73	100	20.14	17.04	62.82	100
2015-16(Q)	21.32	14.14	64.54	100	17.50	16.97	65.53	100
2016-17(A)	21.42	14.44	64.14	100	16.69	17.80	65.51	100
2017-18(P)	21.51	14.78	63.71	100	15.88	18.62	65.45	100

Q: Quick Estimates A: Advance Estimates P: Projected Estimates

Source: Economic Survey Manipur, 2017-18

Net Per Capita Income: Per capita income indicating the economic welfare of the state at current and constant prices in 2017-18 (P) is estimated to be Rs. 67,586 and Rs 50,279 respectively showing a decrease amount from the previous year. Per capita income at current prices in absolute amount of Manipur is much lower than that of All India level throughout the period 2011-12 to 2016-17. The level of per capita income is one of the main economic indicators of vulnerability to climate change impacts. The lower the per capita income the higher is the vulnerability. As per the statistical year book of Manipur, 2016, per capita income of Manipur lies at the lowest among all the North Eastern States.



Q: Quick Estimates A: Advanced Estimates P: Projected estimates

Source: Economic Survey Manipur, 2016-17

Fig 2.5.1: Comparison of Per capita income between Manipur and All India



Poverty: Poverty has a close association with climate change. According to the new poverty estimates recommended by the Rangarajan’s committee translated a monthly per capita consumption expenditure of Rs 1185.19 and Rs 1561.77 respectively in rural and urban areas of Manipur in 2011-12. At the national level, 30.9% in rural and 26.4% in urban areas with a total of 29.5% population are under poverty line. It is striking to note that Manipur has the highest proportion of urban poor in the whole country in 2011-12, with 73.4% of the urban population below poverty line. The poverty ratio in the rural areas even though, decreases from 44.4% in 2009-10 to 34.9% in 2011-12; it is higher than the national level and is still one among the highest in the country. It is spectacular from the fact that Manipur has the overall second highest incidence of poverty next only to Chhattisgarh, with 46.7 % of the population below the poverty line in 2010-11. Even though poverty ratio of Manipur from 2009-10 to 2011-12 shows a slight decrease, 12.9 Lakhs of persons are still living below poverty line. The incidence of poverty in the state itself indicates the magnitude of the high vulnerability of climate change and its impacts on the people.

Work participation: As per 2011 census, the work participation rate of Manipur is 45.1% and out of which 73.8% are main workers and 26.2% are marginal workers. Among the marginal workers, about 79 % work for a period of 3 to 6 months in a year whereas 21 % works less than 3 months a year.

Table 2.5.3: Poverty Ratio and Number of Poor in Manipur in 2009-10 and 2011-12 based on the Expert Group (Rangarajan) Methodology

Year	Rural		Urban		Combined	
	% of persons	No. of Persons (lakhs)	% of persons	No. of Persons (lakhs)	% of persons	No. of Persons (lakhs)
2009-10	44.4	8.3	76.7	6.1	54.1	14.4
2011-12	34.9	6.7	73.4	6.3	46.7	12.9

Housing facilities: Housing condition of Manipur shows nearly 57%of the rural households and 58% of the urban households lived in semi-pucca structures while nearly 7% of the urban households and 27% of the rural households lived in kutccha structures (According to NSS 65th round). Moreover, about 45% of the households in rural areas and 33% in urban areas had open kutccha drainage whereas nearly 50% of the households in rural areas and 39% in



urban areas had no drainage arrangement. Garbage disposal arrangement was also not available to 52% of rural households against 34 % of the urban households.

Basic amenities: Availability of basic amenities of the households is another significant economic measure to understand the standard of living of the people. As source of drinking water in the State only 38.8% of the households' avail taps facility (2011 census) while 13.3% households use wells, hand pumps or tube wells, the rest majority of the households (47.1 %) depends on other sources for drinking water. Shortage of drinking water reached a peak during March in rural areas and January in urban areas. Only 46.6% of the households of the state's use sanitary latrine while 10% defecate in the open, the rest use other types of non-sanitary latrines like pit etc. In terms of source of lighting, while one-fourth of the households use kerosene, 68.3% has electricity, with the rest depending on other sources. About 48.10% of the households of the state use firewood for cooking purposes. Use of non- sanitary latrines, use of kerosene as source of lighting and households depending on other sources of drinking water other than tap, wells and hand-pump etc. are more vulnerable to climate change and its impacts. Lack of connectivity and mobility increases the level of vulnerability.

Demographic and social factors: Demography is another important factor that determines climate change. Population of Manipur as per 2011 census stands at 28,55,794 which continues to be predominantly rural, with rural population constituting about two third of the total population. Increase in population is one important factor that gives pressure on land for settlement and for farming purposes. The state has an agrarian economy and the bulk of population depends mostly on agriculture for their livelihood. About 35% to the State's total population is contributed by 34 scheduled tribal groups whereas about 4% of the state population belongs to Scheduled caste. The tribal largely depend on forests and forests resources which are degrading over time. Urbanisation in the valley districts and shifting cultivation in the hill districts are important drivers of climate change in the State. Urban population of Manipur has increased by 0.3 million between 2001 and 2011 with a decadal growth of 43%. About 70 % of the area under paddy cultivation in the hill districts is covered under shifting cultivation in the year 2014-15 which is not a sustainable mode of cultivation. The problem of shifting cultivation has become acute due to the compulsion of the shortening of the jhum cycle from about 10 years to a bare 3 years now.

The socio-economic condition of the state is characterised with low per-capita income, high incidence of poverty, rapid growth of population, high proportion of marginal workers, limited access to basic amenities, unsustainable use of resources etc. These socio-economic factors,



on one hand contribute immensely to the cause of climate change. On the other hand, climate change makes the people with low socio-economic condition more vulnerable to its impacts. Raising socio-economic status of the region could be one of the main effective measures to climate change and its adverse effects.



CHAPTER 3 : DISTRICT PROFILE AND INFORMATION

Based on the detailed information on climate change occurring from the grass root level, a reliable and accurate climate change database could be constructed for the state as a whole. In order to achieve this goal, every aspect of the district either geographical, socio-economical or any other factor which may be related to climate change in the long run needs to be monitored. Thus, maintaining a district profile which gives a brief but comprehensive account of a district's geography, economy and social structure to provide the necessary background information to understand the history, importance, location, climate and administrative structure of the district is very essential. The district profiles of the various districts are given below.

3.1 Imphal West

Imphal West district was created a district on 17th June, 1997 under the Manipur Land Revenue and Land Reforms Act of 1960. The formation of the district make the sub division bifurcated into two each namely Lamshang and Patsoi sub division in the Imphal West I sub division while Lamphelpat and Wangoi sub division in the Imphal West II sub division. The district is again divided into two community development blocks (CDBs) namely the Imphal West I C.D.Block and Imphal West II C.D.Block. The sub-divisions are further divided into ten circles. Lamshang sub-division has 3 circles (Sekmai, Lamshang and Salam), Patsoi sub-division has 2 circles (Konhoujam and Patsoi), Lamphelpat sub-division has one circle (Lamphel Central) and Wangoi sub-division has 4 circles (Wangoi, Mayang Imphal, Hiyangthang and Lilong). The district is occupied by many community including the Meiteis, Nagas, Kuki-Chin-Mizo and Gorkhas groups and Muslims and other indigenous group which lived in complete harmony for centuries. These are the people whose folklore, myths and legends, dances, indigenous games and martial arts, exotic handlooms and handicrafts are invested with the mystic of nature. The district is also rich in tourism sector. There are many tourist spots in the Imphal west which attracts the tourist. Geographically, the district is located at the centre of the state, the Manipur, covering an area of 519 sq kms. The GPS location for the valley is calculated as 25, 5, 31.9N to 94, 8, 49.3E with 790 metre above mean sea level. The region is mainly consists of alluvial and loamy soil. The soils are made up of shallow black, brown and alluvial soils. It is believe that the Imphal West district was once covered with swamps and marshy lands regarding the names of some famous place like Lamphelpat, Takyelpat, Khonghampat, Kakwapat, Poiroupat (Pat means lake in local dialect). Some of the major rivers flowing in the district are Imphal river, Nambul river etc. The



Nambul River is made up of a number of small streams on its upper course. The course of the river is short and its outlet falls on the Loktak Lake. The Water from these two rivers and their tributaries are used for domestic, irrigational and other purposes. Both the Imphal and Nambul rivers are seasonal type. They are fully filled only during the monsoon season and almost dried up in the dry season. Ground water resource is also available in the district. Various wetlands are also found in the district. The wetland area found in the district is found to be 84.18 sq km or 13.27% of the total wetland area covered while the total crop area in the district is calculated as 345.8. The forest cover of Imphal West district is recorded as 56 and others as 78.02 which leads to the total land use pattern of the district as 559.

Demographically, the district is calculated as one of the most urbanized and densely populated district in the whole state. The district has a total population of 517992 with male population of 255054 and female population of 262938 respectively. The literacy rate in the district is 86.08% while the sex ratio is recorded as 99.05%. The population density in the Imphal West district is recorded as 992. Most of the people in the district are incorporated as workers, 41.19% of the total population in comparison with other districts Imphal West district is progressed in industrial handloom and handicrafts and other traditional cottage and small scale industries; however constitute the bulk of the industrial units. Important products which are manufactured both for local needs and export are bed sheet, pillow cover, shawl, scarf, mosquito net, curtain, phanek (loincloth for women), etc. of various designs and colours. Blacksmith, Jewellery, cane and bamboo works are another important work on cottage industries. In the small scale sector, there are industries like carpentry and wooden furniture, saw mill, rice and flour mill, iron and steel works, repairing of cycles and automobiles, tailoring and embroidery, tyre retreating and vulcanising, etc. The economy of the district is agrarian in nature; the agricultural product is also one of the economic parameter of the district. In spite of the above, many education facilities and infrastructure are abundantly available in this part of the district. Primary schools, middle school, secondary, higher secondary, colleges and university are available in the Imphal district itself.

Health is a major issue for the whole district and now a days many private and public facilities are established in the districts including the Regional institute of medical science, lamphel. With the rising of urban population, decadel growth and other institution and technology are developed in the Imphal west district; the district is regarded as one of the urbanized districts in the whole state.



3.2 Imphal East

Imphal East district came into existence after the division of the Imphal district into two separate districts under the name Imphal East and Imphal West on 18th June, 1997. The district is a valley district having a geographical area of 709 sq.km. Its coordinates of location are 25°5'31.995"N to 24°39'45.25"N latitude and 94°8'49.324"E to 93°53'47.559"E longitude. The total number of households of Imphal East as per 2011 census is 91,822 with a total population of 456,113 persons out of which the proportion of SC and ST population is 15,839 and 27,657 persons. The decadal growth rate from 2001 to 2011 was found to be 15.51. The population density is 643 persons per square kilometre as compared to 557 persons and 466 persons in 2001 and 1991 respectively. As per the census report of 2011, the district has a sex ratio of 1017 female per thousand males which is much higher than the state average of 985. The literate population comprised of 324,664 persons with a literacy rate of 81.95.

The district is the most developed in the state. However, the per capita income of majority of the population of the district is low while comparing to various districts of different states of India even though it is highest in the state. From the 2011 Census we found that about 42.71% of the population of Imphal East are workers i.e. persons whose main activity is participation in any economically productive work by physical or mental activities. Education is considered as one of the main factors which gives direct impact to the upliftment of the social status. Various government and private educational institutes, such as schools, colleges and universities are found in the district.

The district is divided into four sub-divisions and it consists of 11 assembly constituencies. Porompat sub-division is the district head quarter of the district. The average maximum temperature recorded is 37.84° C and the minimum temperature recorded is 3.47°C in 2015. The district received an average annual rainfall of 565.13 mm in 2015 as compared to 660.53 mm in 2014. The average relative humidity recorded for the year 2015 is 74.4 %.

There is marked increase in the total population of Imphal East with around 40.17 % comprising the urban population leading to the changes in the land use pattern. The latest scenario of the land use pattern is comprised of total crop area (38.4%), forest (34.1%), and wetland (3%) while the remaining 24.5% of the land area is utilized in 'others' category which includes cultivable wasteland, area under settlement, market area, urban wasteland.



There has been rapid increase in the urban population in the recent decades. There has been negative change in the rural population but positive change or increase in the urban population during the last decade, i.e. from 2001 to 2011. A decadal increase of 15.51% of the population was observed during the last decade from 2001 to 2011.

Due to urbanization of Imphal city, there is scarcity in the energy sector because of rapid increase of consumer. The agricultural products which were quite of sustainable amount seem to be short of supply for sustenance. There is shortage of potable water supply to the public for domestic use. All these impacts to the society are directly or indirectly because of the climate change. There has been change in climatic phenomenon in the past decades. Due to such changes in climatic phenomena and shortage of the sustainable essential resources of the inhabitants of the district, health conditions and immune against diseases and illness decrease. Such changes in the health of the inhabitants gives rises to the various number of illness, which in turns requires health centres and medical personals to prevent or to cure the illness. Medical facility is the much needed sector in a developing society. In Imphal district there has been increase in the number of health facilities available in the recent years. Many privates and public sector medical health centres are established.

3.3 Bishnupur

Bishnupur District came into existence on the 25th May 1983. The district with its headquarter at Bishnupur (27 Km. from Imphal) lies between 93.43° E and 93.53° E Longitudes and 24.18° N and 24.44° N Latitudes with a total geographical area of 496 Sq. Km. It is bounded on the North by Imphal West District, on the South by Churachandpur District, on the East by Imphal and Thoubal Districts. Physiographically, the district may be divided into three main parts i.e. (i) valley or alluvial plain area, (ii) area under water or wetland / lakes and (iii) area covered under hillocks and forest.

According to the 2011 census report, Bishnupur district has a total population of 237,399 which made up for 9.23% of the population of Manipur. The district has 118,782 male and 118,617 female thus having a sex ratio of 999 females for every 1000 males. It has a population density of 479 inhabitants per square kilometre and a literacy rate of 75.85%.

Out of the total area of 496 Km² of Bishnupur district, 458.98 Km² is in rural area jurisdiction and 37.02 Km² falls in urban area jurisdiction. The district has 3 Sub-division viz. Bishnupur,



Moirang and Nambol; 2 community development blocks viz. Bishnupur and Moirang, 6 (Six) Assembly Constituencies viz. Nambol A.C , Oinam A.C, Bishnupur A.C, Moirang A.C, Thanga A.C, and Kumbi A.C . As for the Local Self Government, the number of Gram Panchayat is 24 (12 G.P each in one block) and there are 4 (four) Municipalities namely Nambol, Bishnupur, Ningthoukhong and Moirang.

The district experiences fair cold climate during winter and hot in summers. The maximum temperature in the last three years is comparatively similar but the winter season temperature was maximum in 2015. In the case of the minimum temperature, the year 2015 is on the lower side as compared to previous years except during the post monsoon. The rain in this region occurs due to the influence of Northeastern wind. The rain in 2015 is on the higher side with 406.26 mm as compared to 364 mm in 2014.

The land use pattern of the district shows that almost half of the total area (49.3%) of the district is being occupied for agricultural purpose and 30.02% is made up of the water bodies. Forest cover occupies about 4.23% of the total geographical area.

Majority of the population are engaged directly or indirectly in the agricultural sector and the major crop grown in the district is rice which is about 216.5 Sq.Km for the year 2014-15. The area under irrigation for the rice cultivation is about 82.60% of the total agricultural land in the district. The total productivity of rice in the district is 69470 tonnes with a yield rate of 3208.25 kg/ha for the year 2014-15. The district has also the highest production of vegetables in the state of Manipur and villages like Toubul Mamang leikai, Toubul Maning leikai, Khoijuman and Kwasiphai are known for their vegetable production.

The area under forest as per the State of Forest Report 2015 of the Forest Survey of India (FSI) is 21 Sq. Km which is only 0.12% of the total forest area in the state. The forest area in Bishnupur district occupied about 4.23% of the total district area and most of the forest of Bishnupur comes under the Open forest category.

The water resources in the district mainly consist of the lakes and the small rivers/stream that drains in to the Loktak Lake. Some of the lakes in the district are Loktak, Ngakrapat, Awangsoi, Laisoi, Zingpat, Loukoipat and Ikokpat etc. Loktak Lake covers the maximum area of the total water bodies and serves as a source of water for hydropower generation, irrigation and drinking water supply.



On the part of the health factor of the district, the Statistical Year Book, Manipur 2015, reported a District Hospital, five primary health centres, 36 sub-health centres, 2 community health centres and one leprosy council unit to have been situated in the district.

Urbanization in the state is in its nascent stage of development and Imphal serve as the nerve center of urban settlements. There is only 7 towns in the Bishnupur district as per the 2011 census and the urban population constituting of 36.86% resides in an area of only 37.02 Sq. Km which is just about 7.46% of the total district area. The year 1961 can be marked as the beginning of urbanization in Bishnupur district, since only after the census of 1971 we began to have urban population which has been increasing steadily till the 2011 census.

3.4 Thoubal

Thoubal District came into existence in May 1983. The district with its headquarter at Thoubal (25 Km. from Imphal) lies 23° 45' N and 24°45' N latitude and 93°45' E and 94°15' E longitude with a total geographical area of 514 km². It is bounded Senapati district on the north, Ukhrul and Chandel districts on the east, Churhandpur and Bishnupur districts on the south and Imphal West and Imphal East districts on the west. Physiographically, the district is mainly of the plain area with few hillocks and hills of low heights.

According to the 2011 census report, Thoubal district has a total population of 422,168 which made up for 16.42% of the population of Manipur. The district has 210845 male and 211323 female thus having a sex ratio of 1002 females for every 1000 males. It has a population density of 821 inhabitants per square kilometre and a literacy rate of 74.47%.

Out of the total area of 496 Km² of Thoubal district, 482.55 Km² is in rural area jurisdiction and 31.45 Km² falls in urban area jurisdiction. The district has 3 Sub-division viz. Thoubal, Lilong and Kakching; 10 (ten) Assembly Constituencies viz. Lilong, Thoubal, Wangkhem, Heirok, Wangjing-Tentha, Khangabok, Wabagai, Kakching, Hiyanglam and Sugnu. As for the Local Self Government, there are 2 (two) Municipalities namely Thoubal and Kakching.

The climatic conditions of the district varies with the season. The maximum temperature recorded on the district was 35.59 °C while the minimum was 21.73°C. Rainfall for the year 2015 was very low with only 147.27mm as compared to 409.05mm in 2014.



The land use pattern of the district shows that 42.40% of the total area is being occupied for agricultural purpose and 24.81% is made up of the water bodies. Forest cover occupies about 5.77% of the total geographical area.

Majority of the population are engaged directly or indirectly in the agricultural sector and the major crop grown in the district is rice which is about 297.10 Sq.Km for the year 2014-15. The total productivity of rice in the district is 64910 tonnes with a yield rate of 2184.94 kg/ha for the year 2014-15.

The area under forest as per the State of Forest Report 2015 of the Forest Survey of India (FSI) is 100 Sq. Km which is only 0.58% of the total forest area in the state. The forest area in Thoubal district occupied about 19.46% of the total district area and most of the forest of Thoubal comes under the Open forest category.

The district has many rivers and the southwestern part of the district is a part of the Loktak Lake region and this area has a number of shallow and rain fed lakes. Due to constant siltation and reclamation of vast areas for agricultural purposes the lakes are gradually shrinking in size and at present some of them are only in name.

On the part of the health factor of the district, the Statistical Year Book, Manipur 2015, reported the presence of a District Hospital, twelve primary health centres, four community health centres and one leprosy council unit.

As for urbanization, there is only 10 towns in the Thoubal district as per the 2011 census and the urban population constituting of 35.85% resides in an area of only 31.45 Sq. Km which is just about 6.12 % of the total district area. The year 1961 can be marked as the beginning of urbanization in Thoubal district, since only after the census of 1971 we began to have urban population which has been increasing steadily till the 2011 census.

3.4 Churachandpur

Churachandpur District is Manipur's largest district, spreading over 4570 sq.km and occupying 20.4 % of state's area. On its eastern flank the district shares an international border with Myanmar. At its broad middle its south lies the neighbouring State of Mizoram, while its western flank has the Cachar District of Assam. Within the state the district of Chandel lies to



its east, Tamenglong to its west and to the north lies the plains of the Imphal Valley, with the famous freshwater lake Loktak. The district with its headquarter at Churachandpur, is located at a latitude of $23^{\circ} 56' 20.4''$ N to $24^{\circ} 36' 46.8''$ N and longitudes of $92^{\circ} 58' 12''$ E to $93^{\circ} 52' 58.8''$ E. The native tribal folks call the district headquarters of Churachandpur as "Lamka". Physiographically, the district is mostly of hilly region with just 5.57% of the area being plain.

According to the 2011 census report, Churachandpur district has a total population of 2,74,143 which made up for 10.67 % of the population of Manipur. The district has 1,38,820 male and 135,323 female thus having a sex ratio of 975 females for every 1000 males. It has a population density of 60 inhabitants per square kilometer and a literacy rate of 82.78%. The district is divided into 5 Revenue Sub-divisions and 6 T.D block in the district.

The Climate is generally moderate, with a hot and humid belt where the River Barak while rushing southwards suddenly does a U-turn at Tipaimukh, and sweeps majestically westwards into the plains of Assam's Cachar District. The month of December, January and February are quite cold, often made chilly because of the cold winds that sweep through the land. The remaining nine months are often rainy, but with dry spells that even make a tinderbox of many a hillside.

According to the survey conducted by Department of Agriculture, Government of Manipur, the net sown area is less than 1 Sq.km. and the whole cultivated area is rain-fed area. Rice is the main crop cultivated in the district. Other major crops are wheat, sugarcane, pulses, oil seed, etc.

The area under forest as per the State of Forest Report 2013 of the Forest Survey of India (FSI) is 4,286 Sq. Km which is about 93.79% of the total district area and most of the forest of Churachandpur also comes under the Open forest category. The wetland area estimated is 4102 ha. Small wetlands, which are less than minimum mapable units (MMU), are 56 in the district. This is mainly due to presence of river/streams. One reservoir is located near Lamzang.

The district is mainly drained by small rivers like Khuga, Tuila, Tuili, Leimatak, Tuivai and Barak of Manipur River. Leimatak River and Tuipuilui River, tributaries of Irang River flow towards northerly direction, while the rest of the rivers flow in general southerly direction.

On the part of the health factor of the district, the Statistical Year Book, Manipur 2013, reported a District Hospital, eleven primary health centre's, one community health centre's



and seven dispensaries to have been situated in the district. Health status especially securing children's lives through intervention in better reproductive is viewed as priority in the district.

The district on an average is a performing district in some facets of development. Basic amenities like housing, drinking water, roads, electricity together with improvement in connectivity and communication system have emerged as priority areas for development interventions in the district.

3.6 Senapati

The Senapati district is the fourth largest district in the state which was earlier known as North District. It is one of the five hill districts of Manipur. It lies between 24.37° and 25.37° North latitude and 93.29°E to 94.15°E longitude with a total geographical area of 3,271 sq. km. Endowed with rich flora and fauna and other natural resources, the district boast of many endemic species. The national highway-2 passes through the district and serves as one of the main linkage to the rest of the state. As such it has a tremendous potential for development not only in the district but also can add as a facilitator for the development of other districts in the state.

The district has a varied topographical settings with different varieties of both flora and fauna species. For example, Mt. Tenepu or Mt Esii, the highest mountain in the state with 2,997 mean sea level, is situated in the North West of the district. At its foot hill is the famous Dziiko Valley, with mesmerizing streams and wild flowers, attracting hundreds of tourist throughout the year. On the other hand the Barak River basin with 25-30 msl formed one of the lowest landscape in the state.

In between 2997 msl of Mt. Tenepu and 25-30 msl of the Barak river basin, many endemic species of flora and fauna thrives. The climatic condition ranging from a minimum temperature of 3.36°C to a max. of 34.14°C, is very conducive for both flora and fauna although in recent years, the average minimum and average maximum temperature of the district has slightly increased.

The administrative set up of the district is not well developed as for example, in the entire district, it has only 6 (six) police stations. There is not a single police station in the remote



area of Poumai Naga tribe, which is one of the largest tribe in the district. The district has 6 (six) sub-divisions and 6 (six) Constituent Assembly.

There are only 1 (one) hospitals in the district, 2 CHC, 1 TB Control Centre, 1 Homeopathic Centre, 11 PHC, 64 PHSC, 2 Dispensary, 6 Dispensaries.

The district population has increased to 4,79,148 in 2011 Census from 2,83,621 in 2001, which has an increase of 1,95, 527. With such drastic change, there is likely to cause environmental imbalances if proper scientific involvement in not taken up in time. Although according to 2001 census, there were 0 urban populations; in 2011 it raised to 7, 476 persons. Nonetheless, majority of the district population are residing in rural areas. Out of the total population in the district, 13.83 % are children. Sex ratio in the district is 959 female per 1000 male.

The literacy rate of the district is 74. 13% which is lower than the state literacy rate of 79.85%, with male and female literacy at 79.98 % and 68.07% respectively.

Climatically, Senapati district falls under humid sub-tropical climate to temperate type with temperature. Thus generally the district enjoys a pleasant temperature throughout the year. The district has alluvium, lateritic black regur and red ferruginous type of soil.

Most of the people are engaged in agriculture and allied activities with poor infrastructure and thus they are climate sensitive. As such in the year 2014, when there was a drought like situation in the district, it grossly affected the overall production of the district.

In 2015, forest cover was increased to 66.55 from 66.43 in 2014. Along with it the average rainfall also increased considerably to 926.95 mm in 2015 comparing to 277.2 mm in 2014. Although many of the important rivers in the state have their genesis from the district, lack of proper irrigational system and infrastructure make the people to live at the mercy of nature. Major rivers such as the Barak, the Iril, the Irang, the Imphal and the Ithai rivers originate from the district. However, there is dearth of proper watershed programme in the district.

Over the last few years, the precipitation of the district has gone down although in 2015, slight positive changes could be observed. One of the main causes for that may be felling of trees for timber and fuel couple with Jhumming activities. Heavy dependent on the forest for



commercial as well as for domestic purposes in the district has led to forest degradation and de-forestations. It not only disturbed the habitations of several endangered species of flora and fauna but also add to drastic climate change in the district.

As the people in the district are still mostly engaged with traditional methods of production, vulnerabilities of the people to negative climate changes are very high. With poor infrastructure and lack of modern technical know-how, the possibilities of mitigating the negative impact of climate change are also very low in present scenario. As such we need to identify the most vulnerable regions in the district in order to identify and prioritize adaptation interventions.

3.7 Tamenglong

The district of Tamenglong, is located on the west of Manipur at an altitude of 1,260 m above the sea level and covers a total area of 4,391 sq.km. It lies between 24°30'N and 25°27'N latitudes and of 93°10'E and 94°54'E longitudes. The district is bounded by Nagaland in the North, Churachandpur district in the South, Senapati district in the East and in the West by the state of Assam. It is the farthest District from the state capital, Imphal and the district headquarter Tamenglong itself is also the farthest District HQ from Imphal with 147 Kms.

The main tribes of the district are Zeliangrong Nagas (with different sub-tribes- Rongmei, Liangmai, Zeme, and Puimei) and Kukis besides minority Hmars, Chirus and Khasis. Racially or physically and linguistically Zeliangrongs are Tibeto-Burman (Indo- Mongoloid) of Sino-Tibetan family of the Mongolian race.

Physiographically, Tamenglong is entirely composed of hills, ranges and narrow valleys. The hilltops and valley sides are dotted with small hamlets. Most of the land is hilly except a few pockets of flat lands such as Barak bank, Khoupum Valley and Kunphung.

According to the 2011 census report, Tamenglong district has a total population of 1,40,651 which made up for 5.47 % of the population of Manipur. The district has 72,371 male and 68,280 female thus having a sex ratio of 943 females for every 1000 males. It has a population density of 32 inhabitants per square kilometre and a literacy rate of 70.05%. Tamenglong District has five sub-divisions namely Tamenglong, Tamei, Tousem, Nungba and Khoupum.



Climatically, Tamenglong belongs to sub-tropical zone. Because of high altitude summer are mild with maximum temperature of 27°C and minimum temperature of 5°C. In 2015, the district however experienced a maximum temperature of 37.71°C in monsoon season although the average temperature of the whole year is 34.175°C. This is far higher than the state average temperature of 26.9° C.

Jhum cultivation is the main method of cultivation. And as per the Department of Agriculture, Government of Manipur, the net sown area in the district is less than 1 Sq.km.

One alarming observation is that the net area sown more than once is decreasing each year. For example in 2013 it was 8.58 but it came down to 7.76 in 2014 and further down to 7.70 in 2015.

The recorded total forest area of Tamenglong District according to 2013 assessment is 3,865 Sq. Km. which is 88.02 percent of the total geographical area. Out of that, 279 Sq. kms are very dense forest, 1,766 are moderately dense and 1,820 are open forest. The forests can be grouped as Tropical-Ever-green forest, Sub-tropical forest and Bamboo brakes. The forests are rich in wildlife and Tamenglong is often called as the land of the Hornbill (Chareng). In 2015, forest cover of Tamenglong district has increased to 85.49 sq/km.

The main rivers flowing in the District are Barak(Ahu), Irang, Makhru(Makhu), Iring, Ijei(Aga) and Apah rivers etc. Barak(Ahu) is the biggest river. Till now, the water of this river are not utilized for irrigation or power production. The wetland area estimated is 5086 ha. The number of small wetlands, which are less than minimum mapable units (MMU), are 47 in the district. Precipitation of the district has drastically increased in 2015 which is 483 mm from 146 mm in 2014.

The Tamenglong district, like other hill districts, is very poor when it comes to health sector. Many villages are in the interior region where the nearest health care delivery system is some 20 kms away. In the entire district, there are three hospitals namely, Tamenglong District Hospital, T.B. Hospital, Hospital Tamenglong and there are six PHCs viz. (1) Haochong Block, Haochong (2) Tamei Block Tamei (3) Tousem Block, Tousem and Oinamlong (4) Nungba Block, Khoupum and Noneh, which serve as the main health centre of the district.



3.8 Ukhurul

Ukhurul is one of the five hill districts of Manipur having a total geographical area of 4544 Sq. Km. Ukhurul district shares borders with Myanmar in the East, Chandel in the South, Imphal East and Senapati districts in the West and Nagaland state in the North. The area of the district was 8,200 Sq. Km. according to the CSI Publication 1976. Later Tengnoupal District, now called Chandel District was carved out from this district on 15th July, 1983 and the area of the then Manipur East District was sliced down to 4,544 Sq. Km. and the title of the district was changed into Ukhurul District in 1983. Ukhurul lies between 24.28 degree and 25.41 degree North Latitude and 94.45 degree and 94.80 degree East longitudes. The headquarter of the district is linked with Imphal, the State capital by the national highway 150 at a distance of about 84 km. The terrain of the district is hilly with varying heights of 913 m to 3114 m (MSL). As per 2011 census, the district has a total population of 1,83,998, comprising of 94,718 males and 89,280 females. It constitutes about 7.16 percent to the state population as against 6.14 percent in 2001. Tangkhul Nagas constitute the bulk of population with some pockets of other communities like the kukis, the Nepalese and the non-tribals.

The total number of households of Ukhurul as per 2011 census is 35,694 and the proportion of ST population is 1,73,606 persons. The decadal growth rate in 2011 over 2001 was found to be 30.68. Ukhurul District recorded the highest growth rate of all the Districts of Manipur for the period 2001-2011. Ukhurul remains the second least thinly populated district next to Tamenglong among the districts of Manipur. It has a population density of 40 persons per square Kilometres as compared to 31 persons and 24 persons in 2001 and 1991 respectively. As per the census report of 2011, Ukhurul has a sex ratio of 943 female per thousand males which is much lower than the state average of 992. Ukhurul district was categorized as an entirely rural district prior 2001 census. Ukhurul ranks 4th in terms of literacy rate out of total 9 districts of Manipur in 2011. As per the census 2011, the average literacy rate of Ukhurul is 81.38 as compared to 73.1 in 2001.

The district consists of 7 Sub-divisions namely; Ukhurul, Chingai, Jessami, Phungyar, kamjong, Kasom Khullen, Lungchong Meiphai. These are co-terminus to 8 development blocks viz: Ukhurul, Chingai, Jessami, Phungyar, kamjong, Kasom Khullen, Lungchong Meiphai, and sakamphang.



The climatic condition of the district is temperately cool in most part of the year. The average maximum temperature recorded is 29.74° C and the minimum temperature recorded is 4.41°C (2015). The average annual rainfall is 412.74 mm in 2015 as compared to 433.9 mm in 2014 and 130.39 mm in 2013. The average maximum and minimum relative humidity is 100% and 4.45 % respectively (2015). The rainy season in the district is from May to beginning of October broadly but winter is chilly.

The land use pattern of the district shows that more than four-fifth of the total geographical area of the district is under forest area. Total cropped area contributes just 4 percent in 2012-13 whereas the proportion of wetland to the total geographical area is minimal or negligible. Agriculture being the main occupation of the people occupies the most dominant place in the economy of the hills in terms of employment and income. Despite its significant importance in the economy, is dependent on monsoons as irrigation facilities in the district is nil or negligible. Thus, agriculture becomes a traditional means of livelihood than a commercial proposition. Rice is the main staple food crop covered about 101.6 Sq Kms of cultivated land in 2014-15. Even though the cultivation area under jhum has decreased comparatively with wet cultivation, it still contributes a large proportion to the total area of paddy cultivation.

The recorded total forest area of Ukhrul District according to 2015 assessment is 3542 Sq. Km. which is 78 percent of the total geographical area. The total area under forest for the state of Manipur is 16,994 Sq. Km as per the State of Forest Report 2015 and Ukhrul contributes about 21 percent of the total forest area in the State.

The district has a lone 50 bedded district hospital commissioned since 1976 apart from 2 accredited private health institutions. There is one Community Health Centre (CHC) at Kamjong and 8 Primary Health Centres (PHC) at Chingai, Jessami, Kasom Khullen, Khangkhui, Lambui, Phungyar, Somdal, and Tallu, apart from 40 Primary Health Sub-Centres (PHSC) spread at various villages of the district.

3.9 Chandel

The Chandel district is one of the important districts of the state given the multi-lingual, multi-ethnicity culture and tradition it possesses. The Chandel district (formerly known as Tengenoupal district) came into existence on 13th May 1974. The district with a total geographical area of 3,313 square km lies in between 23.49 degree and 24.28 degree north



latitude and 94.09 degree to 94.31 degree east longitude. The district total geographical 90% of area is covered by hill ranges. Highest peak is Eswani which is 8,348 ft. The main rivers are (i) The Sekmai River. (ii) Chakpi River (iii) The Lokchao River.

Chandel lies in the south-eastern part of Manipur. Its neighbours are Myanmar (erstwhile Burma) on the south, Ukhrul district on the east, Churachandpur district on the south and west, and Thoubal district on north. It is about 64 km away from Imphal. Prominent tribes are scattered all over the district they are (alphabetical order) Aimol, Anal, Chiru, Chothe, Gangte, Khoibu, Kom, Kukis, Lamkang, Maring, Monsang, Moyon, Paite, Taroa, Thadou, Vaiphei and Zou etc. There are also other communities like Meiteis and Muslims in small numbers as compared to the tribes. Non-Manipuris like the Tamils, Bengalis, Punjabis, and Biharis are also settled in Moreh areas. The Moreh town, the international trade centre of the state lies on the southernmost part of the District. When the Trans-Asian Super Highway comes into existence, Chandel district will be one of the gateways to the Asian countries.

The district total population is 144028 according to census 2011. Males are 74549 and Females are 69479. The population growth rate as per 2011 census was 21.88 per cent as against 66.62 per cent in 2001 was the highest growth rate and 35.96 per cent in 1991. The lowest growth rate of the district recorded was 12.38% per cent in 1971. There is great significant decrease of growth rate in the district.

According to 2011 census report literate people in the district were 95289. Its average literacy Rate is 71.11 as compared to 56.20 in 2001. Positive growth in literacy rate in both male and female accounted for 77.78 percent and 63.96 percent respectively as per 2011 census as against 64.30 percent and 48.00 percent respectively in 2001. The sex ratio in Chandel stood at 933 per 1000 male compared to 2001 census figure of 981. There is gradual decrease in sex ratio in Chandel district.

Per Capita Income of majority of the population of the district is low. In 2006 the Ministry of Panchayati Raj named Chandel district one of the country's 250 most backward districts (out of a total of 640). From the 2011 Census we found that the population of Chandel district are workers i.e. persons whose main activity is participation in any economically productive work by physical. Education is considered as one of the main factor which gives direct impact to the upliftment of the social status. Various government and private educational institute, such as school, 3 colleges are found in the district.



Chandel district is divided into 5 Tehsils, Machi Tehsil is the Smallest Tehsil by population with 17087 populations. Chakpikarong Tehsil is the biggest Tehsil by population with 43202 populations. It is the 2nd least Populated district after Tamenglong.

Transport and communication plays a vital role in economic development. The district headquarters is connected by State Highway in Chandel pallet road, which is of the length of 30 km from National Highway No.102. The total length of roads in Chandel district is 501.96 kms. Chandel district summer highest day temperature is in between 22°C to 37°C. Chandel district is quite rich in mineral wealth like - limestone, copper, nickel, chromites and asbestos, which remain unexploited till date. In the field of agriculture the permanent practice of agriculture is over taking the practice of Jhum/shifting cultivation in the whole of the district gradually. Chandel is one of the districts severely affected by the practice of shifting or jhum cultivation. Chandel district comes under Tengnoupal Forest Division of the state. It has about 81 percent forest cover of the total geographical area. The dense forest on Myanmar border has valuable teak tree in abundance. Forest provides firewood, charcoal, wood and many other forest resources.

There has been change in climatic phenomenon in the past decades. Due to such changes in climatic phenomena and shortage of the sustainable essential resources of the inhabitants of the district, health conditions and immune against diseases and illness decrease. Such changes in the health of the inhabitants gives rises to the various number of illness, which in turns requires health centres and medical personals to prevent or to cure the illness. Medical facility is the much needed sector in a Chandel

Records indicates that Changes have been found in the amount of rainfall received (during monsoon and post monsoon), maximum and minimum temperature and maximum and minimum relative humidity during certain temporal units. Such changes are required to be checked and monitored so that the vulnerable sector of the society can be educated, so as to mitigate and adapt the changes in the climate and flourish as a developed and cultured society.



CHAPTER 4 : RADIO PROGRAMME

The changing trends in the climatic factors such as temperature, humidity, rainfall has confirm that Manipur is also coming under the grasp of the global phenomenon of climate change. Even in the current era, many people mainly in rural areas are not aware of the climate change impacts which might affect their livelihood and the environment as a whole. The emerging problems of population growth, urbanization, deforestation, loss/shrinking of water bodies, lack of stringent policies are sure to exacerbate the issues of the changing climate in the days to come. It is high time to mitigate and adapt to climate change by reducing the actions/activities that are harmful to the environment for which awareness is the key. With the aim to create awareness on climate change and the problems of the vulnerable sections at the grass root level, a weekly radio programme entitled "*Shatlakho Hayengsu*" is broadcast every Wednesday at 6.40 am on All India Radio, Imphal and it is sponsored by the State Climate Change Cell, Directorate of Manipur. The programme is based on the current issues faced by the people related to climate change impacts on various sectors such as agriculture, water, forestry, livelihood, health etc. Field visits and interviews are carried out by the State Climate Change Cell team every week and the voices and issues of the people are aired every Wednesday as a wakeup call against climate change. The first episode of the programme series was aired on 7th of March, 2018 and its being continued till date. The State Climate Change Cell have received lot of inputs and appreciation for the venture.

4.1 7th March, 2018: Community forests of Phayeng village

Phayeng is a schedule caste village in Imphal west district with a very low literacy rate of about 17.15% only. Most of the villagers depend on agriculture for their livelihoods. However, water source of the village, today, depends at only one stream which is also becoming vulnerable and drying up with heavy siltation. Villagers depends their agriculture on seasonal rains, which having only one time crop. The village has strong indigenous knowledge for conservation and local institutions like UMANG KANBA LUP, Land Protection Committee, etc. The way of conservation and protection of their community forest in Phayeng village is very unique and systemic by tradition with certain rules and regulation under control of village Plant Protection Committee i.e. UMANG KANBA LUP.

The Phayeng village has a total catchment area of 705 Ha of which 678 Ha of dense forest was recorded during 1970s. However, it has been decreased at 99 ha of dense forest area in 2016, which is under UMANG KANBA LUP at community forest. Now, most of the stream heads in the catchment of the village has been dried up except only one stream named



Maklang River which is the only water source of the village. This river is also drying up slowly and decreasing its yield. Therefore, the Maklang River in Phayeng village of Imphal West District is also one of the most vulnerable water sources.

Degradation of community of the upper part of the villages is one of the largest sources of greenhouse gas emissions, after the burning of fossil fuels. In addition, harvesting, land clearing, intentionally-set fires and other purposeful actions also affect the amount of carbon stored in the forests. Increasing concentrations of greenhouse gases are likely to accelerate the rate of climate change in the present scenario. The programme focuses on the felling of trees on the upper part of the village , which is one of the major problems leading to degradation of the catchment area. Maklang river and the springs need to be monitored for better provision of freshwater supply and other needs of the local community.

4.2 14th March, 2018: Shifting of agricultural practice

There is unusual increases in the annual temperature and rainfall in the states over the past few decades. These changes of climatic factors in long run led to frequent flood and drought on the other side. For any particular crop, the effect of increased temperature will depend on the crop's optimal temperature for growth and reproduction. In some areas, warming may benefit some types of crops that are typically planted there, or allow farmers to shift to crops that are currently grown in the areas. On the other hand, if the higher temperature exceeds the crop's optimum temperature, yields will decline. More extreme temperature and precipitation can prevent crops from growing. Many weeds, pests and fungi thrive under warmer temperatures and extreme events, especially floods and droughts, and it can harm the crops and reduce yields. Moreover, increase in temperature could directly threaten livestock. All these changes could impose challenges to the farmer and in fact, could threaten food safety of the society. Therefore, the effects of climate change is need to be considered along with other evolving factors that affect agricultural production, such as changes in farming practices and technology.

The total cropland area of the Phayeng village is estimated about 1500 ha, which are non irrigated and with mono cropping pattern i.e. 95% of paddy, others 5%. Mono-cropping of paddy rice farming system is predominant in the Phayeng village. There has been ignorance of scientific approach of farming practices with local non-notified crop varieties and poor quality seeds from local un-recognized sources, improper soil and water management,



injudicious and extensive use of chemical fertilizers (N), plant protection herbicides, pesticides and other inputs leading to fast depletion of soil and environment resources. The farmers followed blind applications of fertilizers, herbicides and plant protection chemicals. In a nutshell, farming in general was unscientific and anti-eco-friendly in nature.

Agricultural and other horticultural crops were severely damaged due to the changing pattern of rainfall. As a result, many farmers have shifted from their age old practice to the new way of System of Rice Intensification (SRI). This will not only increase the productivity but also reduces the use of chemical fertilizer and thereby decreasing the emission of green house gases in the atmosphere. In the first phase of its introduction in this village, 21 farmers have taken part in this new culture of SRI.

4.3 21st March, 2018: Reporting of the workshop on “Empowering Jhumias with secure livelihood: A challenge of Ecological Governance” at Moreh, Manipur

A two-day workshop on “Empowering Jhumias with secure livelihood: A challenge of Ecological Governance” was done at the Trade Centre Hall in Moreh, the border town of Manipur on 10th and 11th March, 2018.

Main Discussions of the workshop:

- The aged old traditional practice of jhum cultivation is leading to reduction in soil fertility and less yield as the jhum cycle is greatly reduced
- Jhumias have no other alternative source of livelihood and is still continuing with the traditional jhum cultivation although they know that is degrading the environment.
- Degradation of the environment in terms of deforestation, loss of soil fertility, forest fires for jhumming preparation is leading to water scarcity and increasing the climate change woes.
- To discuss the various alternative options of livelihood which the Jhumias could take up for a sustainable and secured life.

Main outcomes of the workshop:

- Promotion of integrated farming practices instead of monocropping.
- Shifting of the jhum cultivation from traditional to scientific approach.
- Explore alternative sources of livelihoods.
- Formulation of appropriate land use policy.
- Provide marketing options for the crops and horticulture products.



4.4 28th March, 2018: Jhum cultivation and its effect on the climate

The aged old practice of Jhum cultivation ('Pamlau' in Manipuri) has now become an important issue that affect the livelihood in particular and climatic condition in general. Jhum cultivation need cutting and clearing of forest area, followed by burning of the biomass. At present the jhumming cycle has been reduced to 2-3 years due to the limited availability of land and ever increasing human population. It is mostly practice in the hill area and around 30% of the total paddy cultivation of Manipur is under Jhum, whereas it constitute for about 70% of the total paddy cultivation in the hills alone. Jhum cultivation is a major livelihood source for about 70,000 households in the state of Manipur. Most of these household do not have an alternative source of livelihood. And this practice has been one of the major cause of deforestation, soil erosion, land degradation and overall disturbance to the ecology which leads to anomalies in the weather pattern.

In the wake of climate change occurring all over the world, the impact of jhum cultivation is felt hard and strong. Its impact on the environment has become a challenging issue. Creating awareness through workshops and discussing the major challenges faced by the people can bring some changes in the mindset of the jhum cultivators.



CHAPTER 5 : WORKSHOP AND TRAINING

Spreading awareness on climate change issues along with the dissemination of information is one of the objectives of the Climate Change Cell. Various workshops and training programmes were conducted during the year 2017-18.

Table 5.1: List of trainings/workshops conducted during 2017-18

S. N.	Title	Date & Venue	Host Organization/ Institute	Nodal Person / Contact Person	Level of Participation/ Stakeholders	No of Partic- ipants	Tr. Material if any / Reports Published
1.	Training on “Introduction to GIS and Remote Sensing”.	April- June 2017	Geo-Environmental and Technical Services Manipur	Dr. Rajkumar Chingkhei	Project Scientists of Climate Change Cell Manipur	6 Nos.	Nil
2.	Trainings of Level 2 : State Level Officers on Climate change	29 th May 2017 at State Academy for Trainings, Takyel, Imphal West	State Climate Change Cell in collaboration with SDC – Delhi and NABCONS		State level officers	24 Nos.	
3.	Training workshop on “Vulnerability and Risk Assessment” for Sikkim and Manipur	24-27 July 2017 at Centre for Sustainable Technologies,	Indian Institute of Science (IISc), Bangalore	Dr.N.H. Ravindranath	Project Scientists of Climate Change Cell Manipur	4 Nos	Nil
4.	One-day Orientation programme for legislators and administrative secretaries on climate	13 th October, 2017 at Imperial Hall, Hotel Classic	Directorate of Environment in association with Department of Science		Legislators, administrative secretaries and official of various		



Annual Report 2017-18

S. N.	Title	Date & Venue	Host Organization/ Institute	Nodal Person / Contact Person	Level of Participation/ Stakeholders	No of Partic- ipants	Tr. Material if any / Reports Published
	Change adaptation	Grande, Manipur	and Technology, Government of India and Swiss Agency for Development and Co- Operation (SDC)		departments of the state		
5.	A two days workshop on "Empowering Jhumias with secure livelihood – A challenge of Ecological governance"	10 th and 11 th March, 2018 at Trade Centre, Moreh, Tengnoupal District, Manipur	Directorate of Environment, Government of Manipur		Jhumias, local NGOs, Media	92 Nos.	
6.	Need Assessment Workshop on Climate Change Vulnerability Assessment in the Eastern Himalayan States in India	15 th and 16 th March, 2018 at IIT- Guwahati	Indian Institute of Technology Guwahati (IIT Guwahati) and Indian Institute of Technology Mandi (IIT Mandi)	Dr. Anamika Barua (Associate Prof.)	Officials of State Climate Change Cells of five states	25 Nos.	



5.1 Training on “Introduction to GIS and Remote Sensing”

Geo-Environmental and Technical Services Manipur conducted a training for the staffs of Climate Change Cell Manipur during April-July 2017 on the “Introduction to GIS and Remote Sensing”. The staffs were made familiar with the use of software like Mapinfo, AcrGIS, Erdas, Global Mapper.



Pic: The trainers and trainees

5.2 Training workshop on “Vulnerability and Risk Assessment” for Sikkim and Manipur

Under the supervision of Dr. N.H. Ravindranath (IISc, Bangalore), a Training workshop on “Vulnerability and Risk Assessment” for Sikkim and Manipur was organized at the Centre for Sustainable Technologies, Indian Institute of Science (IISc), Bangalore from 24th to 27th July 2017. Participants of the workshops includes 10 officials form Sikkim and 4 Project Scientists of Climate Change Cell Manipur. The trainees were taught how to assess the vulnerability of a region using primary and secondary data.



Pic: The participant at IISc, Bangalore



5.3 Trainings on Climate change for the Level-2 Officers of the State

A one day Capacity building and Training programme of the State Level officers on planning and implementation of the State Action Plan on Climate Change in Manipur under NMSHE was organized at State Academy for Trainings, Takyel, Imphal West on 29th May 2017. The programme was conducted by the State Climate Change Cell in collaboration with SDC – Delhi and NABCONS. A total of 24 officers from the state took part in the programme.

5.4 Orientation Programme for Legislators and Administrative Secretaries on Climate Change Adaptation

One-day Orientation programme for legislators and administrative secretaries on climate Change adaptation was organised by the Directorate of Environment in association with Department of Science and Technology, Government of India and Swiss Agency for Development and Co-Operation (SDC) on the 13th October, 2017 at Imperial Hall, Hotel Classic Grande, Manipur. The function was graced by Shri N Biren Singh, Hon'ble Chief Minister, Manipur, Shri T. Shyamkumar, Minister, Forest and Environment, MAHUD, Town Planning, Horticulture & Soil Conservation), Manipur and Ms. Marylaure Crettaz, Head and Counselor, Swiss Cooperation Office, India, Embassy of Switzerland. The keynote address was given by Shri Shambhu Singh, Addl. Chief Secretary (Forest and Environment), Manipur.



Pic: Ms. Marylaure Crettaz, Head and Counselor, Swiss Cooperation Office, India, Embassy of Switzerland addressing the gathering



5.5 Two days workshop on “Empowering Jhumias with secure livelihood – A challenge of Ecological governance”

The Directorate of Environment, Government of Manipur organized a two days workshop on “Empowering Jhumias with secure livelihood – A challenge of Ecological governance” on 10th and 11th March, 2018 at Trade Centre, Moreh, Tengnoupal District, Manipur. The output of the workshop would be incorporated in policies and programmes for revision of the State Action Plan on Climate Change (SAPCC) and preparation of the State Climate Change Policy (SCCP).



Pic: The Deputy Commissioner, Tengnoupal, Manipur addressing the participants of the workshop

5.6 Need Assessment Workshop on Climate Change Vulnerability Assessment in the Eastern Himalayan States in India

A workshop on Climate Change Vulnerability was conducted by Indian Institute of Technology Guwahati (IIT Guwahati) and Indian Institute of Technology Mandi (IIT Mandi) on 15th and 16th March, 2018 at IIT-Guwahati.

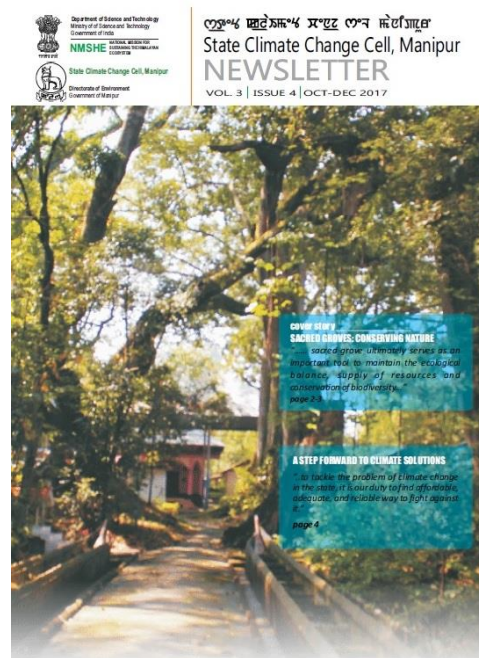
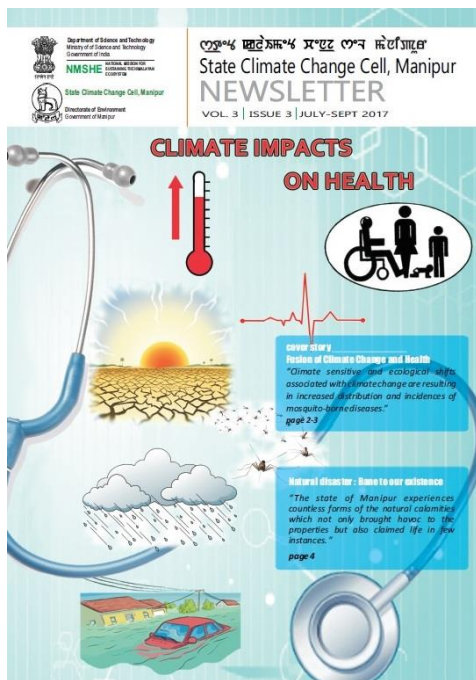
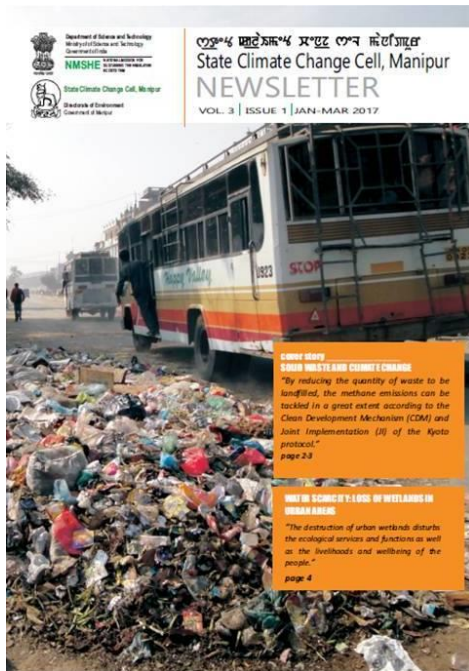


Pic: The staffs of SCCC Manipur



CHAPTER 6 : REPORTS AND PUBLICATIONS

Publication of Newsletter quarterly for continuous reporting on the climate events and activities of the Climate Change Cell. It focuses on agriculture, forests, water, health and socio-economic conditions of the people and address the public on the current events and happenings during the year.



Pic: Published Newsletters